ARMON ARCHITECTURE inc.

Commercial • Residential • Code Consulting

PROJECT MANUAL

QUARRY HILL NATURE CENTER – SAFE ROOM ADDITION

701 SILVER CREEK ROAD NE
ROCHESTER, MINNESOTA
55906
www.QHNC.org

June 1, 2015

Armon Architecture Project No. 2014-091

PROJECT DATA

DATE: **June 1, 2015**

PROJECT NAME: **Quarry Hill Nature Center – Tornado Safe Room Addition**

ARCHITECT:

Armon Architecture, Inc.
11 - 4th Street SW
Rochester, Minnesota 55902
Phone: (507) 261-6140
paul@armonarch.com
Contact: Paul Armon, A.I.A.

OWNER:

City of Rochester
Park and Recreation Department
210 4th Street SE
Rochester, Minnesota 55904
Phone: (507) 328-2525
Contact: Jeff Morton

CIVIL ENGINEERING AND STRUCTURAL ENGINEERING:

Short Elliott Hendrickson, Inc.
717 Third Avenue SE
Rochester, Minnesota 55904
Phone: (507) 288-6464
Fax: (507) 288-5058
bwolf@sehinc.com
Contact: Ben Wolf, P.E.

MECHANICAL / ELECTRICAL ENGINEERING:

MEP Associates, LLC
2900 43rd Street NW
Suite #100
Rochester, Minnesota 55901
Phone: (507) 281-1632
lukej@mepassociates.com
Contact: Luke Johnson, P.E., LEED AP

SECTION 00 01 05

CERTIFICATIONS PAGE

PROJECT

Quarry Hill Nature Center – Safe Room Addition
701 Silver Creek Road NE
Rochester, Minnesota 55906

ARCHITECT

Armon Architecture, Inc.
11 – 4th Street SW
Rochester, MN 55902
Telephone: (507) 261-6140
paul@armonarch.com

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Architect under the laws of the State of Minnesota.

Paul Armon

Reg. No. 40080

Paul Armon - Armon Architecture
June 1, 2015

STRUCTURAL ENGINEER

Short Elliott Hendrickson, Inc.
717 Third Avenue SE
Rochester, MN 55904
Telephone: (507) 288-6464
bwolf@sehinc.com

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Engineer under the laws of the State of Minnesota.

Benjamin A. Wolf

Reg. No. 40807

Benjamin A. Wolf – SEH, Inc.
June 1, 2015

MECHANICAL ENGINEER

MEP Associates
2900 43rd Street NW
Suite 100
Rochester, MN 55901
Telephone: (507) 281-1632
LukeJ@mepassociates.com

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Engineer under the laws of the State of Minnesota.

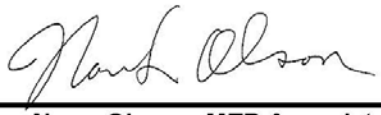
Reg. No. 48683

Luke Johnson – MEP Associates
June 1, 2015

ELECTRICAL ENGINEER

MEP Associates
2900 43rd Street NW
Suite 100
Rochester, MN 55901
Telephone: (507) 281-1632
NormO@mepassociates.com

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Engineer under the laws of the State of Minnesota.



Reg. No. 14171

Norm Olson – MEP Associates
June 1, 2015

END OF SECTION

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ADVERTISEMENT FOR BIDS

Sealed Bids for: Quarry Hill Nature Center – Safe Room Addition
701 Silver Creek Road N.E.
Rochester, Minnesota 55906

will be received by: City Clerk
Rochester City Hall, Room 135
201 4th Street S.E.
Rochester, Minnesota 55904

Until **11:00 A.M., local time, Tuesday, June 30, 2015**, at which time the bids will be opened and publicly read aloud.

Project Scope: The intent of this project is to provide all labor, materials, equipment and skills required for the construction of a new community tornado safe room addition to the existing Quarry Hill Nature Center main building. The safe room shall meet the FEMA 361 standard and is designed to accommodate a maximum of 250 occupants during a storm event. During normal operations the safe room will be used as a multi-use flex space to accommodate the program requirements of the Nature Center. A 2-hour fire rated assembly shall be maintained between the existing building and the new safe room. HVAC systems are separate from the existing building and are supported by an emergency generator during a storm event. Separate contracts will be let for materials and labor for sales tax exemption.

A mandatory Pre-Bid Meeting (for General Contractors) is scheduled for **Tuesday, June 16, 2015 at 3:30 PM at Quarry Hill Nature Center, 701 Silver Creek Road N.E., Rochester, MN 55906.** Please check in at the front desk upon arrival. Upon request the Architect and/or City Representatives will review the bidding procedures, Bidding Documents and other conditions with Bidders and answer questions.

Bidding Documents are as prepared by the Architect: Armon Architecture, Inc.

Interested parties may obtain the Bidding Documents by contacting the Architect or visiting the following website:

http://www.rochestermn.gov/departments/parks-and-recreation/parks-trails/park-projects-construction

END OF SECTION

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INSTRUCTIONS TO BIDDERS

PART 1 GENERAL

1.01 BID INFORMATION

A. Bids will be received by the Owner at the time, date, and place stated in the Advertisement for Bids, Section 00 11 13.

B. The bids must be submitted upon the bid form furnished in the Project Manual and enclosed in an envelope bearing the name of the project.

C. Bid Opening:
1. Bids will be opened publicly and read aloud.
2. Bids received after the time set in the Advertisement for Bids will not be accepted.
3. No fax, telephonic, or electronic bids will be accepted.
4. After opening of the bids, no bid or any part thereof, shall be modified, withdrawn, or canceled for the next 30 days.
5. The Owner reserves the right to accept or reject any or all bids and to waive any informalities or irregularities in the bidding.
6. A modified or withdrawn bid confirmation letter shall bear an official post office postmark. A stamp machine date is not acceptable.

1.02 BID SECURITY

A. Each bid shall be accompanied by a bid security in the form of a bid bond or certified check drawn on a state or national bank duly authorized to do business in the state of Minnesota in an amount not less than 5 percent of the base bid plus additive alternates, payable without condition to the Owner as a guarantee that the bidder will enter into a contract with the Owner for the work described.

B. The successful bidder's security will be retained by the Owner until bidder has delivered to the Owner, in a correct form, a properly executed contract, current insurance certificates, and the required Payment and Performance Bonds. The Owner reserves the right to retain the bid security of the next two contending bidders in each work category until the selected bidder enters into contract with the Owner or until the 30 days after the opening of the bids, whichever is shorter. All other bid securities will be returned as soon as is practical.

C. Bid security will constitute liquidated damages, and not a penalty, for the failure or refusal of the successful Bidder to obtain current insurance certificates, execute the Performance and Payment Bond, and deliver to the Owner, in a correct form, the noted documents within ten (10) days after he/she received notice of acceptance of his/her bid.

1.03 BONDS

A. The successful bidder will be required to furnish and pay for a "Performance Bond" and "Labor and Materials Payment Bond" each in the full amount of the contract by a surety (or sureties) approved by the Owner.

1.04 BASIS FOR AWARD OF CONTRACT

A. Owner Considerations:
1. The Owner reserves the right to reject any or all bids and to waive irregularities.
2. The Owner intends to award the project to the responsible bidder whose bid, conforming to the contract documents, is the lowest in price.

3. In the event the bid of the lowest responsible bidder exceeds available funds for the project, the Owner may request additional alternates to reduce the total cost of the project to an amount acceptable to the Owner.

1.05 TIME OF COMPLETION

A. It is understood that the construction of this project shall substantially by completes by Monday, May 30, 2016 with landscaping as prudent and within a reasonable time frame of this date. Extension of this completion schedule shall be allowed only by written approval of the Owner. Actual starting date shall be coordinated with the Owner after bidding. Tentatively, the starting date is to be on or after September 14, 2015.

1.06 CONSTRUCTION DOCUMENT AVAILABILITY

A. Contract documents may be examined at the following locations:
   1. Armon Architecture office
   2. City Hall – Park & Recreation department
   3. Rochester Area Builders Exchange
   4. Austin Builders Exchange
   5. La Crosse Builders Exchange

B. Contract documents may also be downloaded from the Park & recreation website at: http://www.rochestermn.gov/departments/parks-and-recreation/parks-trails/park-projects-construction

1.07 BID DOCUMENT COSTS

A. Bidders shall bear their own costs for printing or shipping contract documents. Contract documents may be downloaded in PDF format at no charge from the website above.

1.08 EXAMINATION OF DOCUMENTS AND SITE

A. Before submitting a bid, each bidder shall examine all documents, shall visit the site and record their own investigations, and shall inform themselves of all conditions under which the Work is to be performed at the site of the Work, the structure of the ground, the obstacles which may be encountered, all of the conditions of the documents, including superintendence of the Work, requirements of temporary facilities, time of completion, furnishing submittals and a list of Subcontractors, and all other relevant matters which may affect the Work or the bidding. No allowance or extra compensation will be made to a bidder because of lack of such examination or knowledge. The submission of a bid will be considered conclusive evidence that the bidder has become fully informed of all such conditions and limitations.

B. These specifications as a whole are an integral part of the plans. Items of work shown on plans, but not described herein, shall become part of these specifications and vice versa.

C. The bidder is expected to base his/her bid on materials and equipment complying fully with the plans and specifications, and in the event he/she figures his/her bid with materials or equipment which do not conform, he/she will be responsible for furnishing materials and equipment which fully conform at no change in his/her bid price.

1.09 PRE-BID WALK THROUGH

A. Please see Advertisement for Bids, Section 00 11 13, for the date, time, and location for the mandatory pre-bid walk through.

1.10 QUESTIONS, INTERPRETATIONS OF DOCUMENTS

A. Submit all questions about the contract documents in writing immediately to the Architect in writing. Discrepancies, ambiguities, and omissions will be clarified by written addenda posted to website listed above and will become part of the contract.

B. The Architect and Owner will not be responsible for oral instructions

C. No addenda will be issued later than four (4) days prior to the time set for receipt of bids.
   1. Failure of a bidder to receive any addendum shall not release the bidder from any obligations under his/her bid.
   2. In the event that such conflicts are not reported, or such clarifications, interpretations, or decisions are not given, the most stringent (or most costly) course of action shall be followed unless otherwise agreed in writing with the Architect and Owner.

1.11 SUBMITTAL OF BIDS

A. Submit bids in a sealed envelope with Contractor's name and address and the project name clearly written or typed on the envelope front.
   1. Bids shall be made upon forms provided in the contract documents or identical reproduction thereof.
   2. All information requested shall be provided and all banks filled in by typing or legible handwriting in ink.
      a. Bid amounts shall be stated in words and numerals with the written word governing in case of discrepancies.
      b. All requested alternates shall be bid. If "no change" is the intent for an alternate it shall be so stated on the form.
   3. Bids which are signed by others than individuals making them shall have attached thereto Power of Attorney evidencing authority to sign the bid in the name of the person for whim it is signed.
   4. Bids which are signed for a partnership should be signed in the firm name by at least one of the partners, or if another party, there should be attached to the bids a Power of Attorney evidencing authority to sign the bid for the partners.
   5. If bids are signed for a corporation or any other legal entity, evidence of authority of person signing for such legal entity should be attached to the bid.

B. Include the required bid security in the envelope with the bid.

C. Include the Responsible Contractor Certificate Form, Section 00 45 13.13 in the envelope with the bid.

D. Include the Affirmative Action Certificate, Section 00 45 13.19 in the envelope with the bid.

1.12 QUALIFYING THE BID

A. The Bidder shall not stipulate in the bid any condition not contained in the Bidding Documents, Drawings, Specifications, or other documents submitted for bid. Failure to comply may be cause for rejection.

1.13 SALES TAX EXEMPTION REQUIREMENT

A. Upon receipt of written notice of the Owner's Intent to Award the contract, the Bidder shall execute, within ten (10) days and deliver to the Owner a Purchasing Agent Agreement. The Bidder shall be required to enter into a Purchasing Agent Agreement with the City of Rochester to receive sales tax exemptions on material purchased. A sample of the Purchasing Agent Agreement is provided in the Project Manual.

1.14 CONTRACT / AGREEMENT

A. In order to make use of the Sales Tax Exemption, separate contracts will be required for labor and materials. The Owner may accept only one bid without accepting both bids from any one contractor. The contract that will be used between the Owner and the Contractor is a standard AIA form:
   1. A101, 2007 Edition, Owner-Contractor Agreement – Stipulated Sum, as modified by the Owner.
   2. This document may be viewed in the Architect's office upon request.

1.15 SUBSTITUTIONS

A. See Product Substitution Procedures, Section 01 25 13.

1.16 FEDERAL PROVISIONS TO THE CONTRACT

A. A portion of the funding for this project is made through a grant award originating from the Federal Emergency Management Agency (FEMA) with the Minnesota state HSEM department as grantee and the City of Rochester as subgrantee. FEMA requires the additional provisions as stated in 44 CFR 13.36:
   1. Compliance with Executive Order 11246 of September 24, 1965, entitled "Equal Employment Opportunity" and as amended and as supplemented in Department of Labor regulations.
   2. Compliance with the Copeland "Anti-Kickback" Act as supplemented in Department of Labor regulations.
   3. Compliance with the Davis-Bacon Act as supplemented by Department of Labor regulations.
   4. Compliance with Sections 103 and 107 of the Contract Work Hours and Safety Standards Act as supplemented by Department of Labor regulations.
   5. Access by Minnesota state HSEM office, the City of Rochester, FEMA, the Comptroller General of the United States, or any of their duly authorized representatives to any books, documents, papers, and records of the contractor which are directly pertinent to that specific contract for the purpose of making audit, examination, excerpts, or transcripts.
   6. Retention of all required records for three years after final payment and all other pending matters are closed.
   7. Compliance with all applicable standards, orders, or requirements issued under section 306 of the Clean Air Act, section 508 of the Clean Water Act, Executive Order 11738, and Environmental Protection Agency regulations.
   8. Mandatory standards and polices relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act.
   9. Contractor cannot be debarred or suspended or is otherwise excluded from or ineligible for participation in Federal assistance programs under Executive Order 12549, "Debarment and Suspension."

B. A final as-built set is required at the completion of the project to be delivered to the Owner, to be filed through the state HSEM department to FEMA.

END OF SECTION

SECTION 00 31 32

GEOTECHNICAL DATA AND SITE INFORMATION

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
   1. This section identifies the soil investigations and other information reported on the site.
      a. This report was obtained only for the Owner's use in a previous design and is not part of the contract documents. **Please note this report is in reference to the addition constructed in 1990 and is attached only for the Contractor's information, but is not a warrant of subsurface conditions. While it is reasonable to assume soil conditions are similar in the project location, the Contractor shall use their best judgment in determining the need to additional soil investigations (see Section 1.04 below).**

1.02 GOPHER STATE ONE CALL

A. **By law**, all excavators must contact the Gopher State One Call System Notification Center 48 hours, excluding Saturdays, Sundays, and Holidays, prior to excavating in the State of Minnesota.
   2. The telephone number to call are:
      a. Outside the seven county metro (Twin Cities) area: **1-800-252-1166**

PART 2 PRODUCTS

1.03 MATERIALS

A. Reports:
   1. Grading plan: Prepared by Short Elliott Hendrickson, Inc., this information is shown on Drawing Sheet C1.0.
   2. Footing Observation Letter from Braun Engineering Testing dated May 10, 1990.

PART 3 EXECUTION

1.04 INSPECTION

A. The Contractor should visit the site and acquaint himself/herself with all existing conditions. Changes in the cost of the work due to subsurface conditions encountered, which differ substantially from the soils report, shall be adjusted by change order.

B. Inclusion of the soils report shall not serve to relieve the Contractors from their responsibility for examining the site, comparing conditions with the record of investigation, obtaining additional borings and deciding for themselves, the character of material to be encountered including ground water conditions.

C. Should uncharted or incorrectly charted piping or other utilities be encountered during construction, consult Architect immediately for directions as to procedure. Cooperate with Owner and public and private utility companies in keeping services and facilities in operation. Repair damaged utilities to satisfaction of utility Owner.

END OF SECTION

BRAUN
ENGINEERING TESTING
Incorporated

Quality Services Since 1957

CONSULTING ENGINEERS/
GEOTECHNICAL AND MATERIALS

Reply to address/phone #:
310 Service Court, NE
Rochester, MN 55904
(507) 281-2515
FAX # (507) 281-5303

MINNESOTA
Minneapolis
Hibbing
St. Cloud
Rochester
St. Paul

AFFILIATED OFFICES
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J.S. Braun, P.E.
Clarence G. Kruse, P.E.
Geo. D. Klumpke, P.E.
Paul N. Anderson
David R. Hawsley, P.E.
Roger V. Blomquist, PhD
James J. Craig, Jr., P.E.
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Ray A. Huber, P.E.
William K. Cody, P.E.

AFFILIATED COMPANIES
Braun Environmental
Laboratories, Inc.
Braun Pavement
Technologies, Inc.

May 10, 1990

COPY

WAK Construction, Inc.
Attn: Mr. Steve Kreofsky
Hwy. 42, South, Box 3
Plainview, MN 55964

RE: S90-37 FOOTING OBSERVATION
Quarry Hill Nature
Center

Dear Mr. Kreofsky:

As you requested, we recently conducted a visual observation of the footing excavation for the addition to the Quarry Hill Nature Center. The observation was made to assist in determining the suitability of the soils in the excavation for support of the foundation loads of 2,000 psf.

The excavation was observed on April 17, April 19, April 20, and April 24, 1990. The soils in the excavation on the north side of the existing building consisted of a dense sand. The footings step up in elevation on the west side of the proposed addition. Hand auger borings were taken in the footing excavation along the west and south sides of the proposed addition. The soils encountered in the excavation consisted of wet silt. The excavation had been performed by a tractor-mounted backhoe and the wet silt in the excavation bottom was relatively undisturbed.

It is our opinion that the soils encountered in the excavation are natural soils and suitable for foundation loads of up to 2,000 psf without detrimental settlement.

The observation on April 24 was made after the site had received a rather heavy rain the previous night. The rain had washed out a portion of the soil under a footing near the northeast corner of the existing building.

We recommend removing the wet disturbed soil and filling below the footing with non-shrink grout.

The excavation south of the existing building had up to 8 inches of water in the excavation. It was also observed that some soil had washed into the excavation. We recommend that all wet, soft, washed and disturbed soils be removed prior to placing concrete.

It should be noted that standard penetration test borings with power equipment were not taken to evaluate the soils at depth. However, the soils which were visible and the results of the hand auger probes indicate that the risk of detrimental settlement due to poor soils at depth is very small and we, thus, recommend that it be assumed by the owner. The cost for taking soil borings to better define that risk does not appear warranted.

The services of our geotechnical and material engineers for this project have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area under similar budget and time restraints. This is our professional obligation. No warranty, expressed or implied, is made.

It has been a pleasure to be of service to you on this project. If you have any questions or if we can be of further assistance on this project, please feel free to call us at your convenience.

Very truly yours,

BRAUN ENGINEERING TESTING, INC.

Greg Hain
Engineering Assistant

Dale R. Allen, P.E.
Area Engineer

GH/DRA:jm

cc: TSP/ADG

Building and Safety Dept.

BRAUN

SECTION 00 41 13

BID FORM – STIPULATED SUM (SINGLE-PRIME CONTRACT)

QUARRY HILL NATURE CENTER – SAFE ROOM ADDITION

BID OPENING TIME: 11:00 AM, local time

BID OPENING DATE: TUESDAY, JUNE 30, 2015

BID OPENING LOCATION:
CITY HALL
201 4TH STREET SE – ROOM 135
ROCHESTER, MN 55904

ARCHITECT:

Armon Architecture Inc.
11 Fourth Street SW
Rochester, Minnesota 55902

DELIVER SEALED BIDS TO:

City of Rochester
City Clerk
201 4th Street SE
Room 135
Rochester, MN 55904

BASE BID:

I (the undersigned) have examined the site where the work is to be executed and become familiar with local conditions affecting the cost of the work. I have carefully examined all the contract documents, the drawings, specifications and addenda thereto. I propose and agree to provide all labor, materials, equipment, transportation and facilities necessary as herein stipulated for the complete and satisfactory execution of the general construction work for the base bid sum of:

Total Material Costs: _____
(Material Lump Sum)

Total Labor Costs: _____
(Labor Lump Sum)

I agree to furnish, at the request of the Owner, a "Performance Bond" and a "Labor and Materials Payment Bond" each in the full amount of the contract and in accordance with the contract documents for the following amount:

Add $_____ to Labor Lump Sum

I estimate the project will be completed in _____calendar days after the start of project

ALTERNATES:

ADD / DEDUCT ALTERNATE G-1:
Use 8" thick precast concrete wall panel (standard finish) construction in lieu of 8" CMU walls.

If elected, the following amount would be **ADDED / DEDUCTED** from the base bid:

_____ (Material Lump Sum)

_____ (Labor Lump Sum)

ADD ALTERNATE G-2:
Install landscaping as shown on sheet C2.0 – Landscape Plan

If elected, the following amount would be **ADDED** to the base bid:

_____ (Material Lump Sum)

_____ (Labor Lump Sum)

PROPOSED SCHEDULE OF VALUES:

Based on the Bid sum above, I propose the following Schedule of Values (use of dollar amount is for information purposes only):

Division / Section	Description	Scheduled Value	
		Material	Labor
Div 01	General Requirements		
Div 02	Demolition		
Div 03	Cast-in-place Concrete		
Div 04	Masonry		
Div 05	Metals		
Div 06	Carpentry and Exterior Sheathing		
Div 07	Thermal and Moisture Protection		
Div 08	Openings		
Div 09	Finishes		
Div 10	Specialties		
Div 21	Fire Supression		
Div 22	Plumbing		
Div 23	HVAC		
Div 26	Electrical		
Div 28	Electronic Safety and Security		
Div 31	Earthwork		

Material TOTAL: _____

Labor TOTAL: _____

In case of contract award, the following subcontractors will be used and it is my full understanding that these subcontractors cannot be charged without the express approval of the Architect and Owner (use of the dollar amount figures stated for their respective work is for information purposes only).

Subcontractor 1:

Name:_____

Subcontract: $_____ (Material Lump Sum)

$_____ (Labor Lump Sum)

Subcontractor 2:

Name:_____

Subcontract: $_____ (Material Lump Sum)

$_____ (Labor Lump Sum)

Subcontractor 3:

Name:_____

Subcontract: $_____ (Material Lump Sum)

$_____ (Labor Lump Sum)

Subcontractor 4:

Name:_____

Subcontract: $_____ (Material Lump Sum)

$_____ (Labor Lump Sum)

Subcontractor 5:

Name:_____

Subcontract: $_____ (Material Lump Sum)

$_____ (Labor Lump Sum)

(Attach additional sheet if necessary)

BID SECURITY:
Each bid shall be accompanied by either a certified check, payable to the Owner, in the sum of not less than five percent (5%) of the total base bid, or a corporate surety bond for the same amount issued by a surety company duly authorized to do business in the state of Minnesota. The check or bond is submitted as bid security, conditioned upon the Bidder entering into a contract with the Owner in accordance with the terms of the bid. It is agreed that the bid security will constitute liquidated damages, and not a penalty, for the failure or refusal of the successful Bidder to execute and deliver the Owner-Contractor Agreement, in a correct form, within ten (10) days after receipt.

A Bid Security is required for the materials bid and a separate Bid Security is required for the labor bid.

PERFORMANCE AND LABOR AND MATERIALS PAYMENT BOND:
The successful bidder will furnish a Performance Bond to the Owner as listed above.

In submitting this bid, I agree:

1. To hold this bid open for 30 days.
2. To enter into and execute a contract, if awarded, on the basis of this bid.
3. To accomplish work in accord with the contract documents.
4. To furnish "Performance and Labor and Material Payment Bonds" in accordance with contract documents.
5. To complete the work by the date stated above.

I have received the following addenda and have included their provisions in my bid:

Addendum No. _____ Dated _____ Addendum No._____ Dated _____

Addendum No. _____ Dated _____ Addendum No._____ Dated _____

Addendum No. _____ Dated _____ Addendum No._____ Dated _____

ALTERATIONS/ERASURES:
A bid form shall be rejected if it contains any alteration or erasure unless the alteration or erasure is corrected as herein provided. An alteration or erasure must be crossed out and the correction thereof printed in ink or typewritten adjacent to the alteration or erasure and initialed in ink by the person signing the bid. Enter the bid and any alternate amounts in both written format and numerically. In the event that any price used in determining the lowest responsible bid is in discrepancy, the written representation shall take precedence.

Firm Name: _____

By: _____

Title: _____

OFFICIAL ADDRESS: _____

_____

ZIP CODE: _____

TELEPHONE NUMBER: _____

E-MAIL ADDRESS: _____

END OF SECTION

SECTION 00 45 13.13

RESPONSIBLE CONTRACTOR CERTIFICATE FORM

STATE OF MINNESOTA – RESPONSIBLE CONTRACTOR CERTIFICATE

City Project Number _____

A responsible contractor is defined in Minnesota Statutes §16C.285, subdivision 3. Any prime contractor or subcontractor who does not meet the minimum criteria under Minnesota Statutes §16C.285, subdivision 3, or who fails to verify that it meets those criteria, is not a responsible contractor and is not eligible to be awarded a construction contract for the project or to perform work on the project. A false statement under oath verifying compliance with any of the minimum criteria shall render the prime contractor or subcontractor that makes the false statement ineligible to be awarded a construction contract for the project and may result in termination of a contract awarded to a prime contractor or subcontractor that makes a false statement. A prime contractor shall submit to the contracting authority upon request copies of the signed verifications of compliance from all subcontractors of any tier pursuant to subdivision 3, clause 7.

The following is a list of the first-tier subcontractors retained to work on this project (use reverse side for additional space) and I have obtained responsible contractor certificates from each for this project:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

By signing this statement, I, _____ (typed or printed name),_____ (title) certify that I am an owner or officer of the company and do verify under oath that my company is in compliance with each of the minimum criteria listed in the law.

_____

(name and business address of the person, partnership, or corporation submitting this proposal)

Signed:_____ _____
(bidder or authorized representative) Date

Subscribed and sworn to before me this

_____day of _____, 20_____

_____
Notary Public

My Commission Expires _____, 20____

END OF SECTION

SECTION 00 45 13.16

SUPPLEMENTAL RESPONSIBLE CONTRACTOR CERTIFICATE

STATE OF MINNESOTA – CONTRACTOR'S SUPPLEMENTAL RESPONSIBLE CONTRACTOR CERTIFICATE

City Project Number _____

A responsible contractor is defined in Minnesota Statutes §16C.285, subdivision 3. Any prime contractor, subcontractor or motor carrier who does not meet the minimum criteria under Minnesota Statutes §16C.285, subdivision 3, or who fails to verify that it meets those criteria, is not a responsible contractor and is not eligible to be awarded a construction contract for the project or to perform work on the project. A false statement under oath verifying compliance with any of the minimum criteria shall render the prime contractor, subcontractor or motor carrier that makes the false statement ineligible to be awarded a construction contract for the project and may result in termination of a contract awarded to a prime contractor, subcontractor or motor operator that makes a false statement. A prime contractor shall submit to the contracting authority upon request copies of the signed verifications of compliance from all subcontractors of any tier and motor carriers pursuant to subdivision 3, clause 7.

The following is a list of the first-tier subcontractors and motor carriers retained to work on this project (use reverse side for additional space) and I state under oath that I have obtained responsible contractor certificates from each for this project:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

By signing this statement, I, _____(typed or printed name), _____(title) certify that I am an owner or officer of the company and do verify under oath that my company is in compliance with each of the minimum criteria listed in the law.

_____

(*name and business address of the person, partnership or corporation submitting this proposal*)

Signed: _____ _____

(bidder or authorized representative) *Date*

END OF SECTION

SECTION 00 45 13.19

AFFIRMATIVE ACTION CERTIFICATE FORM

TO THE CITY OF ROCHESTER

"I hereby certify that I am in compliance with Minnesota Statutes Section 363 as amended by Laws of 1969, and (check one of the two below, as applicable";

[ ] Have a certificate of compliance issued by the Department of Human Rights.

[ ] Claim an exemption from Section 363.073 of Minnesota Statutes for this project. (See note below)

_____

Signature of Bidder

POSITION:_____

NAME OF FIRM:_____

DATE:_____ 20_____

This form may be used to furnish proof of necessary compliance with Minnesota Statutes, Section 363, implementing the rules and regulations of the Minnesota Department of Human Rights. All questions should be referred to the Minnesota Department of Human Rights, Compliance Division, 500 Bremer Tower, St. Paul. Minnesota 55101. Telephone (612) 296-5663 or toll free 1-800-652-9747 and ask for the Minnesota Human Rights Department.

END OF SECTION

SECTION 00 65 19.26

FINAL SETTLEMENT CERTIFICATE FORM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Contractor shall complete, sign, and submit this certification with his final pay request. This certification is required from the contractor before final payment will be considered or made.

B. Certification of final payment:

We, the undersigned contractors, in addition to acceptance of final payment of Payment Request Forms as paid in full, do hereby certify to the Owner that we have, in fact, paid all of our subcontractors, supplies, sub-subcontractors, all monies due them for work done on this project and also certify that all materials and labor directly furnished by our company are paid in full, leaving a zero net balance due on the contract. We also certify that we are not aware of any liens being directed toward the Owner or any of its agents, pertaining to the work under this contract.

PROJECT NAME:_____

CONTRACTOR'S NAME:_____

CONTRACTOR'S SIGNATURE:_____

DATE:_____

END OF SECTION

SECTION 00 65 36

CONTRACTOR WARRANTY FORM

PROJECT: _____

LOCATION: _____

OWNER: _____

We _____
(company name)

General Contractor for the above referenced project, do hereby warrant that all labor and materials furnished and work performed are in accord with the contract documents and authorized modifications thereto, and shall be free from defects due to defective materials or workmanship for a period of one year from date of substantial completion.

This warranty commences on _____
(date of certificate of occupancy)

and expires on _____
(one year from commencement date)

Should any defect develop during the warranty period due to improper materials, workmanship or arrangement, the same shall, upon written notice by the Owner, be made good by the undersigned at no expense to the Owner.

Nothing in the above shall be deemed to apply to work which has been abused or neglected by the Owner.

Date: _____ For: _____

By: _____

Title: _____

Date: _____

END OF SECTION

SECTION 00 65 36.10

SUBCONTRACTOR WARRANTY FORM

PROJECT: _____

LOCATION: _____

OWNER: _____

We _____
(subcontractor)

Subcontractor for _____,
(list trade)

as described in specification Section(s) _____

_____
(list appropriate sections)

do hereby warrant that all labor and materials furnished and work performed in conjunction with the above referenced project are in accord with the contract documents and authorized modifications thereto, and shall be free from defects due to defective materials or workmanship for a period of _____ year(s) from date of substantial completion.

This warranty commences on _____
(date of certificate of occupancy)

and expires on _____
(expiration date)

Should any defect develop during the warrant period due to improper materials, workmanship or arrangement, the same shall, upon written notice by the Owner, be made good by the undersigned at no expense to the Owner.

Nothing in the above shall be deemed to apply to work which has been abused or neglected by the Owner.

Date: _____ For: _____

By: _____

Title: _____

Date: _____

END OF SECTION

SECTION 00 65 36.20

ROOFING WARRANTY FORM

WHEREAS _____

of (address) _____

herein called the "Roofing Contractor" has performed roofing and associated "work", on the following project:

OWNER: _____

ADDRESS: _____

NAME AND TYPE OF BUILDING:_____

ADDRESS: _____

AREAS/S OF WORK: _____ DATE OF ACCEPTANCE: _____

WARRANTY PERIOD: _____ DATE OF EXPIRATION: _____

AND WHEREAS, Roofing Contractor has contracted (either directly with Owner of indirectly as a subcontractor) to warranty said work against leaks and faulty or defective materials and workmanship for designated warranty period.

NOW THEREFORE, Roofing Contractor hereby warranty, subject to terms and conditions herein set forth, that during warranty period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work, and as are necessary to maintain said work in watertight condition.

This warranty is made subject to the following terms and conditions:

1. Specifically excluded from this warranty are damages to work and other parts of the buildings, and to building contents, caused by:
   - a Lightening, windstorm
   - b Fire
   - c Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration and decomposition
   - d Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports and other edge conditions and penetrations of the work
   - e. Vapor condensation on bottom of roofing.
   - f. Activity on roofing by others, including Construction Contractors, maintenance personnel, other persons, and animals whether authorized or unauthorized by Owner.

   When work has been damaged by any of foregoing causes, warranty shall be null and void until cost and expense thereof has been paid by Owner or by another responsible part so designated.

2. The Roofing Contractor is responsible for damage to work covered by this warranty, but is not liable for consequential damages to building or building contents, resulting from leaks or faults or defects of work.

3. During warranty period, if Owner allows alternations of work by anyone other than Roofing Contractor, including cutting, patching and maintenance in connection with penetrations, attachment of other work and positioning of anything on roof, this warranty shall become null and void upon date of said alterations, but only to extent said alterations affect work covered by this

warranty. If Owner engages Roofing Contractor to perform said alterations, warranty shall not become null and void, unless Roofing Contractor, prior to proceeding with said work, shall have notified Owner in writing, showing reasonable cause for claim that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this warranty.

4. During warranty period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray cooled surface, flooded basin, or other use of service more severe that originally specified, this warranty shall become null and void upon date of said change, but only to extent said change affects work covered by this warranty.

5. The Owner shall promptly notify Roofing Contractor of observed, known, or suspected leaks, defect or deterioration, and shall afford reasonable opportunity for Roofing Contractor to inspect work and to examine evidence of such leaks, defects or deterioration.

6. This warranty is recognized to be the only warranty Roofing Contractor on said work, and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to him in cases of roofing failure. Specifically, this warranty shall not operate to relieve Roofing Contractor of responsibility for performance of original work in accordance with requirements of the contract documents, regardless of whether contract was a contract directly with Owner or a subcontractor with Owner's general Contractor.

ON WITNESS THEREOF, instrument has been duly executed this _____ day of _____, 20____.

FIRM NAME: _____

BY: _____

TITLE: _____

DATE: _____

END OF SECTION

SECTION 00 72 00

GENERAL CONDITIONS OF THE CONTRACT

PART 1 GENERAL

1.01 SECTION SUMMARY

A. AIA Document A201-2007 - "*General Conditions of the Contract for Construction*," published by the American Institute of Architects, hereinafter referred to as the "AIA General Conditions" or the "General Conditions" shall be considered an integral part of this specification. A copy of this AIA Document A201 is available to be viewed at the Architect's office.

1. Note that the "AIA General Conditions" contain changes and additions which have been incorporated directly into the attached printed document.
    a. Where any part is modified or deleted, the modified or deleted portion of text is lined out.
    b. Where any text is added, this new text is underlined.
    c. Unaltered provision shall remain in effect.
2. The "AIA General Conditions" as modified shall apply to all divisions and/or sections of work.
3. Note that DIVISION 1 - GENERAL REQUIREMENTS contains additional specific information relative to the basic requirements of the General Conditions.

END OF SECTION

PURCHASING AGENT AGREEMENT

THIS AGREEMENT is made by and between _____ ("Agent") and _____ ("Owner"), a Minnesota city generally exempt from paying state sales and use tax under Minn. Stat. § 297A.70; and

WHEREAS, Owner is undertaking the construction on its property of certain improvements generally described as Quarry Hill Nature Center - Safe Room Addition ("the Project"); and

WHEREAS, Owner wishes to purchase on its own account materials, supplies and equipment for the Project (collectively "Tax-Exempt Materials") as described in the attached Exhibits 1 and 2; and

WHEREAS, Owner has solicited separate bids for the Tax-Exempt Materials, the award of which was not contingent upon the successful award of any other part of the Project; and

WHEREAS, Agent is the successful bidder for the Tax-Exempt Materials; and

WHEREAS, Agent desires to act as Owner's purchasing agent for purposes of acquiring the Tax-Exempt Materials for use exclusively in the Project

IT IS THEREFORE AGREED between the parties hereto that:

1. This Agreement is made with reference to, and where applicable shall be governed by, the specifications and provisions set forth in the Contract Documents as such are defined in the Owner/Contractor Agreement for the Project.

2. Owner appoints Agent to act as its purchasing agent for purchasing the Tax-Exempt Materials, and further authorizes Agent to appoint such subagents as Agent deems appropriate for carrying out the purposes of this Agreement, which subagents shall have similar powers of appointment.

3. It is understood and agreed that: (a) Owner takes title to the Tax-Exempt Materials at the point of delivery; (b) Owner assumes the risk of loss for all Tax-Exempt Materials; and (c) Owner bears all risk for defects in the Tax-Exempt Materials, including Tax-Exempt Materials incorporated into the real estate.

4. Agent (and any subagents) shall include the following Notice to Vendors/Suppliers in all purchase orders and other documents furnished to a vendor or supplier in connection with the purchase of any Tax-Exempt Materials:

NOTICE TO VENDORS/SUPPLIERS

The materials to which this document relates are being purchased by _____ _____ *(name of Agent)* as the purchasing agent of City of Rochester ("the Owner"). It is the Owner's obligation, not the purchasing agent's, to pay for the materials. Because the Owner is a city of Minnesota, this purchase is exempt from sales tax under Minn. Stat. § 297A.70.

5. Agent shall exercise reasonable care in performance of its duties as purchasing agent, including the inspection of the Tax-Exempt Materials for obvious or apparent defects or the failure of such materials to conform to the plans, specifications and all Contract Documents relating to the Project.

6. Owner shall pay the sum of _____ for all of the Tax-Exempt Materials purchased by Agent under this Agreement. Agent shall direct vendors and suppliers to deliver invoices for the Tax-Exempt Materials to Owner in care of Agent at _____ _____ *(Agent's address)*. Agent shall submit invoices for payment to Owner, which invoices shall be due and payable upon Owner's receipt of the invoices. The contract sum includes the following Alternates which are described in the Contract Documents and are hereby accepted by the Owner:

Alternate # G-01: Precast wall panels $_____
Alternate # G-02: Landscaping $_____

7. Unit Prices: Not Used

8. Agent shall promptly notify Owner of any sales and use tax audit by the Minnesota commissioner of Revenue or of the threatened imposition or assessment of any sales or use taxes. Owner may, at its sole option and cost, dispute, contest or otherwise resist the imposition or assessment of any such taxes. Upon reasonable notice to Owner, Agent may (but is not obligated to) take such actions as it deems reasonable in response to the threatened imposition or assessment of taxes, which actions shall be deemed to have been taken on Owner's behalf. If any Minnesota sales or use taxes are imposed or assessed with respect to any Tax-Exempt Materials purchased pursuant to this Agreement, Owner shall be solely responsible for the payment of such taxes, including any related penalties and interest, and shall hold Agent harmless and indemnify Agent from any such cost or expense related thereto, including any legal fees and costs incurred by Agent in connection therewith or in connection with the enforcement of this paragraph.

9. The agency relationship created by this Agreement is intended to be in compliance with Minnesota Rule 8130.1200 and its current interpretation by the Minnesota Department of Revenue.

10. The alternative dispute resolution provisions (if any) in the Owner/Contractor Agreement are incorporated herein by reference and are applicable to any dispute between the parties hereto arising out of this Agreement.

11. Owner may terminate this Agreement at any time and for any reason. Upon receiving notice of termination, Agent shall cease making any purchases and shall promptly notify any subagents it has appointed that such appointment has likewise been terminated, that they are to cease initiating any new purchases, and that they are to likewise notify any subagents they have appointed that they are to cease initiating any new purchases. Any purchases that were initiated by Agent or subagent prior to its receiving notice of termination and that cannot be reasonably reversed after it received notice of termination shall be deemed to have been made with authority.

12. The provisions of this Agreement shall be binding upon and inure to the benefit of the parties and their respective heirs, legal representatives, assigns, and any subagents appointed pursuant to this Agreement.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement this ___day of _____, _____.

OWNER: By: _____

Its: _____

OWNER: By: _____

Its: _____

AGENT: By: _____

Its: _____

Attachments:

SECTION 01 11 00

SUMMARY OF WORK

PART 1 GENERAL

1.01 GENERAL DESCRIPTION OF THE WORK

A. The following is a general description of the work required for the building renovation, construction, and site work for the project named on the title page, hereinafter specified and shown on the drawings.
   1. Unless otherwise specified, the Contractor shall supply labor, transportation, materials, apparatus, fuel, energy, light, scaffolding, tools, services and incidentals necessary for the entire, proper and final completion of his/her work, and shall install, maintain and remove all equipment of the construction and other utensils or items, and be responsible for the safe, proper and lawful construction, maintenance and use of same, and shall construct in the best and most workmanlike manner, a complete project including everything properly incidental thereto as shown on the plans, stated in specifications and reasonably implied therefrom, all in accordance with the contract documents.
   2. The extent of work required of each section contained within this Project Manual shall be the completion of work stated in the section title together with all other relative and necessary items indicated on the drawings and/or specified herein.
      a. Section Includes: It is the responsibility of the Contractor to establish the extent of the work required for each section in order to complete the project. However, on occasion a list is provided for the convenience of the Contractor to expedite bidding. The Contractor shall verify the completeness of such a list.
         1) Include Work Specified Elsewhere: Work required to be provided under this section of work in accordance with the provision of another section.
      b. Related Sections (and work): On occasion and for the convenience of the Contractor, a list of work provided under other sections of the specifications, by others or the Owner, is included. Completeness of such a list shall be verified by the Contractor.
         1) Work required to be provided under other sections of work as per this section shall be listed here for information.

B. Contract Limits:
   1. The contract limits of this project are defined by the property lines indicated on the drawings unless construction limits are specifically noted otherwise.
   2. Work required on public property such as sidewalks, curb, gutter, utilities, landscaping, paving and other improvements indicated shall be provided and considered within the contract limits.

1.02 LAYING OUT WORK

A. Contractor shall, immediately upon entering project site for purpose of beginning work, locate all general reference points and take such action as is necessary to prevent their destruction, lay out his/her own work and be responsible for all lines, elevations and measurements of building, grading, paving, utilities and other work executed by him/her under the contract. He/she must exercise proper precaution to verify figures shown on drawings before laying out work and will be held responsible for any error resulting from his/her failure to exercise such precaution.

1.03 WORK UNDER THIS CONTRACT

A. Work is under one stipulated sum unified contract, which shall include all phases of work with the General Contractor, the Prime Contractor.
   1. See Section 01 23 00 for Alternates to be provided to the Owner.

B. Proposals:
   1. General Construction Proposal: All general construction work required for the project complete as shown on the drawings and described in the project manual.

1.04 QUALITY ASSURANCE

A. Codes: Comply with all applicable requirements of governing authorities and codes for each trade and type of construction indicated.

B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts, who are completely familiar with the specified requirements and the methods needed for proper performance of the work of each section and have a minimum of five-years experience in the type of work shown specified.

C. Reference in the specifications to known standards, such as codes, specifications, etc., promulgated by professional or technical associations, institutes and societies, are intended to mean the latest edition of each such applicable standard adopted and published as of the date of the invitation to bid on this project except where otherwise specifically indicated. Each such standard referred to shall be considered a part of the specifications to the same extent as if reproduced therein in full.
   1. Where a conflict occurs between referenced documents and project specifications, the most stringent requirements govern.

D. The following is a representative list of such association, institutes and societies, together with the abbreviation by which each is identified.

AAN	American Association of Nurserymen
AASHO	American Association of State Highway Officials
ACI	American Concrete Institute
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
API	American Petroleum Institute
ASA	American Standards Association
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWS	American Welding Society
AWWA	American Water Works Association
BIA	Brick Institute of America
CSI	Construction Specifications Institute
DOT	Department of Transportation
FIA	Factory Insurance Association
LSC	Life Safety Code
MDI	Metal Deck Institute
Mn/DOT	Minnesota Department of Transportation
NCMA	National Concrete Masonry Association
NEC	National Electrical Code
NFPA	National Fire Protection Association
SCPI	Structural Clay Products Institute
IBC	International Building Code
IFC	International Fire Code
UL	Underwriter's Laboratories, Inc.
USASI	United States of American Standards Institute

1.05 WORK PERFORMED UNDER SEPARATE CONTRACT

A. The Owner reserves the right to let separate contracts for work not included in these contract documents.
   1. Items or work noted "N.I.C." are not included in the contract. Provide necessary provisions in the work of the project to permit proper installation of N.I.C. items or work.
   2. Conditions of cooperation between Contractors apply to everyone working on the project including work let under separate contracts.

1.06 INSPECTION

A. Prior to commencing the work installed under each section of work, the Contractor for that section of work shall examine the areas and conditions under which the work will be performed. Notify the Architect, in writing, of unacceptable conditions that exist, prior to acceptance. Do not commence work until unacceptable conditions are corrected. Commencement of any or all work shall be understood as acceptance of existing conditions and substrate.

1.07 INSTALLATION

A. Install each section of work in strict accordance with the original design, the approved shop drawings, pertinent requirements of government agencies having jurisdiction and the manufacturer's recommended installation procedures as approved by the Architect, installing all systems and components firmly into position for long life under hard use.

B. Each Contractor shall protect adjacent and adjoining finished surfaces and work from damage during installation of new work. Repair damages resulting from inadequate or unsuitable protection.

C. Each Contractor shall protect all work installed according to manufacturer's recommended procedures and as herein (project manual) specified. Any damaged or defective materials shall be repaired or replaced by the Contractor to the satisfaction of the Architect.

1.08 COORDINATION

A. General Contractor: Maintain coordination of the project at all times.
   1. All Contractors and subcontractors: Coordinate work with others and cooperate to facilitate orderly progress of work. Perform all work in proper sequence with other Contractors. Join work to that of others in accordance with drawings and specifications. Before proceeding, verify that all inspections required have been made and that all necessary approvals have been secured.
   2. Arrange work and dispose of materials in a manner that will not interfere with the work and storage of materials of other Contractors. Allow all other trades reasonable opportunity to install their work and store materials.
   3. Give adequate notice and information to other Contractors for any special condition required for installation of work in conjunction with other Contractors. Make and pay for any alterations and repairs necessitated by failure to so notify affected Contractors.

B. Final decisions as to the right-of-way and location of ducts, pipes, fixtures and similar items in conflict will be made by the Architect at pre-arranged project conferences with all Contractors present.

1.09 MEANS AND METHODS

A. Means and methods of construction shall be such as the Contractor may choose, subject, however, to the Architect's right to reject means and methods proposed which:
   1. Constitute a hazard to the work, persons, or property.
   2. Will not produce finished work in accordance with terms of the contract.
   3. Are contrary to specific means or methods included in contract.

B. The right to reject means and methods of a Contractor shall not be construed or interpreted as acceptance of control of means and methods by the Architect.

C. The Architect's approval or failure to exercise right to reject means and methods shall not relieve the Contractor of his/her obligation to complete the work required by the contract.

D. Total responsibility for control of all means and methods lies with the Contractor for all work for which he/she is responsible.

1.10 MANUFACTURER'S SPECIFICATIONS

A. Manufacturer's products and processes included in the specifications by reference are included in the specifications as if written in their entirety.
   1. Products and processes included in the specifications shall conform to the manufacturer's latest published specifications as of the bid date.
   2. When products and processes installed in accordance with manufacturers' recommendations and instructions fail, the manufacturer shall assume full responsibility and bear all costs necessary to provide acceptable installation.

B. Upon request of the Architect, provide a sworn affidavit from the manufacturer certifying that material, products, processes delivered and used on the project, meet the specified requirements. Affidavit shall not relieve Contractor from his/her responsibility for full compliance with the requirements of the specifications.

1.11 SPECIAL SITE CONDITIONS

A. **Precaution**: General Contractor and all subcontractors take note and coordinate all work accordingly.
   1. Geotechnical Evaluation for this project is bound in with Section 00 31 32 – Geotechnical Data and Site Information.
   2. It shall be the Contractors responsibility to provide weather sensitive grading and excavation, restricted and controlled construction traffic, placement of temporary coarse aggregate roadways, de-watering, placement of stabilization fill and/or other such means, and methods necessary to maintain the site in a stable condition for required bearing capacity of all project construction/improvements and construction operations.
   3. Failure to maintain the soil stable shall required the Contractor to remove the unstable soils and provide the necessary corrective measures without additional compensation.

B. Provide and maintain barricades with appropriate lighting to properly identify all hazards.

C. **The natural environment is a key element to the Nature Center’s identity and educational programs. Contractor to coordinate with Owner for construction traffic routes, staging area, and environmental protection.**

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 GENERAL

1.01 SECTION SUMMARY

A. To enable the Owner to compare total costs where alternative materials and methods might be used, or establish cost effective use of capital improvements, alternates have been established as described on the drawings and/or in this section of these specifications.

B. Related Work:
1. Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, sections in Division 01 and other pertinent sections of these specifications except as modified in the description of the alternate.
2. Method for stating the contract sum for the proposed change is shown on the bid form.

1.02 SUBMITTALS

A. All alternates described in this section are required to be reflected on the bid form submitted by the bidder.

1.03 ALTERNATE SELECTION

A. If the Owner elects to proceed on the basis of one or more of the described alternates, make modifications to the work required in providing the selected alternates to the approval of the Architect and at no additional cost to the Owner except as proposed on the bid form.

1.04 ADVANCE COORDINATION

A. Immediately after award of the contract, or as soon thereafter as the Owner has made a decision on which if any of the alternates will be selected, thoroughly and clearly advise necessary personnel and suppliers as to the nature of alternates selected by the Owner.

PART 2 ALTERNATES

2.01 ALTERNATE SPECIFICATIONS/DESCRIPTIONS

A. Descriptions:
1. **"Add Alternates":** The amounts stated on the Contractors Bid/Proposal for each Add Alternate may be added to the Contractor's "Base Bid" amount for the addition of the work ascribed to each "Add Alternate."
2. **"Deduct Alternates":** The amounts stated on the Contractors Bid/Proposal for each Deduct Alternate may be deducted from the Contractor's "Base Bid" amount for the work ascribed to each "Deduct Alternate."

B. General Construction:
1. Add / Deduct Alternate G-1: Use 8” thick precast concrete wall panel (standard finish) construction in lieu of 8” CMU walls.
2. Add Alternate G-2: Landscaping as shown

END OF SECTION

SECTION 01 25 13

PRODUCT SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 PRODUCT OPTIONS/SUBSTITUTIONS

A. Products are specified by referenced standards, by manufacturer's name, model number, and/or by trade name. This combined with fitting into this projects design and function, as determined by the Architect and/or Engineer, are the project requirements.
   1. When specified only by referenced standards, the Contractor may select any product meeting the specified standards, by any manufacturer, subject to compliance with project requirements.
   2. When proprietary products with no substitution are specified, substitutions will not be allowed.
   3. Product substitutions which only vary slightly from the project requirements may be submitted with the bid proposal. However, no approvals will be given prior to contract award (see Item B below).
   4. When several products, manufacturers or venders are specified as being acceptable, the Contractor has the option of choosing from among those named subject to compliance with project requirements.
      a. Names of manufacturers and venders listed in the bidding documents are only listed for the convenience of the bidder.
      b. References to a particular product are given for descriptive purposes only.
      c. Products, manufacturers and vendors, in addition to those specifically listed, are acceptable for substitution when proven to the satisfaction of the Architect and/or Engineer that:
         1) The quality level of the proposed manufacturer/vender is equal to or better than the referenced manufacturer's/vendor's quality.
         2) The technical characteristics, including project requirements of function, design and physical dimensions, of the proposed product meets or exceeds that required on the drawings and in the specifications.
         3) The use of the proposed product(s) shall not require major revisions in the project to permit their use.
            a) Any additional cost in other work incurred as a result of these proposed project approvals shall be borne by the Contractor, this includes all costs, foreseen and unforeseen, for modifying other related materials/systems and the cost of any additional engineering or architectural fees required to accommodate the proposed project approvals.

B. **No approvals (prior approvals or substitutions) will be given prior to contract award.**
   1. The Contractor must be confident that the products he/she bases his/her bid upon meets or exceeds the project requirements indicated on the drawings or in the specifications.
   2. It is the Contractor's responsibility to verify and demonstrate that the product he/she bid or the proposed (substitute) product he/she bid meets or exceeds the drawings and specifications at the time of shop drawing review.
      a. If a proposed product is determined to be technically unacceptable as judged by the Architect/Engineer, the Contractor shall be required to supply products that meet the requirements stated on the drawings and in the specifications.
      b. Under no circumstance will the Architect/Engineer be required to prove that a proposed product (substitution) is not equal to the project requirements. The decision of the Architect/Engineer on such requests/proposals is final.

C. In the event that specified items cannot be delivered to the job site and incorporated into the work at such times, and in such quantities as to cause no delay, then the Contractor may request a substitution in the manner described above.

1. Should the accepted substitution provide a cost savings, the contract price shall be adjusted by change order with Owner receiving the benefit of the net savings.
2. No increase in the contract price shall be allowed on substitutions made after the 30 day submittal limit.

D. Inability to obtain specified items due to Contractor's failure to place timely orders shall not be considered reason for authorizing substitutions.

1.02 GENERAL SUBSTITUTION REQUIREMENTS

A. If it is desired to use products different from those indicated in the contract documents, the Contractor requesting the substitution shall make written application as described herein. The burden of proving equality of proposed substitutions rests on the party making the request for substitution.
   1. Requests for substitution shall be made to permit adequate time for approval.
      a. Requests will be considered from the Contractor only, for 30 days following contract award, and prior to shop drawing, product data or sample submittal.
      b. Contract sum shall be based only on products and systems specified in the contract documents and as stated in paragraph 1.01 of this Section 01 25 13.
   2. Requests for substitution shall be accompanied by technical data the party making the request desires to submit. Architect shall consider reports from independent testing laboratories, verified experience records from previous users and other printed or written information valid in the circumstances.
   3. Requests for substitution shall indicate in what respects proposed materials or products differ from those specified.
   4. Requests for substitution shall be accompanied by the manufacturer's dated product data describing the installation, use and care, as applicable, of proposed substitution.
   5. Requests for substitution shall be accompanied by samples or product literature of that specified for comparison with the requested substitution if requested by the Architect.
   6. Requests for substitution shall be accompanied by complete cost data, indicating material cost, installed cost and savings if any, resulting from proposed substitution.
   7. Determination as to acceptability of proposed substitution will be made based only on data submitted.

1.03 ARCHITECT'S/ENGINEER'S DECISION

A. The appropriate decision on such submittals/substitutions shall be issued to the Contractor within 30 days after Contractor's submittal is received by the Architect.
   1. Based on the Architects/Engineers decision, the Contractor shall make any necessary modifications to the work and/or arrangements for the work to proceed in accordance with such decisions and the project requirements.
   2. Changes in costs to the Owner shall be as previously stated in this Section 01 25 13.
   3. Changes in contract time of completion shall be handled separately but in the same manner as stated for costs to the Owner.

B. **NOTE:** Substitutions shown for the first time on shop drawings and even if approved by the Architect does not constitute approval of substitutions.

END OF SECTION

SECTION 01 31 19

PROJECT MEETINGS

PART 1 GENERAL

1.01 PRECONSTRUCTION CONFERENCE

A. Soon after award of contract and prior to the start of construction, each Prime Contractor shall attend a preconstruction conference with representatives of the Owner and the Architect.
   1. Location of the conference will be at the project site at a mutually agreed upon date and time.
   2. Review of project schedule, contract documents, contract administration, construction meetings and resolving project questions will be discussed.
   3. Contractor will take and send notes concerning major points that were discussed during the conference to all Prime Contractors and Owner.

1.02 CONSTRUCTION PROGRESS MEETINGS

A. Bi-weekly project progress meetings (minimum of twice a month) shall be held at the project site by the Prime Contractor for the purpose of coordinating and expediting the work progress, unless an alternate schedule is mutually agreed upon. .
   1. Meetings will be scheduled by the Prime Contractor with timely notification of all Contractors, Owner, Architect and Engineers. The Owner and/or Architect may at their discretion call for Construction Progress Meetings.
   2. Attendance at project progress meetings by all Contractors or their authorized representative, is mandatory.
   3. Contractors shall give verbal reports of progress on the project, discuss the work schedule for the coming period and present all conflicts, discrepancies or other difficulties for resolution.
   4. The Prime Contractor shall take notes of topics discussed and send timely copies to all Contractors, Architect, Owner and Engineers.

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to "General Conditions" for basic requirements for all submittals.

B. Refer to technical specifications for additional submittals required.

1.02 CONSTRUCTION SCHEDULE

A. The General Contractor will be required to furnish a construction schedule as required under Article 3.10 of the "General Conditions" and "Supplemental General Conditions". Monthly updates are required as part of Request for Payment applications.

B. Submit a project construction schedule to the Architect for approval within ten days after award of contract or the preconstruction conference, whichever is earlier.
   1. Bar graph type is acceptable and shall include:
      a. Breakdown of work activities similar to specifications section and segmented as necessary to allow close monitoring of work progress during construction
      b. Order of work shall be as necessary to meet time of completion as set forth on the proposal form and/or as stated in contract documents.
   2. After necessary revisions and approval by the Architect, provide one print of project construction schedule for each Prime Contractor, prime subcontractor and two copies of the Architect.
   3. Upon request of the Architect, update the schedule to reflect changes required by actual conditions and indicate actual work completed. Provide the Architect with same number of copies as required for original submission.

C. At the Contractor's option, he/she may submit a CPM or PERT project schedule containing all information required by this section.

1.03 SUBCONTRACTORS AND MATERIALS LIST

A. Each Prime Contractor: Within ten days after award of contract or at the preconstruction conference, whichever is earlier, submit a subcontractors and materials list in form approved by Architect.
   1. The Architect will promptly review list and indicate in writing approval or disapproval of subcontractors and/or materials. Resubmit revised list upon disapproval of any item until such time as approval of all items has been obtained from the Architect.
   2. Use of unspecified or unapproved materials and equipment will not be permitted.
   3. Certificate of payment may be withheld by the Architect until complete approval of subcontractors and materials list has been obtained.

1.04 SCHEDULE OF VALUES

A. Each Prime Contractor shall submit a Schedule of Values as required under Article 9.2 of the "General Conditions" and "Supplemental General Conditions." The values shall be stated in a breakdown similar to the divisions of the specifications on a form compatible with the Application for Payment (AIA Document G702 and G702A). These forms shall be supplied by the Contractor.
   1. This schedule of values shall be approved by the Architect prior to approval of any Contractor pay requests.
   2. Submit within ten days after award of contract or within ten days after receipt of written request from the Architect, whichever is earlier.
   3. Include profit and overhead costs in each item.

4. Certificate of payment may be withheld by the Architect until receipt of a schedule of values is in acceptable form and has been approved.
5. If the project is under a unified contract, each major division of work such as mechanical and electrical shall have a cost breakdown similar as outlined above included with the Prime Contractors breakdown. This shall be furnished by the subcontractor to the Prime Contractor for submittal to the Architect with each request for payment.

1.05 CERTIFICATES OF INSURANCE

A. The Prime Contractor shall submit two copies of certificates of insurance on all insurance required by Article 11 of the "General Conditions" with the Architect. Acceptance of this insurance by the Owner is mandatory before any work is started on the project.

1.06 PROGRESS PAYMENTS

A. The Prime Contractor shall submit request for payment monthly according to Article 9.3 of the "General Conditions" and 9.3 of the "Supplemental General Conditions." Application for payment shall be submitted in triplicate on AIA Document G702 and G702A or similar forms.
1. The Contractor to furnish all forms.
2. Along with each monthly request. The Contractor is to submit an up-to-date progress schedule form showing the current percentage of completion of all the project's construction stages.

1.07 DAILY REPORT - CONTRACTOR'S LOG

A. The Contractor will be responsible to maintain a job status report on a daily basis hereinafter called the "daily report." This report may be in a format designed by the Contractor, but shall show the following information: 1) Contractor's forces on the job by craft, 2) description of work completed that shift by the Contractor, 3) subcontractor's forces on the job and description of their work, 4) list of Owner furnished items received and condition of same, and 5) general status of job in the opinion of the Contractor's superintendent.

1.08 ON-SITE DRAWINGS

A. The Contractor shall be required to keep a current set of drawings in good condition on the job at all times. The Contractor shall also maintain a complete set of drawings current and showing the actual construction of all work as it is actually performed. This set shall be called the "record drawings" (as-built drawings) and shall be turned over to the Architect at the end of the job prior to final payment. **Note: As-built drawings are required to be submitted as part of the closeout documents and the FEMA grant process of this project.**

1.09 TESTING REPORTS

A. Furnish Architect, Engineer and governing authorities each with one copy of the required test reports made by a testing laboratory as soon as tests have been completed.

B. Refer to Section 01 45 29 – Testing Laboratory Services, 01 45 33 – Code-Required Special Inspections, and/or other technical specification sections for testing and report procedures.

1.10 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

A. See Section 01 33 23

1.11 MASTER COLOR SCHEDULE (If not indicated on the drawings or elsewhere)

A. Within 20 days after receipt of approval by the Architect of the list of subcontractors or sooner if the time of completion requires it, secure and supply to the Architect color cards, finish samples and other information for all items requiring a color or finish selection.

1. As soon as is practical, the Architect will supply the Contractor with a master color schedule for the project.
2. Advise Architect of any deadlines for color or finish selections that may be necessary to ensure delivery of materials on schedule.

END OF SECTION

SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Submit shop drawings, product data and samples required by contract documents.
   1. Make submittals promptly and in such sequence as to cause no delay in the work.

B. Shop drawing checking by the Architect is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of plans and specifications. Contractor is responsible for quantities and dimensions which shall be confirmed and correlated at the job site, fabrication processes and techniques of construction, coordination of his/her work with that of all other trades and the satisfactory performance of his/her work

C. Submit submittal schedule to the Architect within ten days after receipt of contract. Designate items to be submitted, dates for submission and dates that reviewed shop drawings, product date and samples will be needed to maintain construction progress.

1.02 CONTRACTOR'S RESPONSIBILITIES

A. Review shop drawings, product data and samples prior to submission.

B. Determine and verify accuracy of:
   1. Dimensions and field measurements.
   2. Quantities required.
   3. Field construction criteria.
   4. Catalog numbers and similar data.
   5. Conformance with specifications and local authorities and jurisdictions.
   6. Coordinate each submittal with requirements of the contract documents.

C. Notify Architect, in writing, at time of submission, of any deviation in the submittals from requirements of the contract documents, identifying such deviation clearly on the submittals. See submission requirements.

D. Begin no fabrication or work which requires submittals until return of submittal from Architect without objection.

E. The use of the term(s) Architect, Professional Engineer, Geotechnical Engineer, Land Surveyor, or Landscape Architect shall imply and require that the person be licensed (licensed by State authority where the project is located) to perform the duties described to that profession.
   1. Certification by a Licensed (licensed by the State where the project is located) Architect, Professional Engineer, Geotechnical Engineer, Land Surveyor or Landscape Architect.
      a. When required by any specification section that materials, items or systems to be furnished, provided or installed are to be designed and/or certified by a professional, the certification of the required responsible professional shall be affixed to the layouts, design, calculations, drawings and data (shop drawings and product data) when submitted for review.
      b. Such certified submittals are also subject to the review and acceptance by the Building (permit/code) Officials.
         1) The Building Officials acceptance is required prior to fabrication and installation in the project.

1.03 SHOP DRAWINGS

A. Drawings shall be presented in a clear and thorough manner.
   1. Plans and details shall be identified by reference to the projects sheet, detail, schedule and room names shown on drawings or the submittals will be rejected.
      a. Provide erection plans and erection details as well as piece drawings.
   2. Drawings shall be of a scale to clearly indicate in detail the product or assembly.
      a. Provide shop drawings in sufficient detail to show fabrication, installation, anchorage and interface of the work of this section with the work of adjacent trades.
      b. Provide material list of items proposed to be provided under this section.
      c. Provide manufacturer's specifications and other data necessary to prove compliance with the specified requirements.
   3. If submitting printed copies, then submit five prints minimum. Otherwise, a clear electronic copy in PDF format is acceptable to be submitted via e-mail to the Architect with a return receipt requested.
      a. For printed copies, the Architect and/or Engineer shall retain two prints of each shop drawing.
      b. Electronic copies shall also be retained by the Architect and/or Engineer.

1.04 PRODUCT DATA

A. Preparation:
   1. Clearly mark each copy to identify pertinent products.
   2. Show performance characteristics and capacities, dimensions and clearances required, mounting or installation requirements, wiring or piping diagrams and controls and other data necessary to prove compliance with project documents.

B. Manufacturer's Standard Schematic Drawings and Diagrams:
   1. Modify drawings and diagrams to delete information which is not applicable to this work, and supplement drawings and diagrams as required to provide complete information applicable to the work.

C. If submitting printed copies, then submit five prints minimum. Otherwise, a clear electronic copy in PDF format is acceptable to be submitted via e-mail to the Architect with a return receipt requested.

1.05 SAMPLES

A. Submitted samples shall be of sufficient size to clearly illustrate:
   1. Functional characteristics of the product, with integral related parts and attachment devices.
   2. Submit three samples of each color, texture, size, etc., as applicable for each material requiring a sample.
   3. Architect shall retain one sample.

B. Mock ups: Not required.

1.06 SUBMISSION REQUIREMENTS

A. Submittals Shall Contain the Following Requirements:
   1. Date of submission and dates of previous submissions.
   2. Project title and number.
   3. Contract identification.
   4. Names of Contractor, supplier, and manufacturer.
   5. Identification of product, with the specification's section number.
   6. Dimensions and quantities of product or material.
   7. Field dimensions clearly identified as such.
   8. Relation to adjacent or critical features of the work or materials.
   9. Applicable standards such as ASTM, ANSI, or Federal Specifications.

10. Identification of deviations from contract documents.
11. Identification of revisions on resubmittals.
12. A 4" x 4" blank space for Architect's stamps.
13. Contractor's stamp, initialed or signed, shall certify verification of the above requirements, verification of the Contractor's responsibilities and coordination of the information with requirements of the work and of the contract documents. This certification required before Architect or Engineer reviews any submittals.
    a. Submission of any shop drawings, product data or samples, whether stamped and signed or not, shall mean the above requirements and the 1.02 Contractor Responsibilities have been complied with by the Contractor.

1.07 ARCHITECTS STAMP DEFINITION

A. Shop Drawings, Product Data and Samples will be reviewed with reasonable promptness and stamped indicating the appropriate action required by the Contractor as follows:
   1. **"No Exception Taken"** means that fabrication, manufacture, or construction may proceed providing submittal complies with Contract Documents.
   2. **"Make Corrections Noted"** means that fabrication, manufacture, or construction may proceed providing submittal complies with Engineer's notation and Contract Documents. If, for any reason, notations cannot be complied with, resubmit as described for submittal stamped "Reject".
   3. **"Revise and Resubmit"** means submittal information is incomplete or ambiguous and therefore clarification or additional information is required to ascertain compliance with the contract documents, and that fabrication, manufacture or construction shall not proceed. Provide additional data required by the contract documents and resubmit.
   4. **"Reject"** means that submittal does not comply with Contract Documents and that fabrication, manufacture, or construction shall not proceed. Resubmit in accordance with requirements of Contract Documents.
   5. **"Submit Specified Item"** means that submittal does not comply with project requirements as submitted and shall not be used on the project. Revise or make a new selection and resubmit compliant item shop drawings, product data, or samples in accordance with requirements of contract documents.

B. In addition, and for your understanding and convenience, the Architects Shop Drawing stamp reads similar to paragraph 1.01, B of this Section 01 33 23.

1.08 RESUBMISSION REQUIREMENTS

A. Shop drawings and product data: Make corrections and changes in the submittal as required by the Architect and resubmit in same quantities and format until approved.

B. Samples: Submit new samples as required for initial submittal.

C. Submission marked "Rejected" or "Revise and Resubmit" or "Submit Specified Item" shall be so revised and resubmitted as originally required.

1.09 SUBSTITUTIONS

A. All material, equipment and processes to be substituted for those specified or shown in the contract documents must be approved by the Architect in writing prior to submittal of shop drawings for the item or work being installed or performed. Substitutions shown on shop drawings approved by the Architect without prior written approval does not constitute approval of a substituted item.

B. Request for substitution shall be in accordance with Section 01 25 13, Product Substitution Procedures.

END OF SECTION

SECTION 01 35 23

SAFETY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Owner and Architect rely on Contractor's expertise to perform a job properly and safely.

B. The Contractors shall be responsible for understanding, enforcing and complying with all governing safety requirements.

1.02 PROCEDURES

A. Contractor is responsible for controlling the manners and methods of its operations and is directly responsible for the safety of its employees. This includes, but is not necessarily limited to, the following general rules:
   1. Appointing a designated representative for project and safety coordination.
   2. Using only designated entrances and exits and observing any site entrance regulations, such as signing in, and complying fully with security procedures.
   3. Reviewing Contractor's safety policies and procedures with all employees. This review must include, but not be limited to, policies on personal protective equipment, hot work, confined space entry, electrical safety, machine lockout/tagout, and emergency evacuation.
   4. Advising employees of hazards associated with the work to be performed.
   5. Providing all tools and equipment for the work, including personal protective equipment.
   6. Keeping Owner's Project Manager/Project Consultants informed of any work that may affect the safety of the Owner's employees or other Contractor's employees.
   7. Ensuring that Contractor's employees know what to do in case of a medical emergency and notification of any OSHA recordable injuries or illnesses.
   8. Ensuring Contractor's and subcontractors' employees wear hard hats and other necessary protective equipment when performing work on Owner's property.

B. Contractor is responsible for giving special attention to the following fire protection safety procedures. This includes, but is not limited to, the following:
   1. Take precautions against fire and comply fully with requirements of Owner and local Fire Department.
   2. Promptly remove combustible building refuse and dispose of it off site.
   3. Provide and maintain for use during the construction period, 10# type ABC (NFPA 4A:60BC) fire extinguishers. Fire extinguishers shall be located so that no construction activity or portion of the work is more than 75 feet away (travel distance) from a fire extinguisher. Fire extinguishers shall remain the property of the Contractor, but shall not be removed until approved by Owner's Project Manager. Maintain the equipment in good operating condition (i.e., fully charged). Instruct and train personnel in the use of extinguishers.
   4. Exercise extreme care in the use of all open flame equipment. The following items are of particular importance and shall be constantly checked:
      a. Contractor's welding, cutting or spark production shall be permitted in flammable liquid areas only if operations are shut down, vapor checks made, solvents removed and automatic sprinklers are in service.
      b. Contractor shall use flameproof tarpaulins to contain sparks and hot metals.
      c. Contractor shall confine flammable liquids in approved containers.
   5. Restrict the use of flammable liquids and gases to a minimum. Store all flammables not actually needed for immediate use outside building, in a secure shelter. Store rags with oily or flammable residue away from flammable liquids.

C. Contractor is responsible for giving special attention to the following operational safety procedures. This includes, but is not limited to, the following:

1. To protect workers from injury, construct removable replaceable handrails, temporary barricades or secured covers for all openings in the roof and floors, open trenches crossing roads and pedestrian walkways and open manholes in accordance with all applicable safety regulations. Such handrails, barricades and covers may be removed only when removal is necessary for the performance of work near the opening, trench or manhole. They shall be replaced when any of the following occur:
   a. The workers take a break and leave the area; or
   b. The work is not completed by the end of the working day; or
   c. As soon as their absence is no longer necessary for the performance of the work.
   d. When such handrails, barricades or covers are removed by Contractor or any subcontractor, they shall be replaced or rebuilt as necessary by the Contractor or subcontractor who removed them.
2. Posting areas where it is necessary to perform overhead work.
3. Providing barricades, warning lights, signs, cones, flagmen and other safety devices to control traffic around and through the work area as the need arises in the performance of his work.
4. Erecting all necessary barriers and signs and clearing all Owner and Contractor personnel out of restricted areas when lifting steel or concrete to a construction area.
5. Ensuring that all rigging equipment, including ropes, chains and slings, is used in accordance with the safety recommendations of the manufacturers.
6. Training mobile crane operators in safe crane operations and crane operators and signal people in communications signals. Cranes may be used only when directed by a signal person.

END OF SECTION

SECTION 01 45 10

QUALITY CONTROL FOR BUILDING CONSTRUCTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for quality control.
   2. Inspection and testing services to assist in determination of work with specifications and regulations.
   3. Requirements for Contractor cooperation.
   4. Responsibility for payment.
   5. Schedule of required tests.

B. Contractor Responsibility: These required services do not relieve Contractor of responsibility for compliance with any requirements.

1.02 REFERENCES

A. IBC Code: Currently in effect and adopted by state in which Project is located.

B. ASTM:
   1. D3740 - Minimum Requirements for Agencies Engaged in Testing or Inspection of Soil and Rock
   2. E329 - Requirements for Agencies Engaged in Testing or Inspection of Materials Used in Construction

1.03 DEFINITIONS

A. Quality Control: Inspections, tests, related actions including reports, performed by independent agencies and governing authorities, as well as directed by Contractor.

1.04 SUBMITTALS

A. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Institute of Standards and Technology (NIST) during most recent tour of inspection, with memorandum of remedies of any deficiencies reported by the inspection.

B. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full time registered Specialist and responsible officer.

C. After each inspection and test, submit two written copies of report to Engineer and to Contractor no later than 3 working days after completion of inspection or test. Include:
   1. Date issued
   2. Project title and number
   3. Name of inspector
   4. Date and time of sampling or inspection
   5. Identification of product and Specifications Section
   6. Location in the Project
   7. Type of inspection or test
   8. Date of test
   9. Results of tests
   10. Conformance with Contract Documents

D. When requested by Engineer, provide interpretation of test results.

1.05 QUALITY ASSURANCE

A. Laboratory: Select laboratory qualified in accordance with referenced ASTM standard to acceptance of Engineer.

B. Codes and Standards: Comply with requirements of ASTM D3740 and E329.

C. Testing:
   1. Owner shall employ and pay for services of an independent testing laboratory to perform specified inspection and testing.
   2. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.

D. Laboratory Qualifications:
   1. Qualified in accordance with referenced ASTM standard to acceptance of Engineer.
   2. Authorized to operate in state in which Project is located.
   3. Staff: Maintain a full time registered Engineer Specialist on staff to review services.
   4. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Institute of Standards and Technology (NIST) Standards or accepted values of natural physical constants.

1.06 RESPONSIBILITIES

A. Contractor Responsibility:
   1. Quality control testing or inspections scheduled to be Contractor's responsibility.
   2. Code Compliance Testing: Quality control required by codes or ordinances, or by plan approval authority, made by legally constituted authority unless otherwise provided in Contract Documents.
   3. Verification of conformance of the Work within specified construction tolerances.
   4. Contractor's Convenience Testing.
   5. Notify Engineer and laboratory 24 hours prior to expected time for operations requiring inspections and testing services.
   6. Provide incidental labor and facilities to:
      a. Provide access to Work to be tested.
      b. Obtain and handle samples at the Site or at source of products to be tested.
      c. Facilitate tests and inspections, and storage and curing of test samples.
   7. Coordinate with each independent agency the sequence of activities to accommodate required services with minimum delay in progress of Work and to avoid removing and replacing Work. Schedule times for quality control.

B. Owner Responsibility: Quality control not specifically indicated as Contractor's responsibility, or to be provided by another identified entity.

C. Laboratory Responsibility:
   1. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   2. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or Products.
   3. Perform additional inspections and tests required by Engineer.
   4. Limits on Laboratory Authority:
      a. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
      b. Laboratory may not approve or accept any portion of the Work.
      c. Laboratory may not assume any duties of Contractor.
      d. Laboratory has no authority to stop the Work.

D. Retest Responsibility:
   1. Where results of quality control prove unsatisfactory and do not indicate compliance of related Work with requirements of the Contract Documents, retests are responsibility of Contractor, regardless of whether the original test was Contractor's responsibility.

2. Retest of Work revised or replaced by Contractor is Contractor's responsibility, where required tests were performed on original Work.
3. Retesting costs will be deducted from Contract amount by Change Order.
4. Provide 2 retests for each failed test.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 ADJUSTING

A. Upon completion of quality control performed on Work, repair damaged Work, restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."

3.02 PROTECTION

A. Protect Work exposed by or for quality control service activities, and protect repaired Work.

3.03 RESPONSIBILITY FOR ADJUSTING AND REPAIR

A. Contractor's responsibility, regardless of assignment of responsibility for quality control.

3.04 FIELD QUALITY CONTROL

A. Secure inspection and acceptance of subgrades and fill layers before subsequent construction is permitted.

B. The following inspections and testing shall be conducted by an Independent Testing Agency, arranged by Contractor, approved by Owner, and paid for by Owner with the results being reported to Engineer, Building Inspector, Contractor and Structural Engineer of Record.
   1. Excavating, Filling, Grading:
      a. Compaction testing for building pads or paved areas: 1 test per 2,500 square feet per 12-inch lift; minimum 3 tests.
      b. Foundation wall backfill: 1 test per 100 feet or less of wall length, but no fewer than 2 tests.
      c. Footing subgrades: At least 2 tests of each soil stratum to verify design bearing capacities.
      d. Utility trenches: 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.
   2. Proof rolling of parking areas and sidewalks subject to vehicular traffic.
   3. Concrete Specimens:
      a. Compression Testing:
         1) Cast 4 cylinders per set:
            a) One at 7 days
            b) Two at 28 days
            c) One for hold
         2) Cast one set of cylinders for every 50 yards or fraction thereof, of cast-in-place concrete or masonry grout.
         3) Field cure cylinders (2 per set) to check concrete strength prior to critical shoring removal.
      b. Standard Field Tests to be performed on fresh concrete each time cylinders are cast:
         1) Slump
         2) Air Content
         3) Temperature
      c. Proposed Design Mixes
   4. Welding: All structural welding including welding of reinforcing steel.
   5. High strength bolting.

C. Additional Tests: Owner may arrange and pay for the following including, but not limited to:
    1. Masonry Units: For specific lots of materials to be used, test or review submitted product certifications for each type of masonry unit.
        a. Industry Standards:
            1) Compressive strength and absorption as follows:
                a) Hollow load bearing units - ASTM C90.
                b) Solid load bearing units - ASTM C145.
                c) Non-load bearing units - ASTM C129.
        b. Prism testing: Not required.
        c. Grout strength testing for core filled masonry walls: Minimum compressive strength - 2,500 psi.

D. Special Inspections:
    1. Special structural tests and inspections shall be conducted by a Contracted Special Inspector, arranged by the Owner or Engineer acting on behalf of Owner, and paid by Owner, with the results being reported to Engineer, Building Inspector, Contractor and Structural Engineer of Record.
        a. See guidelines for special inspections and testing in IBC Chapter 17.
    2. Preconstruction Meeting:
        a. If requested by Engineer, conduct 1 meeting at Site to review the scope of special structural testing and inspection.
        b. Comply with requirements of Section 01 31 19.
    3. Post Special Structural Testing and Inspection Summary in field office at job Site. Retain all reports submitted by special inspectors for review of the Building Official upon request.
    4. The schedule of special structural testing and inspections is attached to this section.

E. Fabricator:
    1. The following inspections shall be arranged and paid by the fabricator of products with the results being reported to Engineer, Building Inspector, Contractor and Structural Engineer of record.
        a. Prestressing reinforcing and tendons for concrete.
        b. Shop welding of steel fabrications used for structural purposes.

END OF SECTION

Quality Control Testing Schedule

Specification Section	Product	Type of Test	Location		Responsibility	Frequency
			Source	Field		
03 30 00	Concrete	Slump		X	Contractor	See Spec.
03 30 00	Concrete	Air Content		X	Contractor	See Spec.
03 30 00	Concrete	Temperature		X	Contractor	See Spec.
03 30 00	Concrete	Compression		X	Contractor	See Spec.
31 22 10	Backfill	Compaction		X	Contractor	See Spec.

SPECIAL STRUCTURAL TESTING AND INSPECTION PROGRAM
SUMMARY SCHEDULE

Project Name: Quarry Hill Nature Center - Safe Room Addition Project Number: AA2014-091

Location: 701 Silver Creek Road NE, Rochester, MN 55906

Permit Number (1): _____

Technical (2)		Description (3)	Type of Inspector (4)	Report Frequency (5)	Assigned Firm (6)
Section	Article				
03	30-00	Concrete Placement	SI-T	Weekly	
03	21-00	Concrete Reinforcing	SI-T	Weekly	
04	20-00	Masonry – Level 2	SI-T	Weekly	
05	12-00	Field Welding	SI-T	Each Inspection	
05	12-00	Shop Welding (as required) (7)	SI-T	Each Inspection	
31	20-00	Excavation and Backfill	SI-T	Weekly	
03	41-00	Structural Precast Concrete (7)	SI-T	Each Inspection	
03	30-00	Anchor Rods	SI-T	Each Inspection	

Notes: This schedule shall be filled out and included in the Special Structural Testing and Inspection Program.
(1) Permit number to be provided by the Building Official.
(2) Referenced to the specific technical scope section in the program.
(3) Use descriptions per IBC Chapter 17, as adopted by Minnesota State Building Code.
(4) Special Inspector - Technical, Special Inspector - Structural
(5) Weekly, monthly, per test/inspection, per floor, etc.
(6) Firm contracted to perform services.
(7) Provide unless work is performed by approved fabricator per 1704.2.2. Fabricator shall submit Certificate of Compliance to building official at completion of fabrications.

ACKNOWLEDGMENTS

Each appropriate representative shall sign below:

Owner:	_____	Firm:	City of Rochester Park and Recreation	Date:	_____
Contractor:	_____	Firm:		Date:	_____
Architect:	_____	Firm:	Armon Architecture	Date:	_____
SER:	_____	Firm:	SEH-Yaggy	Date:	_____
SI-S:	_____	Firm:		Date:	_____
SI-T:	_____	Firm:		Date:	_____
TA:	_____	Firm:		Date:	_____
SI-T:	_____	Firm:		Date:	_____
F:	_____	Firm:		Date:	_____

If requested by Engineer of record or Building Official, the individual names of all prospective special inspectors and the Work they intend to observe shall be identified (Use reverse side of form if necessary).

Legend: SER = Structural Engineer of Record SI-T = Special Inspector - Technical TA = Testing Agency
SI-S = Special Inspector - Structural F = Fabricator

Accepted for the Building Department by _____ **Date** _____

SECTION 01 45 33

CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 INTENT AND CONDITIONS

A. Intent:
1. Define and coordinate special structural testing and inspection services and establish responsibility for the same.
    a. The inspection and testing individual(s) or firm(s), through the contractor or the Owner, shall be responsible to provide all the services and documentation required to complete this special inspection (and testing) section of work to the satisfaction of the Building Officials through the issuance of an Occupancy Permit for the project.
2. Provide additional assurance that the specified work is constructed in compliance with the contract documents and the intent of applicable codes including Chapter 17 of the 2006 International Building Code as adopted by the current State Building Code.
3. Testing and Inspection services are intended to assist in determining probable compliance of the work with requirements specified. These services do not relieve the Contractor of responsibility for compliance with the requirements of the contract documents.

B. Conditions:
1. If inspection of fabricators work is required, the Owner's representative may require testing and inspection of the work at the plant, before shipment. Owner, Architect, and the Structural Engineer of Record reserve the right to reject material not complying with the Contract Documents.
2. Testing and inspection shall be performed in accordance with the industry standard used as the reference for the specific material or procedure unless other criteria are specified. In the absence of a referenced standard, tests shall be performed in accordance with generally accepted industry standards.
3. Work shall be checked as it progresses, but failure to detect any defective work or materials shall in no way prevent later rejection if defective work or materials are discovered, nor shall it obligate Owner to accept such work.

C. Payment Responsibilities:
1. Except where they are specifically indicated as being the Owner's responsibility, inspections, tests and similar quality control services are the Contractor's responsibility; these services also include those specified to be performed by an independent agency and not directly by the Contractor and not specifically indicated as being the responsibility of the Owner. Costs for these services shall be included in the Contract Sum. The Contractor shall employ and pay an independent agency, testing laboratory or other qualified firm to perform quality control services specified.
    a. The test and design mixes which are specified and required for the project before construction begins shall be contracted for and paid for by the Contractor, these tests include but are not limited to:
        1) Engineered fill approval - Section 31 23 00
        2) Concrete mix design - Section 03 30 00
        3) Test of masonry sand - Section 04 05 13
        4) Test of concrete block - Section 04 22 00
        5) Mortar mix design - Section 04 05 13
    b. In addition, the following tests shall be contracted for and paid for by the Contractor during the course of construction. See the respective specification section.
        1) Earthwork, verification of soil bearing - Section 31 00 00
        2) Earthwork compaction tests - Section 31 00 00
        3) Concrete compression tests - Section 03 30 00

c. All other Special Testing and Inspections shall be performed as indicated in the "Special Inspection Schedule" as listed in Section 01 45 33.10. Inspections and tests indicated in the schedule shall be contracted and paid for by the General Contractor unless noted otherwise in the table or in the specification items above. Fees for re-inspection and re-testing of items requiring correction or replacement due to noncompliance with the code and/or this specification shall be paid by the Contractor.

d. Inspections and tests required by codes or ordinances, other than IBC Chapter 17, or by a plan approval authority and made by a legally constituted authority, shall be the responsibility of and shall be paid for (if costs are incurred) by the Contractor, unless otherwise provided in the contract documents.

e. Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

f. Reports on tests will be sent to the Contractor, the Architect, the Construction Manager and the local building code authority. Rejected materials shall immediately be removed from the job and shall not be used in the work. Inspection and testing shall in no way relieve the Contractor or supplier from responsibility for furnishing materials and workmanship in accordance with the plans and specifications.

g. If tests do not meet specification requirements, any additional tests that are required shall be paid for by the Contractor, including additional tests required on previously Owner paid testing.

1.02 RELATED REQUIREMENTS

A. Refer to individual technical specification sections for specific qualifications, inspections, tests, frequency and standards required.

B. Refer to General Conditions and Supplementary Conditions for general requirements. These requirements form a part of this section and where applicable, govern all work.

1.03 DEFINITIONS

A. Testing:
1. Evaluation of systems, primarily requiring physical manipulation and analysis of materials, in accordance with approved standards.

B. Inspection:
1. Evaluation of systems, primarily requiring observation and judgment.

C. Special Structural Testing and Inspection:
1. Special Structural Testing and Inspection Services herein include items required by the 2006 IBC Chapter 17 as adopted by the current State Building Code, and other items which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure.

D. Architect of Record:
1. The prime consultant in charge of overall design and coordination of the project.

E. Structural Engineer of Record (SER):
1. The Registered Engineer in responsible charge of the structural design of the project.

F. Testing Agency (TA):
1. The testing agency shall be an approved independent testing agency acceptable to the Owner, Architect, SER and meet the requirements noted below:
a. Shall be authorized to operate in the State in which the project is located and experienced with the requirements and testing methods specified in the Contract Documents.
b. Shall meet applicable requirements of references stated in paragraph 1.04.

c. Shall have available testing equipment which is calibrated, at reasonable intervals, by devices of accuracy traceable to either the National Bureau of Standards, or to accepted values of natural physical constants.

G. Special Inspector (SI):
1. The special inspector shall be under the direct supervision of a registered civil/structural engineer, experienced with the type of work requiring special structural testing and inspection.
2. The categories of special inspector are:
a. Special Inspector - Technical I, II and III: Usually an employee of a testing agency.
b. Special Inspector - Structural I and II: Usually an employee of the Structural Engineer of Record.
3. Unique special inspector requirements, for specific materials and systems, are noted in related technical specification sections.

H. Building Official:
1. The Officer or his duly authorized representative charged with the administration and enforcement of the State Building Code.

1.04 REFERENCES

A. ANSI/ASTM E329 - Standard practice for use in the evaluation of testing and inspection Agencies as used in construction.

B. ASTM E543 - Practice for Determining the Qualifications of Non-destructive Testing Agencies.

C. ASTM E548 - Practice for Preparation of Criteria for Use in the Evaluation of Testing Laboratories and Inspection Bodies.

D. ASTM C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory.

E. ASTM C1093 - Practice for the Accreditation of Testing Agencies for Unit Masonry.

F. ANSI/ASTM D3740 - Standard Recommended Practice for Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

G. State Building Code – the current adopted Building Code of the State in which the project is located including any model code incorporated by reference with amendments.

H. ICBO Model Program for Special Inspection (excerpts).

1.05 WORK RESPONSIBILITIES

A. Special Structural Testing and Inspection:
1. Special Inspectors:
a. Test and/or inspect the work assigned for conformance with the building department approved plans, specifications, and applicable material and workmanship provisions of the code. Perform testing and inspection in a timely manner to avoid delay of work.
b. Bring nonconforming items to the immediate attention of the Contractor for correction, then, if uncorrected after a reasonable period of time, to the attention of the Structural Engineer of Record, the Building Official, and to the Architect.
c. Submit test and/or inspection reports to the Building Official, Contractor, the Structural Engineer of Record, and other designated persons in accordance with the Special Structural Testing and Inspection Schedule.
d. Submit a final signed report stating whether the work requiring special inspection was, to the best of his/her knowledge, in conformance with the approved plans, specifications and the applicable workmanship provisions of the code.
e. Sign the Special Structural Testing and Inspection Schedule in conjunction with other responsible parties prior to permit issuance.

2. Architect of Record:
    a. Coordinate the flow of reports and related information to expedite resolution of construction issues.
    b. Arrange and attend a pre-construction meeting to review scope of special structural testing and inspection. Include Contractor, Building Official, SER, Testing Agency and other parties concerned.
    c. Complete and sign the Special Structural Testing and Inspection Schedule in conjunction with other responsible parties prior to permit issuance. Provide a completed copy of the schedule to all signed parties including Building Official.
3. Structural Engineer of Record:
    a. Identify items requiring special structural testing and inspection including special cases.
    b. Define "type" of special inspector required for "description" of work indicated on the special structural testing and inspection schedule.
    c. Attend a pre-construction meeting to review scope of special structural testing and inspection.
    d. Complete and sign the Special Structural Testing and Inspection Schedule prior to permit issuance.
    e. Review reports issued by all special inspectors.
    f. If engaged as a special inspector, provide special structural testing and inspection services as noted in Item 1.05.A.1.
4. Testing Agency:
    a. When engaged as a special inspector, provide special structural testing and inspection services as noted in Item 1.05.A.1.
    b. Sign the Special Structural Testing and Inspection Schedule in conjunction with other responsible parties to permit issuance.
    c. Attend a pre-construction meeting to review scope of special structural testing and inspection.
5. Contractor:
    a. Attend a pre-construction meeting to review scope of special structural testing and inspection.
    b. Post or make available the Special Structural Testing and Inspection Schedule within its office at the job site. Also, provide adequate notification to those parties designated on the schedule so they may properly prepare for and schedule their work.
    c. Provide the special inspectors access to the approved plans and specifications at the job site.
    d. Review all reports issued by special inspectors.
    e. Retain at the job site all reports submitted by the special inspectors for review by the Building Official upon request.
    f. Correct in a timely manner, deficiencies identified in inspection and/or testing reports.
    g. Provide the special inspector safe access to the work requiring inspection and/or testing.
    h. Provide labor and facilities to provide access to the work, to obtain, handle and deliver samples, to facilitate testing and inspection and for storage and curing of test samples.
    i. Verify conformance of the work with specified construction tolerances.
    j. Sign the Special Structural Testing and Inspection Schedule in conjunction with other responsible parties prior to permit issuance.
6. Fabricator:
    a. Submit a Certificate of Compliance to the Building Official, Special Inspector, and Structural Engineer of Record that the work was performed in accordance with the approved plans and specifications.
    b. Sign the Special Structural Testing and Inspection Schedule in conjunction with other responsible parties prior to permit issuance.
7. Building Official:
    a. Review all special inspector qualifications.
    b. Review qualifications of all fabricators who perform work requiring special inspection in their shop.
    c. Accept and sign the completed Special Structural Testing and Inspection Schedule.

d. Review reports and recommendations submitted by the special inspectors.
e. Review the "final signed reports" submitted by the special inspector(s). These documents must be accepted and approved by the building department prior to issuance of a Certificate of Occupancy.
f. Determine work which, in the Building Officials opinion, involves unusual hazards or conditions as defined in the State Building Code.

8. Owner:
a. Establish direct funding to provide for cost of special structural testing and inspection services.
b. Provide special inspector with approved plans, specifications and approved shop drawings.
c. Provide special inspectors and testing agencies with full access to the site at all times.
d. Sign the Special Structural Testing and Inspection Schedule in conjunction with other responsible parties prior to permit issuance.

B. Inspections by Building Official:
1. Contractor shall provide adequate notice for inspections performed by the building official, as required by IBC, the State Building Code, and local ordinance.

C. Periodic Site Observations by Design Consultant:
1. Special structural testing and inspection, conventional testing and inspection, and periodic inspections by the Building Official do not preclude the normal field involvement and site observations by Architect or Engineer of Record, nor shall it relieve the Contractor of any responsibility to complete the work in accordance with the approved drawings and specifications.

D. Limits of Authority:
1. Testing agents and/or special inspectors may not waive or alter contract requirements, or approve or accept any portion of the work unless specifically authorized by the Architect or Engineer of Record. They may not assume any duties of the Contractor, and they have no authority to stop or reject "Work".

1.06 PAYMENT

A. Owner will only directly employ and pay for services of inspection and testing as attributed to the Owner in paragraph 1.01. All other inspection and testing shall be employed and paid for by the Contractor.

B. Unless noted otherwise, the Contractor shall provide and pay for all materials, samples, mock-ups, and assemblies required for testing and inspection and shall pay for shipping costs related to delivery of such items. Testing agency will pay for shipping costs of samples transported from site to lab.

C. If items requiring testing or inspection are enclosed, embedded or obscured prior to testing or inspection or if such items are placed without tests or inspections, the Contractor shall pay for the costs of any exploratory work deemed necessary by the Architect/Engineer to verify compliance with the Contract Documents.

D. Contractor shall pay for the costs of any retests or reinspections caused by the following:
1. Work which does not comply with the Contract Documents based on initial tests or inspections.
2. Work which is later revised or replaced by the Contractor. This does not include revisions requested by the Owner.

E. Any tests required to qualify the Contractor or the workmen for any phase of the work shall be performed at no additional cost to the Owner.

1.07 INSPECTION NOTICE

A. Contractor shall provide a minimum of 24 hours' notice for all items requiring testing or inspection. Items requiring testing and inspection services prior to or during placement shall not be placed until testing and inspection services are available. Items requiring testing and inspection services after placement shall not be enclosed or obscured until testing and inspection services are performed.

1.08 REPORTS

A. Testing agency and/or special inspectors shall submit a report in accordance with the Special Structural Testing and Inspection Schedule and shall conduct and interpret tests and inspections and state in each report whether;
   1. Test specimens and observations comply with Contract Documents, and specifically state any deviations
   2. Record types and locations of defects found in work
   3. Record work required and performed, to correct deficiencies. Discrepancies corrected during an inspection need not be reported.

B. Reports for special structural testing and inspection, shall be submitted in timely manner to the Contractor, Building Official, SER and Architect of Record.
   1. Submit reports for ongoing work, continuing the information noted below:
      a. Date issued
      b. Project title and number
      c. Firm name and address
      d. Name and signature of tester or inspector
      e. Date and time of sampling
      f. Date of test or inspection
      g. Identification of product and specification section
      h. Location in project, including elevations, grid location and detail
      i. Type of test or inspections
      j. Results of tests or inspections and interpretation of same
      k. Observations regarding compliance with Contract Document or deviations therefrom
   2. Submit final signed report stating that, to the best of the special inspector's knowledge, the work requiring testing and/or inspection conformed to the Construction Documents.

1.09 FREQUENCY OF TESTING AND INSPECTION

A. For detailed requirements see individual technical specification sections, and Part 2 of this specification section.

1.10 PROTECTION AND REPAIR

A. Upon completion of testing, sample-taking, or inspection, the Contractor shall repair damaged work and restore substrates and finishes to eliminate deficiencies, including deficiencies in the visual qualities of exposed surfaces, as judged solely by the Architect/Engineer of Record. Protect work exposed by or for testing and/or inspection and protect repaired work. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for testing and/or inspection.

1.11 TESTS TO DEMONSTRATE QUALIFICATION

A. If the Contractor proposes a product material, method, or other system that has not been pre-qualified, the Architect/Engineer of Record may require applicable tests, to establish a basis for acceptance or rejection. These tests will be paid for by the Contractor.

B. The Architect/Engineer of Record reserves the right to require certification or other proof that the system proposed is in compliance with specified tests, criteria or standards. The certificate shall be signed by a representative of an independent testing agency.

PART 2 SCOPE OF TESTING AND INSPECTION

2.01 SPECIAL STRUCTURAL TESTING AND INSPECTION

A. The parties involved shall complete and sign the Special Structural Testing and Inspection Schedule. The completed schedule is an element of the construction documents and after permit issuance, becomes part of the building department approved plans and specifications. The completed schedule shall include the following:
   1. A specific listing of the items requiring inspection and testing.
   2. The associated specification section and article which defines the applicable standards by which to judge conformance with the approved plans and specifications in accordance with IBC, Structural Tests and Special Inspections as adopted by the State Building Code. The specifications section should also include the degree or basis of inspection and testing, i.e. intermittent/will-call or full-time/continuous.
   3. The frequency of reporting, i.e., intermittent, weekly, monthly, per floor, etc.
   4. The parties responsible for performing the inspection and testing work.
   5. The required acknowledgments by each designated party.

B. See attached "Special Structural Testing and Inspection Schedule".

PART 3 EXECUTION

3.01 COOPERATION WITH TESTING LABORATORY

A. Representatives of the testing laboratory shall have access to the work at all times. Provide facilities for such access in order that the laboratory may properly perform its function.

3.02 SCHEDULES FOR TESTING

A. Establishing Schedule: See Schedule form at Section 01 45 33.10
   1. By advance discussion with the testing laboratory, determine the time required for the laboratory to perform its tests and to issue each of its findings.
   2. Provide all required time within the construction schedule.

B. Revising Schedule:
   1. When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the testing laboratory as required.

C. Adherence to Schedule:
   1. When the testing laboratory is ready to test according to the determined schedule, but is prevented from testing or taking specimens due to incompleteness of the work, all extra costs for testing attributable to the delay may be back-charged to the Contractor and shall not be borne by the Owner.

3.03 TAKING SPECIMENS

A. All specimens and samples for testing, unless otherwise provided in these contract documents, will be taken by the testing laboratory, all sampling equipment and personnel will be provided by the testing laboratory, and all deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

END OF SECTION

SECTION 01 66 00

PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Protect products scheduled for use in the work by means including, but not necessarily limited to, those described in this section.

1.02 QUALITY ASSURANCE

A. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

1.03 MANUFACTURERS' RECOMMENDATIONS

A. Except as otherwise approved by the Architect, determine and comply with manufacturers' recommendations on product handling, storage, and protection.

1.04 PACKAGING

A. Deliver products to the job site in their manufacturer's original container, with labels intact and legible.
   1. Maintain packaged materials with seals unbroken and labels intact until time of use.
   2. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the Owner.

B. The Architect may reject as non-complying such material and products that do not bear identification satisfactory to the Architect as to manufacturer, grade, quality, and other pertinent information.

1.05 PROTECTION

A. Protect finished surfaces, including jambs and soffits of openings used as passageways, through which equipment and materials are handled.

B. Provide protection for finished floor surfaces in traffic areas prior to allowing equipment or materials to be moved over such surfaces.

C. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the Owner.

1.06 REPAIRS AND REPLACEMENTS

A. In event of damage, promptly make replacements and repairs to the approval of the Architect and at no additional cost to the Owner.

B. Additional time required to secure replacements and to make repairs will not be considered by the Architect to justify an extension in the contract time of completion.

END OF SECTION

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Comply with requirements stated in the "General Conditions of the Contract for Construction" and in the specifications dealing with administrative procedures in closing out the work to provide an orderly and efficient transfer of the completed work to the Owner.

1.02 RELATED REQUIREMENTS

A. General Conditions of the Contract - Section 00 72 00. Fiscal provisions, legal submittals and additional administrative requirements:
   1. Project Record Documents: Section 01 30 00
   2. Cleaning Up: Section 01 74 00
   3. Operating and Maintenance Data: Section 01 78 23
   4. Warranties and Bonds: Section 01 78 33
   5. The respective sections of specifications: Closeout submittals required of trades.

1.03 SUBSTANTIAL COMPLETION

A. When the work is considered substantially complete, submit to Architect.
   1. A written notice that the work, or designated portion thereof, is substantially complete.
   2. A list of items to be completed or corrected.

B. After receipt of such notice, Architect will make an inspection to determine the status of completion.

C. Should Architect determine that the work is not substantially complete:
   1. Architect will promptly notify the Contractor in writing, giving the reasons therefore.
   2. Contractor shall remedy the deficiencies in the work, and send a second written notice of substantial completion to the Architect.
   3. Architect will re-inspect the work.

D. When Architect concurs that the work is substantially complete, he/she will:
   1. Prepare a "Certificate of Substantial Completion" on AIA Form G704, accompanied by Contractor's list of items to be completed or corrected, as verified and amended by the Architect.
   2. Submit the certificate to Owner and Contractor for their written acceptance of the responsibilities assigned to them in the certificate.

1.04 FINAL INSPECTION

A. When the work is considered complete, submit written certification that:
   1. Contract documents have been reviewed.
   2. Work has been inspected for compliance with contract documents.
   3. Work has been completed in accordance with contract documents.
   4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
   5. Work is completed and ready for final inspection.

B. Architect will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

C. Should Architect consider that the work is incomplete or defective:

1. Architect will promptly notify the Contractor in writing, listing the incomplete or defective work.
2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to Architect that the work is complete.
3. Architect will re-inspect the work.

D. When the Architect finds that the work is acceptable to the requirements of the contract documents, he/she will request the Contractor to make closeout submittals.

1.05 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ARCHITECT

A. Evidence of compliance with requirements of governing authorities:
1. Certificate of Occupancy
2. Certificates of Inspection: As required

B. Project Record Documents: To requirements of Section 01 30 00.

C. Operating and maintenance data, instructions to Owner's personnel: To requirements of Section 01 78 23.

D. Warranties and Bonds: To requirements of Section 01 78 33.

E. Keys and Keying Schedule: To requirements of Section 08 71 00

F. Spare Parts and Maintenance Materials: To requirements of pertinent sections.

G. Evidence of Payment and Release of Liens: To requirements of all "General Conditions of Contract for Construction."

H. "Certificate of Insurance" for products and completed operations.

I. Completed Warranty forms as listed in Division 00.

1.06 RE-INSPECTION FEES

A. Should Architect perform re-inspection due to failure of work to comply with the claims of status of completion made by the Contractor.
1. Owner will compensate Architect for such additional services.
2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

1.07 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to Architect.

B. Statement shall reflect all adjustments to the contract sum.
1. The original contract sum.
2. Additions and deductions resulting from:
    a. Previous Change Orders
    b. Deductions for Uncorrected Work
    c. Penalties and Bonuses
    d. Deductions for Liquidated Damages
    e. Deductions for Re-Inspection Payments
    f. Other Adjustments
3. Total contract sum, as adjusted.
4. Previous payment.
5. Sum remaining due.

C. Architect will prepare a final change order, reflecting approved adjustments to the contract sum which were not previously made by change orders.

1.08 FINAL APPLICATION FOR PAYMENT

A. Submit the final application for payment in accordance with procedures and requirements stated in the "Conditions of the Contract."

1.09 INSTRUCTIONS

A. Instruct the Owner's operating and maintenance personnel in proper operation and maintenance of systems, equipment and similar items which were provided as part of the work.

END OF SECTION

SECTION 01 74 00

CLEANING AND WASTE MANAGEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acceptance
1. Upon completion of each section of work make a thorough inspection of the work and verify that the work has been performed in accordance with the provisions of the contract documents. Review, replace and/or refinish defective work as directed by the Architect.

B. Clean Up
1. Maintain premises and public properties free from accumulations of waste, debris, and rubbish, caused by operations.
   a. Accomplish rubbish removal weekly and additionally as required by the Architect.
   b. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.
   c. Contractor to be responsible for the cost of waste disposal generated by the project. Coordinate dumpster location, delivery, and removal with Owner.
2. Keep interior of building free, at all times, of unattended combustible rubbish.
3. Remove all tools, equipment, scaffolding and temporary facilities immediately when no longer required for execution of the work.
4. Vacuum clean, interior building areas when ready to receive finish painting, and continue vacuum cleaning on an as-needed basis until building is ready for substantial completion or occupancy.
5. **Note: Building will remain in operation during the course of the project, often by grade school children. Extra care should be taken to maintain a secure, clean, and safe construction site to avoid injury to building occupants.**

C. Final Cleaning
1. The General Contractor, upon completion of work and prior to acceptance by the Owner, shall thoroughly clean the project. Foreign matter and protective coverings shall be removed from all surfaces without damage to the surfaces. Project shall be left "vacuum clean" or as additionally indicated in the various sections of work, including:
   a. Exterior paved surfaces shall be swept clean and left without stains, rake clean other ground surfaces.
   b. All glass surfaces, both sides, shall be cleaned and polished just prior to final acceptance of the building by the Owner.
   c. Replace air conditioning filters if units were operated during construction.
   d. Clean ducts, blowers and coils if air conditioning units were operated without filters during construction.
2. Maintain cleaning until project, or portion thereof, is occupied by Owner. **Contractor's cleaning shall be such that when completed, only minor finish cleaning will be required by the Owner to occupy the project or space.**

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under contract.
   1. Prepare operation and maintenance data as specified in this section and as required in other sections of the specification.

B. Instruct Owner's personnel in maintenance of products and in operation of equipment and systems.

C. Quality Assurance
   1. Preparation of data shall be done by personnel:
      a. Trained and experienced in maintenance and operation of described products.
      b. Skilled as technical writer to the extent required to communicate essential data.
      c. Competent to prepare required drawings.

D. Form of Submittals
   1. Prepare data in form of an instructional manual for use by Owner's personnel.
   2. Format: Size: 8-1/2" x 11" (216 mm x 279 mm)
   3. Binders: Commercial quality three-ring binders with durable and cleanable plastic covers.

E. Content of Manual
   1. Neatly typewritten table of contents for each volume, arranged in systematic order.
   2. Product Data
   3. Drawings
   4. Written test, as required, to supplement product data for the particular installation.
   5. Copy of each warranty, bond and service contract issued.

F. Manual for Materials and Finishes
   1. Submit two copies of complete manual in final form.
   2. For Architectural products, applied materials and finishes.
      a. Manufacturer's data, giving full information on products.
      b. Instructions for care and maintenance.
   3. For moisture protection and weather exposed products.
      a. Manufacturer's data, giving full information on products.
      b. Instructions for inspection, maintenance and repair.
   4. Additional requirements for maintenance data as specified in respective sections of the specification.

G. Manual for Equipment and Systems
   1. For each unit of equipment and system as appropriate.
      a. Description of unit and component parts.
      b. Operating Procedures.
      c. Maintenance Procedures.
      d. Servicing and Lubrication Schedule.
      e. Manufacturer's printed operating and maintenance instructions.
      f. Description of sequence of operating by control manufacturer.
      g. As-installed control diagrams by controls manufacturer.
      h. Contractor's coordination drawings.
         1) As-installed color coded piping diagrams.
      i. Charts of valve tag numbers with location and function of each valve.

j. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
k. Other date as required under pertinent sections of the specification.

2. For each electric and electronic system as appropriate:
   a. Description of system and component parts.
   b. Circuit directories of panel board.
   c. As-installed color coded wiring diagrams.
   d. Operating Procedures:
   e. Maintenance Procedures:
   f. Manufacturer's printed operating and maintenance instructions.
   g. Other data as required under pertinent sections of the specifications.
3. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
4. Additional requirements for operating and maintenance data as specified in respective sections of the specification.

END OF SECTION

SECTION 01 78 33

WARRANTIES AND BONDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Contractor verify, compile, provide and submit all items to Architect for review and transmittal to Owner.
   1. Specified warranties and bonds.
   2. Specified service and maintenance contracts.
   3. Co-execute submittals when so specified.
   4. Review submittals to verify compliance with contract documents.

1.02 SUBMITTALS

A. Warranties and Bonds:
   1. Prepare in duplicate packets.
   2. Format:
      a. Size 8 1/2" x 11" (216 mm x 279 mm), punch sheet for standard three-ring binder.
      b. Identify each packet with type or printed title Warranties and Bonds, including:
         1) Title of project.
         2) Name of Contractor.
         3) Date of duration of warranty or bond.

B. Service and maintenance contracts executed by the respective manufacturer, supplier, or subcontractor.
   1. Provide two original signed copies for each contract.
   2. Provide the following information for each copy:
      a. Table of contents typed in orderly sequence.
      b. Product of work item.
      c. Firm, with name of principal, address and telephone number.
      d. Scope
      e. Date of beginning of service and maintenance.
      f. Duration of service maintenance contract.
      g. Information for Owner's personnel on proper procedure in case of failure.
      h. Instances which might affect the validity of the contract.
      i. Contractor, name of responsible principal, address and telephone number.

C. Guarantee: Submit guarantee per attached "Guarantee Form."

D. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.

1.03 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during progress of construction. Submit documents within ten days after acceptance.
   1. Otherwise make submittals within ten days after date of substantial completion, prior to final request for payment.
   2. For items of work, where acceptance is delayed materially beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

END OF SECTION

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
   1. See drawings or demolition drawings

C. Related Sections and Work
   1. Site Clearing: Section 31 10 00.
   2. Excavating and Fill - Section 31 23 00.
   3. Capping, shutting off and other protections of mechanical and electrical items – Divisions 21, 22, 23,26, and 27.
      a. Coordinate with the proper local authority.

1.02 PROTECTION

A. All remaining portions of the building and property not scheduled for demolition shall be completely protected during demolition and removal of debris. Any resulting damage shall be repaired or replaced to like new condition by the Contractor responsible.
   1. Protect all existing utilities against damage. Maintain during demolition operations.
   2. Protect passageways and maintain all exit ways to ensure the safe passage of persons around the area of demolition.

1.03 OCCUPANCY

A. Existing building to remain in operation throughout the duration of the project. Coordinate with Owner for proper times to begin demolition.

PART 2 PRODUCTS

2.01 MATERIALS

A. Barricades, fences and lighting to protect persons and property, shall be in accordance with all applicable codes and regulations.

PART 3 EXECUTION

3.01 DEMOLITION/PROCEDURE

A. Remove existing construction as shown and required to complete the installation of new work as shown or specified.
   1. At any removed construction all mechanical, electrical and/or equipment within or on that construction shall be removed also, unless specifically noted as work of a particular trade.
      a. This Contractor shall employ any other trade required to completely and safely remove, disconnect and/or cap any demolished construction.

B. Careful study of the contract documents, determine the exact location and extent of selective demolition to be performed.
   1. Completely remove items scheduled to be so demolished and removed, leaving remaining construction clean, solid and ready to receive new materials specified elsewhere.

C. In all activities, comply with pertinent regulations of governmental agencies having jurisdiction.

D. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors and to other work being performed on or near the site.

3.02 CLEAN UP/ACCEPTANCE

A. Disposal of Materials:
   1. Materials scheduled for re-use shall be removed, handled, stored and installed with care to maintain them in like new condition. Replacement or repair of destroyed or damaged materials, because of improper care, shall be the responsibility of the Contractor.
   2. All demolition material not scheduled for re-use or property of the Owner shall become property of the Contractor and shall be removed from the Owner's site by the Contractor. No prolonged accumulation of debris will be allowed.
      a. Remove all Contractor retained salvaged items from the site as demolition progresses. Storage or sale of removed items on the site will not be allowed.
   3. No burning on site will be permitted.

END OF SECTION

SECTION 03 11 00

CONCRETE FORMING

PART 1 GENERAL

1.01 SUMMARY

A. Design and installation of formwork with shoring, bracing and anchorage for cast-in-place concrete.

1.02 REFERENCES

A. ACI 347 - Recommended Practice for Concrete Formwork

1.03 SUBMITTALS

A. Submit Product Data for form ties.

1.04 QUALITY ASSURANCE

A. The design, engineering, and proper construction of all formwork shall be the responsibility of the Contractor.

B. Design formwork in accordance with ACI 347.

1.05 PRODUCT HANDLING

A. Do not store forms or equipment on finished slabs.

PART 2 PRODUCTS

2.01 FORM MATERIAL

A. Form Facing Material: Smooth faced, undamaged plywood or other panel type material approved by Architect.

B. The form facing material shall produce a smooth, hard, uniform texture on the concrete.

C. The arrangement of the facing material shall be orderly and symmetrical with the number of seams kept to a minimum.

D. Do not use facing material with raised grain, torn surfaces, worn edges, patches, dents, or other defects which will impair the texture of the concrete surface.

E. Fiber Tube Forms: Continuous laminated fiber tube with exterior moisture protection and non-adhering interior surface similar to “A-Coated Sonotube” as manufactured by Sonoco Products, or approved equal.

F. Void Forms:
   1. Corrugated fiberboard forms impregnated with paraffin, as manufactured by firm regularly engaged in production of corrugated fiberboard forms.
   2. Design to safely support dead load of concrete and construction live loads for period of 2 weeks.
   3. Design to prevent leakage of concrete or backfill materials and treat to prevent loss of strength and softening of form material due to moisture absorption.
   4. Size as shown on Drawings.

2.02 FORM TIES

A. Form Ties: Factory fabricated, adjustable length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling concrete surfaces upon removal.

B. The portion of the tie remaining in the concrete after removal of the tie shall be at least 1 inch from the surface of the concrete.

C. Provide waterseals on all wall ties used in water containment structures and exterior walls.

2.03 FORM COATINGS

A. Form Coatings or Release Agents: Commercially formulated chemical release agents containing no lubrication oil, conventional form oil, fuel oil, or kerosene. Containers shall have manufacturer's instructions for use printed thereon.

B. The form coating shall not penetrate, stain, or leave a residual film on the concrete surface and shall not attract dirt or other deleterious material.

2.04 ACCESSORIES

A. Chamfer Strips: 3/4-inch by 3/4-inch wood or plastic strips.

B. Provide all anchorages, braces, and special forms required to construct cast-in-place concrete components shown on the Drawings.

PART 3 EXECUTION

3.01 GENERAL

A. Establish a benchmark in an accessible location and use as a reference point for various construction levels.

B. Verify lines, levels, and centers before proceeding with formwork.

C. Insure that dimensions agree with the Drawings. Report any discrepancies to Architect before proceeding with Work.

3.02 FORMWORK DESIGN

A. The design and construction of the formwork shall be the responsibility of the Contractor.

B. Design formwork in accordance with ACI 347.

C. Formwork shall be designed, erected, supported, braced, and maintained to safely support all vertical and lateral loads that might be applied until such loads can be supported by the concrete structure.

D. Camber formwork to compensate for anticipated deflections in the formwork prior to hardening of the concrete.

E. Provide positive means of adjustment of shores and struts.
   1. Take up all settlement during concrete placing operations.
   2. Securely brace forms against lateral deflections.

3.03 FORMWORK CONSTRUCTION

A. Provide forms for all concrete work. Do not use earth cuts as forms for vertical surfaces.

B. Construct forms to conform to slopes, lines, and dimensions shown on the Drawings.

C. Forms shall be sufficiently tight to prevent loss of mortar from the concrete.

D. Place chamfer strips at all exposed corners.

E. Install all required openings, frames, pipe sleeves, cavities, slots, and other embedded items.

F. Cut all holes in forms required for installation or embedment of concrete reinforcement bars and ties.

G. Provide sharp clean corners at intersecting planes without visible edges or offsets. Back joints with extra studs or girts to maintain true, square corners.

H. Provide temporary openings at the base of column forms and wall forms to facilitate cleaning and observation immediately before concrete is placed.
   1. Construct closures to ensure a tight fit flush with the adjoining surfaces.

I. Provide runways for moving equipment.
   1. Provide runways with struts or legs and support directly on the formwork.
   2. Runways shall not rest on the reinforcing steel.

J. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris before concrete is placed.

K. Install Void Forms:
   1. Protect from moisture before concrete placement. Store above ground level in dry location.
   2. Do not use forms subjected to water, moist soils, or damp storage unless test loaded.
   3. Install on surface providing uniform support. Conform to recommendations of manufacturer.
   4. Protect from crushing and penetration of form at reinforcing steel supports and at other supports.

3.04 TOLERANCES

A. Construct formwork so that concrete surfaces will conform with the following tolerances:
   1. Variation from Plumb:
      a. In any 10 feet of length: 1/4 inch.
      b. Maximum for entire length: 1/2-inch.
   2. Variation from the Level or Specified Grade:
      a. In any 10 feet of length: 1/4 inch.
      b. Maximum for entire length: 1/2-inch.
   3. Variation of the Linear Building Lines from Established Position in Plan and Related Position of Columns, Walls, Grade Beams and Partitions:
      a. In any 20 feet of length: 1/2-inch.
      b. Maximum for entire length: 1 inch.
   4. Variation in the Sizes and Locations of Sleeves, Floor Openings, and Wall Openings: 1/4-inch plus or minus.
   5. Variation in Cross-sectional Dimensions of Columns and Beams and in the Thickness of Slabs and Walls:
      a. Minus: 1/4-inch.
      b. Plus: 1/2-inch.
   6. Footings (tolerances apply to concrete dimensions only, not to positioning of reinforcing steel):
      a. Variations in dimensions in plan:
         1) Minus: 1/2-inch.
         2) Plus: 1 inch.
      b. Misplacement: 1 inch.
      c. Thickness:
         1) Decrease in thickness: 1/2-inch.
         2) Increase in thickness: No limit

7. Variations in Steps:
    a. In flight of stairs:
        1) Rise: 1/8 inch plus or minus.
        2) Tread: 1/4 inch plus or minus.
    b. In consecutive steps:
        1) Rise: 1/16 inch plus or minus.
        2) Tread: 1/8 inch plus or minus.

3.05 FORM SURFACE PREPARATION

A. Clean surfaces of forms and embedded material of all accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed.

B. Before placing the reinforcing steel or the concrete, cover the surfaces of the forms with an acceptable coating material that will effectively prevent absorption of moisture, prevent bond with the concrete, and not stain the concrete surfaces.

C. Do not allow form coating material to stand in puddles in the forms.

D. Form coating material shall not come in contact with hardened concrete against which fresh concrete is to be placed.

E. Spray form coating on all concrete form surfaces, including wood forms for wall openings, keyway strips, and chamfer strips. Apply coatings in accordance with manufacturer's instructions.

3.06 RE-USE OF FORMS

A. Clean and repair surfaces of forms to be re-used.

B. Do not use split, frayed, delaminated, or otherwise damaged form facing material.

3.07 FORM REMOVAL

A. Time specified below in this Article represents cumulative time during which temperature of concrete is maintained above 50 degree F (10 degree C) and for concrete without set-controlling admixtures.
    1. Reduce removal time in half for high-early strength cement concrete.

B. Formwork for columns, walls, sides of beams, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations, but not less than 24 hours after completing concrete placement and finishing.

C. Forms and shoring used to support the weight of concrete in beams, slabs, and other structural members shall not be removed in less than 10 days and not until the concrete has attained 3,500 psi minimum compressive strength. Determine compressive strength by field-cured specimens.

D. Once forms and shoring supporting beams, slabs, and other structural members have been removed, reshore concrete structural members at each level the same day such that all superimposed loads are uniformly distributed and transferred directly to the foundation through temporary supports.
    1. No construction or other live loads shall be permitted on the members, unless sufficient support is in place or concrete has attained full design strength and loads do not exceed the design maximum, as approved by Architect.

E. Contractor shall be responsible for all damage resulting from removal of forms or premature overloading of structural members.

F. Loosen wood forms for wall openings as soon as possible without damage to the concrete.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish and install concrete reinforcement.

1.02 REFERENCES

A. ACI:
   1. 117 - Standard Specifications for Tolerances for Concrete Construction and Materials
   2. 301 - Specifications for Structural Concrete for Buildings
   3. 315 - Details and Detailing of Concrete Reinforcement

B. CRSI Manual of Standard Practice

1.03 SUBMITTALS

A. Submit complete Shop Drawings and bar lists of all material to be furnished and installed under this Section.
   1. Show bar sizes, spacings, locations, and quantities of reinforcing and bending details.

B. Provide Shop Drawings in accordance with ACI 315 and the CRSI Manual of Standard Practice.
   1. Show in detail the location, size, spacing, bends, and quantities of each and all reinforcing bars to be placed in the structure.
   2. Bars shall have unique identifying labels or marks for each size, length, bend configuration, etc.

C. Submit Product Data on threaded dowel inserts.

D. Submit mill certifications for concrete reinforcement at time of delivery.

E. Submit certification for the epoxy coating at the time of delivery.
   1. Documentation of certification data shall come directly from the manufacturing plant's quality control office.
   2. Certification data shall contain test data and measurements taken at times and locations approved by Engineer.
   3. Monitoring shall be done by personnel not directly involved in production and be sufficient for compliance with approved procedures.

1.04 QUALITY COMPLIANCE

A. Comply with ACI 117, ACI 301, and ACI 315, except as modified in this Section.

1.05 PRODUCT HANDLING

A. Deliver reinforcement to the Site bundled, tagged, and marked.
   1. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement Drawings.

B. Store reinforcement at the Site in a manner to prevent damage from drainage and accumulation of dirt and excessive rust.

C. Do not store reinforcement, supports, or equipment on finished slabs.

D. Store metal bar supports in a weather-proof shelter.

E. Repair coating damage due to shipping, handling, and placing with an epoxy paint or equivalent coating material approved by Engineer.
   1. Damaged areas shall not exceed 2 percent of the surface area per linear foot of each bar.
   2. Coating color fading will not be considered coating damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars: Deformed billet steel bars conforming to ASTM A615, Grade 60.

B. Welded Wire Fabric: Steel wire spot welded at intersections conforming to ASTM A185. Use flat sheets only.

C. Epoxy-Coated Reinforcing Steel: Conform to ASTM A775.

2.02 ACCESSORIES

A. Bar Supports for Elevated Slabs, Walls, Columns, and Beams: All bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place shall be plastic protected, conforming to CRSI Class 1 protection for bar supports.

B. Ground Supported Reinforcing:
   1. All supports for ground supported reinforcement shall conform to CRSI Class 1 protection for bar supports.
   2. All supports shall be supplied with precast concrete blocks with a minimum bearing surface of 100 sq. inches to prevent the support from sinking.

C. Tie Wire for Reinforcing Bars: Black annealed wire, 16 gage or heavier.

D. Tie Wire for Epoxy-Coated Reinforcing Bars: 16 gage or heavier annealed wire epoxy-coated or other polymer approved by Engineer.

E. Threaded Dowel Inserts: Manufactured of minimum Grade 60 steel and shall be capable of achieving 125 percent of specified yield strength of reinforcement steel for the bar size indicated.

F. Mechanical Bar Splices:
   1. Manufactured of minimum Grade 60 steel.
   2. Shall achieve 125 percent of specified yield strength of reinforcement steel for the bar size indicated.

G. Wire Supports for Epoxy-Coated Reinforcement: Supports shall be coated with dielectric material including epoxy or other polymer for a minimum of 2 inches from the point of contact with epoxy-coated reinforcement.

2.03 FABRICATION

A. Shop fabricate reinforcing steel to required shapes and dimensions.

B. Do not rebend or straighten reinforcing steel.

C. Fabricate bars in accordance with the fabricating tolerances given in ACI 315.

2.04 FINISHES

A. Epoxy coating shall be applied in a fusion bonded coating plant that has been granted “Certification” by CRSI (Concrete Reinforcing Steel Institute).

PART 3 EXECUTION

3.01 PLACING

A. Place reinforcing steel in accordance with the Structural Drawings, approved Shop Drawings, and as specified herein.

B. Reinforcing steel shall have the following concrete cover, unless specifically noted differently on the Drawings:
   1. Concrete cast against earth 3 inches.
   2. All other concrete 2 inches.

C. Properly position reinforcing steel and wire it together at intersections and supports to ensure against displacement during concrete placing. Tie all reinforcing steel to wall forms.

D. Support reinforcing steel for slabs on grade by placing the top of precast concrete blocks, flush with grade, at all locations where chairs are to be located. Place chairs or standees over concrete blocks.

E. Wire dowels in place before placing concrete.

F. Place and tie all reinforcing steel before concrete is placed.

G. Do not bend reinforcing steel embedded in hardened or partially hardened concrete after placing.

H. Place wall chairs at the top and bottom of all walls and not greater than 6 feet on center horizontally.

I. All reinforcement at the time concrete is placed shall be free of mud, oil, or other materials that may adversely affect or reduce the bond.

J. Support the reinforcing steel closest to the formed surface with chairs and bolsters. Support beam stirrups and column ties by chairs.

K. After completing welds on epoxy-coated reinforcement, repair damaged coating in accordance with the requirements stated in Part 1 of this Section.

L. Reinforcement used as supports with epoxy-coated reinforcement shall be epoxy coated.

M. After field bending or straightening epoxy-coated reinforcing bars, repair coating damage in accordance with Part 1 of this Section.

N. When epoxy-coated reinforcing bars are cut in the field, coat the ends of the bars with the same material used for repair of coating damage, and repair any coating damage in accordance with Part 1 of this Section.

3.02 SPLICES

A. Provide reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying. Provide lap splice lengths as shown on the Drawings.

B. Provide splices only as shown on the Drawings or as authorized by Engineer.

C. Provide threaded or other approved mechanical bar splices:
   1. Where shown on the Drawings.

2. Elsewhere for the convenience of the Contractor at no additional cost to Owner if specifically requested of and approved by Engineer.

3.03 TOLERANCES

A. Place bars to the tolerances specified in ACI 117.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Furnish and install all cast-in-place concrete and accessories.

B. Related Sections:
   1. Section 03 11 00 - Concrete Forming
   2. Section 03 20 00 - Concrete Reinforcing

1.02 REFERENCES

A. ACI:
   1. 301 - Specifications for Structural Concrete for Buildings
   2. 305 - Hot Weather Concreting
   3. 306 - Cold Weather Concreting
   4. 309 - Recommended Practice for Consolidation of Concrete
   5. 350 - Environmental Engineering Concrete Structures

B. ASTM:
   1. A36 - Carbon Structural Steel
   2. A307 - Carbon Steel Bolts and Studs
   3. A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   4. C33 - Standard Specification for Concrete Aggregates
   5. C94 - Standard Specification for Ready-Mixed Concrete
   6. C171 - Standard Specification for Sheet Materials for Curing Concrete
   7. C260 - Standard Specification for Air-Entraining Admixtures for Concrete
   8. C494 - Standard Specification for Chemical Admixtures for Concrete
   9. C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
   10. C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars
   11. C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures
   12. D1741 - Test Method for Functional Life of Ball Bearing Greases (Withdrawn 1991)

1.03 SUBMITTALS

A. Submit manufacturer’s data for concrete admixtures, liquid curing material, floor joint filler, finishing compounds, bonding agents, and adhesive anchoring material.

B. Submit concrete aggregate test reports and concrete mix designs at least 14 days prior to placement of concrete.

C. Submit results of concrete strength tests.

1.04 QUALITY ASSURANCE

A. Comply with ACI 301, except as modified in this Section.

B. Retain an independent testing laboratory approved by Architect to perform the work listed below. All costs for this testing shall be paid by Contractor:
   1. Test proposed aggregate.
   2. Design concrete mixes for each type of concrete specified.

3. Cast concrete cylinders for strength tests.
4. Test concrete cylinders.

C. Aggregate Tests: Test aggregates for compliance with ASTM C33.

D. Concrete Mix Design:
1. Prepare mix designs for each type of concrete specified.
2. Design concrete mixes in accordance with ACI 301.

1.05 PRODUCT HANDLING

A. Do not store forms, shores, reinforcing, equipment, or other material on finished slab surfaces.

PART 2 PRODUCTS

2.01 CONCRETE MATERIAL

A. Cement: Conform to ASTM C150, Type I.
1. Alkali content less than or equal to 0.6 percent (expressed as Na2O).
2. Provide cement from one source of supply.

B. Aggregate:
1. Coarse Aggregate: ASTM C33-5S
a. Provide from 1 source of supply.
b. For exterior exposed surfaces.
2. Fine Aggregate: ASTM C33.
a. Provide from 1 source of supply.
b. For exterior exposed surfaces.
3. Do not use fine or coarse aggregates containing spalling-causing deleterious substances.
4. Local aggregates not complying with ASTM C33 but which have been shown by special test or actual service to produce concrete of adequate strength and durability may be used when approved by Architect.
5. Maximum Size:
a. 1/5 the narrowest dimension of concrete member; nor
b. 1/3 the depth of slab; nor
c. 3/4 the clear spacing between reinforcement bars; nor
d. 1-1/2 inches
6. Gradation sizes 467, 57 or 67: ASTM C33, Table 2.

C. Water: Clean potable and free from deleterious amounts of oil, acid, alkali, or other foreign matter.

2.02 ADMIXTURES

A. Air Entraining Admixture: ASTM C260.

B. Water Reducing Admixture: ASTM C494, Type A.

C. High Range Water-Reducing Admixtures (Superplasticizer): ASTM C494, Type F and contain no chlorides.

D. Retarding Admixtures: ASTM C494, Types B and D.

E. Set-Accelerating Admixtures: ASTM C494, Type C. No chloride containing admixtures will be allowed.

F. Viscosity Modifying Admixture: Demonstrate compatibility with other admixtures.

G. Pozzolans:
   1. Fly Ash: ASTM C618, Class C or F. Loss on ignition shall be limited to 3 percent maximum.
   2. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
   3. Silica Fume: ASTM C1240, 6 percent maximum.

2.03 MISCELLANEOUS MATERIAL

A. Burlap-Polyethylene Sheet: Burlap weighing not less than 10 ounces per linear yard, 40 inches wide impregnated on 1 side with white opaque polyethylene 0.006 inch thick. Sheeting shall conform to ASTM C171.

B. Liquid Curing Compound: ASTM C309, Type 1-D, Class B clear or translucent with fugitive dye. Do not apply to floor slabs.

C. Expansion Joint Material: Bituminous fiber type conforming to ASTM D1751 with bituminous or paraffin binder.

D. Interior Joint Filler: 1 part, self leveling, polymer reinforced joint filler.
   1. Everjoint manufactured by L&M Construction Chemicals, Inc., or approved equal.

E. Exterior Joint Sealant: 2 parts, self leveling, polyurethane sealant.
   1. Sonolastic SL2 manufactured by Sonneborn, or approved equal.

F. Bonding Agent: Acryl 60 manufactured by Thoro System Products, or approved equal.

G. Adhesive for anchoring steel reinforcement dowels and threaded rods in concrete: 2 component injected epoxy structural adhesive.
   1. Approved Products:
      a. Hilti RE-500 Adhesive by Hilti Fastening Systems
      b. Epoxy-Tie Adhesive by Simpson Strong-Tie
      c. Epogel by Sonneborn

H. Epoxy Injection: Sika 35, Hi-Mod, LV or equal with Sikadur 31 Paste Epoxy or equal to be installed as manufacturer's recommendations.

I. Dovetail Anchor Slot: 18 gage stainless steel.

2.04 CONCRETE MIX PROPORTIONS

A. See Table 2.1 at the end of the Section.

PART 3 EXECUTION

3.01 CONCRETE PRODUCTION

A. Ready-mixed concrete: Comply with ASTM C94.
   1. Air Temperature between 85 degrees F (30 degrees C) and 90 degrees F (32 degrees C): Reduce mixing and delivery time to 75 minutes.
   2. Air Temperature above 90 degrees F (32 degrees C): Reduce mixing and delivery time to 60 minutes.
   3. Batch Ticket: Provide for each batch discharged and used in work, indicating project identification name and number date, mix type, mix time, quantity and amount of water introduced and available.

B. Mix concrete only in quantities for immediate use. Concrete which has set shall be discarded and shall not be retempered.

C. Do not add water at the Site without the approval of Engineer.

D. Add superplasticizer and mix concrete in accordance with manufacturer's specification.

3.02 EMBEDDED ITEMS

A. Place all sleeves, inserts, anchors, and embedded items required for adjoining work or for its support prior to placing concrete.

B. Position all embedded items accurately and supported against displacement.

C. Temporarily fill voids in sleeves, inserts, and anchor slots with readily removable material to prevent the entry of concrete into the voids.

3.03 PREPARATION BEFORE PLACING

A. Complete formwork and secure all reinforcement and embedded items in place.

B. Remove all snow, ice, and mud prior to placing concrete.

C. Do not place concrete on frozen ground.

D. Do not place concrete on ground with standing water or when upper 2 inches of ground is saturated.

E. Do not place concrete during rain, sleet, or snow.

3.04 CONCRETE CONVEYING

A. Deliver concrete from the mixer to the place of final deposit as rapidly as practical by methods, which will prevent segregation or loss of ingredients.

3.05 CONCRETE DEPOSITING

A. Deposit concrete continuously or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section.

B. Place concrete at such a rate that the concrete which is being integrated with fresh concrete is still plastic.

C. Do not deposit concrete which has partially hardened or has been contaminated by hardened materials.

D. Remove rejected concrete from the Site.

E. Deposit concrete as nearly as practicable in its final position to avoid segregation due to handling or flowing.

F. Free fall of concrete shall not exceed 4 feet. Use chutes equipped with hopper heads for placing where a drop of more than 4 feet is required.

3.06 PLACING CONCRETE SLABS

A. Deposit and consolidate concrete slabs in a continuous operation.

B. Consolidate concrete placed in slabs by vibrating bridge screeds, roller pipe screeds, or other methods acceptable to Architect.
   1. Bring slab surfaces to the correct level with a straight edge and then strike off.
   2. Use bullfloats or darbies to smooth the surface, leaving it free from bumps and hollows.

C. Do not leave screed stakes in concrete.

D. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to start of finishing operations.

3.07 COLD WEATHER PLACING

A. Do not place concrete when the air temperature is less than 40 degrees F. without the specific approval of Engineer.

B. Cold Weather Concrete Work: ACI 306.1, except as modified by the requirements of these Contract Documents.

C. Do not place concrete against any frozen substrate, including subgrade soils and surfaces of formwork.

D. Do not place concrete around any embedment, including reinforcing steel that is at a temperature below freezing.

E. The temperature of the concrete delivered at the site shall conform to the following limitations:

	Minimum Concrete Temperature	
Air Temperature	**< 12 Inches Thick**	**12-36 Inches Thick**
Above 30º F	60º F	55º F
0º to 30º F	65º F	60º F
Below 0º F	70º F	65º F

F. If water or aggregate is heated above 100 degrees F., combine water with the aggregate in the mixer before cement is added. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 100 degrees F.

G. When the mean daily temperature is less than 40 degrees F., maintain the temperature of the concrete between 50 and 70 degrees F. for the required curing period.

H. Arrangements for Heating, Covering, Insulation, Or housing the Concrete Work:
   1. Made in advance of placement.
   2. Adequate to maintain the required temperature without injury due to concentration of cold or heat.
   3. Keep protection in place for a minimum of 3 days.

I. Do not use combustion heaters during the first 24 hours, unless precautions are taken to prevent exposure of the concrete to exhaust gases.

J. Once the cold weather concrete protection is removed, continue concrete curing for the remainder of the 10 day curing period.

3.08 HOT WEATHER PLACING

A. Comply with ACI 305 when hot weather conditions exist.

B. Maintain concrete temperature at time of placement below 90 degrees F.

C. When the temperature of the steel is greater than 120 degrees F., spray steel forms and reinforcement with water prior to placing concrete.

D. Keep all surfaces protected from rapid drying. Provide windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering in advance of placement.

3.09 CONSOLIDATION

A. Consolidate all concrete in accordance with provisions of ACI 309.

B. Consolidate each layer of concrete immediately after placing by use of internal concrete vibrators. Maintain a frequency of not less than 8,000 vibrations per minute for each internal vibrator.

C. Provide adequate number of units and power source at all times. Use a minimum of 2 vibrators for all work and maintain spare units to ensure adequacy.

D. Insert the vibrator so as to penetrate the lift immediately below the one being placed. Do not insert the vibrator into lower courses which have begun to set.

E. Limit spacing between insertions of the vibrator to 12-18 inches and do not exceed twice the radius of action as shown in ACI 309 or 18 inches.

F. Do not use vibrators to transport concrete inside the forms.

G. Vibrate concrete to minimize entrapped air and surface voids on formed surfaces.

3.10 CONCRETE SLAB FINISHING

A. Float Finish:
   1. Apply float finish to all slab surfaces.
   2. After placing and screeding concrete slabs, do not work the surface until ready for floating. Begin floating when the surface water has disappeared and when the concrete has stiffened sufficiently to permit operation of a power-driven float.
   3. Consolidate the surface with power-driven float or by handfloating if the area is small or inaccessible to power units.
   4. Check and level the surface plane to a tolerance not exceeding 1/4 inch in 10 feet when tested with a 10 foot straight-edge placed on the surface at not less than 2 different angles.
   5. Immediately after leveling, refloat the surfaces to a smooth, uniform, granular texture.

B. Trowel Finish:
   1. Apply steel trowel finish to all interior floor slabs, topping, and stair treads and all tank slabs which do not receive a concrete topping.
   2. Apply float finish to slabs as described above in Part 3.11.A.
   3. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.
   4. Consolidate the concrete surface by the final hand troweling operation, free from trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8 inch in 10 feet when tested with a 10 foot straight-edge.

C. Broom Finish:
   1. Apply non-slip broom finish to all exterior sidewalks and aprons.
   2. Apply float finish to slabs as described above in Part 3.11.A.
   3. Immediately after floating, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use a fiber-bristle broom.

3.11 FINISHING FORMED SURFACES

A. Provide a smooth formed surface to all formed surfaces not exposed to view, unless otherwise noted in Paragraph B. Smooth formed finish shall consist of the following:
   1. Construct formwork in accordance with Section 03 11 00.
   2. Patch all tie holes and defects larger than 1/8-inch in diameter and/or 1/8-inch deep.
   3. Remove all fins, seams and concrete “buttons” protruding more than 1/16-inch.

B. Provide a special form finish to all formed surfaces exposed to view:
   1. Prepare 3 test samples of various textures for approval by Architect. Each sample shall be approximately 6 feet by 6 feet in size and located on an unexposed wall surface as directed by Architect.
   2. Perform all Concrete Crack Repairs in accordance with Article 3.14.B.
   3. Remove all form release agents, curing compounds, hardeners, salts, efflorescence, laitance, loose material, unsound concrete, and other foreign materials by sandblasting, shot blasting, mechanical scarification, or other suitable methods.
   4. Surface Preparation:
      a. Expose, but not undercut or loosen, aggregate.
      b. Expose all bugholes, cracks and subsurface voids.
      c. Provide a clean, sound substrate with sufficient surface profile.
   5. Filling of deep voids, bugholes, etc., exceeding 1/8-inch depth:
      a. Dampen surface with clean water to obtain saturated surface-dry (SSD) with no standing water.
      b. Brush-apply a small quantity of mixed patching material as a scrub coat to prepare substrate. Thoroughly key-in and work material throughout cavity to promote bond.
         1) If scrub coat dries out before wet mortar can be placed, remove scrub coat similar to laitance removal.
      c. Place repair mortar onto wet scrub coat using brush with firm trowel pressure.
         1) Completely fill voids.
         2) Key in and compact thoroughly to secure bond.
         3) Apply patching material in lifts of 1/4-inch (8mm) to 2-inches (51mm) and trowel to desired finish promptly after placing material.
      d. For successive lifts, thoroughly score each lift and allow reaching initial set before next layer is applied.
      e. Perform wet curing of patched areas for the following conditions:
         1) If temperature exceed 85 degrees F (29 degrees C).
         2) If relative humidity is below 30 percent.
         3) If wind speed exceeds 15 mph
         4) If patches are exposed to direct sunlight for 72 hours after placement.
      f. Special curing compounds are allowed with approval of Owner and Engineer. Do not use solvent-based curing compound.
   6. Dampen surface with clean water just prior to application of finishing compound.
   7. Mix 1 part bonding agent to 3 parts clean water for mixing liquid.
   8. Mix concrete finishing compound with mixing liquid as specified by the manufacturer.
   9. Apply 2 coats using a stiff fiber brush or textured spray equipment. Spray application of the first coat requires back brushing to properly fill voids, bugholes and nonmoving cracks.
      a. First coat: Apply at 2 pounds per sq. yd. and allow to cure a minimum 24 hours.
      b. Second coat: Apply at 2 pounds per sq. yd., allow to set and then float to a uniform finish.
   10. Perform damp curing to applied product.

3.12 CURING

A. Immediately after placement, damp cure all concrete for a minimum of 7 days.

B. Cover all slabs and topping with approved burlap-polyethylene film and keep in place throughout the curing period.

C. Cover walls, beams, columns and other formed surfaces with burlap-polyethylene film or spray with an approved curing compound.

D. Anchor all burlap-polyethylene film at the edges to prevent moisture loss.

E. Rewet all slab surfaces at least once a day during the curing period.

3.13 PATCHING

A. Repair honeycomb and other defective areas, fill surface voids, and fill form tie holes and similar defects in accordance with ACI 301.

B. Inject concrete cracks as observed during construction operations with epoxy to manufacturer's recommendations. Confirm procedures with Owner and Architect prior to installation.

C. Reinforce or replace deficient work as directed by Architect and at no additional cost to Owner.

3.14 CLEAN UP AND DISPOSAL

A. Upon completion of the walls and prior to any painting, thoroughly clean all exposed or painted concrete surfaces of all concrete spatters, form oil, or other foreign material detrimental to appearance or painting.

B. Remove all excess concrete debris remaining after completion of placement and form removal from the Site and dispose of in a proper and legal manner.

3.15 ANCHORING DOWELS

A. Drill hole in concrete to the size and depth recommended by the adhesive supplier and as approved by Engineer.

B. Clean hole with a nylon brush and use compressed air to blow out hole.

C. Fill hole with anchoring adhesive in accordance with manufacturer's recommendations.

3.16 FIELD QUALITY CONTROL

A. Concrete Strength Tests:
   1. Mold and cure 4 specimens from each sample in accordance with ASTM C31. Record any deviations from the requirements of ASTM C31 in the test report.
   2. Test specimens in accordance with ASTM C39. Test 2 specimens at 28 days for acceptance and 1 at 7 days for information. Test 1 specimen at 56 days if desired by Architect.
   3. Conduct at least 1 strength test for each 100 cu.yds. or fraction thereof for each mixture design placed in any 1 day.
   4. Furnish a copy of the test results to Architect as soon as available.
   5. Costs of concrete cylinder testing will be paid by Owner.
   6. Mold and field cure specimens as required in ASTM C31.
   7. Acceptance test results shall be the average strengths of the 2 specimens tested at 28 days.
   8. Conduct load test on test cores of concrete that fail to meet the specified strength, in accordance with ASTM C42.
   9. Failure to meet strength requirements of the cores, shall be a cause for rejection by Architect.
   10. The cost of remedial measures required due to test failures shall be paid for by Contractor.

B. Architect may request adjustment to concrete mixes when characteristics of materials, job conditions, weather, test results, other circumstances warrant.

C. Concrete Slump Tests:
   1. Owner will determine slump of concrete from each truck in accordance with ASTM C143.
   2. If slump exceeds maximum allowed, remove batch from work and dispose of off-site.
   3. Test slump at end of conveying system.
   4. All costs of slump testing will be paid by Owner.

D. Concrete Air Content Tests:
   1. Owner will determine air content of concrete from each truck in accordance with ASTM C231.
   2. Air content shall be tested at end of conveying system.
   3. All costs of air content testing will be paid by Owner.

E. Concrete Temperature:
   1. Owner will determine temperature of concrete from each truck in accordance with ASTM C31.
   2. Test temperature at end of conveying system.
   3. All costs of temperature testing will be paid by Owner.

Table 2-1

	f'c @ 28 days	Maximum Water/Cement + Pozzolan Ratio	Maximum Pozzolan Content (percent of cement content)[1]	Aggregate	Entrained Air Content (Refer to ACI 350, Moderate Exp.)	Slump (inches) before and after superplasticizer
A. Concrete for walls, grade beams, slabs, beams, columns, base slabs, pads and all other concrete unless noted below.	4,000 psi	0.45	ACI 350 - Table 4.2.3	Section 2.01.B	ACI 350 - Table 4.2.1	2 ± 1 before 6 ± 1 after
D. Grout - For Filling In Bottom Of Tanks	4,000 psi	0.45	ACI 350 - Table 4.2.3	Section 2.01.B	ACI 350 - Table 4.2.1	6 ± 1[3]

END OF SECTION

[1] Or with E/As prior approval.

SECTION 03 41 00

PLANT-PRECAST STRUCTURAL CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Provide precast reinforced concrete units as follows:
   1. Deck and roof panels.
      a. Hollow-core slab units.
   2. Accessories.
      a. Bearing pads.
      b. Core end plugs.
      c. Clips, hangers.
      d. Joint sealant.

B. Furnish the following for other sections to install, including, but not limited to:
   1. Structural precast accessories to be embedded in cast-in-place concrete:
      a. Bearing plates.
   2. Structural precast accessories to be embedded in masonry:
      a. Bearing plates.

C. Install the following provided by others:
   1. Sleeves and imbedded items for plumbing, heating, or electrical distribution.

D. Perform the following:
   1. Provide openings as indicated on Drawings.

E. Related Sections:
   1. Section 03 30 00 - Cast-in-Place Concrete
   2. Section 04 20 00 - Unit Masonry Assemblies
   3. Section 05 50 00 - Metal Fabrications
   4. Section 07 92 00 - Joint Sealants

F. Alternates: Refer to Section 01 23 00.

G. Unit Prices: Refer to Section 01 27 00.

1.02 REFERENCES

A. ACI:
   1. 301 - Specifications for Structural Concrete for Buildings
   2. 318 - Building Code Requirements for Reinforced Concrete

B. ANSI/AWS:
   1. D1.1 - Structural Welding Code - Steel
   2. D1.4 - Structural Welding Code - Reinforcing Steel

C. ASTM:
   1. A36 - Structural Steel
   2. A82 - Cold Drawn Steel Wire for Concrete Reinforcement
   3. A123 - Hot Dip Galvanized Coatings on Steel Products
   4. A153 - Zinc-Coating Iron and Steel Hardware
   5. A185 - Wire Fabric for Concrete Reinforcement
   6. A276 - Stainless Steel Bars and Shapes
   7. A416 - Undercoat Seven-Wire Stress-Relieved Strand for Prestressed Concrete

8. A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
9. A666 - Cold-Worked Austenitic Stainless Steel Sheets, Plates, Strips
10. C33 - Concrete Aggregates
11. C144 - Aggregate for Masonry Mortar
12. C150 - Portland Cement
13. C260 - Air Entraining Admixtures for Concrete
14. C1107 - Packaged Dry Nonshrink Hydraulic Cement Grout
15. F593 - Stainless Steel Bolts, Hex Caps, Screws, Studs

D. CRSI - Manual of Standard Practice

E. PCI:
1. MNL 116 - Manual for Quality Control for Plants and Production of Precast Concrete Products
2. MNL 120 - Design Handbook-Precast and Prestressed Concrete
3. MNL 123 - Manual on Design of Connections for Precast Prestressed Concrete
4. MNL 124 - PCI Design for Fire Resistance of Precast Prestressed Concrete

1.03 SYSTEM DESCRIPTION

A. Performance Requirements:
1. Size components to withstand design loads in an unrestrained condition according to State Building Code or the following, whichever is greater:
   a. Floor assembly superimposed load: 125 pounds per square foot.
   b. Roof assembly superimposed load of 100 pounds per square foot FEMA storm load.
2. Grout Keys: Capable of transmitting horizontal shear of 2,000 pounds per foot.
3. Insulation: Total minimum R-Value of ____.

1.04 SUBMITTALS

A. Refer to Section 01 33 00.

B. Product Data: Submit manufacturer's current Product Data including specifications, concrete design mix, handling, storage and installation instructions, and maintenance and cleaning recommendations.

C. Shop Drawings: Show complete information for fabrication and installation of precast concrete units, including:
1. Member dimensions, cross-section, location, size, type of reinforcement, including special reinforcement, and lifting devices necessary for handling and erection.
2. Layout, dimensions, and identification of each unit corresponding to sequence and procedure of installation.
3. Welded connections by AWS standard symbols.
4. Detail inserts, connections, and joints; including accessories and construction at openings in precast units.
5. Location, details of anchorage devices to be embedded in other construction. Furnish templates if required for accurate placement.
6. Erection procedure for precast units and sequence of erection.

D. Samples:
1. Selection Samples: Submit manufacturer's standard color and textures with Product Data and Shop Drawings.
2. Color Verification: Prior to shipping, submit each type of finish indicated; in sets for each color, texture, and pattern specified, showing a full range of variations expected in these characteristics. Include notification to Architect if selection is not within quoted price range.
3. Components: Submit samples of anchors, fasteners, hardware, and other materials and components if requested by Architect.

E. Quality Assurance/Control Submittals:
1. Test Reports: Written report of proposed mix for each type of concrete and/or other materials at least 15 days prior to start of precast unit production if requested by Architect.

2. Certificates:
    a. Certified design calculations: Prepared by structural engineer licensed in state where project is located.
    b. Submit certificates of approval in compliance with Section 01 33 00 and Conform to IBC code for state in which Project is located.
    c. Provide AWS D1.1 certification for welders.
3. Calculated fire-resistance analysis.
4. Material Certificates:
    a. Concrete materials.
    b. Reinforcing materials and prestressing tendons.
    c. Admixtures.
    d. Bearing pads.

F. Maintenance Manual: Provide to Owner, maintenance and warranty data in “Maintenance Manual” compliant with Section 01 78 23.

1.05 QUALITY ASSURANCE

A. Qualifications of Personnel/Firm:
1. Design Calculations: Professional Structural Engineer licensed in the state where project is located.
2. Fabricator: Firm with 5 years successful experience in fabrication of precast concrete units similar to units required for project; with sufficient production capacity to produce required units without delay in work; producer member of PCI and satisfactory participant in its Plant Certification Program.
3. Fabrication Plant: Plant engaged primarily in manufacturing of similar units.
4. Supervision: 1 person present during execution of work, thoroughly trained with 5 year’s experience in materials and methods required, to direct fabrication and installation.
5. Welder: Certified by AWS D1.1.

B. Codes and Standards: Comply with referenced standards unless otherwise indicated.

C. Fire-Resistance Rated Precast Units:
1. Comply with IBC code for state in which Project is located.
2. Conform with PCI MNL-124 to achieve required ratings.

D. Testing: Perform following ASTM tests for each 150 cubic yards of concrete placed, minimum of weekly, and provide documentation of compliance:
1. Slump: C143
2. Compressive Strength: C31, C192, C39
3. Air Content: C231 or C173
4. Unit Weight: C138

E. Field Samples: Furnish sample of each type of finish to Architect for review prior to manufacture.

F. Plant Review: If requested by Architect, review precast products at plant prior to shipment to job site.

G. Field-Erected Mockups:
1. Before installing structural precast concrete, erect mock-up for each form of construction and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution.
2. Build mock-up to comply with the following requirements, using materials indicated for final unit of work.
    a. Location: Locate mock-up on site in location and size indicated or, if not indicated, as directed by Engineer.
    b. Erect mock-up in presence of Engineer after having provided 7 days notification of date and time when mockup is to be constructed.
    c. Scope: Demonstrate the proposed range of aesthetic effects and workmanship.
    d. Acceptance: Obtain Engineer’s acceptance of mock-up before start of final unit of work.

e. Maintenance: Retain and maintain mock-up during construction in undisturbed condition as a standard for judging completed unit of work.

3. Accepted mock-up in undisturbed condition at time of Substantial Completion may become part of completed unit of work.

H. Preinstallation Meetings: Installer and manufacturer's technical representative shall meet with Architect prior to the start of installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protection: Comply with manufacturer's recommendations for job-site storage and protection.

B. Deliver precast structural concrete units to Site in such quantities and at such times to ensure continuity of installation.

C. Damaged Material: Replace damaged material prior to acceptance at no additional cost to Owner.

D. Lift and support units only at designated lifting and supporting points as shown on Shop Drawings.

E. Place stored units so that identification marks are discernible.

F. Separate stacked members by battens across full width of each bearing point.

G. Do not use upper member of stacked tier as storage area for shorter member or heavy equipment.

H. Protect units from contact with soil or ground.

1.07 PROJECT CONDITIONS

A. Environmental Requirements: Heat surfaces to be grouted to above freezing prior to installation of grout; keep temperature above 40 degrees F for 48 hours after completion of grouting.

B. Existing Conditions: Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.08 SEQUENCING

A. Coordination with Other Trades: Coordinate with installation of other materials and erection of other structural systems, including items to be cast in pre-cast units.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Precast Concrete Units:

1. Standard of Quality: Design is based on products of Wells Concrete Products Company, Wells, MN www.wellsconcrete.com
2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
   a. Concrete Inc., Grand Forks, ND www.ciprecast.com
   b. County Materials, Eau Claire, WI www.countymaterials.com
   c. Fabcon, Savage, MN www.fabcon-usa.com
   d. Gage Bros. Concrete www.gagebrothers.com
   e. Hanson www.hansonspancretemidwest.com
   f. Molin, Lino Lakes, MN www.molin.com
   g. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

B. Metallic Grout:
   1. Acceptable manufacturers:
      a. Embeco 885, Master Builders, Inc.
      b. Ferrogrout, L & M Construction Chemicals. Inc.
      c. Vibra-Foil, Grace Construction Products
      d. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

C. Nonmetallic Grout:
   1. Acceptable manufacturers:
      a. Crystex, L & M Construction Chemicals, Inc.
      b. Masterflow 928, Master Builders, Inc.
      c. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

2.02 MATERIALS

A. Formwork:
   1. General Requirements: Provide forms and form facing materials of metal, plastic, wood, other acceptable material, non-reactive with concrete, which produces required finish surfaces.
   2. Construction: Accurate, mortar-tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and when prestressed, pretensioning and detensioning operations; completed units of shapes, lines, dimensions indicated, within fabrication tolerances specified in PCI MNL 116.
   3. Design: Unless forms for plant manufactured prestressed concrete units are stripped prior to detensioning, design so stresses are not induced in precast units due to deformation of concrete under prestress or to movement during detensioning.

B. Reinforcing Materials:
   1. Reinforcing Bars:
      a. Deformed billet-steel: ASTM A615, Grade 60.
      b. Deformed rail-steel: ASTM A616.
      c. Deformed axle-steel: ASTM A617.
      d. Deformed low-alloy steel: ASTM A706.
   2. Steel Wire: Plain, cold-drawn, ASTM A82.
   3. Wire Fabric:
      a. Welded Steel: ASTM A185.
      b. Welded Deformed Steel: ASTM A497.
   4. Supports for Reinforcement:
      a. Bolsters, chairs, spacers, other devices for spacing, supporting, fastening reinforcing.
      b. Comply with CRSI recommendations.
      c. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, support with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).
   5. Dove Tail Slots: 22-gage galvanized steel slots 1-inch-wide by 1-inch-deep with 3/4-inch throat, plastic foam filled.

C. Prestressing Tendons:
   1. Uncoated, 7-wire stress-relieved strand complying with ASTM A416.
   2. Either Grade 250 or Grade 270.
   3. At manufacturer's option, similar strand, but with size and ultimate strength increased approximately 15 percent, or strand with increased strength but fewer number of wires.

D. Concrete Materials:
   1. Portland Cement: ASTM C150, Type I or Type III; one brand and type throughout unless otherwise acceptable to Engineer.
   2. Aggregates: ASTM C33, and as specified, from single source for exposed concrete.
   3. Lightweight Aggregate: ASTM C330.
   4. Water: Drinkable, free from foreign materials in amounts harmful to concrete and embedded steel.

5. Admixtures: Certified by manufacturer to be compatible with other required admixtures.
    a. Air-entraining 6 percent, ASTM C260.
    b. Water reducing, accelerating, high range water reducing admixtures: ASTM C494 Type A.
    c. No other admixtures may be used without Engineer's acceptance.
    d. Salts: The use of calcium chloride, chloride ions or other salts is not permitted.

E. Supplementary Cementitious Materials:
1. Fly Ash: ASTM C618, Class C or F, with maximum loss on ignition of 3 percent.
2. Metakaolin Admixture: ASTM C618, Class N.
3. Silica Fume Admixture: ASTM C1240, with optional chemical and physical requirement.
4. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.

F. Connection Materials:
1. Steel Plates: Structural quality, hot-rolled carbon steel, ASTM A283, Grade C.
2. Wide Flange Shapes: ASTM A992.
3. Miscellaneous Steel Shapes: ASTM A36.
4. Carbon-steel Headed Studs: ASTM A108, cold finished.
5. Stainless Steel: ASTM A240, 302 or 304.
6. Anchor Bolts: ASTM A307, low-carbon steel regular hexagon nuts, carbon steel washers.
7. High Strength Threaded Fasteners: Heavy hexagon structural bolts, and hardened washers complying with ASTM A325.
8. Finish of Steel Unit: Exposed units galvanized per ASTM A153; others painted with rust-inhibitive primer.

G. Bearing Pads:
1. Elastomeric: Vulcanized, chloroprene elastomeric compound, molded to size or cut from molded sheet, 50 to 70 Shore A durometer.
2. Laminated Fabric-rubber: Preformed, unused synthetic fibers, new, unvulcanized rubber, surface hardness 70 to 80 Shore A durometer.
3. Random-oriented, Fiber-reinforced Elastomeric: Preformed, fibers set in elastomer, 70 to 90 Shore A durometer.
4. Cotton-duck Fabric Reinforced Elastomeric: Preformed, horizontally layered fabric bonded to elastomer, 80 to 100 Shore A durometer.
5. Frictionless: Tetrafluoroethylene (TFE), with glass fiber reinforcing as required for service load bearing stress.
6. Tempered Hardboard: PS 58, smooth both sides.
7. Plastic: Multimonomer plastic strips, non-leaching, no visible overall expansion under construction loads.

H. Grout Materials:
1. Cement Grout: Portland cement, ASTM C150, Type I, and clean, natural sand, ASTM C144. Mix 1 part cement to 3 parts sand, by volume, with minimum water required for placement and hydration.
2. Metallic Shrinkage-resistant Grout:
    a. Premixed factory packaged ferrous aggregate grouting compound.
    b. ASTM C1107, Grade B.
3. Nonmetallic Shrinkage-resistant Grout:
    a. Premixed, nonmetallic, noncorrosive, nonstaining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents.
    b. ASTM C1107, Grade B.

I. Insulation Materials:
1. Expanded Polystyrene: R (minimum) = 4.17 per inch at 40 degrees F, 3.85 per inch at 75 degrees F (Aged Values).

2.03 PRECAST CONCRETE UNITS

A. General Requirements:
1. Free of voids or honeycomb, with straight true edges and surfaces.

2. Texture:
    a. Floor members: Broomed or raked top finish for bonding with concrete floor topping.
    b. Roof members: Broomed or raked top finish for bonding with concrete roof topping.
3. Reinforcement: Adequate to resist transporting and handling stresses.
4. Cast-in Weld Plates: Provide where required for anchorage or lateral bracing to structural steel and adjacent precast members, including cast-in weld plate to provide connection of flanges of adjoining members.

B. Hollow Core Plank: Precast prestressed concrete units with open voids running full length of slabs.
1. Provide headers of cast-in-place concrete or structural-steel shapes for openings larger than 1 slab width, according to hollow-core slab unit fabricator's written recommendations.
2. Provide solid, monolithic precast slab units forming an integral part of hollow slab unit system. Design and fabricate to dimensions and details indicated for hollow slab units.

2.04 ACCESSORIES

A. Joint Sealant: As recommended by precast concrete manufacturer for interior and exterior locations, or if no recommendation by manufacture, use multi-component polyurethane sealant, including backing rod.

B. Hollow Core Plank Core End Plugs: Glass fiber insulation.

C. Clips, hangers, other accessories required for installation and for support of subsequent construction or finishes.

D. Other Materials: Materials not specifically described but required for complete, proper installation of structural precast concrete, subject to acceptance of Engineer.

2.05 MIXES

A. General Requirements: Prepared by independent testing facility or by qualified precast manufacturing plant personnel, at precast manufacturer's option for each type of concrete required.

B. Proportioning: By either laboratory trial batch or field experience methods, using materials to be employed for each type of concrete required. Comply with ACI 318.

C. Compressive Strength: 5,000 psi minimum at 28 days.

D. Release Strength for Prestressed Units: 3,500 psi minimum.

E. Curing Compression Test Cylinders:
1. Use same methods as for precast concrete work.
2. Do not begin concrete production until Architect reviews mixes and evaluations.

2.06 FABRICATION

A. Comply with manufacturing and testing procedures, quality control recommendations, dimensional tolerances of PCI MNL-116, and as specified for types of units required.

B. Built-in Anchorages:
1. Accurately position and secure to formwork.
2. Locate where they do not affect position of main reinforcement or placing of concrete.
3. Do not relocate bearing plates in units unless acceptable to Engineer.

C. Openings:
1. Cast-in holes for openings larger than 8-inch diameter or 8-inch square in accordance with final Shop Drawings.
2. Other smaller holes may be field cut by trades requiring them, as acceptable to Engineer.

D. Form Preparation:
   1. Coat surfaces with bond-breaking compound before reinforcement is placed, with commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion.
   2. Comply with manufacturer's instructions.

E. Installation of Reinforcement:
   1. Preparation: Clean off loose rust and mill scale, earth, other materials which reduce or destroy bond with concrete.
   2. Displacement: Accurately position, support, secure reinforcement against displacement by formwork, construction, or concrete placement operations.
   3. Support: Metal chairs, runners, bolsters, spacers, and hangers, as required.
   4. Place to obtain at least minimum coverages for concrete protection.
   5. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations.
   6. Wire Ties: Set so ends are directed into concrete, not toward exposed concrete surfaces.
   7. Cut ends of strands not enclosed or covered flush and cover with high strength mortar, bonded to unit with epoxy resin bonding agent.

F. Pretensioning:
   1. Single strand tensioning method or multiple-strand tensioning method.
   2. Comply with PCI MNL-116 requirements.

G. Concrete Placement:
   1. Continuous operation to prevent formation of seams or planes of weakness in precast units, complying with requirements of ACI 304.
   2. Thoroughly consolidate placed concrete by internal and external vibration without dislocation or damage to reinforcement and built-in items.

H. Identification:
   1. Permanent markings to identify pick-up points and orientation in structure, complying with markings indicated on final Shop Drawings.
   2. Imprint date of casting on each precast unit on a surface which will not show in finished structure.

I. Curing by Moisture Retention:
   1. Form cure minimum 20 hours by moisture retention (without heat) method or accelerated heat curing with low-pressure live steam or radiant heat and moisture.
   2. Do not subject concrete to steam or hot air until after the concrete has attained its initial set. Take precautions to prevent moisture loss from concrete if using hot air for curing.
   3. Do not allow temperature of concrete to exceed 160 degrees F.
   4. Keep wet continuously for at least 6 days after being removed from the forms.
   5. Following curing period, allow the units to air dry for minimum 4 days before shipping to Site.
   6. Extend curing period if air temperature is below 50 degrees F.

J. Detensioning:
   1. Timing: Delay until concrete has attained at least 70 percent of design stress, as established by test cylinders.
   2. Heat-cured Concrete: Perform while concrete is still warm and moist, to avoid dimensional changes which may cause cracking or undesirable stresses in concrete.
   3. Pretensioned Tendons: Gradual release of tensioning jacks or by heat cutting tendons, using sequence and pattern to prevent shock or unbalanced loading.

2.07 FINISHES

A. Formed Surfaces: For formed surfaces of precast concrete as indicated for each type of unit, and as follows:
   1. Standard Finish:
      a. Normal plant run finish produced in forms that impart smooth finish to concrete.

b. Small surface holes caused by air bubbles, normal form joint marks, minor chips and spalls will be tolerated, but no major or unsightly imperfections, honeycomb, or structural defects will be permitted.

2. Commercial Finish:
   a. Exposed-to-view precast-prestressed elements.
   b. Remove fins, large protrusions and fill large holes.
   c. Rub or grind ragged edges.
   d. Faces to be true, well-defined surfaces.

B. Unformed Surfaces:
1. Apply trowel finish to unformed surfaces unless otherwise indicated.
2. Consolidate concrete; bring to proper level with straightedge, float, and trowel to smooth uniform finish.
3. Surfaces for Toppings: Apply scratch finish to precast units that will receive concrete topping after installation.
4. Following initial strike off, transversely scarify surface to provide ridges approximately 1/4 inch deep.

C. Exposed Textures: Fabricate precast units and provide exposed surface finishes as follows to match Architect's control samples:
1. Steel Smooth Form Surface: Make surface free of pockets, sand streaks, honeycomb; with uniform color and texture.
2. Light Broom: After troweling, smooth broom lightly with fine broom drawn over surfaces in direction parallel with long dimension.
3. Exposed Aggregate: Use chemical retarding agents applied to concrete forms with washing and brushing procedures after form removal.
4. Formliners: Impart textured surface by form liners or inserts to provide surfaces free of pockets, streaks, and honeycombs, with uniform color and texture.
5. Sandblasting: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
6. Acid Etching: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
7. Tooling or Bushhammering: Use power or hand tools to remove matrix and fracture coarse aggregates.
8. Hammered Ribs (Fractured Fins)
9. Sand Embedment: Use selected stones placed in a sand bed in bottom of mold, with sand removed following curing.
10. Honing or Polishing: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.

D. Color:
1. Natural gray.
   a. \

2.08 SOURCE QUALITY CONTROL

A. Fabrication Tolerances: Conform to referenced standards.

B. Tests, Inspections:
1. Testing: Unit dimensions smaller or greater than required, and outside specified tolerance limits are subject to additional testing as specified.
2. Strength of Units: Strength of units will be considered potentially deficient if manufacturing processes fail to comply with any requirements which may affect strength, including following conditions:
   a. Failure to meet compressive strength tests requirements.
   b. Reinforcement, pretensioning and detensioning of tendons of prestressed concrete, not conforming to specified fabrication requirements.
   c. Failure to cure, protect units against extremes in temperature as specified.
   d. Precast units damaged during handling and erection.

3. Suspected Non-compliance Testing: When there is evidence that strength of units does not meet specification requirements, the concrete testing service shall take cores drilled from hardened concrete for compressive strength determination, complying with ASTM C42 and as follows:
    a. At least 3 representative cores from units of suspect strength, from locations directed by Engineer.
    b. Test cores in saturated surface dry condition per ACI 318 if concrete will be wet during use of completed structure.
    c. Test cores in air-dry condition per ACI 318 if concrete will be dry during use of completed structure.
    d. Strength of concrete for each series of cores will be considered satisfactory if average compressive strength is at least 85 percent of 28-day design compressive strength.
    e. Test results are to be made in writing on same day tests are made, copies given to Architect, Contractor, and precast manufacturer. Include project name, number, date, manufacturer's name, concrete testing service name, identification letter, name, type of member or members represented by core tests, design compressive strength compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plan of concrete as placed, and moisture condition of core at time of bearing.
4. Patching: Where core test results are satisfactory and precast units are acceptable for use in work, fill core holes solid with patching mortar. Finish to match adjacent concrete surfaces.
5. Defective Work: Replace with units that meet requirements of this section. Make corrections to other work affected by or resulting from corrections to precast concrete work at no cost to Owner.

C. Verification of Performance:
1. Owner may employ separate testing laboratory to evaluate manufacturer's quality control and testing methods.
2. Allow access to materials storage areas, concrete production equipment, concrete placement and curing facilities.
3. Cooperate, provide samples of materials and concrete mixes as requested.

PART 3 EXECUTION

3.01 EXAMINATION

A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.

B. Verification of Conditions: Verify that the structural precast concrete may be installed in accordance with original design, pertinent codes and regulations, and pertinent portions of referenced standards.

C. Discrepancies:
1. Immediately notify Architect.
2. Do not proceed with installation in areas of discrepancy until fully resolved.
3. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

A. Protection: Protect installed work and materials of other trades.

B. Surface Preparation, Field Welding and Cutting: Protect units from damage, provide non-combustible shield as required.

3.03 ERECTION

A. Compliance: Comply with manufacturer's instructions, including product technical bulletin installation instructions and Shop Drawing details.

B. Bearing Pads:
   1. Where indicated, as precast units are being erected.
   2. Set on level, uniform bearing surfaces.
   3. Maintain in correct position until precast units are placed.

C. Powder-Actuated Fasteners: Do not use for surface attachment of accessory items in precast, prestressed unit unless otherwise accepted by precast manufacturer.

D. Installation Tolerances: Do not exceed following tolerance limits:
   1. Variation from plumb: 1/4-inch in 20-foot run or story height, 1/2-inch total in 40-foot or longer run.
   2. Variation from level or elevations: 1/4-inch in 20-foot run; 1/2-inch in 40-foot run; total plus/minus 1/2 inch any location.
   3. Variation from position in plan: plus/minus 1/2-inch maximum any location.
   4. Offset in alignment of adjacent members any joint: 1/16-inch in 10-inch run: 1/4-inch maximum.

E. Grouting Connections and Joints: After precast concrete units placed and secured, grout open spaces at connection and joints.
   1. Retain grout in place until sufficiently hard to support itself.
   2. Pack spaces with stiff grout material; tamp until voids completely filled.
   3. Finish smooth, plumb, level with adjacent concrete surfaces.
   4. Keep grouted joints damp for not less than 24 hours after initial set.
   5. Promptly remove grout material from exposed surfaces before it hardens.

F. Sealing Joints:
   1. Seal exposed and non-exposed, exterior and interior joints. Use primer and backer rod as recommended by sealant manufacturer.
   2. Seal joints between roof elements and floor elements, between wall elements anywhere roof or floor and walls join.

3.04 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections.

B. Field welds and connections using high-strength bolts will be subject to tests and inspections.

C. Testing agency to report tests results promptly in writing to Contractor and Architect.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.05 REPAIR/RESTORATION

A. Touch up marred finishes, but replace units that cannot be restored to factory-finished appearance. Use materials, procedures recommended or furnished by manufacturer.

B. Damaged Metal Surface: Clean, apply coat of liquid galvanized repair compound to galvanized surfaces, compatible primer to painted surfaces.

C. Units Having Dimensions Smaller or Greater Than Required and Outside Specified Tolerance Limits: If appearance or function of structure is adversely affected, or if larger dimensions interfere with other construction, repair, or remove and replace as required to meet construction conditions.

3.06 ADJACENT PANEL ALIGNMENT

A. Panels not in flush alignment with adjacent wall panels, and beyond allowable tolerance, must be replaced or, if possible, may be mechanically straightened and permanently fastened to remain at this intended alignment.

B. Fastener hardware for such corrections must be concealed and cast into the original panels to allow for such correction. See Drawings.

3.07 CLEANING

A. Site:
   1. Do not allow accumulation of scraps, debris arising from work of this section.
   2. Maintain premises in neat, orderly condition.

B. System:
   1. Remove temporary covering and other provisions made to minimize soiling of other work.
   2. Promptly clean, repair surfaces stained, marred or otherwise damaged during work.
   3. Clean exposed surfaces of structural precast concrete using materials and methods recommended by manufacturer.
   4. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes.
   5. When work is completed, remove unused materials, containers, equipment, and debris.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY ASSEMBLIES

PART 1 GENERAL

1.01 SUMMARY

A. Provide:
   1. Concrete masonry:
      a. Concrete masonry units.
   2. Mortar and grout.
   3. Insulation:
      a. Foundation/cavity wall.
      b. Spray foam sealant.
      c. Loose fill.
   4. Embedded membrane flashings.
   5. Reinforcing steel.
   6. Joint reinforcement.
   7. Ties and anchors.
   8. Surface treatment. **NOTE:** See Also Section 07 19 00

B. Installation of material furnished by other sections, including, but not limited to:
   1. Loose steel lintels.
   2. Sleeves.
   3. Embedments.
   4. Hollow metal frames in masonry walls.
   5. Plastic frames in masonry walls.

C. Perform the following:
   1. Preparation of openings in masonry for recessed items.

D. Related Sections:
   1. Section 03 30 00 - Cast-in-Place Concrete
   2. Section 03 41 00 - Plant-Precast Structural Concrete
   3. Section 07 11 13 - Bituminous Dampproofing
   4. Section 07 13 00 - Sheet Waterproofing
   5. Section 07 21 00 - Thermal Insulation
   6. Section 07 26 00 - Vapor Retarder Membrane
   7. Section 07 84 00 - Firestopping
   8. Section 07 92 00 - Joint Sealants
   9. Section 08 11 13 - Hollow Metal Doors and Frames (Commercial)
   10. Section 08 11 16 - Fire-Rated Aluminum Doors and Frames
   11. Section 08 16 00 - Corrosion Resistant Doors and Frames
   12. Section 08 51 13 - Aluminum Windows
   13. Section 09 97 23 - Cementitious Coatings for Concrete and Masonry
   14. Section 10 28 13 - Toilet Accessories
   15. Section 10 44 00 - Safety Specialties

E. Allowances: Refer to Section 01 21 00.

F. Alternates: Refer to Section 01 23 00.

G. Unit Prices: Refer to Section 01 27 00.

1.02 REFERENCES

A. ACI:
   1. 315, SP66 - Details and Detailing of Concrete Reinforcement
   2. 530.1 - Specifications for Masonry Structures

B. ASTM:
   1. A53 - Pipe, Steel, Hot-Dipped, Zinc Coated
   2. A153 - Zinc Coating, Hot Dip, on Iron and Steel Hardware
   3. A240 - Chromium and Chromium-Nickel Stainless Steel Plate
   4. A276 - Stainless Steel Bars and Shapes
   5. A307 - Carbon Steel Bolts and Studs.
   6. A479 - Stainless Steel Bars and Shapes for Use in Pressure Vessels (corrosive situations)
   7. A496 - Steel Wire, Deformed, for Concrete Reinforcement
   8. A580 - Stainless Steel Wire
   9. A615 - Deformed and Plain-Billet Steel Bars for Concrete Reinforcement
   10. A641 - Zinc Coated Galvanized Carbon Steel Wire
   11. A666 - Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar For Structural Applications
   12. A775 - Epoxy Coated Steel Reinforcing Bars
   13. A951 - Masonry Joint Reinforcement
   14. B370 - Copper Sheet
   15. B633 - Electrodeposited Zinc on Iron or Steel
   16. C40 - Test for Organic Impurities in Fine Aggregates for Concrete
   17. C67 - Test for Sampling and Testing Brick and Structural Clay Tile
   18. C90 - Load Bearing CMU
   19. C91 - Masonry Cement
   20. C126 - Ceramic Glazed Brick and Tile
   21. C129 - Non-Loadbearing Concrete Masonry
   22. C140 - Concrete Masonry Units Testing
   23. C144 - Aggregates for Masonry Mortar
   24. C207 - Hydrated Lime for Masonry Purposes
   25. C216 - Facing Brick
   26. C270 - Mortar for Unit Masonry
   27. C315 - Clay Flue Linings
   28. C395 - Chemical Resistant Resin Mortars
   29. C404 - Aggregates for Masonry Grout
   30. C476 - Grout for Masonry
   31. C494 - Chemical Admixtures for Concrete
   32. C150 - Portland Cement
   33. C578 - Rigid Cellular Polystyrene Thermal Insulation
   34. C780 - Mortar Mixes
   35. C1019 - Grout Sampling and Testing
   36. C1093 - Testing Agency Qualifications
   37. C1142 - Ready-Mixed Mortar for Unit Masonry
   38. C1261 - Chimney Flue
   39. C1283 - Installation of Clay Flue Liners
   40. C1314 - Prism Compressive Strength
   41. C1329 - Mortar Cement
   42. D226 - Asphalt Saturated Organic Felt for Roofing and Waterproofing
   43. D1056 - Flexible Cellular Materials
   44. D3278 - Flash Point of Liquids
   45. E96 - Water Vapor Transmission
   46. E119 - Fire Tests of Building Construction and Methods
   47. E488 - Strength of Concrete and Masonry Anchors
   48. E514 - Water Penetration and Leakage Through Masonry
   49. F593 - Stainless Steel Bolts, Screws, Studs
   50. F594 - Stainless Steel Nuts
   51. F738 - Stainless Steel Metric Bolts, Screws, Studs
   52. F836 - Stainless Steel Metric Nuts, Style 1

C. AWS D1.4 - Structural Welding Code - Reinforced Steel

D. BIA:
   1. Technical Note No. 20 Revised - Cleaning Brick Masonry
   2. M1 - Specifications for Portland Cement-Lime Mortar for Brick Masonry

E. IBC Code: Currently in effect and adopted by state in which Project is located

F. National Concrete Masonry Association: Tek 19-1 Water Penetration Resistance

1.03 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. Provide unit masonry that develops the following installed compressive strengths (f'm) at 28 days:
      a. For Concrete Unit Masonry: Based on net area: f'm = 1900 PSI (13.1 MPa).
   2. Provide unit masonry that meets or exceeds fire resistance requirements.

B. Surface coating: Brick with colors of textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C67 with no observable difference in the applied finish when viewed from 10 feet, or shall have a history of successful use in Project's area.

1.04 SUBMITTALS

A. Refer to Section 01 33 00.

B. Product Data:
   1. For each product indicated. Include size variation data verifying that actual range of sizes for brick falls within ASTM C216 dimension tolerances.
   2. Mix designs for each type of mortar and grout, including description of type and proportions of ingredients.

C. Shop Drawings:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315.
   3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

D. Samples:
   1. Color Samples: Submit manufacturer's standard color samples with Product Data.
   2. Samples for Verification Purposes: Unit masonry samples for each type of exposed masonry unit required; include the full range of exposed color and texture expected in complete work.

E. Quality Assurance/Control Submittals:
   1. Qualification Data:
      a. Manufacturers, Contractor: Include lists of completed, similar sized projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
      b. Testing agency: ASTM C1093.
   2. Mockup Materials:
      a. List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used.
      b. Include mix proportions for mortar and grout and source of aggregates.
      c. Submittal is for information only. Approval does not constitute approval of deviations from the Contract Documents.
   3. Cold-weather Procedures: Describe methods, materials and equipment to be used to comply with cold-weather requirements, if applicable.
   4. Material certificates and test reports.

1.05 QUALITY ASSURANCE

A. Single Source Responsibility: Provide materials made of components, with uniform texture and color or blend, furnished by one manufacturer for each type of masonry, mortar, aggregate and accessory.

B. Qualifications:
   1. Manufacturer: 5 year's experience in the manufacture of unit masonry.
   2. Contractor: 3 years' experience in the installation of unit masonry.
   3. Personnel:
      a. Foreman: Competent, in charge of work at all times, for duration of work unless otherwise permitted by Architect.
      b. Installer of masonry units: Skilled journeyman masons.
      c. Mixer personnel: Thoroughly trained, with at least 1 person with 1 year experience (minimum) mixing mortar.

C. Regulatory Requirements: Comply with pertinent requirements of governing authorities and referenced portions of ACI, NCMA and BIA industry standards.

D. Certificate for Fire Performance and Characteristics: Certify materials and construction are in compliance with ASTM E119, by recognized testing and inspecting organization, or by other means, acceptable to authority having jurisdiction.

E. Field Samples: If requested, before masonry materials are delivered to job site, furnish sample of each type of unit masonry, including the full range of exposed color and texture expected in complete work, to Architect for review prior to installation.

F. Material Certificates and Test Reports: Provide statements and tests of material properties indicating compliance with standards for each type and size of the following:
   1. Masonry Units:
      a. Material test reports and statement of compressive strength.
      b. \
      c. Concrete masonry units: ASTM C140.
      d. Structural masonry units, including data and calculations establishing average net-area compressive strength of units.
   2. Prism: ASTM C1314.
      a. Prisms shall consist of concrete block assembly such that 2 grouted face shell levels are in compressed zone and laid in stack bond.
      b. Prior to construction: Construct and test 5 ungrouted concrete block prisms.
      c. During construction: Construct and test 3 ungrouted concrete block prisms.
      d. 28 days after construction:
         1) Test in accordance with ASTM E447. The acceptable test result shall be the average of each set of prisms.
         2) Masonry prism compressive strength: 2500 psi.
   3. Cementitious materials.
   4. Mortar: ASTM C780.
   5. Preblended, dry mortar mixes.
   6. Grout mixes: ASTM C1019.
   7. Reinforcing bars.
   8. Joint reinforcement.
   9. Anchors, ties, and metal accessories.

G. Mockups:
   1. After award of Contract, before installing unit masonry, erect mock-up for each form of construction and finish required to verify selections made under sample submittals, and to demonstrate aesthetic effects as well as qualities of materials and execution.

2. Build mock-up to comply with the following requirements, using materials indicated for final unit of Work.
    a. Location: Locate mock-up on site in location and size indicated or, if not indicated, as directed by Architect.
    b. Scope: Demonstrate the proposed range of aesthetic effects and workmanship.
    c. Acceptance: Obtain Architect's acceptance of mock-up before start of final unit of Work.
    d. Maintenance: Retain and maintain mock-up during construction in undisturbed condition as a standard for judging completed unit of Work.
    e. Remove mock-up after Substantial Completion.

H. Preinstallation Meetings: Conduct conference at Site to comply with requirements of Section 01 31 19.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection:
1. Assume responsibility for acceptance of masonry units delivered to site being in compliance with specified ASTM requirements for chippage and dimensional tolerances.
2. Comply with manufacturer's recommendations for job-site storage and protection.
3. Unit Masonry: Store off ground and protected from wetting or contaminants likely to cause staining or defects in the masonry.
4. Cementitious Materials: Store off ground, under cover, in dry location.
5. Aggregates: Store to maintain grading, other required characteristics, and avoid contamination.
6. Preblended, Dry Mortar Mix: Deliver in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store on elevated platforms, under cover, and in dry location or metal dispensing silo with weatherproof cover.
7. Masonry Accessories Including Metal Items: Store to prevent corrosion and accumulation of dirt and oil.

1.07 PROJECT CONDITIONS

A. Environmental Requirements:
1. Cold and Hot Weather Protection: Conform to recommendations for hot and cold weather masonry included in International Building Code.
    a. Do not lay wet or frozen masonry units.
    b. Ice or snow formed on masonry bed: Carefully apply heat until top surface is dry to touch.
    c. Remove masonry damaged by freezing conditions.
    d. If temperatures expected to fall below 40 degrees F within 12 hours, do not lay unless proper heated enclosures are provided.
    e. Minimum temperature of masonry: 40 degrees F for 48 hours after installation.
    f. In temperatures below 50 degrees F, use surface conditioner when installing flexible flashing.
    g. Hot weather: Keep masonry moist until mortar has cured.

B. Existing Conditions: Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

1.08 MAINTENANCE

A. Extra Materials:
1. Provide for maintenance purposes, quantity unit masonry equal to 2 percent of each type of material installed.
2. Package and mark to identify building and material type and color.
3. Store as directed after completion of Work.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Concrete Masonry Units:
   1. Standard of Quality: Design is based on products of _____
   2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
      a. Amcon Block and Precast Company, St. Cloud, MN www.amconblock.com
      b. Anchor Block Company, North St. Paul, MN www.anchorblock.com
      c. Arlington Concrete Products Inc., Arlington, MN
      d. County Materials, Marathon WI www.countymaterials.com
      e. W.W. Thompson Concrete Products, Brainerd, MN
      f. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

B. Mortar and Grout Materials:
   1. Portland Cement, Mortar Cement, Masonry Cement, and Lime: Acceptable manufacturers, subject to compliance with requirements, are:
      a. Lafarge Corporation, Dallas, TX www.lafargenorthamerica.com
      b. Lehigh Cement Company, Allentown, PA www.lehighwhitecement.com
      c. Manufacturer of comparable products submitted in compliance with Section 01 25 13.
   2. Water Repellent Admixture: Acceptable manufactures, subject to compliance with requirements are:
      a. DryBlock by Grace Construction Products, Cambridge, MA www.DryBlock.com
      b. Manufacturer of comparable products submitted in compliance with Section 01 25 13.
   3. Premixed Mortar: Acceptable manufacturers, subject to compliance with requirements, are:
      a. Spec Mix www.specmix.com
      b. Manufacturer of comparable products submitted in compliance with Section 01 25 13.
   4. Epoxy Pointing Mortar (Joint Grout): Acceptable manufacturers, subject to compliance with requirements, are:
      a. Summitville Tiles Inc., Summitville, OH www.summitville.com
      b. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

C. Joint Reinforcement:
   1. Standard of Quality: Design is based on products of Heckman Building Products, Inc., Chicago, IL www.heckmanbuildingprods.com
   2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
      a. Dur-O-Wall Inc., Aurora, IL www.dur-o-wall.com
      b. Hohmann & Barnard, Hauppauge, NY www.h-b.com
      c. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

D. Ties and Anchors:
   1. Standard of Quality: Design is based on products of Heckman Building Products, Inc., Chicago, IL
   2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
      a. Dur-O-Wall, Inc., Aurora, IL www.dur-o-wall.com
      b. Hohmann & Barnard, Hauppauge, NY www.h-b.com
      c. Masonry Reinforcing Corporation of America, Charlotte, NC www.wirebond.com
      d. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

E. Insulation:
   1. Rigid Foundation/Cavity Wall Insulation: Acceptable manufacturers, subject to compliance with requirements, are:
      a. DiversiFoam Products, Inc., New Brighton, MN www.diversifoam.com
      b. Dow Chemical Company, Midland, MI www.dow.com/styrofoam
      c. Foamular 250 by Owens Corning, Toledo, OH www.owenscorning.com
      d. Pactiv Corporation, Atlanta, GA www.pactiv.com
      e. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

2. Spray Foam Sealant: Acceptable manufacturers, subject to compliance with requirements, are:
   a. *Handi-Foam*, Fomo OProducts Inc. www.fomo.com
   b. *Polycel*, Polycel Foam Products, Sommerville, NJ www.polycel.com
   c. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

F. Embedded Membrane Flashings:
   1. Rubberized Asphalt Flashing: Acceptable manufacturers, subject to compliance with requirements, are:
      a. *CCW-705-TWF*, Carlisle Corporation, Sapulpa, OK
      b. Hohmann & Barnard, Inc. www.h-b.com
      c. *Flashgard*, Firestone Building Products, Carmel, IN
      d. *Miradri TWF*, Nicolon-Mirafi Group, Norcross, GA
      e. *Perm-a-Barrier Wall Flashing*, Grace Construction Products, Cambridge, MA
      f. Polyguard 400, Ennis TX
      g. *Safseal 6634*, Safseal Innovations, Denver, CO
      h. *Sealtight*, WR Meadows, Elgin, IL
      i. *York Seal,* York Manufacturing, Sanford, ME
      j. Manufacturer of comparable products submitted in compliance with Section 01 25 13.
   2. Metal Flashings: Acceptable manufacturers, subject to compliance with requirements, are:
      a. York Manufacturing, Sanford, ME www.yorkflashings.com
      b. Manufacturer of comparable products submitted in compliance with Section 01 25 13.
   3. Stainless Steel Drip Plates: Acceptable manufacturers, subject to compliance with requirements, are:
      a. Hohmann & Barnard, Hauppauge, NY www.h-b.com
      b. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

G. Masonry Accessories:
   1. Weep Vents: Acceptable manufacturers, subject to compliance with requirements, are:
      a. CavClear, Hudson, WI www.cavclear.com
      b. Dur-O-Wal Cell Vent, Aurora, IL www.dur-o-wal.com
      c. Hohmann & Barnard, Hauppauge, NY www.h-b.com
      d. Manufacturer of comparable products submitted in compliance with Section 01 25 13.
   2. Cavity Drainage Material: Acceptable Manufacturers, subject to compliance with requirements, are:
      a. CavClear, Hudson, WI www.cavclear.com
      b. Mortar Net USA, LTD, Gary, IN www.mortarnet.com
      c. Mortar Stop by Dur-O-Wall, Aurora, IL www.dur-o-wal.com
      d. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

H. Masonry Cleaner:
   1. Standard of Quality: Design is based on products of ProSoCo, Inc., Lawrence, KS www.prosoco.com
   2. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers and products are:
      a. Diedrich Technologies, Inc., Oak Creek, WI www.diedrichtechnologies.com
      b. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

I. Surface Treatments:
   1. Cementitious Coating: Acceptable manufacturers, subject to compliance with requirements, are:
      a. *Thoroseal* by BASF Building Systems, Shakopee, MN www.basfbuildingsystems.com
      b. Manufacturer of comparable products submitted in compliance with Section 01 25 13.
   2. Gloss (Burnished Block) Sealer: Standard of Quality: Design is based on *Bright Seal* WB by TK Products, Minnetonka, MN www.tkproduct.com
      a. Other Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufactures and products are:
         1) BASF Building Systems, Shakopee, MN www.basfbuildingsystems.com
         2) Conspec, Kansas City, KS www.conspecmkt.com
         3) Prosoco, Lawrence, KS www.prosoco.com
         4) Manufacturer of comparable products submitted in compliance with Section 01 25 13.

3. Water Repellant: Acceptable manufacturers, subject to compliance with requirements, are:
    a. BASF Building Systems www.buildingsystems.basf.com
    b. Evonik/Degussa www.protectosil.com
    c. L&M Construction Chemicals www.lmcc.com
    d. Grace Construction www.graceconstruction.com
    e. Rainguard www.rainguard.com
    f. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

2.02 MATERIALS

A. Portland Cement: ASTM C150, Type I.

B. Lime: ASTM C207, Type S.

C. Mortar Cement: ASTM C1329. Contractor has option of using pre-mixed mortar indicated below.
1. Comply with ASTM C270 for types of mortar indicated below.
    a. At or below grade: Type S.

    b. Above grade: Type N, except as noted.

D. Pre-Mixed Mortar:
1. Meet ASTM C1142.
2. Preblended, dry mortar mix
3. Measure by weight to ensure accurate proportions.
4. Thoroughly blend ingredients before delivering to Site.

E. Epoxy Pointing Mortar (Joint Grout):
1. Meet ASTM C395, epoxy-resin-based material formulated for use as pointing mortar.
2. Product: *S-400*.
3. Mix to comply with mortar manufacturer's written instructions.
4. Color: As selected by Engineer from manufacturer's standard colors.

F. Grout Design Mix:
1. ASTM C476.
2. Minimum Compressive Strength: 3000 psi at 28 days.
3. Mix Proportion: 1 part portland cement, 2-1/2 parts sand, 1-1/2 parts pea gravel, and adequate water to produce a concrete of approximate 10-inch slump.

G. Masonry Cement: ASTM C91.

H. Aggregate:
1. Mortar: ASTM C144, natural or manufactured sand.
2. Grout: ASTM C404, natural or manufactured sand, gravel, crushed stone, or slag.

I. Water: Clean and free of oils, acids, alkalis, salts, organic materials, or other substances in amounts that may be harmful to mortar, grout, or embedded metals.

J. Admixtures:
1. Do not use air-entraining admixtures or materials containing air-entraining admixtures.
2. Do not add set-retarding or set-accelerating, bond modifying, or corrosion-inhibiting admixtures to mortar or grout without written approval of Engineer.
3. Do not use chloride or products containing chloride in mortar or grout in which metal reinforcement or accessories will be embedded.
4. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
5. Water-Repellent Admixture: Intended for use with concrete masonry units, containing integral water repellent by same manufacturer.

K. Mortar Pigments: Liquid or powdered pigments mixed in accordance with manufacturer's printed instructions.
   1. Pigments shall not exceed 5 percent of mortar cement by weight for mineral oxides, nor 1 percent for carbon black.
   2. Use only pigments with a record of satisfactory performance in masonry mortars.
   3. Provide natural color or white cement as required to produce mortar color indicated.
   4. Color: Color selected from manufacturer's standard formulations.

2.03 MANUFACTURED UNITS

A. Concrete Masonry Unit:
   1. Provide architectural CMU with integral water repellant admixtures.
   2. Modular, hollow and solid load-bearing standard weight.
   3. Conforming to ASTM Standard C90, Type I, Grade N.
   4. Corner blocks, jamb units, bond beam units, and special sizes and shapes as indicated or otherwise required.
   5. Defects:
      a. Exposed common CMU: Limited to 1/2-inch diameter defect in no more than 5 percent of the block. 2 defects maximum per block.
   6. Block Types (normal weight unless otherwise specified):
      a. Block Type "A":
         1) Nominal block size: 8 inch by 8 inch face **OR** 8 inch by 16 inch face **OR** 16 inch by 16 inch face **OR** 6 inch by 24 inch face.
         2) Face style: Common **OR** Split Face **OR** Corduroy **OR** Break-off **OR** Rock Face **OR** Splyt Stone **OR** Castle Rock **OR** Burnished.
         3) Unscored where not exposed to view and 1 score (2 nominal 8 inch by 8 inch faces) where exposed.
         4) Block color: Natural gray **OR** As selected by Engineer from manufacturer's standard **OR** premium **OR** custom colors.
      b. Block Type "B":
         1) Nominal block size: 8 inch by 8 inch face **OR** 8 inch by 16 inch face **OR** 16 inch by 16 inch face **OR** 6 inch by 24 inch face.
         2) Face style: Common **OR** Split Face **OR** Corduroy **OR** Break-off **OR** Rock Face **OR** Splyt Stone **OR** Castle Rock **OR** Burnished.
         3) Unscored **OR** Two scores (2 nominal 8 inch by 8 inch faces).
         4) Block color: As selected by Engineer from manufacturer's standard **OR** premium **OR** custom colors.
      c. Block Type "C":
         1) Sound absorbing structural masonry units.
         2) Fillers: noncombustible fibrous material with metal septa.
         3) Product: SoundBlox, type RSC/RF.
         4) Meet ASTM C90 or ASTM C129 requirements as appropriate.
         5) Face style: Unscored **OR** Split rib.
         6) Block color: As selected by Engineer from manufacturer's standard **OR** premium **OR** custom colors.

2.04 REINFORCEMENT

A. Reinforcing Steel:
   1. Reinforcing Bars:
      a. Uncoated deformed steel, ASTM A615, Grade 60.

B. Joint Reinforcement:
   1. Meet ASTM A951.
   2. Prefabricated welded-wire units with deformed continuous side rods and plain cross rods, straight lengths of not less than 10'-0", with prefabricated corner and tee units.
   3. Width: Approximately 2 inches less than nominal width of walls and partitions.
   4. Mortar coverage: Minimum 5/8-inch on joint faces exposed to exterior and 1/2-inch elsewhere.

5. Steel Wire Size:
    a. Standard: 9 gage side and cross rods.

C. Finishes:
1. Interior Walls: Mill galvanized or hot dip.
2. Exterior Walls, Foundations
    a. Class B2 Hot Dipped Galvanized carbon.

D. Design:
1. Single-Wythe Masonry: Truss or ladder type with single pair of side rods and continuous diagonal cross rods spaced not more than 16 inches on center.

2.05 TIES AND ANCHORS

A. Structural Back-up Types:
1. Concrete Block (Cavity Wall): See joint reinforcement.
2. Concrete Block (veneer addition to existing masonry): Contractor's choice of flexible tie (H&B No. 345-BT) or channel anchor (H&B No. 362&363).
3. Cast or Precast Concrete:
    a. Dovetail slots with filler strips of slot size indicated, fabricated from 18 gage stainless steel.
    b. Dovetail anchors: 3/16-inch diameter wire triangle with 12 gage dovetail designed to hold brick rigidly in place.
4. Stud:
    a. Veneer anchor: screw on strap; 12 gage; 4-inch adjustment.
    b. Veneer tie: 3/16-inch diameter rod.
5. Steel Framing:
    a. Veneer anchor: Contractor option, weld on rod; 1/4 diameter, 4-inch adjustment or weld on strap; 12 gage, 4-inch adjustment.
    b. Veneer tie: 3/16-inch diameter rod.
6. Corrugated ties or anchors: Not allowed.

B. Finishes:
1. Wire Ties or Anchors; Exterior Walls/ Cavity Walls/Foundations; Completely Embedded in Mortar or Grout: Mill galvanized ASTM A641 Class 3 (0.80 ounce per square foot).
2. Wire Ties or Anchors; Exterior walls/ Foundations; Not Completely Embedded in Mortar or Grout: Hot dipped galvanized ASTM A153 Class 2 (1.50 ounces per square foot); prime following welded fabrication.

Sheet Metal Ties or Anchors; Exposed to Weather or Earth; or Completely Embedded in Mortar or Grout: Hot dipped galvanized ASTM A153 Class 2 (1.50 ounces per square foot); prime

C. Anchor Bolts:
1. Steel bolts with hex nuts and flat washers.
2. Carbon: ASTM A307, Grade A
    a. Hot-dip galvanized, Class C.
    b. In sizes and configurations indicated.

D. Shelf Angle Anchors: Unit type masonry inserts in concrete: cast iron or malleable iron inserts of type and size indicated.

E. Post-installed Anchors: Chemical or torque-controlled expansion anchors with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in concrete, per ASTM E488 testing by qualified testing agency.
1. Corrosion Protection:
    a. Carbon-steel components zinc-plated to comply with ASTM B633, Class Fe/Zn 5 for Class SC 1 service condition (mild).
    b. Stainless-steel components complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.
        1) Bolts and nuts ASTM F738 and ASTM F836.
        2) Anchors: ASTM A666 or ASTM A276 304 or 316.

2.06 INSULATION

A. Rigid Foundation/Cavity Wall Insulation (extruded polystyrene):
   1. Rigid, cellular thermal insulation with closed-cells and integral high density skin, formed by expansion of polystyrene base resin in extrusion process complying with ASTM C578, type IV.
   2. Thermal Value: 5-year aged R-values of 5.4 and 5 at 40 and 75 degrees F respectively.
   3. Density: 1.6 pounds per cubic foot minimum density, unless otherwise indicated.
   4. Compressive Strength (foundation insulation): 25 pounds per square inch.
   5. Preformed Units: To fit applications indicated, selected from manufacturer's standard thicknesses, widths, lengths.
   6. Thickness: As indicated on Drawings, or if not indicated, 2 inches.
   7. Adhesive: Include manufacturer's recommended adhesive or other fasteners to make positive attachment to inner wythe or concrete masonry unit.

B. Spray Foam Sealant: Non-shrink closed cell expanding urethane.

C. Loose Fill Block Insulation: ASTM C578, Type 1, pourable polystyrene bead insulation.

2.07 EMBEDDED MEMBRANE FLASHINGS

A. Rubberized Asphalt Sheet Flashing:
   1. Self-sealing, self-healing, fully adhering composite flexible flashing, consisting of pliable, highly adhesive, rubberized asphalt, bonded completed, and integrally to multiple plies of 8 mil (minimum) high density cross laminated polyethylene film, 40 mil thick total (minimum), protected by release sheet.
   2. Include primer, surface conditioner, mastic, and other accessories as recommended by manufacturer.
   3. Sheet Metal Flashing and Cavity Bridge:
      a. 24-gage prefinished steel hemmed.
      b. Use to ensure rubberized asphalt sheet flashing will not bow and collect water.

B. Stainless Steel Drip Plates: ASTM A666, 300, 20-gage custom fabricated of size as shown on Drawings, or prefabricated by manufacturer.

C. Miscellaneous Flashing Accessories: Flashing pans, end dams, flashing corners, adhesives, primers, and seam tapes: Use flashing manufacturer's standard products or products recommended by flashing manufacturer.

2.08 MISCELLANEOUS MASONRY ACCESSORIES

A. Termination Bars: 304 stainless steel.

B. Compressible Filler, Non-metallic Expansion Joint Strips:
   1. Premolded, flexible cellular neoprene rubber filler strips.
   2. ASTM D1056, Grade 2A1.
   3. Capable of compression up to 35 percent of width and thickness indicated.

C. Premolded Control Joint Gaskets:
   1. Designed to fit standard sash block and to maintain lateral stability in masonry wall.
   2. Size and configuration as indicated.

D. Bond Breaker Strips:
   1. Asphalt-saturated organic roofing felt.
   2. ASTM D226, Type I, (No. 15 asphalt felt).

E. Mortar Nets: Lightweight polyethylene or nylon net (90 percent open woven mesh), allowing water to flow through mortar droppings.

F. Weep Vents:
   1. Plastic Weep Hole/Vent:
      a. One-piece, flexible extrusion manufactured from ultraviolet-resistant polypropylene, medium density.
      b. Designed to weep moisture in masonry cavity to exterior.
      c. Sized to fill head joints with outside face held back from exterior face of masonry.
      d. Color: Selected from manufacturer's standard.
   2. Vinyl Weep Hole/Vent:
      a. One-piece, offset.
      b. T-shaped units formed to fit in a vertical mortar joint by injection molding of flexible polyvinyl chloride (PVC).
      c. Consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and top flap.
      d. Color: Approved by Architect to match that of mortar.

G. Pipe Sleeves: 3-inch diameter Schedule 40, ASTM A53, 14 inches long, at locations above ceiling as directed by Architect. Provide and installas needed.

H. Pressure Treated Wood Blocking: See Section 06 10 53.

I. Isolation Sheet: 4 mil polyethylene; use to separate incompatible metals from direct contact.

J. Masonry Cleaners:
   1. Do not use cleaning agents other than water without approval of Architect and unit manufacturer.
   2. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gallon of water.

K. Surface Treatments:
   1. Cementitious Coating. See Section 09 97 23.
   2. Water Repellant:
      a. Silane/Siloxane, bonds with silica.
      b. Solvent based. **NOTE:** Solvent based is better in cold climates
      c. Clear, non-yellowing, non-staining.
      d. Penetrating, breathable.
      e. Minimizes efflorescence.
      f. VOC compliant.
      g. Repels water, mildew, dirt, and airborne contaminants.
      h. Meet ASTM D3278 for flash point, ASTM E96 for water vapor transmission, and ASTM E514 for water penetration.

PART 3 EXECUTION

3.01 EXAMINATION

A. Work of Other Trades: Prior to commencing work, carefully inspect, with installer present, and verify that work is complete to point where this installation may properly commence. Examine surfaces that will support masonry work to ensure completion to proper lines and grades.

B. Verification of Conditions: Verify that unit masonry systems may be installed in accordance with original design, pertinent codes and regulations, and pertinent portions of referenced standards.

C. Discrepancies:
   1. Immediately notify Architect.
   2. Do not proceed with installation in areas of discrepancy until fully resolved.
   3. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

A. Protection of Work:
   1. During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress. Extend cover minimum 24 inches down both sides and hold securely in place.
   2. Masonry to be exposed or painted: Prevent grout, mortar or soil from staining face. Immediately remove grout or mortar in contact with such masonry.
   3. Base of walls: Protect from rain-splashed mud, mortar splatter by spreading coverings on ground and over wall surface.
   4. Sills, ledges, projections: Protect from droppings of mortar.

B. Cleaning Reinforcing: Before placing, remove loose rust, ice, other coatings from reinforcing.

3.03 INSTALLATION, GENERAL

A. Wetting:
   1. Concrete Masonry Units: Do not wet.

B. Procedures:
   1. Cavity and composite walls, floors, other masonry construction: Build to full thickness shown.
   2. Single-wythe walls: Build to actual thickness of masonry units, using units of nominal thickness indicated.
   3. Chases and recesses: Build as shown or required for work of other trades, with at least 8 inches of masonry between chase or recess and jamb of openings, between adjacent chases, recesses.
   4. Use bullnose masonry at corners and jambs, unless detailed otherwise.
   5. Leave openings for equipment to be installed before completion of masonry work.
   6. After installation of equipment, complete masonry work to match work immediately adjacent to opening.

C. Cutting:
   1. Use motor-driven saws to provide clean, sharp, unchipped edges.
   2. Cut to provide continuous pattern and to fit adjoining work.
   3. Use full-size units without cutting where possible.
   4. Use dry cutting saws to cut concrete masonry units.

3.04 LAYING MASONRY UNITS

A. General:
   1. Do not install masonry units that are cracked, broken, or chipped in excess of ASTM allowances.
   2. When possible, orient units so that small chips and cracks are not on exposed side of wall.
   3. Align unit cells or cores that are to be grouted.
   4. Place units in final position while mortar is soft and plastic.
   5. Match approved mock-up panel to provide uniform color blending in walls of exposed brick or CMU and to avoid patchy effect.

B. Layout and Tolerances:
   1. Layout in advance for accurate spacing of surface bond patterns with uniform joint widths, accurate location of openings, movement-type joints, returns, and offsets.
   2. Avoid use of less- than-half-size units at corners, jambs, and wherever possible at other locations.
   3. Comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.
   4. Install masonry to distance from adjoining dissimilar materials as detailed or if not detailed, 3/4-inch maximum.

C. Pattern Bond:
   1. Match patterns as indicated. If not shown, lay in running bond with vertical joint in each course centered on units in courses above and below.

2. Concealed masonry: Lay with units in wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners.
3. Do not use units with less than nominal 4-inch horizontal face dimensions at corners, jambs.

D. Stopping and Resuming Work:
1. Rake back 1/2-unit length in each course; do not tooth.
2. Clean exposed surfaces of set masonry, wet units lightly (if required), remove loose masonry units and mortar prior to laying fresh masonry.

E. Built-in Work:
1. As work progresses, build-in items specified under this and other sections of these specifications.
2. Coordinate with any other trades involved.
3. Install all metal frames, bolts, inserts, sleeves, bearing plates, and other items required to be set in masonry.
4. Fill all hollow metal frames with concrete unless indicated otherwise. Rake out joint between frame and concrete masonry unit to create 3/8-inch reveal.
5. Fill in solidly with masonry around built-in items.
6. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
7. Built-in items to be embedded in cores of hollow masonry units: Place layer of metal lath in joint below, rod mortar or grout into core.
8. Embed anchors and ties at least 1/2 inch in mortar of outer face shell of hollow units and 1-1/2 inch in mortar of solid masonry.
9. Hollow concrete masonry units: Fill cores with grout 3 courses (24 inches) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
10. Do not disturb or bend ties or anchors after embedding in grout or mortar.

3.05 BEDDING AND JOINTING

A. Mortar Mixing:
1. Mix mortar in accordance with the requirements of ASTM C270.
2. Control batching procedure to ensure proper proportions by measuring materials by volume or weight as specified.
3. Control amount of mixing water and mortar consistency.
4. Discard mortar or grout that has partially set or is not used within 1-1/2 hours of mixing.
5. Re-temper with 1-1/2 hours of mixing to replace moisture lost by evaporation. Do not retemper colored mortars.

B. Hollow Concrete Masonry Units:
1. Lay full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout.
3. For starting course on footings where cells are grouted, spread out full mortar bed including areas under cells.

C. Joints:
1. Joint widths: Maintain as shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8-inch joints.
2. Masonry walls to be concealed or covered by other materials: Cut flush unless otherwise indicated.
3. Exposed joints: Tool brick or concrete masonry joint slightly concave using jointer larger than joint thickness, unless otherwise indicated.

D. Masonry Units Disturbed After Laying:
1. Clean, reset in fresh mortar.
2. Do not pound corners of jambs to shift adjacent stretcher units that have been set in position.
3. If adjustment required, remove units, clean off mortar, reset in fresh mortar.

E. Epoxy Mortar (Grout):
   1. Substrate: Cured masonry surfaces.
   2. Fill bond beams, block cores, voids with specified grout indicated on Drawings, where specified, or where otherwise required by construction.
   3. Installation:
      a. Rake back cement mortar 3/8-inch (minimum) while still toolable.
      b. Force as much epoxy mortar into joint as possible
      c. Tool prior to mortar loosing plasticity.
   4. Keep grout cores clean. When grout pour exceeds 5 feet, provide cleanout holes in bottom course of masonry for each core, as required for inspection and cleaning. Replace cleanout plugs only after area to be grouted has been accepted.
   5. Notify Engineer when grout elements are ready for inspection.
   6. Use grout within 1-1/2 hours of mixing.
   7. Clean Up: Use “Scotch-Brite” pad and minimum amount of water, clean completely.

F. Sand:
   1. Concrete masonry units: Fill cores, voids with mason sand.
   2. Seal around electrical devices, other built in items; fill cores in two-course lifts, rodding or vibrating to ensure filling of all voids and spaces.

3.06 NON-BEARING INTERIOR PARTITIONS

A. Height: Build to underside of solid floor or roof structure above, unless otherwise shown.

B. Install with steel angles leaving a gap between top of wall and deck.

C. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

D. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 00.

3.07 CONSTRUCTION OF CAVITY WALLS

A. Lay to dimensions and details shown, minimum 1 inch, clear and free of mortar bulges, droppings from top to bottom. Lay in bonds specified.

B. Side Mortar Joint: Bevel to minimize mortar bulges or use clean-out strip to remove droppings and bulges from cavity. Spread mortar protruding into cavity on back of masonry units immediately following laying.

C. Vapor Retarder Membrane: Coordinate with Section 07 26 00.

D. Weep Vents: Install as indicated on Drawings to allow equalization of air pressure in the cavity and to ventilate the cavity. If not indicated on Drawings, install at bottom above embedded flashing and top of wall, 16 inches on center.

E. Weep Holes:
   1. Where weep vent is not appropriate, with approval of Architect, parge bottom of cavity with mortar, provide weep holes 16 inches on center.
   2. Fill with cotton cord rope, attached minimum of 12 inches above flashing. For sills, fasten to highest point of installation.
   3. Attach wick vertically to insulation.
   4. Keep clear of mortar, other obstructions throughout construction process.

F. Cavity Drainage Material: Install in bottom of cavity as indicated on Drawings to allow seepage of water in cavity to weeps.

G. Foundation/Cavity Insulation:
   1. Securely attach to interior masonry wythe with ties or adhesives specifically recommended by insulation manufacturer.
   2. Cut to fit around pipes, conduit, reinforcing, etc., using sharp knife, saws, drills as required.
   3. Use spray foam sealant at joints between rigid insulation sheets and at opening to provide complete seal.

H. Loose Fill Block Insulation: Install within block cells of hollow concrete masonry units at inside wythe of exterior cavity walls. Fill void spaces completely. Limit fill to lifts of 6 courses maximum.

I. Treated Wood Blocking: Coordinate with Section 06 10 53 for wood blocking in cavity walls.

3.08 REINFORCED MASONRY

A. Set reinforcing bars in grout; do not use mortar.

B. Schedule:
   1. Bond beams.
   2. Vertical cores at each side of lintels.
   3. Vertical reinforcing for walls.
   4. Mitered concrete masonry unit corners, every other course.
   5. Vertical reinforcing in parapets as indicated on Drawings, or if not indicated, 2'-8" on center.

3.09 HORIZONTAL JOINT REINFORCEMENT

A. Continuous Horizontal Joint Reinforcement as Indicated:
   1. Longitudinal side rods in mortar for entire length with minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere.
   2. Lap reinforcing minimum 6 inches.
   3. Cut or interrupt at control and expansion joints, unless otherwise indicated.
   4. Reinforce walls with continuous horizontal joint reinforcing unless specifically noted to be omitted.
   5. Provide continuity at corners and wall intersections by use of prefabricated “L” and “T” sections.
   6. Cut, bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, other special conditions.
   7. Space continuous horizontal reinforcement as follows:
      a. Multi-wythe walls where continuous horizontal reinforcement acts as structural bond or tie between wythes: As required by code but not more than 16 inches on center vertically.
      b. Single-wythe walls: 16 inches on center vertically, unless otherwise indicated.
   8. Parapets: 8 inches on center vertically, unless otherwise indicated.

B. Reinforcement at Openings:
   1. Reinforce masonry openings greater than 1-foot wide with horizontal joint reinforcement placed in 2 joints approximately 8 inches apart, immediately above lintel and immediately below sill.
   2. Extend minimum 2 feet beyond jambs of opening except at control joints.

3.10 CONTROL AND EXPANSION JOINTS

A. Vertical and horizontal expansion, control, isolation joints in masonry where shown must be unobstructed by structure, mortar, or reinforcing. Build-in related items as masonry work progresses.
   1. Build flanges of metal expansion strips into masonry.
   2. Lap each joint 4 inches in direction of water flow.
   3. Seal joints below grade and at junctures with horizontal expansion joints, if any.
   4. Build flanges of factory-fabricated expansion joint units into masonry.
   5. Build in non-metallic fillers where indicated.
   6. Build in horizontal pressure relieving joints where indicated; construct joints by either leaving an air space or inserting non-metallic compressible joint filler of width required to permit installation of sealant and backer rod.
   7. Locate horizontal pressure relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

8. Space joints as indicated on Drawings, or if not indicated 24 feet (maximum) on center. Verify location in writing with Architect.
9. Offset control joints in wythes of dissimilar materials.

3.11 ANCHORING MASONRY WORK

A. Anchor devices of type indicated to structural members where masonry abuts or faces structural members, to comply with following:
   1. Open space not less than 1 inch width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
   2. Flexible anchors embedded in masonry joints and attached to structure.
   3. Dovetail anchors at precast concrete panels that will hold brick veneer rigidly in place and transfer wind loading back to panels.
   4. Space as indicated, but not more than 16 inches on center vertically, 16 inches on center horizontally.

3.12 LINTELS

A. Steel Lintels: Install where indicated.

B. Masonry Lintels:
   1. Prefabricated or built-in-place from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout.
   2. Where shown and wherever openings of more than 12 inches for brick size units and 24 inches for block size units are shown without structural steel or other supporting lintels.
   3. Cure before handling and installing.
   4. Temporarily support built-in-place lintels until cured.

C. Hollow Concrete Masonry Unit Walls:
   1. Specially formed U-shaped lintel units, reinforcement bars placed as shown, filled with concrete.
   2. Match CMU in color, texture, and compressive strength.
   3. Where no reinforcement is shown, two Number 5 bars minimum.
   4. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.13 FLASHING OF MASONRY WORK

A. Provide concealed flashing in masonry work at, or above, shelf angles, lintels, ledges, and other obstructions to divert water to exterior.

B. Location of Cavity Wall Base Flashing:
   1. The line of flashing and weep assemblies at the bottom of all cavity walls must occur above grade, sidewalks, or adjacent construction to allow proper drainage.
   2. Adjust elevation as required.

C. Preparation: Prepare masonry surfaces smooth and free from projections which could puncture flashing.

D. Extent of Flashing: Full length of lintels and shelf angles, minimum of 4 inches into masonry each end. Extend 1 inch from outer edge of drip plate at exterior face of outer wythe of masonry through outer wythe, turned up minimum 12 inches, through inner wythe to within 1/2 inch of interior face of wall in exposed work or fastened with termination bar and mastic.
   1. Where interior surface of inner wythe is concealed by furring, carry completely through inner wythe, turn up approximately 2 inches.
   2. At heads and sills turn up ends not less than 2 inches to form a pan.
   3. Interlock end joints of deformed metal flashings by over-lapping deformations at least 1-1/2 inches, seal lap with elastic sealant.
   4. Support all sheet flashings.
   5. Ensure positive drainage with use of sheet metal cavity bridges as required.

E. Installation of Flashing: Comply with Drawings using only adhesives and materials specifically recommended.
   1. Form flashing to correct profile without wrinkles or buckles, and protect from punctures and tears during installation.
   2. Press flashing firmly in place using steel roller.
   3. Apply mastic at top edge, laps, and seams.
   4. Install metal drip plate at all locations of flashing.
   5. Place through-wall flashing on sloping bed of mortar.
   6. Seal penetrations in flashing with mastic before covering with mortar.
   7. Set drip plate in bed of mastic.
   8. Lap embedded flashing over top of drip plate but not exposed.
   9. Construct end dams by turning up the flashing at ends to prevent spillage.
   10. Fold flashing. Do not cut.
   11. Cover embedded flashing with mortar.
   12. Install reglets and nailers for flashing and other related work where shown to be built into masonry work.
   13. Provide expansion joints in metal flashing.

3.14 ADJUSTING

A. Remove damaged masonry units and units that do not match adjoining units as intended. Replace with new units to match adjoining units; install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During tooling of joints, enlarge voids or holes, except weep holes, and completely fill with mortar. Point-up joints including corners, openings, and adjacent work to provide a neat, uniform appearance, prepared for application of sealants. Tuck point and repair cracks or nail holes 1/32 of an inch or larger.

C. Shoring and Bracing: Provide temporary support for masonry elements such as lintels, beams, arches, and soffits. Do not remove until masonry has cured sufficiently to carry its own weight and other temporary loads that may be placed on it during construction.

3.15 FIELD QUALITY CONTROL

A. Site Tests: Comply with requirements of Section 01 45 00.

B. Construction Tolerances:
   1. Variation from plumb: Do not exceed 1/4 inch in 10 feet, or 3/8 inch in a story height not to exceed 20 feet, or 1/2 inch maximum.
   2. Variation from level:
      a. Bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, other conspicuous lines: Do not exceed 1/4 inch in 10 feet or 1/2 inch maximum.
      b. Top surface of bearing walls: Do not exceed 1/4 inch in 10 feet or 1/2 inch maximum.
   3. True to a line: Do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
   4. Variation in cross-sectional dimensions or elevations: Shall not exceed minus 1/4 inch, plus 1/2 inch.
   5. Alignment of columns and walls (bottom versus top):
      a. Bearing walls: 1/2 inch.
      b. Non-bearing walls: 3/4 inch.
   6. Grout space or cavity width: Minus 1/4 inch, plus 3/8 inch.
   7. Variation in mortar joint thickness:
      a. Do not exceed bed joint thickness indicated by more than plus/minus 1/8 inch, with maximum thickness limited to 1/2 inch.
      b. Do not exceed head or collar joint thickness indicated by more than minus 1/4 inch or plus 3/8 inch.

3.16 CLEANING

A. Dry brush masonry surfaces after mortar has set at end of each work day and after final pointing.

B. Clean exposed, unglazed masonry with stiff brush and clean water, or with mild cleaning agent approved by Architect and unit manufacturer.

C. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.

D. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

E. Protect adjacent surfaces from contact with cleaner by covering with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

F. Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

3.17 SURFACE TREATMENTS

A. Cementitious Coatings:
   1. Exterior Walls: Apply to concrete masonry units exposed to the weather in accordance with manufacturer's instructions.
   2. Projecting Masonry: Apply to top of exterior masonry where 1 course of masonry projects beyond vertical plane of wall but is not covered by flashing.

B. After masonry units have been cleaned, apply water repellent in accordance with manufacturer's instructions.

3.18 PROTECTION

A. Provide final protection and maintain conditions in manner acceptable to installer, which ensures unit masonry work being without damage and deterioration at time of substantial completion.

B. Uniform floor, roof loading: Do not apply for at least 12 hours after building masonry walls or columns.

C. Concentrated loads: Do not apply for at least 3 days after building masonry walls or columns.

3.19 WASTE MANAGEMENT

A. Separate and recycle waste materials to the maximum extent economically feasible.

B. Fold up metal banding, flatten, and place in designated area for recycling.

C. Collect wood packing shims and pallets and place in designated area.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill or in landscaping of the Project, and other masonry waste, and legally dispose of off Owner's property.

E. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches in each dimension.
   2. Mix masonry waste with at least 2 parts of specified fill material for each part of masonry waste.
   3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

A. Provide:
   1. Miscellaneous framing and supports:
      a. Toilet partition support framing.
   2. Metal fabrication accessories including, but not limited to:
      a. Rough hardware.
      b. Grout and anchoring cement.

B. Furnish the following for other sections to install including, but not limited to:
   1. Loose bearing and leveling plates.
   2. Loose lintels.
   3. Shelf and relieving angles.
   4. Metal fabrication accessories including, but not limited to:
      a. Rough hardware.

C. Related Sections:
   1. Section 03 30 00 - Cast-in-Place Concrete
   2. Section 04 20 00 - Unit Masonry Assemblies
   3. Section 05 05 24 - Capacitor Discharge Stud Welding
   4. Section 05 12 00 - Structural Steel Framing
   5. Section 07 92 00 - Joint Sealants
   6. Section 09 91 50 - Shop Painting

D. Alternates: Refer to Section 01 23 00.

E. Unit Prices: Refer to Section 01 27 00.

1.02 REFERENCES

A. Building Codes:
   1. International Building Code
   2. Minnesota State Building Code

B. AASHTO H20 - Loading Conditions for Gratings

C. ASTM:
   1. A27 - Steel Carbon Castings, General Applications
   2. A36 - Carbon Structural Steel
   3. A47 - Ferritive Malleable Iron Castings
   4. A48 - Gray Iron Castings
   5. A53 - Pipe, Steel, Black, Hot Dipped, Zinc Coated, Welded, Seamless
   6. A123 - Zinc Coatings on Iron and Steel Products
   7. A153 - Zinc Coatings on Iron and Steel Hardware
   8. A167 - Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet, and Strips
   9. A500 - Cold-Formed, Welded and Seamless Carbon Steel Structural Tubing
   10. A501 - Hot-Formed, Welded and Seamless Carbon Steel Structural Tubing
   11. A510 - Wire Rods and Coarse Round Wire, Carbon Steel
   12. A513 - Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
   13. A536 - Ductile Iron Castings
   14. A569 - Tables, Mess, Marine, Steel

15. A653 - Steel Sheet, Galvanized or Galvannealed by Hot Dip Process
16. A780 - Repair of Damaged Galvanized Coatings
17. A786 - Hot Rolled Carbon, Low Alloy, High Strength Low Alloy, and Alloy Steel Floor
18. A992 - Structural Steel Shapes
19. A1008 - Steel Sheet, Cold Rolled, Carbon, Structural High Strength, Low Alloy
20. B632 - Aluminum Alloy Rolled Tread Plates
21. E119 - Test Method for Fire Tests of Building Construction and Methods
22. E894 - Test for Anchorage of Permanent Metal Railing Systems and Rails for Buildings
23. E935 - Performance of Permanent Metal Railing Systems and Rails for Buildings
24. E985 - Permanent Metal Railing Systems and Rails for Buildings
25. E936 - Roof Systems Assemblies Employing Steel Deck, Preformed Insulation, and Bituminous Built-up Roofing
26. G90 - Standard for Performing Outdoor Weathering of Nonmetallic Materials Using Sun

D. AWS:
1. D1.1 - Structural Welding Code - Steel
2. D1.2 - Structural Welding Code - Aluminum
3. D1.3 - Structural Welding Code - Sheet Metal

E. NAAMM:
1. Metal Finishes Manual
2. MBG 532 - Heavy-Duty Metal Bar Grating Manual

F. SSPC:
1. PA1 - Paint Application Specification No. 1
2. SP3 - Power Tool Cleaning
3. SP6 - Commercial Blast Cleaning

1.03 DEFINITIONS

A. Metal Fabrications: Items made from iron and steel shapes, plates, bars, strips, tubes, pipes, castings not part of structural steel or other metal systems specified elsewhere.

1.04 SYSTEM DESCRIPTION

A. Design Requirements:
1. Thermal Movement: Allow for thermal movement for exterior assemblies resulting from maximum 150 degree change in ambient temperature in design, fabrication, installation to prevent buckling, opening up of joints, over stressing of welds and fasteners.
2. Base design calculations on actual surface temperatures of metals due to solar heat gain and nighttime sky heat loss.

1.05 SUBMITTALS

A. Product Data: Data for products used, including paint products and grout.

B. Shop Drawings:
1. Detail fabrication, erection of each metal fabrication indicated. Include plans, elevations, sections, details of metal fabrications, their connections. Show anchorage and accessory items.
2. Provide templates for anchors, bolts specified for installation under other sections.

C. Samples:
1. Two sets, representative of materials, finished products as requested by Engineer.

D. Calculations:
1. Where indicated to comply with certain design loadings, include structural computations, material properties, other information needed for structural analysis, signed and sealed by qualified professional engineer, registered in the state where project located, responsible for their preparation.

E. Welder Certificates: Signed by Contractor certifying that welders comply with specified requirements.

F. Qualification Data: For firms and persons specified, to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

1.06 QUALITY ASSURANCE

A. Qualifications:
   1. Fabricator: Firm experienced in successfully producing metal fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.
   2. Installer: Arrange for installation of metal fabrications specified in this section by same firm that fabricated them.
   3. Welding Processes and Welding Operators:
      a. Qualify in accordance with AWS D1.1 “Structural Welding Code - Steel,” D1.3 “Structural Welding Code - Sheet Steel,” and D1.2 “Structural Welding Code - Aluminum.”
      b. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.07 SITE CONDITIONS

A. Field Measurements:
   1. Check actual locations of walls, other construction to which metal fabrications must fit, by accurate field measurements before fabrication.
   2. Show recorded measurements on final Shop Drawings.
   3. Coordinate fabrication schedule with construction progress to avoid delay of Work.
   4. Where field measurements cannot be made without delaying Work, guarantee dimensions, proceed with fabrication without field measurements.
   5. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Grout and Anchoring Cement:
   1. Approved Manufacturers: One of the following or approved in advance by Engineer.
   2. Non-shrink Metallic Grouts:
      a. *Metox RM* by ChemMasters Corporation www.chemmasters.net
      b. *Hi-Flow Metallic Grout* by Euclid Chemical Company www.euclidchemical.com
      c. *Embeco 636* by BASF www.basfbuildingsystems.com
   3. Non-shrink Nonmetallic Grouts:
      a. *Bonsal Construction Grout* by W. R. Bonsal Company www.bonsal.com
      b. *Hi-Flow Grout* by Euclid Chemical Company www.euclidchemical.com
      c. *Kemset* by ChemMasters Corporation www.chemmasters.net
      d. *Crystex* by L & M Construction Chemicals, Inc www.lmcc.com
      e. *Masterflow 713* by Unicon of BASF www.unicon.ca
      f. *Sonogrout* by BASF www.basfbuildingsystems.com
   4. Erosion-Resistant Anchoring Cement:
      a. “Super Por-Rok”; Minwax Construction Products Division
   5. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

2.02 FERROUS METALS

A. Metal Fabrications Exposed to View:
   1. Provide materials selected for surface flatness, smoothness, and freedom from surface blemishes.

2. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.

B. Wide flange shapes and structural tees cut from: ASTM A992.

C. Steel Shapes, Plates, and Bars: ASTM A36.

D. Structural Steel Sheet: Hot-rolled, ASTM E936; or cold-rolled ASTM 1008, Class 1; grade required for design loading.

E. Galvanized Structural Steel Sheet: ASTM A653, grade required for design loading. Coating designation indicated; if not indicated, G90.

F. All other steel shapes, plates and bars: ASTM A36.

G. Brackets, Flanges, and Anchors: Cast or formed metal of same type material, finish as supported rails, unless otherwise indicated.

H. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM 153.

I. Stainless Steel: ASTM A167 W/No. 2B Mill Finish.

2.03 FINISHES

A. Steel and Iron Finishes:
   1. Galvanizing: Apply zinc-coating by the hot-dip process, complying with:
      a. ASTM A153 for galvanizing iron and steel hardware.
      b. ASTM A123 for galvanizing fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, forged shapes, plates, bars, and strips 0.0299 inch thick and heavier.
      c. ASTM A386 for assembled steel products.

B. Preparation for Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated.

2.04 FABRICATION, GENERAL

A. Forming:
   1. Form from materials of size, thickness, shapes indicated, complying with performance requirements indicated.
   2. Work to dimensions indicated or noted on Shop Drawings.
   3. Form exposed work true to line, level, with accurate angles and surfaces and straight sharp edges.

B. Cutting and Shaping:
   1. Shear, punch metals cleanly, accurately. Remove burrs.
   2. Ease exposed edges to radius of approximately 1/32 inch unless otherwise indicated.
   3. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
   4. Remove sharp or rough areas on exposed traffic surfaces.

C. Welding:
   1. Comply with AWS recommendations.
   2. Use materials, methods to minimize distortion, develop strength and corrosion resistance of base metals.

3. Fuse without undercut or overlap.
4. Remove welding flux immediately.
5. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Joints:
1. Form exposed connections with hairline joints flush, smooth, using concealed fasteners wherever possible.
2. Use exposed fasteners of type indicated or, if not indicated, Phillips flathead (countersunk) screws or bolts.
3. Locate joints where least conspicuous.

E. Anchorage:
1. Provide for type indicated; coordinate with supporting structure.
2. Fabricate, space anchoring devices to provide adequate support for intended use.

F. Joints: Fabricate joints exposed to weather in manner to exclude water, or provide weep holes where water may accumulate.

G. Shop Assembly:
1. Preassemble in shop to greatest extent possible.
2. Disassemble only as necessary for shipping, handling limitations.
3. Use connections that maintain structural value of joined pieces.
4. Clearly mark for reassembly and coordinated installation.
5. Cut, reinforce, drill, tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

H. Finishes:
1. Comply with referenced NAAMM manual.
2. Finish metal fabrications after assembly.

2.05 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area.

B. Drill plates to receive anchor bolts and for grouting as required.

C. Galvanize after fabrication unless indicated otherwise.

2.06 LOOSE STEEL LINTELS

A. Fabrication:
1. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
2. Weld adjoining members together to form a single unit where indicated.

B. Sizing:
1. Size loose lintels for equal bearing of 1 inch per foot of clear span but not less than 8 inches bearing at each side of openings, unless otherwise indicated.
2. Galvanize loose steel lintels located in exterior walls unless indicated otherwise.

2.07 SHELF AND RELIEVING ANGLES

A. Fabrication:
1. Fabricate from steel angles of sizes indicated, for attachment to concrete framing.
2. Provide slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and not more than 24 inches on center, unless otherwise indicated.

B. Shelf Angles:
   1. Galvanize shelf angles to be installed on exterior concrete framing.
   2. Furnish wedge-type concrete inserts, complete with fasteners, for attachment of shelf angles to cast-in-place concrete.

C. Furnish wedge-type concrete inserts, complete with fasteners, for attachment of shelf angles to cast-in-place concrete.

2.08 STEEL FRAMED STAIRS

A. General:
   1. Construct stair to conform to sizes and arrangements indicated.
   2. Join pieces together by welding, unless otherwise indicated.
   3. Provide complete stair assemblies, including metal framing, hangers, columns, railings, newels, balusters, struts, clips, brackets, bearing plates, and other components necessary for the support of stairs and platforms, and as required to anchor and contain the stairs on the supporting structure.

B. NAAMM Stair Standard: Comply with “Recommended Voluntary Minimum Standards for Fixed Metal Stairs” in NAAMM “Metal Stair Manual” for class of stair designated, except where more stringent requirements are indicated:
   1. Commercial class, unless otherwise indicated.
   2. Architectural class where indicated.

C. Exterior Stairs: Fabricate treads and platforms of exterior stairs to accommodate slopes to drain in finished traffic surfaces.

D. Stair Framing:
   1. Fabricate stringers of structural steel channels, or plates, or a combination thereof, as indicated.
   2. Provide closures for exposed ends of stringers.
   3. Construct platforms of structural steel channel headers and miscellaneous framing members as indicated.
   4. Bolt or weld headers to strings, newels, and framing members to strings and headers.
   5. Fabricate and join so that bolts, if used, do not appear on finish surfaces.

E. Metal Pan Risers, Subtreads, and Subplatforms:
   1. Shape metal pans for risers and subtreads to conform to configuration shown.
   2. Provide thicknesses of structural steel sheet for metal pans indicated, but not less than that required, supporting total design loading.

F. Floor Grating Treads and Platforms:
   1. Provide patterns, spacing, and bar sizes indicated; fabricate to comply with NAAMM “Metal Bar Grating Manual.”
   2. Shop prime paint unless indicated otherwise.
   3. Fabricate grating treads with steel plate nosing on one edge and with steel angle or steel plate carrier at each end for stringer connections.
   4. Secure treads to stringers with bolts.
   5. Fabricate grating platforms, with nosing matching that on grating treads, at all landings.
   6. Provide toe plates at open-sided edges of grating platform.
   7. Secure grating to platform frame with welds.

G. Stair Railings and Handrails: Comply with applicable requirements specified elsewhere in this section for steel tube and pipe railings and handrails.

2.09 GROUT AND ANCHORING CEMENT

A. Rough Hardware:
   1. Bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, other miscellaneous steel and iron shapes required for framing and supporting woodwork, anchoring or securing woodwork to concrete or other structures.

2. Fabricate to sizes, shapes, dimensions required.
3. Malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

B. Non-shrink Metallic Grout: Premixed, factory-packaged, (int. ferrous aggregate grout complying with CE CRD-C 621, only) specifically recommended by manufacturer for heavy duty loading applications of type specified in this section.

C. Non-shrink Nonmetallic Grout: Premixed, factory-packaged, (non-staining, noncorrosive, nongaseous grout complying stain) with CE CRD-C 621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

D. Erosion-Resistant Anchoring Cement:
1. Factory-prepackaged, non-shrink, non-staining, hydraulic expansion cement formulation for mixing with potable water at Site to create pourable anchoring, patching, and grouting compound.
2. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.

2.10 FINISHES

A. Comply with NAAMM “Metal Finishes Manual” for recommendations relative to application and designations of finishes.
1. Refer to Section 09 91 50.

B. Finish metal fabrications after assembly.

C. Steel and Iron Finishes:
1. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process in compliance with the following requirements:
a. ASTM A153 for galvanizing iron and steel hardware.
b. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299-inch thick and heavier.
c. Use process for galvanizing that will prepare item for painting
2. Primer Application:
a. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated.
b. Comply with requirements of SSPC-PA1 “Paint Application Specification No. 1” for shop painting.

D. Surfaces to Receive Fireproofing: In addition to above, shop paint only with materials that are approved by the fireproofing manufacturer in compliance with UL or FM assemblies.

E. Galvanizing Repair Paint: High zinc dust content; dry film containing at least 94 percent zinc dust by weight; comply with DOD-P-21035 or SSPC-Paint-20.

F. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint-12 except containing no asbestos fibers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Work of Other Trades: Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.

B. Verification of Conditions: Verify that Metal Fabrications may be installed in accordance with original design, pertinent codes and regulations, and pertinent portions of referenced standards.

C. Discrepancies: Immediately notify Architect. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.02 PREPARATION

A. Coordination:
   1. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction.
   2. Coordinate delivery of such items to Site.

B. Utilize templates and other systems required to ensure accurate placement of items that will be embedded in concrete and masonry.

3.03 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Temporary Bracing: Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.04 SETTING LOOSE PLATES

A. Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

B. Setting: Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
   1. Use metallic non-shrink grout in concealed locations where not exposed to moisture.
   2. Use nonmetallic non-shrink grout in exposed locations, unless otherwise indicated.
   3. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.05 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. Anchor supports securely to, and rigidly brace from, overhead building structure.

3.06 TOLERANCES

A. Install in required position and within following tolerances:
   1. Maximum variation from plumb: 1/4-inch.
   2. Maximum offset from true alignment: 1/4-inch.

3.07 ADJUSTING AND CLEANING

A. Touch-Up Painting: Cleaning touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Section 09 91 50 of these specifications.

B. Galvanizing: For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

C. Collect offcuts and scrap and place in designated areas for recycling.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
1. Wood framing
2. Sheathing (except exterior gypsum board and polystyrene types)
3. Wood trusses
   a. See Licensed Engineering requirements Item 1.02.
4. Wood curbs, cants, nailers, sleepers, rough bucks, blocking, furring, bracing, fire blocking and similar items necessary or required. Also include like items to make roof, walls, floors, ceilings, ready for finishes and to receive installed items.
5. Roof ventilation curbs
6. Roof blocking and roof attachment blocking.
7. Concealed blocking and bracing in walls and ceilings for all installed items.
8. Roof truss and roof joist hurricane ties and clips
9. Framing angles, ties, and clips as detailed on plans
10. I-Joist blocking at bearing points and joist hangers as required
11. Wood bucks at all interior and exterior opening required for window and door installation.

C. Related Sections
1. Gypsum Board: Section 09 29 00
2. Shop Fabricated Wood Trusses: Section 06 17 53
3. Finish Carpentry: Section 06 20 00
4. Thermal Protection: Section 07 20 00

1.02 SUBMITTALS

A. Shop Drawings:
1. Shop drawings and engineering data required on all wood trusses certified by a Licensed Engineer, licensed by the State authorities where the project is located.
   a. Show species, size, stress grade of lumber, pitch, span, configuration, spacing; bearing details and installation procedures.
   b. Contractor shall submit the engineered documents to the local building authorities for review and approval.

B. Samples: None Required

1.03 QUALITY ASSURANCE

A. Lumber Grading Rules and Wood Species to be in conformance with Voluntary Product Standard PS 20-70 Grading Rules of the following associations apply to materials furnished under this section:
1. Northeastern Lumber Manufacturer's Association, Inc. (NELMA)
2. Southern Pine Inspection Bureau (SPIB)
3. West Coast Lumber Inspection Bureau (WCLIB)
4. Western Wood Products Association (WWPA)
5. Grade Marks: Identify all lumber and plywood by official grade mark.
   a. Lumber: Grade stamp to contain symbol of grading agency, mill lumber or name, grade of lumber, species or species grouping or combination designation, rules under which grades, where applicable, and condition of seasoning at time of manufacturer.
      1) S-GRB: Unseasoned

2) S-Dry: Maximum 19% moisture content.
3) MC015 or KD: Maximum of 15% moisture content.
4) Dense

b. Softwood Plywood: Appropriate grade trademark of the American Plywood Association (APA).
1) Type, grade, class, and identification index.
2) Inspection and testing agency mark.

c. Hardwood Plywood: Appropriate grade mark of qualified inspection, testing, or grading agency.

B. Requirements of Regulatory Agencies
1. Span tables - National Forest Products Association.
2. Working stresses - Softwood Lumber, National Design Specification, National Forest Products Association (NFPA).

C. Plywood Grading Rules: Each panel of construction and industrial plywood shall meet the requirements of the latest edition of U.S. Product Standard PS 1-83 and Uniform Building Code (UBC) Standard Number 25-9.

D. Grade Mark: Identify lumber and plywood by official grade mark. Lumber grade mark shall contain symbol of grading agency, mill number or name, grade of lumber, species or species grouping or combination designation, rules under which graded and condition of easoning at time of manufacturer. Plywood grade mark shall be that of the American Plywood Association and shall include plywood type, veneer grades, product standard governing manufacturer, mill number, glue type and identification index.

E. Moisture content of dimension lumber shall not exceed 19 percent at time of installation, and moisture content of finish lumber shall not exceed 14 percent. Lumber shall be dressed S4S, unless otherwise specified.

PART 2 PRODUCTS

2.01 MATERIALS

A. Framing Lumber of all framing and blocking. The following lumber grades are acceptable, unless noted otherwise on structural drawings:
1. Douglas Fir Larch (DFL), Spruce-Pine-Fir (SPF), or Southern Pine Grade No. 2 or better is required for headers, blocking, bridging, and floor platform framing.
2. Spruce-Pine-Fir (SPF) or Hem-Fir (HF) Stud Grade lumber is acceptable for wall framing.

B. Lumber Preservative-treated:
1. Wood except when installed 6" above grade or 2" above interior slabs; or except when foundation redwood is used.
a. Plates, sills sleepers and similar items on concrete or masonry in direct contact with earth.
b. Sills or plates on concrete or masonry foundations.
2. Wood curbs, cants, nailers and similar items in contact with roofing. Verify compatibility of preservative and roofing with roofing contractor.

C. Wood Preservative:
1. Conform to recommendations of American Wood Preservers Institute (no petroleum vehicle preservatives allowed).
2. Product Manufacturer: "Wolman Preservative Salts", Koppers Company, Inc.

D. Wood Wall Sheathing:
1. Plywood: 1/2" C-DX EXT-APA 32/16
2. Oxboard Potlatch: 1/2" - 32/16

3. Electrical and/or Telephone Backboard: 3/4" (19 mm) thick, A-D, Group 1, interior.

E. Wood Roof Sheathing:
   1. Supports 16"o.c. maximum with minimum 3-16" spans.
      a. Plywood: 1/2" C-DX APA 32/16. Structural I Rated Sheathing.
      b. Nonveneer APA Rated Sheathing: 1/2" 32/16.
   2. Supports 24" (610 mm) o.c. maximum with minimum 2-24" spans.
      a. Plywood: 5/8" or 19/32" C-DX 5 ply APA 40/20 Structural I Rated Sheathing.
      b. Nonveneer APA Rated Sheathing: 5/8" 40/20.

F. General Blocking: General blocking, framing, cants, grounds, nailers and furring shall be Standard grade Douglas Fir, Western Hemlock or Western Larch.

G. Plates and Blocking at Masonry or Concrete: Where wood is in contact with concrete floors or masonry walls, use preservative treated Douglas Fir or equal.
   1. Wood Preservative: Wood preservative is required for all exterior and interior wood used next to masonry, concrete, ground and where directly exposed to moist conditions.
      a. Plant treat wood with Kopper's "Wolmanized" chromated copper arsenate pressure treatment or equal, conforming to Federal Specification TT-W-550, SQPA Standard, P-5 and AWPB Standard LP-2.
      b. Treat job cut surfaces with generous application of preservatives.

H. Plywood Concealed Backing: 3/4" standard grade INT-DFPA.

I. Sub-floor/Underlayment Combination: 3/4" T & G, C-DX INT-APA nailed and glued floor system.

J. Wood Trusses:
   1. Including all "low profile" type roof trusses that use dimension type lumber for top and bottom chords and web members.
   2. The truss manufacturer shall design the wood trusses to sustain the indicated loads for the spans, profiles, arrangements and other pertinent design conditions indicated on the drawing.
   3. The truss manufacturer shall furnish all layout, design, engineering data, drawings with a Licensed Engineer's Certification required for compliance with the governing building codes and local governing building officials, to obtain a building permit.
      a. See 1.02 Shop Drawing submittal requirements.
   4. Provide strongbacks, bridging and bracing in accordance with truss manufacturer design requirements and recommendations.

K. Rough Hardware: Provide rough hardware including nails, screws, anchors, toggle bolts, framing anchors, hangers and similar items. Rough hardware shall be of the proper size, type and strength for the use intended and for the material to be fastened. Use non-corrosive, non-staining, rough hardware for exterior application.
   1. Provide anchor rods indicated on the drawings or otherwise required to attach wood plates and bucks to masonry and concrete. Unless noted otherwise on structural drawings, rods shall be 1/2" diameter with welded nut on imbedded end. Rods shall extend not less than 7" into concrete and masonry, unless noted otherwise.
      a. Standards:
         1) Steel items:
            a) Comply with ASTM A 7 or ASTM A 36.
            b) Use galvanized at exterior locations.
         2) Machine bolts: Comply with ASTM A 307.
         3) Lag bolts: Comply with Federal specification
         4) Nails:
            a) Use common except as otherwise noted.
            b) Comply with Federal Specification FF-N-1.
            c) Use hot dipped galvanized at exterior locations.

PART 3 EXECUTION

3.01 GENERAL

A. Carpentry:
1. Work shall be done by experienced workmen, skilled in their trade and workmanship shall conform to the best practices and standards of the trade.
2. Work shall be accurately constructed, square, true at required levels and lines, and adequately fastened and anchored to produce a sturdy, rigid system of sufficient strength to support the loads. Work not otherwise detailed or specified shall conform to the recommendations of the National Lumber Manufacturers Association as minimum standards of construction and assembly.
3. Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate the work with a minimum of joints or the optimum jointing arrangement.

B. Use only sound, thoroughly seasoned, well manufactured materials of longest practical lengths and sizes to minimize jointing.
1. Cut and fit all framing members accurately, true to line and level, avoiding shims.
2. Use largest size screws, spikes, nails practical for the application.
3. Bolt nailers and blocking to steel, masonry or concrete members, with bolts of proportionate strength of members attached, length required, spaced 2'-0" o.c. and 4" from each end, except as otherwise indicated. Unless otherwise indicated, anchor bolts shall be 3/8" diameter by length required or comparable power actuated fasteners.
4. Provide blocking, bucks and framing for all trades as required.
5. Drive nails and spikes home. Turn screws tight. Pull bolt nuts tight with heads and washers in close contract with work.
6. Conform to good trade practice, applicable codes and recommendations of recognized associations.
7. Provide washers under bolt heads and nuts in contact with wood.
8. Nail all plywood in accord with APA recommendations.
9. Conform all carpentry to good trade practice, applicable codes, and recommendations of recognized associations.
10. Provide all rough and miscellaneous hardware work shown on the drawings, specified herein, or otherwise required to complete the work. Installed in a neat and workmanlike manner, true and firm in every respect.
11. Fastenings for wood bucks, blocking, etc., to masonry or concrete shall be metal and types and spacing best suited to conditions. Hardened steel nails, expansion screws, toggle bolts, self-clinching nails, metal plugs or similar fastenings shall be used. Wood plugs or nailing blocks are not acceptable. Wire ties shall not be used.
12. Nails, spikes, bolts, anchors, screws, joist anchors, toggle bolts, expansion bolts, strap anchors, government anchors, etc., shall be required for adequate construction of the particular parts of the work. such items shall be aluminum, brass or galvanized or otherwise rustproofed for exterior work.

3.02 FRAMING METHODS

A. Layout and set accurately to lines and levels. Secure rigidly in place. Use concrete nails or power activated fasteners where required.
1. Unless otherwise indicated:
   a. Set studs 16" o.c.
   b. Set trusses 24" o.c.
   c. Set floor joist 16" o.c.
2. Framing not detailed: 2" x 4" or larger as required for supporting members and spaced not over 16" o.c.
3. Where finish trim is applied directly to framing members or blocking, such members shall be perfectly straight, clear and well seasoned.

4. Double studs around all openings; triple studs at all corners and partition junctures; and in general provide 1-1/2" solid surface to apply finishes at all corners.
5. Double floor joist under all partitions parallel to joist.
6. Provide cross bridging at all floor joists and elsewhere detailed. Equivalent to 1" x 3" pine. Minimum 8' o.c. Secure after sub-floor is nailed in place.
7. Maintain framing at least 2" away from chimney of fireplace masonry and fill spaces with non-combustible materials.
8. Foundation plates and sills: Bolt to foundation with 1/2" dia. headed rods 6' o.c. extending 7" into concrete (15" into grouted walls), minimum 2 rods per piece, maximum 12" from ends unless noted otherwise in structural drawings.

3.03 WOOD TRUSSES

A. Details, profiles, spans: See drawings.
   1. Spacing: 24" o.c. unless shown otherwise on the drawings.
   2. Provide all required temporary and permanent horizontal ties or bridging for a stable installation.
   3. Design Data: Snow load as indicated on structural drawings.
   4. Specific design and engineering data shall be approved by the building permit authorities prior to manufacture of the trusses.

3.04 SUBFLOORING

A. Plywood:
   1. Install in accord with recommendations of APA.
   2. Combination subfloor and underlayment: Apply with annular or spiral thread nails. Combination must be tongued and grooved or supported at joints with solid blocking.

3.05 WALL SHEATHING

A. Plywood:
   1. Place vertically or horizontally with all joints over studs, plates or 2" blocking.
   2. Stagger end joints.
   3. Fasten with 8d nails at 6" o.c. at all edges and 12" o.c. at all intermediate supports.
   4. Install in accord with recommendations of APA.

3.06 ROOF SHEATHING

A. General:
   1. Install with face grain at right angles to supports with end joints over supports.
   2. Stagger end joints.
   3. Provide side joint support: metal clip, 2" wood blocking, T&G material as recommended by sheathing manufacturer.
   4. Install in accord with recommendations of APA and as a minimum fasten with 8d nails spaced 6" o.c. at all edges and 12" o.c. at intermediate supports. .

3.07 COORDINATION

A. Correlate location of all framing, furring, blocking, grounds and similar items with all trades.

B. Verify all dimensions, shop drawing requirements prior to proceeding with work.

C. Avoid delay of work of other trades dependent on or affected by carpentry work.

3.08 PROTECTION

A. Protect all carpentry work from damage by the work of other trades during construction.

END OF SECTION

SECTION 06 16 43

GYPSUM SHEATHING

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
   1. Exterior gypsum sheathing system

1.02 RELATED SECTIONS

A. Rough Carpentry (Framing): Section 06 10 00

1.03 SUBMITTALS

A. Product Date:
   1. Submit manufacturer's descriptive literature indicating material composition, thickness, sizes and fire resistance.
   2. Certificates: Submit manufacturer's written certification that product meets specified requirements.

1.04 QUALITY ASSURANCE

A. Fire-resistance ratings: Where applicable, provide materials and construction which are identical to those of assemblies whose fire-resistance ratings are indicated.

B. No topping edges or ridges, no fasteners or their location and no gypsum board surfaces shall be visible through the applied finishes.

C. It shall be the Contractor's responsibility to provide the "Level of Gypsum Board Finish" required to achieve the perfection indicated herein with the applied surface finishes indicated on this project.

D. When applicable, all board shall be installed a maximum of 1/4" from floor with this space clean, clear and sealed if detailed or required. No protrusions, over runs or globs of topping to interfere with base. No holes to permit the base to indent.

1.05 LIMITATIONS

A. During winter months, use of non-vented direct combustion heaters shall not be used in excess to the point where moisture accumulation/condensation occurs in or around the gypsum sheathing.
   1. The use of forced air heaters create volumes of water vapor which, when not properly vented, can condense on building materials. The use of these type heaters and any resulting damage is not permitted. Consult heater manufacturer and provide proper use and ventilation.

B. Caution:
   1. THIS PRODUCT CONTAINS CONTINUOUS FILAMENT FIBERGLASS.
   2. Fiber released during normal handling of this product can cause skin, eye and respiratory irritation. Follow standard work practices to avoid breathing dust, and contact with skin and eyes.

PART 2 PRODUCTS

2.01 EXTERIOR SHEATHING BOARD

A. Acceptable manufacturers:
   1. Georgia-Pacific Gypsum Corporation
   2. American Gypsum
   3. USG, Inc.

B. Characteristics:
   1. Size:
      a. Fireguard, Type X: Nominal 5/8" thick, 48” width, and 8' or 9' or 10' lengths.
   2. Composition: Gypsum sheathing manufacturing in accordance with ASTM C 1177 with glass mats both sides and long edges, silicone-treated water-resistant core.
   3. Fire resistance:
      a. Non-combustible when tested in accordance with ASTM E 136.
      b. 5/8” Fireguard, Type X: Achieves one-hour fire resistance when tested in accordance with ASTM E 119.

2.02 ACCESSORIES

A. Joint tape: 2" wide, 10 by 10 glass mesh tape.

B. Joint compound: As required by manufacturer and consistent with project requirements.

C. Nails, wood framing: Hot dip, 11 ga. galvanized nails with 7/16" head, 1-1/2" min. length.

D. Screws, metal or wood framing:
   1. Wafer head, rust-resistant, Type S-12 drill or hi-lo, min. 1-1/4" length. Or, Type W rust resistant, bugle head coarse thread, sharp point for wood.

E. Metal trim: Fabricated of materials for exterior exposure in accordance with ASTM D 1784.
   1. Provide all metal trim of type finished out with the joint compound, not the type with exposed metal edges.

F. Miscellaneous Items: Furring channels, resilient channels, rigid channels, brackets, unistrut, adhesives, sealant, fasteners and all other similar items required for a complete installation of wall systems detailed or specified.

PART 3 EXECUTION

3.01 INSTALLATION

A. General
   1. Maintain temperature of drywalled space in range of 55° to 90° F until building is entirely closed and ventilated, as required to eliminate excessive moisture buildup in building.
   2. All work shall be done in strict accordance with the manufacturer's published specifications.
   3. Examine subframing. Verify that surface of framing and furring members are ready to receive the gypsum board. Start of work indicates acceptance of the substrate and responsibility for the finished application of the system.

3.02 SHEATHING

A. Provide Gypsum drywall with glass mat where indicated on drawings. Install sheathing in accordance with manufacturer's instructions and applicable instructions in GA-253.
   1. Always provide 5/8" thick material on framing spaced 24" o.c. on walls or ceilings.

B. Install per manufacturer’s recommendations.

C. Use maximum lengths possible to minimize number of joints.

D. Wood framing: Attach to wood framing with nails spaced 4" o.c. at perimeter for racking shear resistance; and 8" o.c. in field.

E. Drive fasteners to bear tight against and flush with surface of sheathing. **Do not countersink.**

F. Locate fasteners minimum 3/8" from edges and ends of sheathing panels.

G. Joint treatment and finish preparation:
   1. Finished surfaces:
      a. Apply joint tape over joints and embed in setting type joint compound specified.
      b. Skim coat surface with setting type joint compound for smooth finish.
      c. Priming and finishing materials provided as per the appropriate section of work for the finish application.

3.03 ACCEPTANCE

A. Test all gypsum drywall for true and level surfaces with an oblique light source. Any telegraphing of joints, compound edges, improper finishing, fastenings or irregularities of surface evident even after subsequent application of the specified painting or decoration will require immediate and proper correction satisfactory to the Architect including the painting or decorating.

B. Cracking along metal or plastic trim lines is not acceptable and shall be corrected.

END OF SECTION

SECTION 06 17 53

SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.01 SUMMARY

A. Provide wood trusses:
   1. Common.
   2. Hipset.
   3. Monopitch.
   4. Girder.
   5. Parallel chord trusses.
   6. Accessories including, but not limited to:
      a. Lateral bracing.
      b. Fasteners, connectors, anchorage devices, bolts, clips, etc.

B. Alternates: Refer to Section 01 23 00.

C. Unit Prices: Refer to Section 01 27 00.

1.02 REFERENCES

A. American Institute of Timber Construction - Timber Construction Standards

B. ASTM:
   1. A653 - Steel Sheet, Galvanized or Galvannealed by Hot Dip Process
   2. A666 - Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate
   3. A780 - Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings

C. Truss Plate Institute (TPI):
   1. TPI 1 - National Design Standard for Metal Plate Connected Wood Truss Construction
   2. TPI DSB - Recommended Design Specification for Temporary Bracing of Metal Plat Connected Wood Trusses
   3. TPI HIB - Commentary and Recommendations for Handling, Installing and Bracing Metal Plate Connected Wood Trusses

D. International Building Code

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Design, engineer, fabricate, and erect wood trusses to withstand specified design loads within limits and under conditions required.
   1. Design Loads: As specified.
   2. Deflections: Live load deflection meeting the following (unless otherwise specified):
      a. Floor trusses: Vertical deflection less than or equal to 1/480 of the span.
      b. Roof trusses: Vertical deflection less than or equal to 1/360 of the span.
   3. Design framing systems to provide for movement of framing members without damage or over-stressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 120 degrees F.

1.04 SUBMITTALS

A. Refer to Section 01 33 00.

B. Product Data:
   1. Complete materials list of items to be provided including manufacturer specifications and other data to prove compliance with specified requirements.
   2. Wood Treatment Data: Chemical treatment manufacturer's instructions for handling, storing, installation, finishing.
   3. Treatment Certificates:
      a. Preservative treatment: Treatment plant certification stating type of preservative solution and pressure process used, net amount of preservative retained, conformance with applicable standards.
      b. Waterborne treatment: Statement that moisture content was reduced to levels indicated prior to shipment to Site.
      c. Fire-retardant treatment: Treatment plant certification that treatment material complies with specified standards and other requirements.
      d. For wood members treated with FRT chemicals, NDS for Wood Construction Section 2.3.4 requires submittal of design values, including connections, from the company providing the treatment and redrying service.
      e. Submit organic chemical formulation, third party inspected, ICBO and NER report, EPA registered as a preservative, with a builder's warranty.
   4. Submit product data for each composite wood product used indicating that products contain no urea formaldehyde.

C. Shop Drawings: Show species, sizes, stress grades of lumber proposed to be used, pitch, span, camber, configuration, spacing of truss, connector type thickness, size, location, design value, splice and bearing details of trusses.

D. Installation Procedure: Manufacturer's complete recommended installation procedures that will become basis for accepting or rejecting actual installation.

E. Design Calculations: Submit, if required, complete design calculations for trusses as necessary to obtain building permits, other acceptance.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain metal connector plates from a single manufacturer.

B. Qualifications:
   1. Structural Engineer: Provided by manufacturer, registered to practice in Minnesota to design wood trusses to sustain indicated loads, specified or required by local codes, with spans, profiles, and arrangements shown on Drawings.
   2. Fabricator: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
   3. Installers: Only skilled workers completely familiar with requirements and methods needed for proper performance of work of this section.

C. Referenced Standards:
   1. Comply with pertinent provisions of *TPI 1, TPI DSB,* and *TIP HIB*.
   2. Comply with applicable requirements in AF&PA's *National Design Specifications for Wood Construction* and its *Supplement*.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work follows.

B. Storage and Protection:
   1. Protect materials before, during, after installation.
   2. Protect installed work, materials of other trades.
   3. Prevent contact with ground or other horizontal surface.

4. Provide for air circulation around stacks and under coverings.

1.07 PROJECT CONDITIONS

A. Drawings do not purport to show actual field dimensions, but are intended only to establish location and scope of Work. Field-verify dimensions and assume full responsibility for their accuracy.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Wood Trusses:
   1. Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
      a. Fargo Truss Systems, Fargo, ND
      b. Littfin Truss, Winsted, MN
      c. Lloyd Trusses, Mankato, MN
      d. Mathew Hall Lumber Company, St. Cloud, MN
      e. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

B. Fire Treated Wood Trusses:
   1. Standard of Quality: Design is based on products of Dricon Fire Retardant Treated Wood, Smyrna, GA www.dricon.com
   2. Other Acceptable Manufacturers: Subject to compliance with specified requirements, acceptable manufacturers and products are:
      a. *FirePro* by Osmose www.osmose.com
      b. Hoover Treated Wood Products, Thomson, GA www.frtw.com
      c. Manufacturer of comparable products submitted in compliance with Section 01 25 13.

2.02 PRODUCTS

A. Lumber: DOC PS 20 and applicable rules of grading agencies certified by ALSC Board of Review.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
   3. Provide dressed lumber, S4S.
   4. Provide dry lumber with 15 percent maximum moisture content at time of dressing.

B. Grade and Species: For truss chord and web members, provide dimension lumber of any species, graded visually or mechanically, capable of supporting required loads without exceeding allowable design values, according to AF&PA.

C. Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 06 10 53.

D. Metal Connector Plates: Comply with TPI 1.
   1. Interior Locations:
      a. Hot-dip galvanized steel sheet meeting ASTM A653.
         1) Structural steel, high strength, low alloy Type A.
         2) High strength low alloy steel Type B.
         3) Not less than 0.036 inch thick.
      b. Stainless steel:
         1) ASTM A666, Type 304 **OR** 316.
         2) Minimum 0.035 inch thick.

2.03 FIRE-RETARDANT TREATED LUMBER

A. Where FRT is indicated, pressure impregnate with fire-retardant chemicals to comply with AWPA C20.
   1. Use Exterior type for exterior locations and where indicated.
   2. Use Interior Type A, High Temperature (HT) for enclosed roof trusses and where indicated.
   3. Use Interior Type A, unless otherwise indicated.

B. Identify wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction:

C. For exposed trusses and bracing indicated to receive a stained or natural finish, mark end or back of each piece.

D. All FRT wood to be in contact with steel shall be non-corrosive. Contact company providing FRT treatment.

E. For exposed trusses indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

2.04 ACCESSORIES

A. Fasteners:
   1. Provide fasteners of size and type indicated that comply with requirements for material and manufacture.
   2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153.

B. Anchor Clips: *Teco*, “Trip-L-Grip” galvanized framing anchor at each truss end.

C. Roof Truss Clips:
   1. Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls.
   2. 1-1/4 inches wide by 0.05 inch thick.
   3. Fasten clip to truss through slotted holes to allow for truss deflection.

D. Other Materials: Other materials not specifically described, but required for complete and proper installation as selected by Contractor subject to acceptance of Architect.

2.05 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air of hydraulic press.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which work will be performed.

B. Discrepancies: Correct conditions detrimental to timely, proper completion of work. Do not proceed until unsatisfactory conditions are corrected.

3.02 COORDINATION

A. Coordinate with other trades performing Work that interfaces this Section.

B. Install trusses only after supporting construction is in place and is braced and secured.

3.03 INSTALLATION

A. Install work in strict accordance with original design, accepted Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, TPI recommendations, and manufacturer's recommended installation procedures.

B. Hoist into position with proper bracing secured at designated lifting points.

C. Do not bend trusses. Install temporary, horizontal, cross bracing to hold trusses plumb and in safe condition until permanent bracing is installed.

D. Install permanent bracing, related components prior to application of loads to trusses.

E. Tighten loose connectors. Restrict construction loads to prevent over-stressing of truss members. Install within installation tolerances in TPI 1.

F. Do not cut or remove truss members.

G. Replace wood trusses that are damaged or do not meet requirements.

H. Do not alter trusses in field.

3.04 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

B. Protective Coating:
   1. Clean and prepare exposed surfaces of metal connector plates.
   2. Brush apply primer, when part of coating system, and 1 coat of protective coating to dry film thickness recommended by coating system manufacturer.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
1. Exterior corner boards, trim, etc.
2. Exterior siding, soffits, etc.
3. Attic vent
4. Exterior paneling
5. Related work specified elsewhere; Contractor shall verify and coordinate the extent of installation work required of this Section 06 20 00 for each of, but not limited to, each of the following:
    a. Rough Carpentry: Section 06 10 00
    b. Caulking and Sealants: Section 07 90 00
    c. Doors and Windows: Section 08 11 13 and 08 54 13
    d. Door and Window Hardware: Section 08 71 00 and 08 75 00
    e. Finishes: Division 9
    f. Specialties: Division 10

1.02 QUALITY ASSURANCE

A. Codes and Standards: Quality standards; except as otherwise shown or specified. Comply with specified provisions of the following:
1. Architectural Woodwork Institute (AWI), Quality Standards.

B. Measurements:
1. Before proceeding with work required to be fitted to other construction, obtain measurements and verify dimensions and any shop drawing details as required for accurate fit.

C. Source Quality Control:
1. Optimum Moisture Content: Kiln-dry woodwork to an average moisture content as recommended by applicable Quality Standards for the regional climatic conditions involved.
    a. Interior wood finish lumber - 5 percent to 10 percent, average 7 percent.

1.03 SUBMITTALS

A. Shop drawings in sufficient detail to show fabrication, installation, anchorage and interface of the work of this section with the work of adjacent trades.

B. Samples: (Required, if requested by Architect)
1. One sample of each exposed finish material specified.

1.04 DELIVERY, STORAGE AND HANDLING

A. Do not deliver materials until wet work, grinding and similar operations which could damage, soil or deteriorate materials, have been completed in installation areas. If, due to unforeseen circumstances, materials must be stored in other than installation areas, store only in areas which meet the requirements specified for installation areas.

PART 2 PRODUCTS

2.01 MATERIALS

A. General:
   1. Provide materials in the quantities needed for the work as shown on the drawings and meeting or exceeding the following standards of quality.
      a. Grading requirements: Conform to the applicable grading and workmanship rules of the Southern Pine Association, Hardwood Plywood Association, Architectural Woodwork Institute, National Forest Products Association, California Redwood Association and the American Plywood Association, under whose rules the lumber is produced.
   2. All interior exposed running and standing trim for transparent finish to be AWI quality grade premium quarter-sawn cedar; Grade I.
   3. Rough Hardware: Stock nails, screws, bolts, clips, anchors and similar attachments as necessary to complete the work. Use galvanized or non-oxidizing alloy on the exterior and stainless steel or aluminum where subject to moisture on interior.
   4. Finish Hardware: As shown on the drawings and as necessary to complete the work of this section.

B. Wood Material
   1. Exterior Solid Stock:
      a. Western Red Cedar, rough sawn: exterior trim, facias where "cedar" indicated.

C. Miscellaneous Materials
   1. Adhesive: Water resistant of the type recommended by Architectural Woodwork Institute for installed condition.

PART 3 EXECUTION

3.01 INSTALLATION

A. Preparation: Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.

B. Architectural woodwork shall be installed by experienced finish carpenters.
   1. Rout or groove back of flat trim members, kerf backs of wide flat members.
   2. Do not install millwork and trim until back-priming is completed.
   3. Install, plumb, level, true and straight with no distortions. Shim as required using concealed shims.
   4. Where field cutting and fitting is required, allow ample material. Before making cutouts, drill pilot holes at corners.
   5. Where woodwork abuts other finished work, scribe and cut for accurate fit.
   6. Distribute defects allowed in the quality grade specified to the best overall advantage, when installing job assembled woodwork items.
   7. Trim and moldings: Install in single, unjointed lengths for openings and for runs less than 10'. For longer runs, use only one piece less than 10' in any straight run. Stagger joints in adjacent members.
   8. Cope interior angles and miter exterior corners.
   9. Attach securely in place with uniform joints providing for thermal and building movements.
   10. Blind nail items where possible. Glue where necessary. Use fine finishing nails where exposed. Set exposed nail heads for filling.
   11. Provide blocking as required for securing items in place.
   12. Provide all work with sandpaper finish ready for painting or other finish. No sanding across grain permitted.
   13. Where screws are indicated or required, in exposed work, countersink all screw heads and cover with neatly fitted wood plugs to match grain.

3.02 MISCELLANEOUS INSTALLATION

A. Install such items as toilet room accessories, toilet room partitions, miscellaneous specialties, shelves, fire extinguishers and other items furnished by others requiring fasteners, cutting, trimming and scribing of furnished materials or finished substrate. (See coordination and verification item, see related sections).
   1. Install according to manufacturer's recommendations and as further specified under the specific sections.
   2. Install, plumb, level true and straight with no distortions. Shim as required using concealed shims.
   3. Scribe and cut for accurate fit to other finished work.

3.03 CLEAN UP/ACCEPTANCE

A. Before final acceptance:
   1. Clean all visible surfaces.
   2. Adjust and lubricate hardware for proper operation.
   3. Repair or replace damaged or defective work as directed.

END OF SECTION

SECTION 07 11 00

DAMPPROOFING

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 - Contract Conditions and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
1. Preformed Vapor Barrier
2. Elastomeric Membrane (waterproofing) Dampproofing

C. Related Sections
1. Vapor Barrier with Blanket Insulation: Section 07 20 00

1.02 QUALITY ASSURANCE

A. Unless specifically otherwise approved by the Architect, provide all products of this section from a single manufacturer.

1.03 SUBMITTALS

A. Product Data: Required

PART 2 PRODUCTS

2.01 MATERIALS

A. Preformed Vapor Barrier:
1. Membrane: Polyethylene sheeting: 6 mil (0.15 mm) thickness.
   a. Nervastral P.E.T., Rubber & Plastics Compound Company.
   b. Visqueen, The Plastic Divn., Viking Company
   c. Sisalite, American Sisalkraft Corporation
   d. Durathene, The Koppers Company
   e. Polyfilm, The Dow Chemical Company
   f. Moistop-2, Sisalkraft Division, St. Regis Paper Company
2. Membrane Sealant: Plastic joint sealant as recommended by manufacturer of membrane used and applied as specified by manufacturer.

B. Elastomeric Membrane Waterproofing:
1. Bituthene rubberized asphalt and polyethylene film, self-adhering membrane.
   a. "Bituthene 4000 , W. R. Grace Company
   b. “TW-60”, Tamko Building Products
   c. “SikaBit S-60), Sika Corporation
   d. "Polyken 660", Polyken Technologies
   e. “CCW-701”, Carlisle Coating and Waterproofing

PART 3 EXECUTION

3.01 INSTALLATION

A. Pre-Formed Vapor Barrier:

1. Location: Continuously under all slabs on grade within building perimeter.
2. Provide one layer of plastic film placed 2" under the bottom of the concrete floor slab within under slab granular fill under all interior slabs on grade.
3. Start film at exterior walls. Seal to interior face with sealant.
4. Lap all joints 12" minimum and seal with joint sealant, full lap.
5. Seal all film punctures prior to connecting.
6. Cut film accurately around openings for piping, conduit, outlet boxes and similar items with rayon filament acetate tape to ensure maximum barrier effectiveness. Cut openings for pipes and conduit and stretch over same to ensure tight fit.
7. Provide minimum number of joints. Use largest size sheets of membrane practicable.
8. Protect against damage prior to and during concreting operations.

B. Membrane Waterproofing:
1. Location: Outer face of all foundation walls in contact with the earth and common to interior space from 12” above grade down to the bottom of the wall.
2. Clean all surfaces of dust, oil, grease, laitance and loose particles.
3. Repoint all holes, cracks, honeycomb and other joints. Round off exterior corners to be coved.
4. All surfaces: clean, dry.
5. Temperature: Use 4000 series for temperatures as recommended by manufacturer.
6. Concrete surfaces must be cured a minimum of 7 days before application.
7. Prime surfaces as recommended by manufacturer.
8. Lap all joints 3" (76 mm); do not puncture membrane; seal around all penetrations; reinforce all joints in foundation with 6" (152 mm) wide strip and exterior corners with 11" (279 mm) wide strip under the full membrane; wrinkles, bubbles or fishmouths not permitted.
9. Adhere protection board to membrane with recommended adhesive. Provide a continuous overall protection layer for the dampproofing. Butt edges tightly, stagger end joints and cut accurately to fit tightly around and on all surfaces.
    a. Perimeter (foundation) insulation board applied over the damproofing can also serve as the protection board.
10. Exercise care in application so that dampproofing is not applied to exposed surfaces.

END OF SECTION

SECTION 07 20 00

THERMAL PROTECTION

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
   1. Building Insulation and Accessories.

C. Related Sections

1.02 QUALITY ASSURANCE

A. Fire and Insurance Ratings: Comply with fire-resistance and flammability ratings as shown and specified. Comply with code interpretations by governing authorities.

1.03 SUBMITTALS

A. Project data required.

B. Contractor shall submit to the Architect and building code authorities verification of compliance with the following:
   1. All foam and plastic type insulation shall have a flamespread rating of not more than 75 and shall have a smoke-developed rating of not more than 450 when tested in the maximum thickness intended for use in accordance with I.B.C. Standard No. 8-1 and all packaging and containers shall bear a label of an approved agency stating compliance with these requirements.

1.04 DELIVERY, STORAGE AND HANDLING

A. Do not allow insulation materials to become wet, soiled or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

B. All expanded, extruded, or foam shall be protected from sunlight. Opaque covering required with ventilation for insulation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. All manufacturers listed are acceptable subject to compliance with project requirements.
   1. Perimeter and Wall Insulation:
      a. Amoco Foam Products
      b. Celotex Corporation
      c. DiversiFoam Products
      d. Dow Chemical Company
   2. Batt Insulation:
      a. Owens-Corning
      b. Johns-Manville
      c. CertainTeed

2.02 MATERIALS

A. Perimeter Insulation: Slab Insulation –
   1. Under slab on grade and at foundations of slab on grade: Extruded polystyrene insulation density 2.0 pcf (32 kg/m^2), R=5.0 per inch (25 mm), provide minimum code R=10.0 thickness, or more if so indicated on the drawings. 2" (51 mm) minimum thickness.
   2. Foundation Wall Adhesive: As recommended by insulation manufacturer for installation condition.
   3. Protective Cap on top of perimeter insulation that is placed on outside of foundations.
      a. Protective Cap shall be 24 gal. galvanized bent sheet metal channel with minimum 1.5" flanges and inside channel depth equal to insulation thickness. Extend exterior flanges if necessary to provide full coverage of exposed insulation above grade.

B. Blanket Insulation and Vapor Barrier:
   1. Fiberglass blankets or batts, provide a minimum R-value of 30.0 (minimum thickness 8.25").

C. Insulation Sheathing:
   1. Extruded polystyrene insulation density 1.7 pcf (27.2 kg/m^2), tongue and groove sheets, R=5.0 per inch (25 mm), thickness indicated on the drawings.

D. Insulation Board:
   1. Extruded polystyrene insulation density 2.0 pcf (32 kg/m^2), R=5.0 per inch (25 mm), thickness as indicated on drawings.

E. Blown Insulation:
   1. Insul-Safe II blown fiberglass insulation, Class A, non-combustible by CertainTeed.
   2. Thickness as indicated on the drawings.

F. Insulation Baffle:
   1. Scored (for folding) cardboard or polystyrene sheets that are sized to truss spacing and insulation depth.

G. Firestop: USG Thermafiber Safing Insulation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Perimeter Insulation:
   1. Install on outside face of all exterior walls as detailed. Extend to top of footing.
   2. Remove all dirt, laitance, projections and other foreign matter from surfaces.
   3. Apply thin layer of adhesive.
   4. Firmly press insulation to adhesive, butting sections tightly.

B. Blanket Insulation:
   1. Protect against damage, moisture during storage at site.
   2. Do not install until all piping, conduit, wiring in space to be insulated has been installed.
   3. Where applied over ceilings without wood framing, fold edges of adjoining blankets and staple together at 5" (127 mm) o.c. Fasten securely in place.
   4. Where applied to wood framing, compress end joints tight together and to construction, staple to framing at 5" (127 mm) o.c.
   5. Provide complete continuity of insulation around heated spaces.
   6. Use blanket insulation for insulating voids behind outlet boxes, pipes, conduits and cavity of roof expansion joints (and other similar type locations). Fasten mechanically to one face of curb.

C. Vapor Barrier:

1. Install on the warm heated side (winter) of all areas that receive blanket or blown insulation.
2. Vapor barrier that does not get covered with a surface material (such as gypsum board, plaster, plywood, etc.) shall be secured to framing with nails/screws 6" (150 mm) o.c. through wood lath.
3. Provide complete continuity of coverage over the total insulated area and lap and seal all joints.

D. Insulation Board:
1. Apply with approved adhesion in strict accord with manufacturer's recommendations.
2. See that proper conditions exist at time of installation.
3. Remove and re-install all insulation failing to properly bond to substrate.
4. Start of work indicates acceptance of conditions of substrate as being satisfactory to the proper installation of insulation.

E. Blown Insulation:
1. Place loose fiber, machine blown, into spaces and on surfaces shown.
2. Level horizontal applications to a uniform thickness indicated, lightly settled, but not excessively packed.
3. Provide insulation baffles in each truss space (stapled firmly to trusses) at exterior wall to maintain a clear 3" (75 mm) minimum space between eave ventilated space and attic space.

END OF SECTION

SECTION 07 25 00

WEATHER BARRIERS

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
1. Weather barrier membrane
2. Seam tape
3. Flashing
4. Fasteners

C. Related Sections:
1. Rough Carpentry, Section 06 10 00
2. Gypsum Sheathing, Section 06 16 43

1.02 REFERENCES

A. ASTM International
1. ASTM C920; Standard Specification for Elastomeric Joint Sealants
2. ASTM C1193; Standard Guide for Use of Joint Sealants
3. ASTM D882; Test Method for Tensile Properties of Thin Plastic Sheeting
4. ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics
5. ASTM E84; Test Method for Surface Burning Characteristics of Building Materials
6. ASTM E96; Test Method for Water Vapor Transmission of Materials
7. ASTM E1677; Specification for Air Retarder Material or System for Framed Building Walls
8. ASTM E2178; Test Method for Air Permeance of Building Materials
9. ASTM E2357; Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

B. AATCC – American Association of Textile Chemists and Colorists
1. Test Method 127 Water Resistance: Hydrostatic Pressure Test

C. TAPPI
1. Test Method T-410; Grams of Paper and Paperboard (Weight per Unit Area)
2. Test Method T-460; Air Resistance (Gurley Hill Method)

1.03 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures.

B. Product Data: Submit manufacturer current technical literature for each component.

C. Quality Assurance Submittals
1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
2. Manufacturer Instructions: Provide manufacturer's written installation instructions.
3. Manufacturer's Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather barrier assembly installation.

D. Closeout Submittals
1. Refer to Section 01 70 00 Execution and Closeout Requirements.

2. Weather Barrier Warranty: Manufacturer's executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

1.04 QUALITY ASSURANCE

A. Qualifications
   1. Installer shall have experience with installation of weather barrier assemblies under similar conditions.
   2. Installation shall be in accordance with weather barrier manufacturer's installation guidelines and recommendations.
   3. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 01 66 00 Product Storage and Handling Requirements.

B. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Store weather barrier materials as recommended by weather barrier manufacturer.

1.06 SCHEDULING

A. Review requirements for sequencing of installation of weather barrier assembly with installation of windows, doors, louvers and flashings to provide a weather-tight barrier assembly.

B. Schedule installation of weather barrier materials and exterior cladding within nine months of weather barrier assembly installation.

1.07 WARRANTY

A. Refer to Section 01 78 33 Warranties and Bonds.

B. Special Warranty
   1. Special weather-barrier manufacturer's warranty for weather barrier for a period of ten (10) years from date of final weather barrier installation.
   2. Pre-installation meetings and jobsite observations by weather barrier manufacturer for warranty is required prior to assembly installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers:
   1. DuPont (Tyvek)
   2. Dow Chemical Company
   3. Typar

2.02 MATERIALS

A. Basis of Design: spunbonded polyolefin, non-woven, non-perforated, weather barrier is based upon DuPont™ Tyvek® CommercialWrap® and related assembly components.

B. Performance Characteristics:
   1. Air Penetration: 0.001 cfm/ft^2 at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677. ≤0.04 cfm/ft^2 at 75 Pa, when tested in accordance with ASTM E2357.

2. Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E96, Method B.
3. Water Penetration Resistance: Minimum 280 cm when tested in accordance with AATCC Test Method 127.
4. Basis Weight: Minimum 2.7 oz/yd^2, when tested in accordance with TAPPI Test Method T-410.
5. Air Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.
6. Tensile Strength: Minimum 38/35 lbs/in., when tested in accordance with ASTM D882, Method A.
7. Tear Resistance: 12/10 lbs., when tested in accordance with ASTM D1117.
8. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84. Flame Spread: 10, Smoke Developed: 10.

2.03 ACCESSORIES

A. Seam Tape: As recommended by the weather barrier manufacturer.

B. Fasteners:
1. Nail Caps: #4 nails with large 1-inch plastic cap fasteners, or 1-inch plastic cap staples with leg length sufficient to achieve a minimum penetration of 5/8-inch into the wood stud.

C. Sealants
1. Products: Sealants recommended by the weather barrier manufacturer.

D. Adhesives:
1. Provide adhesive recommended by weather barrier manufacturer.

E. Primers:
1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.

F. Flashing
1. Flexible membrane flashing materials for window openings and penetrations recommended by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

3.02 INSTALLATION – WEATHER BARRIER

A. Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.

B. Install weather barrier prior to installation of windows and doors.

C. Start weather barrier installation at a building corner, leaving 6-12 inches of weather barrier extended beyond corner to overlap.

D. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface with subsequent layers installed in a shingling manner to overlap lower layers. Maintain weather barrier plumb and level.

E. Sill Plate Interface: Extend lower edge of weather barrier over sill plate interface 3-6 inches. Secure to foundation with elastomeric sealant as recommended by weather barrier manufacturer.

F. Window and Door Openings: Extend weather barrier completely over openings.

G. Overlap weather barrier
   1. Exterior corners: minimum 12 inches.
   2. Seams: minimum 6 inches.

H. Weather Barrier Attachment:
   1. Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommend fasteners, space 12-18 inches vertically on center along stud line, and 24 inch on center, maximum horizontally.

I. Apply flashing to weather barrier membrane prior to installing cladding anchors.

3.03 SEAMING

A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.

B. Seal any tears or cuts as recommended by weather barrier manufacturer.

3.04 OPENING PREPARATION (for use with flanged windows)

A. Cut weather barrier in an "I-cut" pattern. A modified I-cut is also acceptable.
   1. Cut weather barrier horizontally along the bottom and top of the window opening.
   2. From the top center of the window opening, cut weather barrier vertically down to the sill..
   3. Fold side and bottom weather barrier flaps into window opening and fasten.

B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

3.05 FLASHING (for use with flanged windows)

A. Cut flexible flashing a minimum of 12 inches longer than width of sill rough opening.

B. Cover horizontal sill by aligning flexible flashing edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.

C. Fan flexible flashing at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges if necessary.

D. On exterior, apply continuous bead of sealant to wall or backside of window mounting flange across jambs and head. Do not apply sealant across sill.

E. Install window according to manufacturer's instructions.

F. Apply strips of flashing at jambs overlapping entire mounting flange. Extend jamb flashing 1-inch above top of rough opening and below bottom edge of sill flashing.

G. Apply strip of flashing as head flashing overlapping the mounting flange. Head flashing should extend beyond outside edges of both jamb flashings.

H. Position weather barrier head flap across head flashing. Adhere flashing over the 45-degree seams.

I. Tape head flap in accordance with manufacturer recommendations.

J. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer's instructions and ASTM C 1193.

3.06 THRU-WALL FLASHING INSTALLATION

A. Apply primer per manufacturer's written instructions.

B. Install preformed corners and end dams bedded in sealant in appropriate locations along wall.

C. Starting at a corner, remove release sheet and apply membrane to primed surfaces in lengths of 8 to 10 feet.

D. Extend membrane through wall and leave ¼ inch minimum exposed to form drip edge.

E. Roll flashing into place. Ensure continuous and direct contact with substrate.

F. Lap ends and overlap preformed corners 4 inches minimum. Seal all laps with sealant.

G. Trim exterior edge of membrane 1-inch and secure metal drip edge per manufacturer's written instructions.

H. Apply sealant bead at each termination.

3.07 THRU-WALL FLASHING / WEATHER BARRIER INTERFACE AT BASE OF WALL

A. Overlap thru-wall flashing with weather barrier by 6-inches.

B. Mechanically fasten bottom of weather barrier through top of thru-wall flashing.

C. Seal vertical and horizontal seams with tape or sealing membrane.

3.08 FIELD QUALITY CONTROL

A. Notify manufacturer's designated representative to obtain periodic observations of weather barrier assembly installation.

3.09 PROTECTION

A. Protect installed weather barrier from damage.

END OF SECTION

SECTION 07 27 29
FLUID-APPLIED VAPOR PERMEABLE AIR BARRIER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section specifies a water-resistant fluid-applied vapor permeable air barrier in exterior wall assemblies.

B. Related Work in other Sections include the following:
1. Section 03 30 00 – Cast-In-Place Concrete; requirement that backup concrete be free of fins, protrusions and large holes.
2. Section 04 20 00 – Unit Masonry; requirement that backup masonry joints are flush and completely filled with mortar, and that excess mortar on brick ties will be removed; requirement for gap at deflection joints and fillers; coordination with sequencing of through-wall flashing.
3. Section 07 27 29 - Fluid-Applied Vapor-Permeable Air Barrier.

1.02 PERFORMANCE REQUIREMENTS

A. Material Performance: Provide materials which have an air permeance not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 0.3 in. water (1.57 psf) (0.02 L/m^2 @ 75 Pa.) when tested according to ASTM E 2178.

B. Connections to Adjacent Materials: Provide connections to prevent air leakage at the following locations:
1. Foundation and walls, including penetrations, ties and anchors.
2. Walls, windows, curtain walls, storefronts, louvers or doors.
3. Different wall assemblies, and fixed openings within those assemblies.
4. Wall and roof connections and penetrations.
5. Floors over unconditioned space.
6. Walls, floor and roof across construction, control and expansion joints.
7. Walls, floors and roof to utility, pipe and duct penetrations.
8. Seismic and expansion joints.
9. All other leakage pathways in the building envelope.

1.03 SUBMITTALS

A. Submittals: Submit in accordance with Division 1 requirements.

B. Quality Assurance Program: Submit evidence of current accreditation and certification under the Air Barrier Association of America's (ABAA) Quality Assurance Program. Submit accreditation number of manufacturer and certification number of installers.

C. Product Data: Submit manufacturer's product data, installation instructions, and manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.
1. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer.
2. Include statement that materials are compatible with adjacent materials proposed for use.
3. Submit reports indicating that field peel-adhesion test on all materials to which sealants are adhered have been performed and the changes made, if required, to other approved materials, in order to achieve successful adhesion.

D. Samples: Submit clearly labeled samples, 3 by 4 inch (75 mm by 100 mm) minimum size of each material specified.

E. Compatibility: Submit letter from manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from manufacturer stating that cleaning materials used during installation are chemically compatible with each of the adjacent materials proposed for use.

1.04 QUALITY ASSURANCE

A. Air Barrier Installer Qualifications: Currently accredited by the Air Barrier Association of America (ABAA) whose applicators are certified in accordance with the ABAA Quality Assurance Program.

B. Manufacturer: Obtain primary materials from a single manufacturer regularly engaged in manufacturing vapor permeable air barrier materials. Obtain secondary materials from a source acceptable to the primary materials manufacturer.

C. Accredited Laboratory Testing for Materials: Laboratory accredited by International Accreditation Service Inc. (IAS), American Association for Laboratory Accreditation (A2LA).

D. VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds for the specific authority having jurisdiction.

E. Field Quality Assurance: Implement the ABAA Quality Assurance Program requirements. Cooperate with ABAA inspectors and independent testing and inspection agencies engaged by the Owner. Do not cover air barrier until it has been inspected, tested and accepted.

F. Mock-Ups: Build mock-up representative of primary exterior wall assemblies and glazing assemblies including backup wall and typical penetrations as acceptable to the Architect. Mock-up shall be approximately 4 feet long by 4 feet high and include the materials proposed for use in the exterior wall assembly.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.
B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by the manufacturer. Protect stored materials from direct sunlight.
C. Handle materials in accordance with manufacturer’s recommendations.

1.06 PROJECT CONDITIONS

A. Temperature: Install vapor permeable air barrier within range of ambient and substrate temperatures recommended by vapor permeable air barrier manufacturer.
B. Field Conditions: Do not install vapor permeable air barrier in snow, rain, fog, or mist without temporary protection and supplemental heat as required. Do not install vapor permeable air barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the vapor permeable air barrier manufacturer. Apply vapor permeable air barrier to a surface dry substrate, or in accordance with manufacturer’s recommendations.

1.07 WARRANTY

A. Material Warranty: Provide manufacturer’s standard product warranty, for a minimum 3 years from date of Substantial Completion.
B. Installation Warranty: Provide air barrier subcontractor’s 2 year warranty from date of Substantial Completion, including all components of the air barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of adhesion, loss of cohesion, failure to cure properly.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fluid-Applied Vapor Permeable Air Barrier: Fluid-applied proprietary materials as specified. Use regular or low-temperature formulation depending on site conditions, within temperature ranges specified by manufacturer. Provide related accessories including primer, seam tape, mastic, fluid and sealant recommended by manufacturer. Subject to compliance with requirements, provide one of the following:

1. Grace Construction Products or approved equal:
    a. Perm-A-Barrier VP acrylic fluid applied vapor permeable air barrier membrane
    b. Perm-A-Barrier VP LT two component acrylic fluid-applied vapor permeable air barrier for low temperature application
    c. Membrane for details and Terminations: Bituthene Liquid Membrane
    d. Transition Membrane: Perm-A-Barrier Detail Membrane or Perm-A-Barrier Aluminum Flashing
    e. Through-Wall Flashing: Perm-A-Barrier Wall Flashing
    f. Water-based Primer: Perm-A-Barrier Primer Plus or WB Primer
    g. Solvent-based Primer: Bituthene Primer B2 LVC or Bituthene Primer B2
    h. Penetrations & Termination Sealant: Bituthene Liquid Membrane
    i. Joint Sealant: Refer to Technical Letter 1 for details on compatible waterproofing sealants

2.02 AUXILIARY MATERIALS

A. Membrane at Transitions in Substrate and Connections to Adjacent Elements: Neoprene, ASTM D 2000 Designation 2BC415 to 3BC620, 50 to 65 mils (1.3 mm to 1.6 mm) thick with non-corrosive termination bars and fasteners. Adhesive and lap sealant as recommended by manufacturer.

B. Transition Membrane Between Air Barrier Membrane and Roofing and Other Adjacent Materials: Comply with both vapor permeable air barrier barrier manufacturer's recommendations and roofing material manufacturer's recommendations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions under which air barrier assemblies will be applied, with Installer present, for compliance with requirements.

1. Verify that surfaces and conditions are suitable prior to commencing work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.
2. Do not proceed with installation until after minimum concrete curing period recommended by air barrier manufacturer.
3. Ensure that the following conditions are met:
    a. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants
    b. Concrete surfaces are cured and dry, smooth without large voids, spalled areas or sharp protrusions.
    c. Masonry joints are flush and completely filled with mortar, and all excess mortar sitting on masonry ties has been removed.
4. Verify substrate is surface dry. Test for capillary moisture by plastic sheet method according to ASTM D 4263 and take suitable measures until substrate passes moisture test. Surface dry is an acceptable substrate condition if acceptable to the manufacturer.
5. Verify sealants used in sheathing are compatible with membrane proposed for use. Perform field peel-adhesion test on materials to which sealants are adhered.
6. Notify Architect in writing of anticipated problems using air barrier over substrate prior to proceeding.

3.02 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application. Mask off adjoining surfaces to prevent overspray and spillage

B. Prime substrate for application of sheet membrane transition strips as recommended by manufacturer and as follows:
   1. Prime masonry, concrete substrates with conditioning primer.
   2. Prime glass-fiber surfaced gypsum sheathing an adequate number of coats to achieve required bond, with adequate drying time between coats.
   3. Prime wood, metal, and painted substrates with primer.
   4. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air barrier and at protrusions.

C. Prime substrate for application of fluid-applied vapor permeable air barrier if recommended by manufacturer based on project conditions and as follows.

3.03 INSTALLATION

A. Vapor Permeable Air Barrier Installation: Install transition strip materials and fluid-applied vapor permeable air barrier to provide continuity throughout the building envelope. Install materials in accordance with manufacturer's recommendations and as follows, unless manufacturer recommends other procedures in writing based on project conditions or particular requirements of their recommended materials:
   1. Apply primer for transition strips at rate recommended by manufacturer. Allow primer to dry completely before transition strip application. Apply as many coats as necessary for proper adhesion.
   2. Apply primer for fluid-applied vapor permeable air barrier as recommended by fluid-applied vapor permeable air barrier manufacturer. Based on manufacturer’s recommendation, no primer may be required for the fluid-applied materials.
   3. Apply fluid-applied vapor permeable air barrier using equipment and methods recommended by manufacturer, to achieve a dry film thickness as recommended by the manufacturer.
   4. Apply fluid-applied vapor permeable air barrier and transition strips to shed water naturally without interception by a sheet edge, unless that edge is sealed with permanently flexible termination mastic.
   5. Position subsequent sheets of transition strips applied above so that membrane overlaps the membrane sheet below by a minimum of 2 inches (50 mm), unless greater overlap is recommended by manufacturer. Roll into place with roller.
   6. Overlap horizontally adjacent pieces of transition strips a minimum of 2 inches (50 mm), unless greater overlap is recommended by manufacturer. Roll seams with roller.
   7. Seal around all penetrations with termination mastic, extruded silicone sealant, membrane counterflashing or other procedure in accordance with manufacturer’s recommendations.
   8. Connect vapor permeable air barrier in exterior wall assembly continuously to the air barrier of the roof, to concrete below-grade structures, to windows, curtain wall, storefront, louvers, exterior doors and other intersection conditions and perform sealing of penetrations, using accessory materials and in accordance with the manufacturer’s recommendations.
   9. At changes in substrate plane, provide transition material (bead of sealant, mastic, extruded silicone sealant, membrane counterflashing or other material recommended by manufacturer) under membrane to eliminate all sharp 90 degree inside corners and to make a smooth transition from one plane to another.
   10. Provide mechanically fastened non-corrosive metal sheet to span gaps in substrate plane and to make a smooth transition from one plane to the other. Membrane shall be continuously supported by substrate or as recommended by the manufacturer.
   11. At through-wall flashings, provide an additional 6 inch wide strip of manufacturer’s recommended membrane counterflashing to seal top of through-wall flashing to membrane or as recommended by manufacturer. Seal exposed top edge of strip with bead of mastic or as recommended by manufacturer.

12. At deflection and control joints, provide backup for the membrane to accommodate anticipated movement.
13. At expansion and seismic joints provide transition to the joint assemblies.
14. Apply a bead or trowel coat of mastic along membrane seams at reverse lapped seams, rough cuts, and as recommended by the manufacturer.
15. At end of each working day, seal top edge of the self-adhered membrane to substrate with termination mastic.
16. Do not allow materials to come in contact with chemically incompatible materials.
17. Do not expose membrane to sunlight longer than as recommended by the manufacturer.
18. Inspect installation prior to enclosing assembly and repair punctures, damaged areas and inadequately lapped seams with a patch of membrane lapped as recommended by manufacturer.

3.04 FIELD QUALITY CONTROL

A. Owner's Inspection and Testing/ABAA Audits: Cooperate with Owner's testing agency and ABAA auditors. Allow access to work areas and staging. Notify Owner's testing agency/ABAA auditor in writing of schedule for Work of this Section to allow sufficient time for testing and inspection. Daily inspection and testing may be required. Do not cover Work of this Section until testing and inspection is accepted.

3.05 PROTECTING AND CLEANING

A. Protect vapor permeable air barrier assemblies from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Coordinate with installation of materials which cover vapor permeable air barrier, to ensure exposure period does not exceed that recommended by the vapor permeable air barrier manufacturer.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

END OF SECTION

SECTION 07 31 13

ASPHALT SHINGLES

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
1. Asphalt shingles, felt, ice dam and other required accessories.
2. Ridge Vents

C. Related Sections
1. Flashing and Sheet Metal: Section 07 60 00

1.02 SUBMITTALS

A. Samples: Provide 3" x 5" samples of manufacturer's full range of colors for Architect's selection if color is not stated on the drawings, or for approval before ordering if color is selected on drawings.

B. Product data: Required

PART 2 PRODUCTS

2.01 MATERIALS

A. Asphalt Shingles:
1. Rectangular asphalt strip shingle, seal down type, three tab, 12" x 36".
2. UL rated, wind resistant, Class "A" fire and casualty hazard.
3. Color: as selected from full range of manufacturer's line.
4. Conform to FS SS-S-00298 thick butt type subject to following:
   a. Exposure: 5" (127 mm)
   b. Weights are minimum: 235 lb. (105 kg), seal down.

B. Shingle-Over Ridge Vent:
1. Provide ridge vents with external wind baffle to create negative air pressure that pulls air out of attic and helps prevent clogging of vent slots, and deflect weather and debris from entering attic space; provide ridge vents with internal weather filter to help form complete barrier against wind-blown rain, snow, dust, or insects.
   a. Acceptable product: ShingleVent II-9, size 9 inches wide, Model SHFV209 by Air Vent Inc., A Certain Teed Company (Tel: 800 AIR-VENT)
   b. Net free area: 18 square inches per linear foot (3.5 sq m/lin m).
   c. Color: Charcoal

C. Miscellaneous Materials
1. Asphalt Felt: Conform to FS HH-F-191, Type 1, 15 lbs (6.75 kg).
2. Nails: Standard large-head galvanized roofing nails of sufficient length to penetrate deck at least 3/4 inch (19 mm).
3. Plastic Cement: FS SS-C-153, Type 1
4. Ice Dam:
   a. Ice and water shield by Grace
   b. Storm Guard HT by GAF Materials Corp.
   c. Dri-Start-A by Carlisle Coating and Waterproofing

PART 3 EXECUTION

3.01 INSTALLATION

A. General Requirements:
   1. Do not start work until sheet metal work and bituminous roofing that extends under roofing is complete.
   2. Coordinate work with other trades.
   3. Roofing and flashings must be weather tight, free from leaks, and other defects.

B. Start of work indicates acceptance of roof deck as satisfactory for the installation of roofing as specified.
   1. All edges at shingled roofs shall have a prefinished sheet metal drip.
   2. All shingled roofs shall have one layer of ice dam perimeter underlayment horizontally installed, lapping each course downward and extending the full area of the roof from the eave to the peak.
   3. Lay starter course only, inverted at lower edge of eave with tabs up. Lay succeeding courses with tabs down, the first on top of starter course, stagger joints between courses.
   4. Provide prefinished metal flashing where top of shingle abuts a vertical surface. Flashing shall extend from a minimum of 6" over the top of the shingles to 6" minimum up under the finish siding.

C. Install shingles in strict accord with manufacturer's recommendations using a minimum of four roofing nails per shingle.
   1. Securely seal each tab of strip shingles to undercourse by means of an approved adhesive, factory applied.
   2. Lay shingles to 5" (127 mm) exposure with ends barely touching, true horizontal.

D. Install ridge vents in accordance with manufacturers printed instructions.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
   1. Prefinished Sheet Metal:
      a. Fascia flashing
      b. Coping flashing
      c. Counter flashing
      d. Drip flashing
      e. Shingle flashing
      f. Diverters (Rain Diverters), aluminum
      g. Flashing over windows
      h. Downspouts, scuppers
      i. Gutters with brackets
   2. Galvanized Sheet Metal:
      a. Fascia flashing
      b. Coping flashing
      c. Counter flashing
   3. Aluminum Sheet Metal:
      a. Fascia flashing
      b. Downspouts, scuppers
   4. Roof Vents

C. Related Sections
   1. Asphalt Shingles: Section 07 31 13
   2. Caulking and Sealants: Section 07 90 00

1.02 SUBMITTALS

A. Samples: Required
   1. Provide samples of prefinished metal finishes for Architect's selection.

1.03 WARRANTIES, GUARANTEES

A. Warranty Prefinished Sheet Metal: The manufacturer of the prefinished sheet metal shall furnish a written warranty covering color fade, chalking and film integrity of the prefinished sheet metal for a period of 20 years from the completion and acceptance of the project. Submit the warranty in to the Architect.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers subject to compliance with project requirements shall be
   1. Vincent Metals
   2. Peterson Aluminum
   3. Copper Sales, Inc.
   4. Berridge Manufacturing Co.

2.02 MATERIALS

A. Prefinished Sheet Metal:
   1. Galvanized steel sheet with factory applied finish and back priming.
   2. Finish: Floropolymer or polyvinyl chloride, 20-year finish, with protective film on finish.
   3. Thickness: 24 gauge (0.6 mm)
   4. Color: As selected by Architect

B. Galvanized Iron Sheet Metal:
   1. Zinc coated steel flashing, ASTM A 526 with minimum 0.20 percent copper content.
   2. Hot dip galvanized, ASTM A 525, 1.25 commercial class, mill phosphatized.
   3. Thickness: 24 USS gauge (0.6 mm) unless otherwise detailed.
   4. Location: Where "G.I. Sheet Metal" is indicated on drawings.

C. Aluminum Sheet Metal: 0.032 gauge (0.8 mm) sheet aluminum unless otherwise noted.

D. Miscellaneous Materials
   1. Bituminous Paint: Acid and alkali-restant type; black color; FS TT-C-494 or SSPC-Paint 12 solvent type, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
   2. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.
   3. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed.
   4. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior and interior nonmoving joints, including reveted joints.
   5. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.
   6. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

E. Other Materials: Provide other materials, not specifically described, but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:
   1. Comply with details and profiles as shown, and comply with SMACNA Architectural Sheet Metal Manual recommendations for installation of the work.
   2. Shape and install sheet metal items as indicated. Furnish items to be installed by other trades to the proper trade for installation.
   3. Fabricate and install all work with lines and corners true and accurate. Form exposed faces flat and free of buckles, waves and tool marks.
   4. Exposed edges on flashing shall be blind. Turn back 1/2" (13 mm).
   5. Fabricate items to maximum length possible with minimum number of joints.
   6. On vertical joints, lap flashings a minimum of 6" (152 mm).
   7. Blind fasten all sheet metal work wherever possible. If not possible, provide neoprene gasket type washers under exposed screw and nail heads. Shim and seal under units as required to provide continuous, level, plumb lines.
   8. Erect sheet metal level, plumb, in proper plane and make watertight.

B. Install coping and fascia as detailed. Fabricate to profiles as shown. No face nailing will be permitted. Sections to clip over previously placed clips. Form in 8 foot lengths or longer, butt sections together and cover joints with 4" wide covers. Hook bottom edge to continuous face cleat.

C. Flashing and Counterflashings:
   1. Provide reglet type flashing receivers where detailed.
   2. Provide counterflashing receivers in new masonry walls as walls are laid up.
   3. Locate receivers at least 12" above roof.
   4. Counterflash all vertical surfaces with felt base flashing. Hook counterflashing into receivers, stagger joints and nail at 24" intervals.
   5. Lap base flashing with bottom edge crimp. Crease counterflashing longitudinal at center of exposed surface enough to provide spring action that will hold bottom edge firmly against base flashing.
   6. Where reglets occur, insert flashings, lock in place with lead wedges 12" o.c. and seal.

D. Pitch/Sealant Pockets:
   1. Construct watertight of galvanized sheet metal.

E. Expansion Joints:
   1. Fabricate of material shown.
   2. Allow adequate joints for construction and expansion. Base computations on difference between highest and lowest known temperatures and allow for twice the calculated movement.

F. Gutters and Downspouts:
   1. Stock prefacricated shapes of prefinished metal in standard size approximately 2 ¾" x 5".
   2. Slope gutters to drain 1" in 20 feet.
   3. Provide all accessories required for complete installation, such as end pieces, elbows, caps, outlet tubes, strainers and similar items.
   4. Space gutter hangers and braces not over 36" apart and secure with screws, bolts or approved clips.
   5. Lap gutter joints 1" in direction of flow, seal watertight and secure.
   6. Make headers (downspouts) with 1 ½" telescoped joints. Set plumb clear of walls. Fasten with straps not over 6 feet apart, spaced equally with one near top and bottom.

G. Precautions:
   1. Coat all metals coming in contact with cedar, redwood or wolmanized lumber with asphaltum paint.
   2. Protect all dissimilar metals against electrolytic action with other metals by coating with asphaltum paint, asphalt varnish or apply Teflon tape.
   3. All surfaces to which sheet metal is applied must be clean, dry.

3.02 CLEAN UP/ACCEPTANCE

A. After installation of prefinished sheet metal is complete, touch-up scratches, abraded and exposed fasteners with manufacturer's touch-up paint. Clean exposed surfaces with soap and water as necessary to remove dirt and stains.

B. Upon completion of all work, thoroughly clean all surfaces with an approved cleaner and wash down with water. Repair all damaged areas and leave work in perfect condition.

C. Remove protective films prior to final acceptance of the building.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
   1. Seal empty holes and penetrations at floors, fire rated and sound rated walls and smoke barrier walls.
      a. Including voids above or below these partitions, such as flutes in steel decks and like items
      b. Seal holes accommodating penetrating items such as cables, cable trays, pipes, ducts, conduits and similar items.
   2. The seal penetration system used shall maintain the integrity of time rated construction by providing a sealant against the spread of heat, flame and smoke.
   3. See 1.03 SUBMITTALS for additional contractor responsibilities.

C. Related Sections
   1. Thermal Protection: Section 07 20 00
   2. Weather protective caulking and sealants: Section 07 90 00

1.02 QUALITY ASSURANCE

A. Systems shall be Underwriter's Laboratories (UL) Classified or Listed by Warnock Hersey International for the appropriate required time rating.

B. Materials shall meet the requirements of National Fire Protection Association (NFPA) 101 - Life Safety Code and NFPA 70 - National Electric Code.

C. Through-penetration fire stops required shall have an F or T rating as determined by tests conducted in accordance I.B.C. and ASTM E 814.
   1. Through-penetration fire stops may be used for membrane penetrations.
   2. The F rating shall apply to all through penetrations and shall not be less than the required fire-resistance rating of the assembly penetrated.
   3. The T rating shall apply to those through-penetration locations required to have T ratings as specified in I.B.C. and shall not be less than the required fire-resistance rating of the assembly penetrated.

D. References and Standards
   1. ASTM E 814: Fire Tests of Through-Penetration Firestops.
   2. ASTM E 119: Fire Tests of Building Construction and Materials.
   3. ASTM E 84: Surface Burning Characteristics of Building Materials.
   4. UL 723: Standard Test Method for Surface Burning Characteristics of Building Materials.
   5. UL 1479: Fire Tests of Through-Penetration Firestops.
   6. UL 263: Fire Tests of Building Construction and Materials.
   7. UL Fire Resistance Directory: Through-Penetration Firestops Systems (XHEZ), and Fill, Void or Cavity Materials (XHHW).
   8. NFPA 70: National Electric Code.
   9. NFPA 101: Life Safety Code.
   10. NFPA 255: Method of Testing of Surface Burning Characteristics of Building Materials.
   11. I.B.C.: Section 714 and Standard 7-5.
   12. ULC CAN4-S115M: Standard Method of Fire Tests of Firestop Systems.

1.03 SUBMITTALS

A. Product data for each type of product used.

B. Qualifications
   1. Product test reports from a qualified testing and inspecting agency certifying the firestopping product and installation meet or exceed the required standards.
   2. Certification by firestopping manufacturer that products supplied comply with governing regulations controlling use of volatile organic compounds and are nontoxic to building occupants.
   3. Evidence (letter) that the firestop installation contractor is a certified applicator by the firestop manufacturer.

C. Shop Drawings detailing materials, installation methods and relationships to adjoining construction for each through-penetration firestop system, each type of construction penetrated and each kind of penetrating item.
   1. Provide firestop design designation of qualified testing and inspecting agency evidencing compliance with requirements for each condition where installed.
   2. It shall be the Contractors responsibility to familiarize themselves with the project and provide the above information to the satisfaction of the Architect and local building authorities.

1.04 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered in their original unopened containers and shall bear full product identification including approved listing laboratory classification marking.

B. All materials shall be stored and handled to prevent their deterioration or damage due to moisture, temperature changes, contaminants or other causes. Provide ventilation when required.

C. Damaged or deteriorated material shall be removed from the site and shall not be used.

1.05 ENVIRONMENTAL CONDITIONS

A. Install firestopping only when ambient or substrated temperatures are within the limits permitted by the material manufacturer.
   1. During and following installation, area temperatures shall be maintained for a period of not less than 24 hours.

B. Substrates shall be clean, dry and in sound condition before and during application.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. This specification is based on Rectorseal Corporation
   1. Subject to compliance with project requirements, provide firestopping as manufactured by one of the following:
      a. Dow Corning Fire Stop
      b. G.E. Pensil Firestop System
      c. Hilti Firestop Systems
      d. Thermal Ceramics FireMaster Systems
      e. Tremco Firestopping Systems
      f. 3M Fire Barrier.

2.02 MATERIALS

A. Fire Rated Fire Stopping Sealants:
   1. Metacaulk 900 Series inorganic sealants for interior use only.

2. Metacaulk 800 Series silicone sealants for exterior and interior use.

B. Materials shall be Metacaulk as manufactured by the RectorSeal Corporation. All fire stopping sealants shall be thixotropic so as not to slump or sag and shall be trowelable. Fire stopping sealants shall be intumescent and shall be free of asbestos, halogens, and volatile solvents.
   1. All fire stopping sealants shall be capable of maintaining an effective barrier against flame, heat, and smoke in compliance with the requirements of ASTM E 814, UL 1479, ASTM E 119, UL 723, ASTM E 84 and UL 263.
   2. Fire stopping materials shall be classified in the Underwriters Laboratories (UL) Fire Resistance Directory or listed in the Warnock Hersey International Director.
   3. Fire stopping materials shall be paintable or capable of receiving finish materials in those areas which are exposed to view and which are scheduled to receive finishes.

PART 3 EXECUTION

3.01 COORDINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Preparation:
   1. Clean all penetration (hole) and penetrating item surfaces of foreign materials including loose debris, dirt, oil, grease, concrete laitance, form release agent, wax and/or caulking before sealant is applied.
   2. Field measure and verify dimensions as required
   3. Mask off and protect adjacent areas or surfaces from damage, staining or excess material as a result of the work of this section.
   4. Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

B. Application:
   1. Installation of firestopping materials shall be in exact accordance with the manufacturer's latest published instructions, requirements, specifications, details and approved shop drawings.
   2. Installation shall be in accordance with the appropriate UL Fire Resistance Directory or Listing with the appropriate Warnock Hersey International Listing.
   3. Seal holes or voids made by penetrating items to ensure an effective, sound fire and smoke barrier.
   4. Seal intersections and penetrations of floors, ceilings, walls and columns.
   5. Seal around cutouts for lights, cabinets, pipes, plumbing, HVAC ducts and electrical boxes, etc.
   6. Where floor openings are four inches or more in width and subject to traffic or loading, install cover plate systems capable of supporting same loading as floor.
   7. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
      a. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
      b. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
      c. For fill materials that will remain exposed after completing work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
   8. Keep areas of work accessible until inspection by applicable code authorities.

9. Correct unacceptable work and provide further inspection to verify compliance with requirements.

3.03 FIELD QUALITY CONTROL

A. Inspecting agency employed and paid by Owner will examine completed firestopping to determine, in general, if it is being installed in compliance with requirements.
   1. Inspecting agency will report observations promptly and in writing to Contractor and Architect.
   2. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.
   3. Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

3.04 CLEAN UP/ACCEPTANCE

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

B. Protect firestopping 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 firestopping immediately and install new materials to produce firestopping complying with specified requirements.

C. Upon the completion of the work of this section, dispose of (away from site) debris, trash, containers, residue, remnants and scraps which result from the work of this section in accordance with all local, state and federal regulations.

END OF SECTION

SECTION 07 90 00

JOINT PROTECTION

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.
   1. "Caulk" and/or "Sealant" as used on the drawings and herein, may be used to mean either/or and are interchangeable. Both terms shall include providing the complete compatible system for the design conditions.

B. Section Includes:
   1. Caulking around perimeter of all exterior metal frames and louvers.
   2. Caulking around perimeter of all windows.
   3. Caulking around perimeter of all interior metal frames in masonry.
   4. Caulking of all joints where items penetrate the walls above grade.
   5. Caulking of all other joints indicated on the drawings or required to be caulked so as to leave the building entirely weathertight.
   6. Caulking around plumbing fixtures at walls and floor.
      a. Applicable when not provided for by the mechanical specifications. This Contractor shall verify this requirement.

C. Related Sections
   1. Work shall be performed under the following sections as per this specification.
      a. Caulking around doors, frames and windows: Division 8
      b. Caulking Under Thresholds: See Section 08 71 00

1.02 SUBMITTALS

A. Product Data:
   1. Materials list of items proposed to be provided under this section.
   2. Manufacturer's specifications and other data necessary to prove compliance with the specified requirements.
   3. Samples:
      a. Color samples for approval by Architect.
   4. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Specification Basis: Vulkem/Mameco International, Inc. and General Electric.

B. Acceptable manufacturers subject to project compliance:
   1. Pecora
   2. Tremco
   3. Sonneborn
   4. Dow Corning
   5. General Electric.

2.02 MATERIALS

A. General Exterior Caulk:
   1. Exterior joints in vertical surfaces and non-traffic horizontal surfaces such as, but not limited to:
      a. Control and expansion joints in cast-in-place concrete.
      b. Control and expansion joints in unit masonry.
      c. Joints between different materials listed above.
      d. Perimeter joints between materials listed above and frames of doors, windows, storefronts, louvers and similar openings.
      e. Control and expansion joints in ceiling and overhead surfaces.
      f. Bedding bead for sheet metal flashings and frames of metal or wood.
      g. Between laps in fabrications of sheet metal.
      h. Other joints as indicated.
   2. Provide single-component or multi-component, low-modulus, non-sag polyurethane sealant that is suitable for continuous immersion in water, comply with ASTM C 920, Type S or M, Grade NS, Class 25.
   3. Acceptable sealants: Vulkem 921/922.

B. General Interior Caulk:
   1. Interior joints in vertical surfaces and non-traffic horizontal surfaces such as, but not limited to:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints on exposed interior surfaces of exterior openings.
      c. Perimeter joints between interior wall surfaces and frames of interior doors, windows, storefronts, louvers, elevator entrances and similar openings.
      d. Trim or finish joints subject to movement.
      e. Between laps in fabrications of sheet metal.
      f. Other joints as indicated.
   2. Provide single-component or multi-component, non-sag polyurethane sealant having plus-or-minus 25 percent joint movement capability that is suitable for continuous immersion in water, comply with ASTM C 920, Type S or M, Grade NS, Glass 25.
   3. Acceptable sealants: Vulkem 116/227/921/922.

C. Plumbing Fixture Caulk:
   1. Joints at plumbing fixtures to wall, floor or counter surfaces. Vanity top and backsplash to wall joints.
   2. Acceptable sealant; Sanitary 1700 Silicone Sealant, General Electric Co.

D. Joint Backing: Provide compressible rod of material as recommended by sealant manufacturer for joint types and widths indicated on construction drawings.

E. Joint Preparation and Accessories: Provide joint cleaner, sealer, breaker, masking tape and primer as recommended by manufacturer of caulk or sealant and compatible with substrate.

PART 3 EXECUTION

3.01 INSTALLATION

A. Environmental Requirements: Meet requirements of sealant manufacturer's recommendations for maximum and minimum application temperatures and humidity. Sealant shall not be applied when temperature is below 40° F (5° C) unless approved by Architect.

B. Joint Preparation:
   1. Clean joint surfaces immediately before installation of sealant compound, remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant.

2. Prime, provide bond-breaker or seal the joint surfaces wherever shown or recommended by the sealant manufacturer. Do not allow preparation materials to spill or migrate on to adjoining surfaces.
3. Mask adjacent surfaces as necessary for a neat application.

C. Installation:
1. Joint backing material shall be a width greater than the joint, as recommended by the manufacturer to guarantee a tight fit when forced into place.
2. Apply materials in strict accordance with manufacturer's printed instructions. Observe manufacturer's requirements regarding temperature control, usability of materials and protection of adjacent surfaces. Make continuous tooled ribbons of sealant, surface slightly concave, free of wrinkles, air pockets, embedded impurities and skips, uniformly smooth and with perfect adhesion along both sides of joint.

3.02 CLEAN UP/ACCEPTANCE

A. Leave joints in a clean, neat condition.

B. Defective joints shall be removed, cleaned and replaced at no additional cost.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
1. Hollow metal doors
2. Hollow metal frames

C. Related Sections
1. Door Hardware: Section 08 71 00
2. Perimeter caulking of frames: Section 07 90 00

1.02 QUALITY ASSURANCE

A. Unless specifically otherwise approved by the Architect, provide all products of this section from a single manufacturer.

B. Rated Assemblies:
1. Refer to door schedule for openings requiring labels.
2. Provide UL or Warnock Hersey fire label on all doors, frames and panels indicated as fire rated. The appropriate label shall be attached to the door and frame as follows:
   a. "A" label (3-hour rating)
   b. "B" label (1-1/2 hour rating)
   c. "C" label (3/4 hour rating)
   d. "20" label (tested 20-minute rating)
   e. "S" label (identification label after the fire label indicating compliance with I.B.C. Section 1004)
      1) **This label shall be required on all fire label door and frame systems in corridors whether scheduled or not.**
      2) **This label shall be the responsibility of the door manufacturer/supplier including coordination and compatibility requirements with the frame manufacturer/supplier.**
      3) **The smoke gasket provided under Section 08 71 00 shall be applied to the frame and is required in addition to the "S" label/identification treatment.**
3. Fire label requirements of construction shall govern where materials or methods of construction specified are inconsistent with labeling requirements.

1.03 SUBMITTALS

A. Shop Drawings: (Required)
1. Provide one set of approved drawings to finish hardware supplier.
   a. Obtain templates of finish hardware from hardware supplier.
2. Show all details of construction, anchorage, and special conditions.
3. Identify all items with Architect's mark and type. (No exceptions)

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers subject to compliance with project requirements shall be
   1. Steelcraft
   2. Kewanee
   3. Mesker
   4. Ceco Corporation
   5. Trussbuilt Co.
   6. Fenestra
   7. Curries
   8. Republic
   9. Pioneer

B. **Doors and frames specified as FEMA 361 rated must be installed as a full and complete system where all components have been properly tested to meet a FEMA 361 rating. In order to maintain proper performance under a storm event, elements of the rated system may not be substituted.**

2.02 MATERIALS

A. Materials and Fabrication:
   1. Provide neat accurately placed mortise and reinforcement for all finish hardware items. Use minimum 12 gauge steel, welded in place, reinforcement for all mortised, flush mounted and through bolted finish hardware. Drill and tap ready for hardware application.
   2. Thoroughly clean and remove all tool marks and surface imperfections, grind all welds smooth, and give all hollow metal one shop coat of baked on rust inhibitive enamel primer.
   3. Provide glazing beads where required:
      a. Match steel gauge of frame or door.
      b. Secure with oval head countersunk machine screws approximately 8" o.c.
   4. Hollow metal not properly prepared for hardware, or with warps, bends, breaks, dents or other damage, or that having faulty materials or workmanship will be rejected.

B. Doors:
   1. Flush surface sheets cold rolled stretcher level steel, ASTM A 366, welded to perimeter frame and bonded to inner core. No seams visible on face of doors or vertical edges.
      a. Interior Doors: minimum 18 gauge steel face sheets
      b. Exterior Doors: minimum 16 gauge steel face sheets
      c. All doors: Provide top and bottom edges with closed continuous recessed 18 gauge channels welded to each face panel.
   2. Exterior Doors:
      a. Provide doors with flush watertight top caps.
      b. Provide with insulation filled cores.
   3. Clearances for Installed Doors:
      a. Head and Jambs: 1/8"
      b. Meeting Edges of Doors in Pairs: 1/8"
      c. Jamb, latch side: 1/8"
      d. Jamb, hinge side: 1/16"
      e. Door Bottom: 5/8” maximum
      f. Coordinate with Section 08 71 00 for installation and function of threshold and weatherstripping

C. Frames:
   1. Shapes as detailed, cold rolled, commercial grade steel, ASTM A 366.
      a. Minimum 16 gauge steel for interior frames.
      b. Minimum 14 gauge steel for exterior frames.
      c. Sizes, shapes, if not otherwise indicated on drawings:

1) Masonry Openings: Stock 2" x $5^{3}/_{4}$" frames with 4" head sections where required for coursing.
2) Contractor shall verify correct size and shape to installed conditions.

2. Cold form with head and jamb members mitered or coped to smooth hairline joints continuously welded and ground smooth.
3. Anchors: Provide standard anchors for each condition of use, space not over 36" o.c. each jamb and within 8" of head and sill. Provide floor anchors, 12 gauge steel welded inside each jamb with two holes for securing to floor.
   a. All existing wall "Thru-Bolted" type anchors shall have counter sunk heads and the depression filled with body putty and ground smooth.
4. Provide temporary spreader at bottom of all frames. Remove after frames are secured in placed.
5. Frames shall be provided with manufacturer's standard door silencers, three for each leaf except in double openings which shall have one each leaf in the head.

PART 3 EXECUTION

3.01 INSTALLATION

A. Setting Frames: Set frames to maintain scheduled dimensions. Hold frame level and maintain jambs plumb and square. Wherever possible, leave frame spreader bars intact until frames are set perfection square and plumb and anchors are securely attached and:
   1. Frames in masonry walls shall be grouted full of mortar at jambs.
   2. Anchorage: Securely anchor frames to adjacent construction.
      a. Follow manufacturer’s instructions for anchorage.
   3. Hang doors with all clearances accurately maintained.
   4. Arrange with painter to apply one coat of specified finish to top and bottom edges of doors before installation.
   5. Apply hardware in accordance with hardware manufacturer's templates and instructions. Install hardware after finish paintwork is completed and without damage to paint finish.
      a. Coordinate work so that hardware items and installation meet required fire classification of door and frame.
   6. Adjust operable parts for correct function.

3.02 CLEAN UP/ACCEPTANCE

A. Immediately after erection, thoroughly clean metal surfaces of doors and frames of dirt and stains caused during installation. Areas where prime coat has been damaged shall be sanded smooth and touched up with same primer as applied at shop. Remove rust before touch up coat is applied. Touch up shall not be obvious.

B. Protect from damage resulting from work of others and general use after installation. Damaged work will be rejected and replacement will be at the Contractor's expense.

END OF SECTION

SECTION 08 14 00

WOOD DOORS

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
1. Wood door panels.

C. Related Sections
1. Door Hardware: Section 08 71 00
2. Hollow Metal Frames: Section 08 11 13
3. Staining and Transparent Finishing: Section 09 93 00

1.02 QUALITY ASSURANCE

A. In addition to complying with pertinent codes and regulations of governmental agencies having jurisdiction, comply with:
1. Manual of Millwork of the Woodwork Institute of California, for the grade or grades specified.
2. Architectural Woodwork Quality Standards of the Architectural Woodwork Institute (AWI), for the grade or grades specified.
3. Certification stamps will not be required.

B. Unless specifically otherwise approved by the Architect, provide all products of this section from a single manufacturer.

C. Fire Rate Assemblies:
1. Refer to door schedule for ratings and locations.
2. Provide UL or Warnock Hersey fire label on all doors and panels indicated for fire rated openings. The appropriate label shall be attached to the door and/or panel as follows:
   a. "A" label (3-hour rating)
   b. "B" label (1-1/2-hour rating)
   c. "C" label (3/4-hour rating)
   d. "20" label (tested 20-minute rating)
   e. "S" label (identification label after the fire rating label indicating compliance with I.B.C. Section 1004)
      1) **This label shall be required on all fire labeled door and frame systems in corridors whether scheduled or not.**
      2) **This label shall be the responsibility of the door manufacturer/ supplier including coordination and compatibility requirements with the frame manufacturer/supplier.**
      3) **The smoke gasket provided under Section 08710 shall be applied to the frame and is required in addition to the "S" label/identification treatment.**
3. Fire label requirements of construction shall govern where materials or method of construction specified are inconsistent with labeling requirements.

1.03 SUBMITTALS

A. Shop Drawings: Required
1. Indicate Architect's door marks for reference.

B. Product Data: Required

1.04 DELIVERY, STORAGE AND HANDLING

A. Protect doors from damage, soiling and deterioration. Doors shall not be delivered until all wet operations such as placing concrete, plastering and laying masonry have been completed and dry conditions exist. Store in dry place and protected from the elements. Stack in accordance with manufacturer's instructions.

B. Seal all four edges of unfinished doors when delivered to the job site.

C. Do not drag doors across one another, lift door and carry them into position. Use dry, clean, canvas gloves to prevent finger marks and stains.

1.05 WARRANTIES, GUARANTEE

A. Provide door manufacturer's standard warranty signed by the manufacturer and Contractor, agreeing to repair or replace any defective doors which have warped (bowed, cupped or twisted) or which show photographing of construction as defined in National Woodwork Manufacturers Association (NWMA) Standard Door Guarantee, except provisions for refunding the price of door only shall not apply. Guarantee shall include finishing and re-installation of defective doors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers subject to compliance with project requirements shall be:
1. General Plywood/Paine
2. U.S. Plywood
3. Marshfield Door Systems
4. Eggers Industries
5. Graham
6. VT Industries
7. Maiman Company.

2.02 MATERIALS

A. Provide flush wood doors in accordance with Architectural Woodwork Institute (AWI)-1300 standards to the specification herein listed.
1. Face Material: Rift cut red oak, premium grade.
2. Edge Banding: Solid hardwood to match face veneer.
3. Provide core construction needed to accommodate hardware specified in Section 08 71 00.
   a. All doors shall have internal blocking to receive screw-mounted closers, through bolting of closers not permitted.

B. Interior Solid Core Flush Door: AWI-PC-5 or AWI-SLC-5 specification.

C. Fire Rated Doors: AWI-FD specification for the fire label required.
1. Pairs of doors shall be constructed so as not to require astrigals for the fire rating.

D. Interior Flush Hollow Core Doors: AWI specification as follows:
1. IHC - Institutional Hollow Core
2. SHC - Standard Hollow Core

PART 3 EXECUTION

3.01 INSTALLATION

A. Store flat on a level surface in dry, well-ventilated building, off floor.
   1. Protect against abnormal changes in heat, humidity.
   2. Acclimate to building conditions before hanging.

B. Comply with all recommendations of manufacturer to ensure warranty provision specified and:
   1. Door tops and bottoms shall be sealed immediately upon delivery of site; coordinate with painter.
   2. Fitting and Machining: Unless doors are completely fitted and machined at the mill, fit them for width by planing and fit them for height by sawing.
      a. Bottom: 5/8" clearance maximum
      b. Top: 1/8" clearance maximum
      c. Lock Edge and Hinge Edge: Bevel 1/8" in 2" maximum
      d. 1/8" at meeting stiles for pairs of doors.
      e. Replace or rehang doors which are hinge bound and do not swing or operate freely.
      f. Maintain clearances required by UL for all fire (labeled) doors.
      g. Make all hardware cuts true and neat. Fit hardware so doors will close without binding and without rattle.
      h. Do all cutting, altering of doors to accommodate hardware and similar items without impairing utility or strength of door.
   3. Machine and install finish hardware according to NBHA's *Recommended Locations for Builder's Hardware* and NFPA's *80 Requirements for Fire Doors*.

3.02 CLEAN UP/ACCEPTANCE

A. Doors which warp or are found to have unfinished edges or telegraph interior core items through the face veneer or have other defects, will be rejected. Immediately replace with new doors, properly hung and finished.

END OF SECTION

SECTION 08 31 00

ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
   1. Furnish Metal Access Doors (Panels)

C. Related Sections
   1. Installation, furnish to appropriate trade, for installation.
   2. Painting: Section 09 91 00

1.02 QUALITY ASSURANCE

A. Fire Rated Assemblies: Fire rated assemblies shall be tested to satisfy requirements of Underwriters Laboratories, Inc., and shall bear Underwriters Laboratories labels for rating required.

1.03 SUBMITTALS

A. Shop Drawings, Product Data: Required

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers subject to compliance with project requirements shall be:
   1. Cesco Products
   2. Milcor
   3. Nystrom
   4. Karp Associates
   5. J.L. Industries
   6. Larsen's Manufacturing Co.

2.02 MATERIALS

A. Metal Access Panels:
   1. Size and Location: Refer to drawings
      a. Provide 22” x 30” minimum size for attic access doors.
      b. Provide 24” x 24” access panels if not otherwise indicated (verify size to location).
   2. Frame: 16 gauge steel (with attached casing bead at plaster surfaces)
   3. Panel: 14 gauge steel
   4. Finish: Chemically bonded prime coat of baked enamel.
   5. Hinges: Concealed spring hinges, with removable pins, that will allow door to open 175 degrees.
      a. Fire rated wall panels - automatic closer.
   6. Locks: Flush, screwdriver operated with case hardened steel cam.
      a. Fire rated panels - interior latch release.
   7. Provide all required anchors, finish trim and accessories necessary for type of construction and finish of the wall or ceiling it is installed in.
   8. Manufacturers and Type for plastered surfaces:

a. Milcor, "Style K"
b. Nystrom, "Style APK"
c. Larsen's, "L-PSW"
d. Karp Associates, "Style DSC 214 PL"

9. Manufacturers and Type for masonry and drywall surfaces:
   a. Milcor, "Style M"
   b. Nystrom, "Style NT"
   c. Larsen's, "L-MPG"
   d. Karp Associates, "Style DSC 214 M"
10. Manufacturers and Type for fire rated - 1-1/2 hours:
   a. Milcor, "Style UFR"
   b. Nystrom, "Style APFR"
   c. Larsen's, "L-FRAP"
   d. Karp Associates, Style KRP 150 FR"
11. Manufacturers and Type for acoustical ceilings - concealed suspension:
   a. Milcor, "Style AT"
   b. Nystrom, "Style APA"
   c. Larsen's, "L-CPA"
   d. Karp Associates, "Style DSC 210"

PART 3 EXECUTION

3.01 INSTALLATION

A. Furnish to applicable trades for installation.
   1. Securely anchor to adjacent construction. Adjust operable parts for correct functioning.
   2. Install in accord with manufacturer's recommendation.
      a. UL requirements govern where required.

3.02 CLEAN UP/ACCEPTANCE

A. Immediately after erection, thoroughly clean metal surfaces of panels and frames of dirt and stains caused during installation. Touch-up marred or abraded surfaces to match original finish.

END OF SECTION

SECTION 08 52 00

WOOD WINDOWS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Casement windows.
2. Awning windows.
3. Casement and awning picture windows.
4. Glazing.
5. Accessories.

1.02 RELATED SECTIONS

A. Section 01 33 23—Submittal Procedures: Shop Drawings, Product Data, and Samples.

B. Section 01 62 00—Product Options

C. Section 01 65 00—Product Delivery

D. Section 01 66 00—Storage and Handling requirements

E. Section 01 71 00—Examination and Preparation

F. Section 01 73 00—Execution

G. Section 01 74 00—Cleaning and Waste Management

H. Section 01 76 00—Protecting Installed Construction

I. Section 06 22 00—Millwork: Wood trim other than furnished by window manufacturer

J. Section 07 92 00—Joint Sealants: Sill sealant and perimeter caulking

K. Section 09 90 00—Paints and Coatings: Paint or stain other than factory applied finish

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. E 283: Standard Test Method for Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors.
2. E 330: Standard Test Method for Structural Performance of Exterior Windows, Curtains Walls, and Doors by Uniform Static Air Pressure Difference.
3. E 547: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
4. E 2190: Standard Specification for insulating Glass Unit Performance and Evaluation.
5. C 1036: Standard Specification for Flat Glass.
6. E 2068: Standard Test Method to Determine the Operating and Breakaway Forces of Sliding Windows and Doors.
7. E 90-09: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

B. Insulating Glass Manufactures Alliance / Insulating Glass Certification Council (IGMA / IGCC).

C. American Architectural Manufacturers Association/Window and Door Manufacturers Association/ Canadian Standards Association (AAMA/WDMA/CSA):
   1. ANSI/AAMA/NWWDA 101 / I.S.2-97: Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.
   2. ANSI/101/I.S. 2/NAFS-02: North American Fenestration Standard, Voluntary Performance Specification for Windows, Skylights and Glass Doors.
   3. AAMA/WDMA/CSA 101/I.S.2/A440-05: Standard/Specification for windows, doors, and unit skylights.
   4. AAMA/WDMA/CSA101/I.S.2/A440-08: Standard/Specification for windows, doors, and skylights.

D. Window and Door Manufacturers Association (WDMA): Hallmark Certification Program.

E. American Architectural Manufactures Association (AAMA): 623-10: Voluntary Specification, Performance Requirements and Test Procedures for Organic coatings on fiber Reinforced Thermoset Profiles.

F. American Architectural Manufacturers Association (AAMA): 613: Voluntary Performance Requirements and Test Procedures for Organic Coatings on Plastic Profiles.

G. National Fenestration Rating Council (NFRC): 101: Procedure for Determining Fenestration Product Thermal Properties.

1.04 SYSTEM DESCRIPTION

A. Performance Requirements: Provide products/systems that have been manufactured, fabricated, and installed to the following performance criteria:
   1. Comply with ANSI/AAMA/NWWDA 101/I.S.2.
   2. U-Factor (NFRC 100): máximum U-0.47
   3. Solar Heat Gain Coefficient (SHGC) (NFRC 200) : maximum 0.26

1.05 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 01 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product data and installation guides.

C. Shop Drawings: Provide drawings indicating direction of operable parts, typical jamb, head and sill conditions, and special mullion reinforcement details.

D. Color Samples: Submit selection and verification samples, including the following:
   1. Hardware: Submit Sample indicating typical finish on hardware.
   2. Cladding: Submit color samples of exterior cladding.

E. Quality Assurance/Control Submittals: Submit the following:
   1. Performance Data: Provide manufacturer's published performance data for specified products.

F. Contract Closeout Submittals: Submit the following:
   1. Warranty documents specified herein.
   2. Owner's Manual: Bound manual clearly identified with project name, location, and completion date. Identify type and size of units installed. Provide recommendations for periodic inspections, care, and maintenance. Identify common causes of damage with instructions for temporary repair.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Utilize an installer having demonstrated experience on projects of similar size and complexity.

B. Certifications:
   1. Insulating Glass Units: Provide insulating glass units permanently marked with certification label of Insulating Glass Certification Council (IGCC) indicating compliance with ASTM E2190.

1.07 DELIVERY

A. Comply with provisions of Section 01 66 00.

B. Deliver in original packaging and protect from weather.

1.08 STORAGE AND HANDLING

A. Prime or seal wood surfaces, including surface to be concealed by wall construction, if more than thirty (30) days will expire between delivery and installation.

B. Store window units in an upright position in a clean and dry storage area above ground and protect from weather under provisions of Section 01 66 00.

1.09 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimension of openings by field measurement before fabrication. Record measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

B. Install units in strict accordance with manufacturer's safety and weather recommendations.

1.10 WARRANTY

A. Windows shall be warranted to be free from defects in manufacturing, materials, and workmanship for a period of ten (10) years from purchase date.

B. Window glass shall be warranted to be free from defects in manufacturing, materials and workmanship for period of twenty (20) years from the purchase date.

C. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard limited warranty document. Manufacturer's limited warranty is in addition to, and not a limitation of, other rights Owner may have under contract documents.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Basis of Design: Andersen Windows, 400 series, casement

B. Acceptable manufacturers:
   1. Andersen Windows, Inc.
   2. Pella Windows, Inc.
   3. Marvin Windows, Inc.

2.02 MANUFACTURED UNITS

A. Description: Vinyl clad wood window with integral color exterior. Casement function. Nailing flange.

2.03 MATERIALS

A. Frame and Sash: Fabricated from wood species approved in WDMA Industry Standard I.S.2.

B. Vinyl Cladding: Rigid vinyl (PVC) complying with requirements of ASTM D4216, in the following color:
   1. Match existing (Sandtone)

C. Weatherstripping:
   1. Stationary Casement/Awning Sash: Weatherstripped with foamed PVC gaskets or tubular flexible vinyl.

2.04 GLAZING

A. General: Insulating glass units certified through the Insulating Glass Certification Council as conforming to the requirements of IGCC. Provide dual sealed units consisting of polyisobutylene primary seal and silicone secondary seal. Provide metal spacers with bent or soldered corners.
   1. Glass – Operating Units: Tempered insulating glass units consisting of an outboard and inboard lite of clear tempered glass conforming to ASTM C1048, Type 1, Class 1, q3, Kind FT.
   2. Magnetron sputtering vapor deposition (MSVD) TiO2 coating applied to the No. 1 surface.
   3. High-Performance™ Low-E4™ Coating: Magnetron sputtering vapor deposition (MSVD) Low-E coating applied to the No. 2 surface.
   4. Filling: Fill space between glass lites with argon gas blend.
   5. Protective removable polyolefin film applied to glass surfaces No. 1 and No. 4.
   6. Color: Clear.

2.05 HARDWARE

A. Venting Casement Hardware:
   1. Hardened steel operator arm stamped with a gear ring. Set arm gear between nylon bushing and nylon spacer. Encase drive shaft and worm gear assemblies in zinc die cast base and removable polycarbonate cover.
   2. Hinges: Stainless steel and heavy gauge steel arms. Stainless steel reinforcing insert in low friction shoe for rectangle units. 2-knuckle stainless steel butt hinges for shaped units. Apply hinges to venting sash indicated on Drawings.
   3. Operator Handle and Covers:
      a. Zinc die cast handle with powder coated painted finish and polycarbonate operator cover with integral color in the following finish.
         1) Style: Compact or folding handle
         2) Color: Match window
      b. Estate™ forged brass handle and operator cover available in the following finish:
   4. Lock Handle and Bezel: Universal lock handle of die cast zinc with powder coated paint finish and polycarbonate bezel with the following integral color:
      a. Color: Match window
   5. Sash Locks: Single actuation lock concealed by trim stops. Die cast zinc, galvanized steel link and engineered polymer components.

2.06 ACCESSORIES

A. Insect Screens: Provide venting sash with an insect screen, including attachment hardware.
   1. Frames: 0.024 inch (0.61 mm) rolled aluminum frame with chromate conversion coating. Provide matching corner locks and latch retainers.
      a. Insect Screen Cloth: 18 by 16 aluminum mesh, gunmetal finish.
      b. Frame Finish: High-bake polyester finish in color to match window frame

B. Extension Jambs: Wood members machined from clear material or veneered finger joined clear material approved in WDMA Industry Standard I.S.4. Pre-drill extension jambs for application.

2.07 FABRICATION

A. Preservative Treatment: Treat wood frame members after machining with a water repellent preservative in accordance with WDMA I.S.4.

B. Vinyl Cladding:
1. Sash Members: Completely encase sash members with seamless, 0.047 inch (1.19 mm) thick, rigid vinyl extrusions. Heat-weld corners.
2. Frame Units: Clad frame units with preformed rigid vinyl to provide joint-free cover. Provide integral flanges of 0.040 inch (1.02 mm) vinyl. Bond sheathing to wood frame with vinyl-to-wood adhesive.

C. Glazing: Factory glaze with high quality glazing sealant and snap-in rigid vinyl glazing bead.

D. Factory-apply weatherstripping.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Comply with the instructions and recommendations of the window manufacturer.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that site conditions are acceptable for installation of units, including the following:
1. Concrete surfaces are dry and free of excess mortar, rocks, sand, and other construction debris.
2. Masonry openings are square and dimensions are correct.
3. Rough openings are square and dimensions are correct.
4. Sill plates are level.
5. Wood frame walls are dry, clean, sound, and well nailed or glued, free of voids and without offsets at joints.
6. Nail heads are driven flush with surfaces in openings and within 3 inches (75 mm) of rough opening.
7. Do not proceed with installation of units until unacceptable conditions are corrected.

3.03 INSTALLATION

A. General:
1. Remove unit components, parts, accessories, and installation guides from carton.
2. Inspect unit components and verify that components are not damaged and that parts are included before disposing of carton.
3. Shop-assemble multiple units before installation in accordance with manufacturer's installation guides.

B. Interface With Other Work:
1. Perform installation in accordance with Manufacturer's instructions.
2. Install units level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
3. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

4. Install insulation in shim space around unit perimeter to maintain continuity of building insulation. Do not overfill.
5. Hold back exterior siding or other finish materials from edge of unit to allow for expansion and contraction and installation of proper joint sealant with backing materials. Seal perimeter of unit after exterior finish is applied per requirements of Division 07 “Joint Sealants” Section.
6. Finish interior units per requirements specified in related sections. Refer to, and comply with, additional requirements in manufacturer’s installation guides.
7. Install optional hardware and unit accessories after cleaning.

C. Site Tolerances:
1. Adjust operation, insect screens, hardware, and accessories for a tight fit at contact points and weatherstripping for smooth operation and weathertight closure.

3.04 CLEANING

A. Clean units using cleaning material and methods specifically recommended by window manufacturer.

B. Remove excess sealants, glazing materials, dirt, and other substances.

C. Avoid damaging protective coatings and finishes.

D. Protect unit surfaces from masonry cleaning solution that could damage insulation glass panels or hardware.

E. Remove debris from work site and properly dispose of debris.

3.05 PROTECTION

A. Protect installed work from damage due to subsequent construction activity on the site

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

1.02 WORK INCLUDED

A. Furnish all finish hardware specified herein, listed in the hardware schedule, or required by the drawings.

B. Where items of hardware are not definitely or correctly specified and are required for the intended service, such omission, error, or other discrepancy should be directed to the Architect prior to the bid date for clarification by addendum. Otherwise, furnish such items in the type and quantity established by this specification for the appropriate service intended.

1.03 RELATED WORK

A. Section 06 20 00 – Finish Carpentry.

B. Section 08 11 13 – Hollow Metal Doors and Frames.

C. Section 08 14 16 – Flush Wood Doors: Any intumescent material that may be required to comply with positive pressure fire door testing to be supplied by the wood door supplier.

D. Division 26 - Electrical.

E. Division 27 - Communications

1.04 REFERENCES

A. A.D.A. - Americans with Disabilities Act.

B. ANSI A117.1 - Specifications for making facilities accessible to physically handicapped people.

C. NFPA 80 - Standards For Fire Doors and Windows.

D. NFPA 101 - Life Safety Code.

E. U.L. - Building Material Directory.

F. D.H.I. - Recommended Locations for Architectural Hardware

G. Applicable State and Local Building Codes, including IBC2000.

1.05 SUBMITTALS

A. Submit a detailed hardware schedule, vertical format. Prepare under the supervision of an AHC, registered Architectural Hardware Consultant, and under provisions of Division One.
   1. Itemize hardware in the sequence and format established by this specification.

2. List and describe each opening separately. Include all doors with identical hardware, except hand, in a single heading. Include door number, room designations, degree of swing, and hand.
3. List related details. Include dimensions, door and frame material, and other considerations affecting hardware.
4. List all hardware items to be supplied. Include manufacturer's name, quantity, product name, catalog number, size, finish, attachments, and related details where applicable.
5. Resubmit a copy of the corrected schedule when required.

B. Keying Schedule: After receipt of approved hardware schedule submit a copy of keying schedule as a result of a keying meeting between the Owner and the hardware supplier.

C. Samples: If so directed by the Architect, submit samples of finish hardware items for approval. Properly identify each sample as to make and number, and furnish in the specified finish.

D. Templates: Furnish a copy of approved hardware schedule, along with applicable templates for factory-prepared hardware to each door and frame fabricator.

E. Electrical Hardware: Submit electrical specifications and applicable information to the electrical contractor after receipt of the approved hardware schedule.

F. Substitutions: Submit under provisions of Division One. Provide detailed information and catalog cuts indicating the comparison to the specified hardware. If requested by the Architect, provide a sample accompanied by a sample of the specified item for comparison.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Furnish UL or Warnock Hersey listed hardware for all fire labeled and 20 minute openings in conformance with requirements for class of opening scheduled, whether specifically called for in this specification or not.
2. Furnish hardware that conforms to all applicable state and local building codes, including IBC positive pressure testing requirements. Where specified hardware is not in conformance with applicable codes, such omission or error should be directed to the Architect prior to the bid date for clarification by addendum; otherwise furnish hardware as required by code.

B. Training and Inspection:
1. Hold pre-installation meeting to coordinate training of installation personnel. Installers shall be trained by manufacturer’s representative.
2. Manufacturer’s representative shall inspect installation of hardware as part of substantial completion requirements.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle in accordance with Division One. Mark each original container with a door number that corresponds to the approved hardware schedule for the installation location.

B. Receive, inventory and store hardware in a secure and dry environment; protect against loss and damage.

C. Report any shortages to the hardware supplier no later than 48 hours after receipt of delivery to the job site.

D. Stockpile items sufficiently in advance to ensure their availability. Coordinate delivery, handling, and installation of hardware items to ensure orderly progress of total work, and minimize or eliminate losses and damage.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. FEMA 361 rated doors are part of a complete rated system. Components are not interchangeable unless specifically tested as a system. Verify with door manufacturer all hardware components are part of a FEMA 361 tested system. Acceptable manufacturers include those that comply and are coordinated with the door and frame system.

B. For non-FEMA 361 rated doors:

Products	Specified	Acceptable
Hinges	PBB	Stanley, McKinney, Hager
Flush Bolts	Rockwood	DCI, Trimco, Ives
Locks and Latches	Falcon	LCN, Stanley, Schlage
Push/Pull Latches	Rockwood	Trimco, Burns, Hager
Exit Devices	Falcon	Schlage, Von Duprin
Door Closers	Falcon	LCN, Stanley
Low Energy Automatic Operators	LCN	Besam, Tormax (certified installers only)
Protective Plates	Rockwood	Burns, Hager
Overhead Stops/Holders	ABH	Dorma, Glynn Johnson
Wall Stops/Floor Stops	Rockwood	Trimco, Hager, DCI
Electromagnetic Door Holders	Dorma	LCN, Rixson
Thresholds, Sweeps, Weatherstrip	Reese	National Guard Products, Pemko

2.02 HINGES

A. Acceptable manufacturers and respective catalog numbers:

Description	P.B.B.	Stanley	McKinney	Hager
Std. Wt. Plain Bearing - Steel	PB81	F179	T2714	1279
Std. Wt. Ball Bearing - Steel	BB81	FBB179	TA2714	BB1279
Std. Wt. Ball Bearing -non ferrous	BB21/BB51	FBB191	TB2314	BB1191
Hvy. Wt. Ball Bearing Steel 4B81	FBB168	T4B3786	BB1168	
Hvy. Wt. Ball Bearing – non ferrous	4B21/4B51	FBB179	T4B3386	BB1199

B. Hinges supplied must be tested and comply with ANSI/BHMA standards for consistency, wear and corrosion resistance.

C. Quantity: Furnish hinges for each door leaf as follows, unless otherwise noted in groups:
1. Doors up to and including 90" high - 3 hinges.
2. Doors over 90" high through 120" high - 4 hinges.

D. Type: Furnish as follows, unless otherwise noted in groups:
1. Standard weight, plain bearing hinge for interior openings through 36" wide without a door closer.
2. Standard weight, ball bearing hinge for interior openings over 36" through 40" wide with a door closer, and for interior openings through 40" wide with a door closer.
3. Heavy weight, four ball bearing hinge for all exterior openings unless noted in groups.

E. Size: Furnish as follows, unless otherwise noted in groups:
1. 1 3/4" doors: 4-1/2" x 4-1/2"
2. Provide proper hinge width to clear trim and allow full 180° swing.

F. Hinges for all lockable doors opening outward shall have non-removable pin (NRP). All other hinges shall have non-rising pins.

2.03 FLUSH BOLTS

A. Acceptable manufacturers and respective catalog numbers:

Description	Rockwood	Ives	Trimco	DCI
Manual - Metal Door	555	FB458	3917	780F
Manual - Wood Door	557	FB358	3913	790F
Automatic - Metal Door	1842	FB31P	3810	842
Automatic - Wood Door	1962	-----	----	962
Self Latching - Metal Door	1845	FB51P	3820	845
Self Latching - Wood Door	1945	FB61P	3825	945
Dust Proof Strike	570	DP2	3911	82

B. Furnish a dustproof strike for all bottom bolts.

2.04 LOCKS AND LATCHES

A. Acceptable manufacturers and respective catalog numbers:

Description	Falcon
Hvy. Duty Grade 1 Cylindrical	T Series
Std. Duty Grade 2 Cylindrical	B Series

B. Furnish lock types and functions as specified in the hardware schedule, and as follows:
1. Provide 2-3/4" backset.
2. Provide 2-3/4" x 1-1/8" “T” strike with a dust box for use in wood doors or frames.
3. Provide 4-7/8" x 1-1/4" ANSI strike for installation in a hollow metal door or frame.
4. Locksets to conform to ANSI A156.2, Series 4000, Grade 1 and be UL listed.

2.05 EXIT DEVICES

A. Acceptable manufacturers and respective catalog numbers:

Description	Falcon
Wide Stile	25 series

B. Furnish exit device types and functions as specified in the hardware schedule.

C. Lever handles supplied with exit devices shall match the design specified for locks and latches.

2.06 PULLS, PUSHBARS, PUSH/PULL PLATES

A. Acceptable manufacturers and respective catalog numbers:

Description	Rockwood	Trimco	Burns

B. Supply product as listed in groups or equal to acceptable manufacturers..

2.07 DOOR CLOSERS

A. Acceptable manufacturers and respective catalog numbers:

Description	FALCON
Grade 1	SC71

B. Furnish complete with mounting brackets, drop plates, spacers, special shoes, and thru bolts as may be required by the door and frame conditions.

2.08 LOW ENERGY AUTOMATIC OPERATORS

A. Acceptable manufacturers and respective catalog numbers:

Description	Dorma	LCN	Besam	
Operator - Push Side	ED800J	4640	SM455 OS	Tormax approved
Operator - Pull Side	ED800T	4630	SM455 IS	Tormax approved
Hard Wired Wall Switch	800WS-1	956	75-02-101	LARCO approved
Wireless Wall Switch	800WS/RFT-1	957	75-02-272	LARCO approved
Wireless Receiver	800RFR-12	931	75-15-248	LARCO approved

B. Provide arms, mounting plates, sizes, stops, and any component that may be necessary to interface with electrified hardware that are required for complete and proper operation of the openings affected. Completed installation must meet or exceed requirements of ANSI A159.19.

C. Provide actuators as detailed in groups.

D. Conduit, electrical back boxes, wiring, and 120 VAC input power by Division 16 - Electrical.

2.09 PROTECTIVE PLATES

A. Acceptable manufacturers: Rockwood, Trimco, Burns, Hager.

B. All kickplate heights shall be as listed in groups and 2" less door width single doors and 1" less for pairs.

C. Thickness shall be .050" (16 gauge).

2.10 OVERHEAD STOPS/HOLDERS

A. Acceptable manufacturers and respective catalog numbers:

Description	A.B.H. Dorma	Glynn Johnson	
Heavy Duty Surface	9000	900	90
Heavy Duty Concealed	1000	910	100
Standard Duty Surface	4400	700	450
Standard Duty Concealed	4000	710	410

B. Furnish an overhead stop if a door opens against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in the hardware groups.

2.11 WALL STOPS

A. Acceptable manufacturers and respective catalog numbers:

Description	Rockwood	Hager
Wrought Convex Wall	407	232W
Wrought Concave w/Toggle	409	237W

B. When "wall stop" is called for in hardware group, provide 407 or 409. When overhead stops are required, they will be specified by product number in the group.

C. Wall stops shall not be mounted to casework, cabinet work, sidelights, or equipment.

2.12 ELECTROMAGNETIC DOOR HOLDERS

A. Acceptable manufacturers and respective catalog numbers:

Description	LCN	Rixson
Floor Mounted - Single	SEM7820	FM980

Floor Mounted - Double	----	FM981
Flush Wall Mount - Std. Catch Plate	SEM7850	FM998
Surface Wall Mount	SEM7830	FM996

B. Provide the voltage as required by electrical.

2.13 THRESHOLDS, SWEEPS, WEATHERSTRIP, DRIP CAPS, GASKET, ASTRAGALS

A. Acceptable manufacturers and respective catalog numbers:

Description	Reese	Pemko	National Guard
Threshold	S205	171A	425A
Sweep	323	315N	200N
Sweep	967	18133CP	OV633
Weatherstrip	970	45100CP	603
Weatherstrip	DS78	315CR	130N
Gasket	797B	S88	1010

B. Where specified in groups, furnish the above products unless otherwise detailed.

2.14 DOOR HARDWARE FINISHES

A. Unless indicated otherwise in the groups provide finishes as follows:

1.	Hinges, exterior:	US32D
2.	Hinges, interior:	US26D
3.	Flush Bolts:	US26D
4.	Exit Devices:	US32D
5.	Locks and Latches:	US26D
6.	Pulls, Pushbars, Push/Pull:	US32D
7.	Door Closers:	Painted Aluminum
8.	Low Energy Automatic Operators:	Painted Aluminum
9.	Protective Plates:	US32D
10.	Overhead Stops:	Painted Aluminum
11.	Wall Stops:	US32D
12.	Gasket:	Black
13.	Thresholds:	Mill Aluminum
14.	Weatherstrip, Sweeps:	Clear Anodized Aluminum

2.15 KEYING

A. The Hardware Supplier, in consultation with the Owner's authorized representative, shall prepare a detailed keying schedule. A copy of the final approved keying schedule bearing the signature of approval of the Owner's Representative shall be filed with the Architect. All locks shall be keyed into the same system as is used on the existing building.

B. Key locks in sets or subsets, master key and grand master key as directed by Owner.

C. Furnish the required number of keys for each keyed group in quantity as directed by the Owner.

D. Grand master and master keys shall be delivered by registered mail direct from the manufacturer to the Owner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine doors, frames, and related items for conditions that would prevent the proper application of finish hardware. Do not proceed until defects are corrected.

3.02 INSTALLATION

A. Install each hardware item in strict compliance with the manufacturer's printed instructions and recommendations, using only fasteners supplied by, or called for by the manufacturer.

B. Set units level, plumb and true to the line and location. Prepare and reinforce the attachment substrate as necessary for proper installation and operation.

C. Mortise and cut to close tolerance and conceal evidence of cutting in the finished work. Drill and countersink units which are not factory prepared for anchorage fasteners.

D. If manufacturer’s instructions do not call out a mounting location, refer to the Door and Hardware Institute's publication *Recommended Locations for Architectural Hardware.*

E. Deliver to the Owner one (1) complete set of installation and adjustment instructions, as well as all tools that were furnished with the hardware.

3.03 ADJUSTMENT AND CLEANING

A. At final completion, adjust and check each operating item of hardware at each door to ensure proper operation and function of every unit. Lubricate any moving parts that do not operate freely, smoothly, and quietly using only lubricant as recommended by the manufacturer of the hardware item. Replace units that cannot be adjusted or lubricated to operate properly.

B. Instruct the Owner’s personnel in the proper adjustments of the hardware as needed.

C. Clean and restore hardware to the original finish.

3.04 HARDWARE SCHEDULE: REFER TO DRAWINGS

END OF SECTION

SECTION 08 90 00

LOUVERS AND VENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers and Vents:
   1. Stationary louvers.

1.02 RELATED SECTIONS

A. Section 04 20 00 - Masonry Units.

B. Section 06 10 00 - Rough Carpentry.

C. Section 07 60 00 - Flashing and Sheet Metal.

D. Section 07 90 00 - Joint Sealants.

E. Division 23 - Heating, Ventilation and Air Conditioning Equipment.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Cleaning and maintenance instructions.

C. Shop Drawings: Submit shop drawings indicating materials, construction, dimensions, accessories, and installation details including but not limited to anchorage and flashing conditions.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9000 accredited, regularly engaged in manufacturing louvers, vents and dampers.

B. Product Qualifications:
   1. Louvers listed by Underwriters Laboratory (UL) for wind resistance in accordance with testing with ASTM E 330 for 50 psf (2.39 kPA) wind load.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards. Store materials within absolute limits for temperature and humidity recommended by the manufacturer. Protect materials and finishes during handling and installation to prevent damage.

B. Deliver materials to site and store in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

1.06 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 WARRANTY

A. Manufacturer's Warranty for Louvers: Standard limited warranty for louver systems for a period of 1 year from date of installation, no more than 18 months after shipment from manufacturing plant. When notified in writing from the Owner of a manufacturing defect, manufacturer shall promptly correct deficiencies without cost to the Owner.

B. Manufacturer's Warranty for Fluoropolymer-Based Finish on Aluminum Substrates.
   1. Warranty Period: 20 year limited warranty. Finish coating shall not peel, blister, chip, crack or check.
   2. Chalking, fading or erosion of finish when measured by the following tests:
      a. Finish coating shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D 4214.
      b. Finish coating shall not change color or fade in excess of 5 NBS units as determined by ASTM D 2244 and ASTM D 822.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers subject to project compliance:
   1. Ruskin Company
   2. Airline Products Company
   3. The Airolite Company
   4. Cesco Products.

2.02 STATIONARY LOUVERS

A. Stationary Louvers: Extruded aluminum stationary louvers with drainable blades.
   1. Performance Ratings: AMCA licensed.
   2. Frame: Hidden support style, extruded aluminum, Alloy 6063-T5.
      a. Frame Depth: 6 inches.
      b. Wall Thickness: 0.125 inch, nominal.
   3. Blades: Drainable style, 37.5 degree blade angle, formed aluminum, Alloy 6063-T5.
      a. Wall Thickness: 0.081 inch, nominal.
      b. Centers: 4 inches, nominal.
   4. Gutters: Drain gutter in head frame and each blade.
   5. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade.
   6. Assembly: Factory assembled louver components. Mechanically fastened.
   7. Performance Data: Based on testing 48 inch by 48 inch size unit in accordance with AMCA 500.
      a. Free Area: 58 percent, nominal.
      b. Maximum Recommended Air Flow through Free Area: 1250 feet per minute.
      c. Air Flow: 11600 cubic feet per minute (328 cu. m/min).
      d. Maximum Pressure Drop (Intake): .20 inches w.g.
      e. Water Penetration: Maximum of 0.01 ounces per square foot of free area at an air flow of 1250 feet per minute free area velocity.

2.03 ACCESSORIES

A. Blank-Off Panels when required by mechanical:
   1. Aluminum Insulated Blank-Off Panels: 1 inch (25 mm), aluminum skin, insulated core, factory installed with removable screws and neoprene gaskets.

B. Bird Screens:
   1. Frame: Removable, rewireable.
   2. Screen Type: Aluminum, 1/2 inch mesh by 0.063 inch (13 mm mesh by 1.6 mm), intercrimp.

C. Extended Sills: Extruded aluminum, Alloy 6063-T5. Minimum nominal thickness 0.060 inch (1.5 mm).

2.04 FINISHES

A. Fluoropolymer-Based Painted Finishes, 70 percent resin: Kynar 500 or manufacturer approved equal. Coating shall conform to AAMA 2605. Apply following cleaning and pretreatment.
   1. Cleaning: AA-C12C42R1X.
   2. Finish: Standard 2-coat.
   3. Color: Manufacturer's standard in paint system specified.

B. Anodized Finishes:
   1. Color Anodized: Dark Bronze.

PART 3 EXECUTION

3.01 PREPARATION

A. Inspect areas to receive louvers. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the louvers.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

C. Do not proceed with installation until substrates have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.02 INSTALLATION

A. Install louvers at locations indicated on the Drawings in accordance with manufacturer's written instructions and recommendations and the following
   1. Provide necessary fastenings and anchors as required to complete installation.
   2. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.
   3. Form tight joints. Fit exposed connections accurately.
   4. Protect metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces that are in contact with concrete, masonry, or dissimilar materials.
   5. Adjust units for proper function.
   6. Install joint sealants as specified in Division 7.

3.03 CLEANING AND PROTECTION

A. Remove temporary coverings and protection of adjacent work areas. Protect installed products until completion of project.

B. Clean installed products per manufacturer's instructions before Substantial Completion.

C. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
   1. Includes gypsum board and wood stud construction required for drywall and finishes other than drywall where detailed, specified or required.

C. Related Sections
   1. Section 06 10 00 – Rough Carpentry
   2. Section 07 21 00 – Thermal Insulation
   3. Section 06 16 43 – Gypsum Sheathing

1.02 QUALITY ASSURANCE

A. Requirements
   1. Rated Assemblies: Gypsum board construction has been selected to meet or exceed the code for fire ratings and sound ratings which shall be maintained.
   2. Comply with all applicable requirements of "American Standard Specification for Application and Finishing of Gypsum Wallboard", by the American Standards Association, except where more stringent requirements are called for herein, in local codes or by manufacturer of wallboard.
   3. All drywall to conform ASTM C 36 or C 442 as applicable to the type of drywall.
   4. No topping edges or ridges and no roughed up gypsum board surfaces shall be visible through the wall finish.
   5. It shall be the Contractor's responsibility to provide the "Level of Gypsum Board Finish" required to achieve the perfection indicated herein with the applied surface finishes indicated on this project.
   6. All board shall be installed a maximum of 1/4" from floor with this space clean, clear and sealed if detailed or required. No protrusions, over runs or globs of topping to interfere with base. No holes to permit the base to indent.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers subject to compliance with project requirements shall be:
   1. United States Gypsum Company, Inc.
   2. Gold Bond Building Products.

B. U.S. Gypsum catalog numbers and trade names used in this section unless otherwise noted.

2.02 DRYWALL SYSTEMS

A. Materials
   1. Metal Trim:
      a. #101 Dura-A-Bead or 103 Dura-A-Bead for all external corners.
      b. J-Trim and L-Trim for all exposed edges. No J-Stops permitted.
      c. #093 control joints.

2. Fasteners:
    a. Screws at wood frame partitions - 1-5/8" type "S" drywall screws.
3. Floor and Ceiling Anchors: Expansion bolts of size and spacing as required to provide rigid construction as recommended by stud manufacturer and approved by the Architect. Power activated fasteners are not allowed, except into concrete floor slabs.
4. Taping System Material: Tape and joint compounds as recommended by the board manufacturer.
5. Face Boards: (Gypsum Wallboard):
    a. Regular: Use for facing all vertical surfaces unless otherwise indicated or required.
    b. Firerated Type Board: F.C. or Firecode or Type X or Firecode Core or Firecode C-core or Ultracode Core or Gypsum Liner panel; use the respective fire rated board as required for each of the various fire resistive rated assemblies.
    c. Water Resistant (WR): ASTM C 630, use in all locations where board forms base for ceramic tile and not requiring Durock board. Use in all toilet rooms, baths, janitor closets and high moisture locations.
        1) Use under all "FRP" (fiberglass reinforced panels) glassboard or similar type wall finish panels, 5/8" thick. "FRP" provided under Section 09 77 20.
        2) Except DO NOT install WR board on ceiling framing over 12" o.c.
        3) Except DO NOT install WR board over vapor barrier on walls or ceiling.
            a) Substrates under ceramic tile or under vinyl fabric or under similar moisture resistant materials over a vapor barrier, shall be Durock instead of WR board.
            b) Paint finish gypsum board over a vapor barrier shall be any other code acceptable gypsum board approved by the manufacturer.
    d. Durock, Tile Backer Board: Use for interior ceramic tile substrate on all exterior walls and ceilings in lieu of gypsum board.
        1) Under ceramic tile exposed directly to water, such as showers, provide Durock under tile in such locations.
    e. Sheathing: 5/8" thick, Type X or Firecode Core or Firecode C-core exterior gypsum board, water resistant.
    f. Thickness: Provide in thickness indicated or, if not indicated in either 1/2" or 5/8" thickness to comply with ASTM C 840 for application system and support spacing indicated.
    g. Edges: Tapered
    h. All faceboard: 48" width in as long lengths as possible to minimize joints. Provide boards in combination of types to meet requirements, such as WR-Type X to comply with both needs.
6. Caulking: Per Section 07 90 00
7. Insulation: Per Section 07 20 00
8. Neoprene Filler Blocks: Provide size and shapes required for the detailed or installed conditions.
9. Sound Insulation: Sound attenuation mineral fiber blankets, thickness as detailed.
10. Miscellaneous Items: Furring channels, resilient channels, rigid channels, brackets, unistrut, adhesives, sealant, fasteners and all other similar items required for a complete installation of wall systems detailed or specified.

PART 3 EXECUTION

3.01 INSTALLATION

A. Maintain temperature of drywalled space in range of 55° to 90° F until building is entirely closed and ventilated, as required to eliminate excessive moisture build-up in the building.

B. General:
1. All work shall be done in strict accordance with the manufacturer's published specifications.
2. Align runners accurately along floor, ceiling and at top of partitions. Apply runner anchors at 24" o.c.

3. Place ceiling joist true and aligned 16" o.c.
4. Place studs plumb and true at maximum 16". Do not splice ends.
5. Locate studs no more than 2" from all door frame and window jambs, abutting partitions, partition corners and other construction. Securely anchor to the jamb and head of each door, borrowed light or other opening frame by screw attachment. Double studs at all door and borrowed light frames.
6. Provide additional members where heavy fixture anchorage is required.
7. Install corner beads on all vertical and horizontal external corners.
8. Install metal trim wherever wallboard abuts other materials and is not protected by metal or wood trim.

C. Gypsum Board:
1. Apply gypsum wall board with long dimension parallel to framing members, with abutting ends over framing member flanges. Use boards of maximum practical lengths to minimize end joints. Neatly fit and stagger end joints. Place joints on opposite sides of partitions on different studs.
2. Space screw fasteners 12" o.c. at each support in the field of the board and 8" o.c. at all abutting edges (stagger adjacent 8" spacings).
3. Screws: Power-driven with an electric screw driver to provide a light depression below the surface of the board. Do not drive screws closer than 3/8" to edges and ends on wallboard.
4. Modify screw spacing in accord with UL recommendations for all applications at fire-rated partitions.
5. Apply acoustical sealant as recommended by drywall manufacturer. All walls scheduled for soundwool shall be perimeter caulked with acoustical sealant. Also, caulk perimeter of all electrical boxes. Caulk and back all opening in drywall.

D. Taping and Finishing:
1. Mix joint and finishing compounds per manufacturer's directions.
2. Center tape over joint and embed in uniform layer of joint compound of sufficient width and depth to provide firm and complete bond. Apply skim coat while embedding tape.
3. Provide "fire taping" of all joints not exposed to view. This shall include all joints located on and off framing without exception.
4. Treat angles with reinforcing tape folded to conform to adjacent surfaces and straight true angles.
5. Allow compound to thoroughly dry for at least 24 hours.
6. Over joint compound and tape apply coat of finishing compound. Spread evenly and feather out beyond edge of board. After first finishing coat is thoroughly dry, at least 24 hours, cover with second coat with edges feathered out slightly beyond preceding coat.
7. Give all dimples at fastener heads and all marred spots on surface of board one coat of joint compound and two coats of finishing compound, applied as each coat is applied to joints.
8. Install metal corner reinforcement at all external corners. Tape and conceal flanges or metal reinforcement with at least two coats compound. When complete, compound shall extend approximately 8" to 10" on each side of metal nosing.
9. After each application of joint or finishing compound has dried, lightly sand all joints. Leave all board and treated areas uniformly smooth and ready for finishing. Do not rough paper.

3.02 FIELD QUALITY CONTROL

A. Test all gypsum drywall for true and level surfaces with an oblique light source. Any telegraphing of joints, compound edges, improper sanding, fastenings or irregularities of surface evident even after subsequent application of the specified painting or decoration will require immediate and proper correction satisfactory to the Architect.

B. Cracking along metal or plastic trim lines is not acceptable and shall be corrected.

3.03 CLEAN UP/ACCEPTANCE

A. Gypsum board surfaces will/may receive glossy or shiny finishes and will be in places that are washed horizontally with natural or artificial light. Such finishes and such lighting shall not be construed as reason for any irregularities of gypsum board being visible or acceptable.
   1. Contractor shall correct the above unacceptable conditions and the unwanted conditions listed under 1.02 Quality Assurance including the replacement of any applied finish that are affected.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
1. Porcelain Ceramic Tile
2. Sealant at tile control (expansion) joints
3. Metal divider strips at transition to other floor materials.
4. Coordinate with Division 3 to recess concrete floors to receive tile work.
5. Coordinate recessed floor requirements with Section 06 10 00 Rough Carpentry for recessed wood framed floors or Section 03 30 00 Cast-in-place Concrete for recessed concrete floors.

C. Related Sections
1. Gypsum Drywall and Durock Substrates: Section 09 29 00

1.02 QUALITY ASSURANCE

A. All tile shall be set by expert journeyman tile setters.

B. Conform with all applicable requirements of the Tile Council of America and the *Handbook for Ceramic Tile Installation*.

C. Control joints shall be provided in applications of tile in accordance with the recommendations of the Tile Council of America in their publication titled *Handbook for Ceramic Tile Installation*.

1.03 SUBMITTALS

A. Shop Drawings: Not required

B. Samples: Required
1. Sample board of manufacturer's full range of colors and patterns, if required by the Architect for selection and if the selection is not stated on drawing.
2. If selection of tile is stated on drawing, submit samples for approval before ordering.
3. Provide color samples for each type and color of grout.

PART 2 PRODUCTS

2.01 MATERIALS

A. Acceptable manufacturers:
1. Crossville
2. Back Bay
3. Atlas Concorde

B. Products
1. Provide all necessary shapes required to complete the installation as indicated.
   a. Provide coved base units to match floor tile unless indicated otherwise.
   b. Internal wall corners: Field butted square corners
2. If tile selection is not specifically named on the drawings, the architect shall select from the following:

a. Ceramic Porcelain Tile Base (CTB-01): If/when indicated or required on the drawings.
   1) Ceramic Porcelain tile base 6" x 6" with cove base
   2) Color: As selected by Owner from manufacturer's standard colors.

C. Setting Material and Accessories.
1. Water: Clean, potable and free from injurious substances.
2. Water Resistant Organic Adhesives: Manufactured in accord with requirements of ANSI A136.1, Type 1.
3. Dry Set Cement Mortar Adhesive: Manufactured according to Formula 756 under license agreement with the Tile Council of America, Inc. Comply with requirements of ANSI A118.1.
4. Hydroment Joint Filler: (For floor and base grouting) By the UPCO Company.
   a. Color shall match the tile unless otherwise indicated on drawings.
5. Commercial Cement Grout: A proprietary compound of Portland Cement and additives, factory blended to decrease shrinkage and increase moisture resistance.
   a. White color unless otherwise indicated on drawings.
6. Underlayment: As recommended by manufacturer of tile and organic adhesive, used for filler voids and leveling existing concrete floor slabs scheduled to receive flooring. Material must be compatible with adhesive used.
7. Stone Thresholds Fabricated to size profiles indicated or required from stone of uniform color and finish to provide transition between tile surfaces and adjoining finished floor surfaces.
8. Metal Edge Strips: Zinc alloy or stainless steel, 1/8" (3 mm) thick exposed top of vertical edge.
9. Two-Component Sealants: ASTM C 920, Type M, Grade P, Class 25, use T (for use in joints subject to pedestrian traffic).
   a. Provide different colors for patterns indicated.
10. Waterproof Membranes: Waterproof wall liner and waterproof floor pan membranes, nonmetalic single-ply membranes with joint sealant.

PART 3 EXECUTION

3.01 INSTALLATION

A. Setting Tile:
1. All tile setting shall be in accordance with the current edition of specifications sponsored by the Tile Council of America, Inc.
   a. Walls: Organic adhesive
   b. Floors and Base: Dry set Portland Cement mortar.
   c. Floor, base and wall tile shall be installed to carry out the joint pattern of each other. Any variations shall be approved by Architect.
2. Beginning tile work on any surface constitutes tile subcontractor's acceptance of the surface as suitable to receive tile work and his/her acceptance of full responsibility for results of his/her finished work.
3. Do not start tile work on walls for a minimum of seven days after walls have been constructed and not until they are thoroughly cured. Do not commence tile work on concrete floor surfaces for a minimum of 14 days and not until surfaces are thoroughly cured, leveled with underlayment and dry.
4. Apply approved underlayment to depths and in quantity necessary to prepare existing concrete floor slabs for application of ceramic tile.
5. Clean and prime all surfaces receiving tile work in accord with recommendations of applicable ANSI specifications.
6. Provide all floor slopes in a continuous plane where indicated and particularly to drains.
7. Variation in the plane of underbeds shall not be more than 1/8" in 8' - 0".
8. Lay out all work so that, where possible, no tiles less than half size occur. In any event, install no half tiles above first course up from the bottom or away from first vertical course at internal and external corners. Align all joints, vertically and horizontally. Cut, fit, adjust, and establish tiles neatly and accurately to accommodate accessories, interruptions, chases, returns, mechanical and electrical outlets, and finish at their exact location (as determined by job-site

conditions.) Maximum variation shall be 1/8" in 8' when a straight edge is laid on the surface in any direction.

9. Furnish and install all required trim pieces as specified, required or detailed for the various tile selected.
10. Accurately cut or shape tile neatly where tile is placed against vertical surfaces such as at floor drains, walls, curbs and similar items. Grind cut edges before installing. Make joints and pattern consistent.
11. Cut openings in tile to fit neatly around penetrations without splitting the tile. The tile face shall remain whole with the penetration space cut-out to fit over the penetration.
12. Allow mortar to cure for 24 hours before placing joint filler.
13. Leave joint open and free of all mortar (from surface to subfloor) at junction of all floors with walls, curbs, columns, pipes and other restraining surfaces and elsewhere required as an expansion joint.
14. Adjacent surfaces and finishes shall be protected to prevent damage. If damaged due to work of this Contractor, damage shall be repaired by this Contractor.
15. The difference between any adjacent floor finishes shall not exceed ½". Cut, recess and/or taper materials as required to achieve the ½" maximum difference.

B. Metal Edge Strips:
1. Install at all locations, except doorways where stone thresholds are used, where tile abuts another applied floor finish.
2. Install as per manufacturer's recommendations true to the lines of the tile and flush with the top of the tile, no projection above tile permitted.

C. Grouting:
1. Allow all tile to set for a minimum of 24 hours before grouting.
2. Thoroughly wash out joints and saturate with clean water before grouting. Thoroughly grout into all joints to fill entire length and depth. Fill flush with face of tiles, making a neatly finished, smooth surface. Prevent staining of grouted joints.
3. Refer to above specified grout materials and locations for their use.
4. Mix and apply grout in accordance with applicable ANSI standards and manufacturer's instructions.
5. Before grout sets, strike or tool the joints to depth of cushion. Fill all gaps and skips. Do not permit cement to show through grouted joints.
6. Clean excess grout from all surfaces before it sets up and hardens.

D. Curing: Cure all grouted joints on floors and base as recommended by manufacturer.

E. Protection:
1. Close off spaces in which tile work is being performed to all traffic and other work. Keep closed for three days after all tile work is completed. Protect all tile work from damage until project completion or until acceptance.
2. Do not install tile when temperature is below 50° F or when backing surfaces contain frost. Maintain temperature above freezing until mortar and grout are cured.
3. Tile which is stained, broken or damaged in any way is not acceptable.

F. Waterproof Liner:
1. Provide waterproof sheeting under the shower ceramic tile floor installed sloped to weep into the floor drain. The waterproof liner shall extend a minimum of 48" up all shower walls, under the ceramic tile and seal to the inside of the floor liner/pan. All joints of the waterproofing liner shall be sealed watertight.
    a. Coordinate installation of ceramic tile and all other trades to permit proper installation.

3.02 TRAINING/MAINTENANCE

A. Provide maintenance information for all types of tile installed. Submit to Owner as part of the maintenance manual.

3.03 CLEAN UP/ACCEPTANCE

A. Upon Completion

1. Wipe surface clean after grouting, remove all traces of mortar and grout. Any open or cracked joints shall be pointed up. All joints shall be of uniform width.
2. Close spaces to traffic during installation until acceptance. Repair all damaged work at no additional cost to Owner.
3. Do not use acid or acid cleaners to clean glazed tile.
4. Remove and replace all cracked or otherwise damaged tile.
5. See that sealing of expansion joints has been completed in a manner satisfactory to successful performance of tile work.

END OF SECTION

SECTION 09 77 20

FIBERGLASS REINFORCED WALL PANELS

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Contract Documents and all provisions of Division 01 – General Requirements, apply to this section.

B. Section Includes:
   1. Section Includes: Prefinished polyester glass reinforced plastic sheets and adhered to unfinished gypsum.

C. Related Sections:
   1. Section 09 29 00 – Gypsum substrate board
   2. Section 09 90 00 – Painting and Coating

D. References
   1. American Society for Testing and Materials: Standard Specifications (ASTM)
      a. ASTM D 256 - Izod Impact Strengths (ft #/in)
      b. ASTM D 570 - Water Absorption (%)
      c. ASTM D 638 - Tensile Strengths (psi) & Tensile Modulus (psi)
      d. ASTM D 790 - Flexural Strengths (psi) & Flexural Modulus (psi)
      e. ASTM D 2583- Barcol Hardness
      f. ASTM D 5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
      g. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials

1.02 SUBMITTALS

A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.

C. Selection Samples: Submit manufacturer’s standard color pattern selection samples representing manufacturer's full range of available colors and patterns.

D. Samples for Verification: Submit appropriate section of panel for each finish selected indicating the color, texture, and pattern required.
   1. Submit complete with specified applied finish.
   2. For selected patterns show complete pattern repeat.
   3. Exposed Molding and Trim: Provide samples of each type, finish, and color.

E. Manufacturers Material Safety Data Sheets (MSDS) for adhesives, sealants and other pertinent materials prior to their delivery to the site (available as downloads for most Marlite’s products at http://www.marlite.com/tech-details.aspx or by contacting Marlite at info@marlite.com)

1.03 QUALITY ASSURANCE

A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:
   1. ASTM E 84 (Method of test for surface burning characteristics of building Materials)
      a. Wall Required Rating – Class [A] [C].

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials factory packaged on strong pallets.

B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (70°) for 48 hours prior to installation.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Building are to be fully enclosed prior to installation with sufficient heat (70°) and ventilation consistent with good working conditions for finish work

B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
   1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

1.06 WARRANTY

A. Furnish one year guarantee against defects in material and workmanship.

PART 2 PRODUCTS

1.07 MANUFACTURERS

A. Specification Basis: Marlite

B. Acceptable manufacturers to be:
   1. Marlite
   2. Crane Composites
   3. Glasteel

1.08 MATERIALS

A. Style: Standard FRP

B. Color: As selected by Owner from manufacturer's standard colors

1.09 PANELS

A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.
   1. Coating: Multi-layer print, primer and finish coats or applied over-layer.
   2. Dimensions:
      a. Thickness – 0.090 " (2.29mm) nominal
      b. Width - 4'-0" (1.22m) nominal
      c. Length – 10'-0" (3.0m) nominal
   3. Tolerance:
      a. Length and Width: +/-1/8 " (3.175mm)
      b. Square - Not to exceed 1/8 " for 8 foot (2.4m) panels or 5/32 " (3.96mm) for 10 foot (2.4m) panels

B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
   1. Flexural Strength - 1.0 x 10^4 psi per ASTM D 790. (7.0 kilogram-force/square millimeter)
   2. Flexural Modulus - 3.1 x 10^5 psi per ASTM D 790. (217.9 kilogram-force/square millimeter)
   3. Tensile Strength - 7.0 x 10^3 psi per ASTM D 638. (4.9 kilogram-force/square millimeter)
   4. Tensile Modulus - 1.6 x 10^5 psi per ASTM D 638. (112.5 kilogram-force/square millimeter)
   5. Water Absorption - 0.72% per ASTM D 570.
   6. Barcol Hardness (scratch resistance) of 35 55 as per ASTM D 2583.
   7. Izod Impact Strength of 72 ft. lbs./in ASTM D 256

C. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
   1. Verify that stud spacing does not exceed 24” (61cm) on-center.

B. Repair defects prior to installation.
   1. Level wall surfaces to panel manufacturer’s requirements. Remove protrusions and fill indentations.

3.02 INSTALLATION

A. Comply with manufacturer's recommended procedures and installation sequence.

B. Cut sheets to meet supports allowing 1/8” (3 mm) clearance for every 8 foot (2.4m) of panel.
   1. Cut and drill with carbide tipped saw blades or drill bits, or cut with shears.
   2. Pre-drill fastener holes 1/8” (3mm) oversize with high speed drill bit.
      a. Space at 8” (200mm) maximum on center at perimeter, approximately 1” from panel edge.
      b. Space at in field in rows 16’ (40.64cm) on center, with fasteners spaced at 12” (30.48 cm) maximum on center.

C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.
   1. Install panels with manufacturer's recommended gap for panel field and corner joints.
      a. Adhesive trowel and application method to conform to adhesive manufacturer’s recommendations.
      b. Drive fasteners for snug fit. Do not over-tighten.

D. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.
   1. All moldings must provide for a minimum 1/8 “ (3mm) of panel expansion at joints and edges, to insure proper installation.
   2. Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation

3.03 CLEANING

A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.

B. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Contract Documents and all provisions of Division 01 – General Requirements, apply to this section.

B. Section Includes:
1. Painting and sealing of interior surfaces, doors, and door frames.
2. Arrange with Contractor for work of the following sections to apply specified finish to the top and bottom edges of doors before installed.
   a. Section 08 11 13: Hollow Metal Doors and Frames

C. Related Sections:
1. 03 30 00 – Cast-In-Place Concrete
2. 04 22 00 – Concrete Unit Masonry
3. 08 11 13 – Hollow Metal Doors and Frames

D. Work not Included
1. Painting of non-ferrous metals.
2. Prime coats on items delivered with prime coats applied.
3. Painting of items delivered with shop finish unless otherwise indicated.
4. Prefinished sheet metal.
5. Mechanical and electrical work in non-painted spaces.

E. References
1. SSPC-SP 1 – Solvent Cleaning
2. SSPC-SP 2 – Hand Tool Cleaning
3. SSPC-SP 3 – Power Tool Cleaning
4. SSPC-SP 13 / NACE No. 6 Surface Preparation for Concrete

F. Samples: If requested by the Owner.
1. Submit manufacturer's color charts in duplicate to the Architect within 30 days after the award of the contract and material approval. Include schedule of paint materials to be used.
2. Color, if not indicated on the drawings, will be selected by the Architect and submitted to the Contractor in scheduled form. Different colors may be selected in each room. More than one color may be selected for a room or space.
   a. If color breaks are required other than in/on corners they shall be indicated on the drawings.
   b. Match selected colors exactly. Mix as required if factory mixed colors are not available
3. Provide two 8" (200 mm) x 8" (200 mm) samples of each paint color, on special cardboard used for this purpose, to the Architect for approval prior to start.
4. Before proceeding with painting, finish one space or item of each color scheme required showing selected colors, finished texture, materials and workmanship. After approval by the Architect, these items shall serve as a standard for similar work throughout the building.

1.02 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in manufacturer's sealed containers, labels intact. Store materials and equipment in one place where directed by the General Contractor's foreman. Protect floors and walls of storage room. Remove oily rags, waste, etc., from the building every night and under no circumstances allow it to accumulate. Take every precaution to avoid the danger of fire.

1.03 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not apply coatings under environmental conditions outside manufacturer's absolute limits

PART 2 PRODUCTS

1.04 MANUFACTURERS

A. Specification Basis: Sherwin Williams

B. Substitutions: Under provisions of Division 01.

C. Acceptable manufacturers to be:
1. Pratt & Lambert
2. Benjamin Moore
3. Devoe
4. Sherwin Williams
5. PPG
6. Hirshfield.

1.05 MATERIALS

A. Finish Schedule: Product names and number refer to products as manufactured by Sherwin-Williams, except as otherwise specified. The following specification for finishing is not intended to mention every particular item which will receive painters finish, but it is intended to establish type and quality of finish which will be required on various materials.
1. Interior:
   a. (PT-01) Drywall: Latex System, Semi-Gloss Finish
      1st coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5.0 mils wet, 2.0 mils dry)
      2nd coat: S-W Solo Acrylic Semi-Gloss, A76 Series
      3rd coat: S-W Solo Acrylic Semi-Gloss, A76 Series
      (4.0 mils wet, 1.5 mils dry per coat)

   b. Galvanized Metal: Alkyd Enamel, Semi-Gloss Finish
      1st coat: S-W Solo Acrylic Semi-Gloss, A76 Series
      2nd coat: S-W Solo Acrylic Semi-Gloss, A76 Series
      (4.0 mils wet, 1.5 mils dry per coat)

   c. (SC-01) Concrete Floors: Silicone Acrylic System, Transparent Finish
      1st coat: H&C Concrete Sealer Solvent Based Clear
      2nd coat: H&C Concrete Sealer Solvent Based Clear with H&C Sharkgrip Slip Resistant Additive

   d. Masonry Walls: Silicone Acrylic System, Transparent Finish
      1st coat: H&C Concrete Sealer Solvent Based Clear
      2nd coat: H&C Concrete Sealer Solvent Based Clear

B. Provide other materials, not specifically described, but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 EXECUTION

3.01 INSPECTION

A. The Contractor shall examine all surfaces to be finished and make certain that they can be put in proper condition for finishing by customary cleaning, sanding and puttying. The Contractor assumes full responsibility for producing a satisfactory job with the materials specified.
   1. Painting coats as specified are intended to cover surfaces perfectly (completely and uniformly). If surfaces are not covered perfectly, additional coats shall be applied at no extra cost to the Owner.

3.02 INSTALLATION

A. Workmanship shall be of the very best. All materials evenly spread and smoothly flowed on, giving a uniform sheen and color without runs and sags. Transparent finishes shall have all coats brushed out smooth. Only skilled mechanics shall be employed and all materials shall be applied in strict accordance with manufacturer's directions. Except as otherwise specified, only one manufacturer's materials shall be used in each of the finishes specified.

B. This Contractor shall do all interior and exterior painting indicated on the drawings, schedules and herein specified including, but not necessarily limited to, wood, masonry, gypsum board, ferrous metals, prime coated metal surfaces, louver, registers and grilles.
   1. Field paint exposed bars, covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under the mechanical and electrical work in paint finished spaces.
   2. Unless otherwise indicated, painting is not required on surfaces in concealed areas and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces and duct shafts.
   3. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finished materials will not require painting under this section except as may be so specified.
   4. Do not paint moving parts of operating units, mechanical or electrical parts such as valve operators, linkages, sensing devices, and motor shafts unless otherwise indicated.
   5. Do not paint over required labels or equipment identification, performance rating, name or nomenclature plates.

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

D. Surface Preparation:
   1. Protect items not to be painted or remove prior to painting. If required to be removed, reposition after painting.
   2. Make any exposed miscellaneous metal items, such as steel bollards, anchors, hollow metal frames and the like, clean, free of rust, dust, grease and dirt. Marred shop coats shall be touched-p to a like new condition.
   3. Wash any unprimed galvanized metal with a solution of “Galvacleaner” and allow to dry.
   4. Prime exposed duct work with one coat of Pittsburgh G-9514, Galvanized Dry Fog.
   5. Make any wood surfaces to be painted or stained, clean smooth, dry and fully sanded. Knots and pitch pockets under paint finish shall be sealed with shellac. Fill joints, cracks, nail holes, disfigurations, etc., with putty after priming, then sand smooth.
   6. Prepare all surfaces to receive scheduled finish per paint manufacturer's recommendations and specifications.

E. Application:
   1. During interior application, maintain minimum temperature of 65^{o} F (18^{o} C), unless otherwise directed by Architect or manufacturer’s printed instructions. Hold temperature constant as possible. Provide adequate ventilation at all times so the humidity cannot rise above the dew

point of the coldest surface to be painted. Do no exterior painting below 50° F (10° C) temperature.

2. Paint all exposed surfaces of every member: Paint anything inaccessible after installation before installation, if required to be painted.
3. Apply all coatings without reduction except as specifically required by label directions, or required by this specification. In such cases, reduction shall be the minimum permitted.
4. Thoroughly cover with uniform color and finish, the number of coats specified being a minimum. Undercoats shall be colored to approximately match the final color.

3.03 CLEAN UP/ACCEPTANCE

A. Where coverage is incomplete or not uniform, provide additional coats at no additional cost to the Owner.

B. On completion of work, carefully clean all glass, hardware, etc., and remove all misplaced paint and stain spots or spills and leave work in a condition acceptable to Architect.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 0 - Contract Conditions and all provisions of Division 1 - General Requirements, apply to this section.

B. Section Includes:
   1. Room Identification Signs
   2. Signs required by code, including, but not limited to:
      a. Accessibility signage
      b. Storm Shelter signage
      c. Life Safety signage

C. Related Sections
   1. 06 10 00 – Rough Carpentry: blocking as required.

1.02 REFERENCES

A. ANSI A117.1: Providing Accessibii ANSI A117.1: Providing Accessibility and Usability for Physically Handicapped People.

B. Department of Justice, Office of the Attorney General, "Americans with Disabilities Act", Public Law 101-336, (ADA).

C. 2010 Standards for Accessible Design (SAD): The updated ADAAG (ADA Accessibility Guidelines), effective on March 15, 2011 and made mandatory on March 16, 2012.

1.03 SUBMITTALS

A. Shop Drawings: Required
   1. Identifying all materials, sizes, construction details, graphics layouts, typestyle specifications, mounting methods, and mounting heights.

B. Samples: If requested by Architect
   1. Standard styles, colors, finishes, graphics and type styles for selection by Architect, if not stated on the drawings or herein specified.

1.04 QUALITY ASSURANCE

A. All signs shall comply with Iowa code requirements and the Americans with Disabilities Act requirements, including mounting heights and locations. These requirements shall supersede the specification if the two are in conflict and it shall be the suppliers responsibility to conform to these requirements within the design herein stated.

B. Product Warranty: Provide manufacturer’s warranty against defects in materials and workmanship for a minimum of one (1) year.

1.05 DELIVERY, STORAGE & HANDLING

A. Package signs to prevent damage during shipment, handling, storage and installation. Products are to remain in their original packaging (unless otherwise specified) until removal is necessary for installation.

B. If installation site is not ready for signage upon delivery, store signs in a dry, air-conditioned environment.

C. Handle signage in accordance with manufacturer's instructions.

1.06 PERFORMANCE REQUIREMENTS

A. Provide signage that conforms to the requirements of all regulatory agencies holding jurisdiction.

B. Comply with all applicable provisions of the 2010 Standards for Accessible Design (the updated ADA Accessibility Guidelines, ADAAG), effective in March 2011. Requirements include, but are not limited to the following:

1. Tactile copy must be all upper case and raised at least 1/32". Tactile characters must be san serif, not italic, not oblique, script or highly decorative.
2. The stroke width of the upper case "I" has to be 15% of the letter height or less. The character width of the uppercase "O" must be between 55% and 110% of the height of the corresponding uppercase "I".
3. The copy height for tactile information must be between 5/8" and 2". If separate visual characters are provided, raised characters can be ½" and need not contrast with the background.
4. The distance between characters on tactile copy must be a minimum of 1/8" and a maximum of 4 times the character stroke width. These distances are measured between the closest points of adjacent characters.
5. Spacing between lines of tactile copy needs to be a minimum of 135% and a maximum of 170% of the corresponding uppercase "I" height (measured from baseline to baseline).
6. Braille must be Grade II and positioned directly below the corresponding raised characters. If text is multi-lined, Braille is placed below the entire body of text and separated 3/8" from any other tactile characters and 3/8" minimum from raised borders and decorative elements.
7. Visual characters and symbols, and their background, are to have a non-glare finish. The color of raised characters must contrast as much as possible with their background to make sure signs are more legible for persons with low vision.
8. Pictograms, selected from International Standards, are to be located within a 6" vertical void and accompanying text descriptions are to be located directly below the pictogram.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Specification Basis: Compliance Signs.com
56 South Main Street
Chadwick, IL 61014
www.compliancesigns.com
(800) 578-1245

B. Substitutions: Under provisions of Division 01

C. Acceptable manufacturers, subject to compliance with project requirements:

1. Compliance Signs
2. Inpro
3. Best Sign Systems, Inc.

2.02 PRODUCT DETAILS

A. Panel/Plaque Construction: Tactile layer consisting 1/32” symbols and wording (English) and grade 2 Braille. Acrylic Substrate layer 1/16” laminated impact acrylic matte finish.

B. Typography: As selected from manufacturer’s standards.Manufacturer’s standard ADA-compliant fonts. 5/8” (16 mm) minimum standard bold condensed, upper case only. All lettering shall have the same copy in raised Braille below the lettering, in accordance with the State Code and A.D.A. requirements.

C. Colors and Finishes: As selected by Owner from manufacturer’s standard color palette. Characters and their background shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark charactoers on a light background.

D. Overall Panel/Plaque Size: 9 inches in height by 6 inches in width. Pictogram field to be 6 inches in height minimum.

E. Panel/Plaque Shape: Reference 3.06 SIGN SCHEDULES.

F. Graphics: As selected from manufacturer’s standards and as indicated in Signage Schedule for particular units; must meet ADA requirements for letter proportions, stroke thickness, sizes and inter-character spacing.

G. Quantity: Verify with drawings.

2.03 FABRICATION

A. Fabricate units as per specifications and details indicated on reviewed drawings.

B. Fabricate signs via a photopolymer process, using computer-generated film negatives for creation of crisp, UV-hardened raised characters and Braille. Engraved plaques, adhesive-applied raised characters and applied Braille are not acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install products in accordance with manufacturer’s instructions, in locations and with mounting methods as specified in sign and location drawings.

B. Square, plumb and level all installed products.

C. Install all signage in accordance with the 2010 Standard for Accessible Design (SAD), effective in March 2011, and any applicable local regulations and/or codes.

D. Installation Method:
   1. Silicon Adhesive (SA)
   2. Masonry Anchors

E. Upon completion of the work, sign installer shall remove any unused products, materials, packaging and debris from the installation site.

3.04 CLEANING

A. Clean all exposed surface not more than 48 hours prior to Date of Substantial Completion in accordance with manufacturer's written cleaning instructions.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.06 SIGN SCHEDULES

A. Refer to examples shown below, applicable code requirements, and Drawings for sizes, locations, sign types, layouts, typography specifications, sign text/copy and sign graphics.

B. Womens Toilet Room:
   1. Accessibile signage example:

C. Mechanical Room:

1. Accessible signage example:

D. Mens Toilet Room:

1. Accessible signage example:

E. Accessible Storm Shelter signage example:

END OF SECTION

SECTION 10 28 00

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
   1. Washroom accessories as scheduled in the section and as indicated on the drawings.

C. Related Sections
   1. Rough Carpentry: Section 06 10 00

1.02 QUALITY ASSURANCE

A. Codes and Standards:
   1. All grab bars shall be designed and installed to sustain a dead weight of 250 pounds for 10 minutes.
   2. All accessories in rooms designed for disability use shall conform to all state accessibility code requirements and the Americans with Disabilities Act requirements, including mounting heights and locations. These requirements shall supersede the specification.

B. Single Source Requirements: To the greatest extent possible, provide products from a single manufacturer.

1.03 SUBMITTALS

A. Product Data:
   1. Installation instructions and recommendations
   2. Cleaning and maintenance instructions
   3. Replacement parts information

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials and products in compliance with manufacturer's instructions and recommendations. Protect from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Specification Basis: Specifications for public restrooms are based on Bobrick Washroom Equipment, Inc.

B. Acceptable manufacturers, subject to compliance with project requirements:
   1. Alno
   2. Bobrick
   3. Bradley
   4. Moen
   5. American Standard

2.02 TOILET ACCESSORY SCHEDULE

A. Mirrors: B-165 series without shelf, 24" x 36" unless indicated otherwise on drawing. One required at each lavatory (excluding residential units).

B. Toilet Paper Dispenser: B-4288 ConturaSeries Multi-Roll Toilet Tissue Dispenser. One required at each water closet (excluding residential units).

C. Grab Bars: 5806 series, 1-1/2" (38 mm) diameter, 1-1/2" (38 mm) wall clearance, all satin finish. See restroom elevations; required at each accessible toilet, ambulatory toilet, or toilet seat and each accessible shower seat.

D. Soap Dispenser: B-4112 ConturaSeries Surface-Mounted Soap Dispenser. One required at each lavatory (excluding residential units).

E. Paper Towel Dispenser/Waste Receptacle: B-4369 ConturaSeries Recessed paper Towel Dispenser/Waste Receptacle. One required at each lavatory (excluding residential units).

F. Sanitary Napkin Disposal: B-270 Surface-Mounted Sanitary Napkin Disposal. One required at each women's water closet (excluding residential units).

G. Residential Unit Toilet Paper Holder: #PAN50-SN Panache Single-Post Toilet Paper Holder. Zinc construction with satin nickel finish.

H. Other Materials: Provide other materials, not specifically described, but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

2.03 FABRICATION

A. All fastening devices, exposed or concealed, shall be non-corrosive, including all internal screws, bolts, nuts, etc.
   1. Provide concealed fastening devices in all locations possible.
   2. Where exposed, fastening devices shall be same finish as specified for accessory.

PART 3 EXECUTION

3.01 INSTALLATION

A. Requirements
   1. Install accessories in location as indicated on the drawings. If not shown on drawings, as directed by the Architect.
   2. Contractor shall verify all quantities as stated in the specification with the drawing requirements.
   3. Units shall be plumb, straight, securely mounted and flush to wall. Provide all blocking required for attachment of toilet accessories.
      a. Install in accord with approved shop drawings and manufacturer's recommendations for each type of substrate encountered.
      b. All fastening devices must be of sufficient number, type to rigidly hold all accessories in position when subject to normal use.
   4. For items where location and mounting heights of accessories for disability use are not shown, request item location on shop drawing.
   5. Mount toilet accessories in rooms/compartments designated "Accessible" or Ambulatory", according to Minnesota Code Requirements and ADA requirements.
   6. All keyed units shall be keyed alike, deliver two keys per unit to Owner.

3.02 CLEAN UP/ACCEPTANCE

A. Leave all units clean and completely functional.
   1. Remove all protective coverings.

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 – Procurement and Contracting Requirements and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
   1. Fire Extinguishers

1.02 QUALITY ASSURANCE

A. Fire Rated Assemblies: Fire rated assemblies shall be provided to satisfy requirements of Underwriters Laboratories, Inc., and shall bear Underwriters Laboratories labels for rating required.

1.03 SUBMITTALS

A. Shop Drawings and Product Data: Required

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Specification Basis: J. L. Industries.

B. Acceptable manufacturers, subject to project compliance:
   1. Larsens
   2. Modern Metal Products
   3. Kidde

2.02 MATERIALS

A. Fire Extinguishers:
   1. Class: ABC dry chemical, pressurized.
   2. UL Rating: 3A40 BC.
   3. Quantity: As indicated on drawings.
   4. Provide extinguisher with wall brackets if not mounted in a cabinet.

PART 3 EXECUTION

3.01 INSTALLATION

A. Refer to drawings for locations.
   1. Install extinguishers, one each on bracket specified.

B. Mounting Heights:
   1. Bracket: At 5' - 0" (1 524 mm).

3.02 CLEAN UP/ACCEPTANCE

A. All extinguishers shall be fully charged and ready for use as approved by local authority just prior to acceptance of the building by the Owner.

END OF SECTION

SECTION 10 57 23.13

WIRE CLOSET AND UTILITY SHELVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vinyl coated ventilation shelving.

B. Storage accessories

1.02 RELATED SECTIONS

A. Section 06100 – Rough Carpentry

B. Section 09260 – Gypsum Board Assemblies

1.03 SUBMITTALS

A. See Section 01300 – Administrative Requirements, for submittal procedures.

B. Shop Drawings: Prepared specifically for this project, show dimensions of shelving and interface with other products.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Rubbermaid Consumer Products (Newell Rubbermaid); 3320 W. Market Street, Fairlawn, Ohio, 44333-3306; Tel: (888) 895-2110

B. Acceptable manufacturers, subject to compliance with project requirements: ClosetMaid

C. Single Source Requirements: To the greatest extent possible, provide products from a single manufacturer.

2.02 MATERIALS

A. Steel Wire: Basic cold drawn, Grade C-1006; average tensile strength over 100,000 psi; coated.

B. Wire Coating: Heavy-duty polyvinyl chloride (PVC) formula resin, plasticizers, stabilizers, pigments, and other additives.
   1. Thickness: 9 to 11 mils
   2. Classification: No ingredients listed as hazardous per OSHA 29CFR1910.0017

2.03 MANUFACTURED UNITS

A. Wire Shelving: Coated steel wire, ½ to 1 inch incremental cross-deck spacing.

B. Shelf and rod system: Provide ‘FreeSlide’ type at all areas.

C. Provide ‘C’ clips at the back and sides of all shelves

2.04 ACCESSORIES

A. Wall Clips

B. End Brackets

C. Support Brackets

D. Poles

E. Standards

F. Shelf Brackets

G. Pole Clips

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared spaces are sized and located in accordance with shop drawings.

B. Verify that framing, reinforcement, and anchoring devices are correct type and are located in accordance with shop drawings.

C. Installer's Examination:
   1. Examine conditions under which installation is to be performed; submit written notification if such conditions are unacceptable.
   2. Installation activities before unacceptable conditions have been corrected is prohibited.
   3. Installation indicated installer's acceptance of conditions.

3.02 INSTALLATION

A. Cut shelves ½ inch to 1-3/8" shorter than actual wall measurements; cap all exposed ends.
B. Install shelving plumb and level at heights indicated in accordance with shop drawings and manufacturer's printed installation instructions.
C. Place #3D69 back clips every 12 inches on level line.
D. Install #3D68 end brackets on same level line as wall clips, centered on the front rods of shelves. Support shelves 36 inches maximum with end brackets, support brackets, or poles.
E. Drill holes where required using sharp bit; do not punch.
F. Drywall: Drill 1/4 inch hole, insert anchor for back clip.
G. Standards and brackets:
   1. Install standards vertically every 16 inches on studs.
   2. Install horizontal tracks level, secured with screws or mollies in study or drywall; use hanging adapter to connect wall standards for hanging.
   3. Attach shelf brackets to FreeSlide, TightMesh, or Linen Shelf 12" or 16" decking.
H. Shelf Supports:
   1. Place shelf support braces #3R01 or #3R02 vertically every 16 inches on studs. Attach with wall anchors.
   2. Install #3D30 'C' clips behind support braces every 16 inches on studs.36 inches on center maximum.
I. Use #3G49 or #3G40 corner shelf at all corner 'butt' joints.
J. Use #3D66 or #3D65 rod spacers at all open end conditions.

3.03 CLEANING

A. As work proceeds, maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris related to this work.

B. Upon completion of installation, clean all surfaces that have become soiled during installation.

END OF SECTION

TABLE OF CONTENTS

SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 SCOPE

A. This section includes information common to two or more technical fire protection specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Quality Assurance.
      f. Continuity of Existing Services.
      g. Protection of Finished Surfaces.
      h. Sleeves and Openings.
      i. Sealing and Firestopping.
      j. Codes.
      k. Design Criteria.
      l. Certificates and Inspections.
      m. Submittals.
   2. PART 2 – PRODUCTS.
      a. Sealing and Firestopping.
   3. PART 3 – EXECUTION.
      a. Coordination.
      b. Sleeves and Openings.
      c. Sealing and Firestopping.

1.02 RELATED WORK

A. This section applies to all Division 22 sections of fire suppression.

B. Section 07 84 00 - Firestopping

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:
   1. AGA American Gas Association.
   2. ANSI American National Standards Institute.
   3. ASME American Society of Mechanical Engineers.
   4. ASPE American Society of Plumbing Engineers.
   5. ASTM American Society for Testing and Materials.
   6. AWWA American Water Works Association.
   7. AWS American Welding Society.
   8. CGA Compressed Gas Association.
   9. CS Commercial Standards, Products Standards Sections, Office of Engineering Standards Service, NBS.
   10. EPA Environmental Protection Agency.

11. FM FM Global
12. FS Federal Specifications, Superintendent of Documents, U.S. Government Printing Office.
13. IAPMO International Association of Plumbing & Mechanical Officials.
14. IEEE Institute of Electrical and Electronics Engineers.
15. ISA Instrument Society of America.
16. DSPS State of Wisconsin Dept. of Safety and Professional Services.
17. MCA Mechanical Contractors Association.
18. MICA Midwest Insulation Contractors Association.
19. MSS Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
20. NBS National Bureau of Standards.
21. NEC National Electric Code.
22. NEMA National Electrical Manufacturers Association.
23. NFPA National Fire Protection Association.
24. STI Steel Tank Institute.
25. UL Underwriters Laboratories Inc.

1.05 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Section 01 25 13 - Product Substitution Procedures.

B. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

C. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the intended performance from the system into which these items are placed.

1.06 CONTINUITY OF EXISTING SERVICES

A. Do not interrupt or change existing services without prior written approval from the Owner's Project Representative. When interruption is required, coordinate scheduling of down-time with the Owner to minimize disruption to his activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

1.07 PROTECTION OF FINISHED SURFACES

A. Refer to Division 1, General Requirements, Protection of Finished Surfaces.

1.08 SLEEVES AND OPENINGS

A. Refer to Division 1, General Requirements, Sleeves and Openings.

1.09 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between piping, etc. and the sleeve or structural opening shall be the responsibility of the Contractor whose work penetrates the opening. The Contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with Section 07 84 00 - Fire Stopping.

1.10 CODES

A. Comply with requirements of Minnesota Administrative Code, Dept. of Safety and Professional Services, NFPA Standards and local Fire Chief or Fire Marshal (AHJ, Authority Having Jurisdiction) regarding design, materials and installation.

1.11 DESIGN CRITERIA

A. Design fire protection systems in accordance with codes, standards and regulations noted above.

1.12 CERTIFICATES AND INSPECTIONS

A. Refer also to Division 1, General Conditions, Permits, Regulations, Utilities and Taxes.

1.13 SUBMITTALS

A. Refer to Refer to Section 01 33 00 - Submittal Procedures.

B. Shop drawing submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.

PART 2 PRODUCTS

2.01 SEALING AND FIRESTOPPING

A. FIRE AND/OR SMOKE RATED PENETRATIONS:
   1. Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with Section 07 84 00 - Firestopping.

B. NON-RATED PENETRATIONS:
   1. Pipe Penetrations:
      a. At pipe penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required, use urethane caulk in annular space between pipe insulation and wall material.

PART 3 EXECUTION

3.01 COORDINATION

A. Coordinate all work with other Contractors prior to installation. Any work that is not coordinated and that interferes with other Contractor's work shall be removed or relocated at the installing Contractor's expense.

B. Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

3.02 SLEEVES AND OPENINGS

A. Pipe penetrations in new poured concrete horizontal construction requiring F and T rating: Form opening using hole form or core drill opening. Alternatively provide cast in place fire stopping devices/sleeves. Pipe penetrations in new poured concrete horizontal construction requiring F rating but no T rating: Same as pipe penetrations in new poured concrete construction requiring F and T ratings except that schedule 40 steel sleeves may also be used.

B. Where penetrating pipe or conduit weight is supported by floor, provide manufactured product or structural bearing collar designed to carry load.

3.03 SEALING AND FIRESTOPPING

A. FIRE AND/OR SMOKE RATED PENETRATIONS:
   1. Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with Section 07 84 00 - Fire Stopping.

B. NON-RATED PARTITIONS:
   1. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

END OF SECTION

SECTION 21 10 00

WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 GENERAL

1.01 SCOPE

A. This section contains specifications for fire suppression pipe and pipe fittings for this project. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Shop Drawings.
      f. Quality Assurance.
      g. Delivery, Storage, and Handling.
      h. Design Criteria.
   2. PART 2 – PRODUCTS.
      a. Fire Suppression Piping.
      b. Mechanical Grooved Pipe Connections.
      c. Sprinkler Heads.
   3. PART 3 – EXECUTION.
      a. General.
      b. Preparation.
      c. Erection.
      d. Threaded Pipe Joints.
      e. Mechanical Grooved Pipe Connections.
      f. Mechanically Formed Tee Fittings.
      g. Installation.

1.02 RELATED WORK

A. Section 21 05 00 - Common Work Results for Fire Suppression.

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. ANSI A21.4.

B. ANSI A21.11.

C. ANSI A21.51.

D. ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings.

E. ANSI B16.3 Malleable and Ductile Iron Threaded Fittings.

F. ANSI B16.4 Cast Iron Threaded Fittings.

G. ANSI B16.5 Pipe Flanges and Flanged Fittings.

H. ANSI B16.9 Factory Made Wrought Steel Buttweld Fittings.

I.	ANSI B16.11	Forged Steel Fittings, Socket Welded and Threaded.
J.	ANSI B16.18	Cast Bronze Solder Joint Pressure Fittings.
K.	ANSI B16.22	Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings.
L.	ANSI B16.29	Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
M.	ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
N.	ASTM A105	Forgings, Carbon Steel, for Piping Components.
O.	ASTM A126	Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings.
P.	ASTM A135	Electric Resistance Welded Steel Pipe.
Q.	ASTM A181	Forgings, Carbon Steel for General Purpose Piping.
R.	ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
S.	ASTM A536	Ductile Iron Castings.
T.	ASTM A795	Black and Hot Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
U.	ASTM B88	Seamless Copper Water Tube.
V.	AWS A5.8	Brazing Filler Metal.
W.	AWS D10.9	Qualification of Welding Procedures and Welders for Piping and Tubing, Level AR3.
X.	NFPA 13	Installation of Sprinkler Systems. (Latest prevailing edition).
Y.	NFPA 14	Installation of Standpipe and Hose Systems. (Latest prevailing edition).
Z.	UL	Underwriters' Laboratories Listing.
AA.	FM	Factory Mutual Approval.

1.05 SHOP DRAWINGS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Schedule from the Contractor indicating the ANSI/ASTM specification number of the pipe being proposed along with its type and grade, if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Order all copper and steel pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

C. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

C. Offsite storage agreements will not relieve the Contractor from using proper storage techniques.

D. Storage and protection methods must allow inspection to verify products.

1.08 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

B. Construct all piping systems for the highest pressures and temperatures in the respective system but not less than 175 psig.

C. Where mechanical grooved fittings are used, use only ASTM standard radius fittings, short radius grooved fittings is not allowed.

D. Where ASTM A53 or A795 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where ASTM A135 grade A pipe is specified, grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

PART 2 PRODUCTS

2.01 FIRE SUPPRESSION PIPING

A. Steel Pipe:
   1. Black steel pipe welded and seamless, Type F, Grade A, ASTM A53; black welded and seamless steel pipe for fire protection use, Type F, ASTM A795; electric resistance welded steel pipe, Grade A, ASTM A135.
   2. Pipe wall Thickness:
      a. Threaded pipe shall have a minimum wall thickness of schedule 40.
      b. Piping 2” and under shall be minimum schedule 40 unless stated otherwise herein.
   3. Fittings: Cast iron threaded fittings, Class 125 or 250, ASTM A126/ANSI B16.4. Malleable and ductile iron threaded fittings, Class 150 or 300, ASTM A197/ANSI B16.3. Standard weight seamless carbon steel weld fittings, ASTM A234 grade, ANSI B16.9. Mechanical grooved fittings with EPDM gaskets, ASTM A536 ductile iron, ASTM A47 malleable iron or ASTM A53 fabricated steel. For wet pipe systems mechanical tee fittings with full iron back equal to Grinnell Figure 730 will be allowed only as needed for connection to existing systems. Outlets for drypipe and pre-action systems shall be mechanical tees. Mechanical tees with U-bolt back or other fastening means are not allowed.
   4. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.
   5. Finish: Hot dipped zinc coated (galvanized) finish on piping and fittings shall be used in drypipe and pre-action systems, piping exposed to weather and piping exposed to corrosive environments where indicated. Thread or cut groove hot dipped zinc coated pipe ends for fitting connections. Indoor dry standpipe systems supplied by a Fire Dept. connection only may be black steel piping and fittings.

2.02 MECHANICAL GROOVED PIPE CONNECTIONS

A. Mechanical grooved pipe couplings and fittings, ASTM F1476, as manufactured by Victaulic, Anvil or Grinnell may be used with steel pipe. Mechanical grooved components and assemblies to be rated for minimum 175 psi working pressure unless noted otherwise.

B. All mechanical grooved pipe material including gaskets, couplings, fittings and flange adapters shall be from the same manufacturer.

C. Couplings and fittings to be malleable iron, ASTM A47, or ductile iron A536 with painted finish. Fittings used on galvanized steel pipe to have galvanized finish, ASTM A153.

D. Gaskets to be EPDM, ASTM D2000. Gaskets for dry systems to be flush seal design. Heat treated carbon steel oval neck track bolts and nuts, ASTM A-183, with zinc electroplated finish.

2.03 SPRINKLER HEADS

A. Manufacturer: Sprinkler head model numbers establish type and style of head. Products of the following manufacturers determined to be equal by the Engineer will be accepted:
   1. Tyco: www.tycofire.com.
   2. Reliable: www.reliablesprinkler.com.
   3. Victaulic: www.victaulic.com.
   4. Viking: www.vikingfire.com.
   5. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Standard coverage sprinkler heads are to be the basis for design unless noted otherwise on the plans or within these specifications.

C. Fusible link or glass bulb type, cast brass or bronze construction. Provide heads with nominal 1/2" or 17/32” discharge orifice except where greater than normal density requires large orifice.

D. Select fusible link or glass bulb temperature rating to not exceed maximum ambient temperature rating allowed under normal conditions at installed location. Provide ordinary temperature (155 to 165 degree) fusible link or glass bulb type except at skylights, sealed display windows, unventilated attics and roof spaces, over cooking equipment, adjacent to diffusers, unit heaters, uninsulated heating pipes or ducts, mechanical rooms, storage rooms, or where otherwise indicated.

PART 3 EXECUTION

3.01 GENERAL

A. Install pipe fittings, and other fire suppression system components in accordance with reference standards, manufacturer recommendations and recognized industry practices.

3.02 PREPARATION

A. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

3.03 ERECTION

A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of fire protection piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, ceiling grid layout, light fixtures and grilles before installing piping.

B. Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

C. Provide 3/32" min. thickness steel nailing plates behind or on either side of piping where the possibility of penetration from nails or drywall screws exists.

D. Maintain piping in clean condition internally during construction.

E. Provide clearance for access to valves and piping specialties.

F. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

G. Install piping so that system can be drained. Where possible, slope to main drain valve. Slope dry pipe and pre-action systems subject to freezing at minimum 1/4"/10' on mains and 1/2"/10' on branches. Where piping not susceptible to freezing cannot be fully drained, install nipple and cap for drainage of less than 5 gallons or ball valve with hose thread outlet and cap for drainage over 5 gallons. Pipe main drain valve to grade or to air gap sewer receptor.

H. Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

I. Do not route piping within exterior walls.

J. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

K. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

3.04 THREADED PIPE JOINTS

A. Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.05 MECHANICAL GROOVED PIPE CONNECTIONS

A. Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools available for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.

3.06 MECHANICALLY FORMED TEE FITTINGS

A. Form mechanically extracted collars in a continuous operation, consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. Use an adjustable collaring device. Notch and dimple the branch tube. Braze the joint with neutral flame oxy-acetylene torch, applying heat properly so that pipe and tee do not distort; remove distorted connections.

3.07 INSTALLATION

A. Install fire protection system components in accordance with NFPA rulings, listings and manufacturers recommendations. Locate where accessible for servicing and replacement.

B. Sprinkler Heads: Locate sprinkler heads as indicated on fire protection plan and reflected ceiling plan maintaining minimum clearances from obstructions, ceilings and walls. Install sprinkler heads level in locations not subject to spray pattern interference. Provide fire sprinkler head installations below ductwork, soffits, etc.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 SCOPE

A. This section includes information common to two or more technical plumbing specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Reference.
      c. Standards.
      d. Lead Free Requirements
      e. Quality Assurance.
      f. Continuity of Existing Services.
      g. Protection of Finished Surfaces.
      h. Sleeves and Openings.
      i. Sealing and Firestopping.
      j. Codes.
      k. Request and Certification for Payment.
      l. Certificates and Inspections.
      m. Submittals.
      n. Operating and Maintenance Data.
      o. Record Drawings.
   2. PART 2 – PRODUCTS.
      a. Identification.
      b. Bedding and Backfill.
      c. Sealing and Firestopping.
   3. PART 3 – EXECUTION.
      a. Demolition.
      b. Excavation and Backfill.
      c. Sheeting, Shoring and Bracing.
      d. Rock Excavation.
      e. Surface Repair.
      f. Building Access.
      g. Equipment Access.
      h. Coordination.
      i. Identification.
      j. Sleeves.
      k. Sealing and Firestopping.

1.02 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

B. This section applies to all Division 22 sections of plumbing.

1.03 STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:
   1. ABMA American Boiler Manufacturers Association.
   2. ACPA American Concrete Pipe Association.
   3. AGA American Gas Association.

4.	AMCA	Air Movement and Control Association.
5.	ANSI	American National Standards Institute.
6.	AHRI	Air-Conditioning, Heating and Refrigeration Institute.
7.	ASME	American Society of Mechanical Engineers.
8.	ASPE	American Society of Plumbing Engineers.
9.	ASSE	American Society of Sanitary Engineering.
10.	ASTM	American Society for Testing and Materials.
11.	AWWA	American Water Works Association.
12.	AWS	American Welding Society.
13.	CISPI	Cast Iron Soil Pipe Institute.
14.	CGA	Compressed Gas Association.
15.	CS	Commercial Standards, Products Standards Sections, Office of Eng. Standards Service, NBS.
16.	EPA	Environmental Protection Agency.
17.	FS	Federal Specifications, Superintendent of Documents, U.S. Government Printing Office.
18.	GAMA	Gas Appliance Manufacturers Association.
19.	IAPMO	International Association of Plumbing & Mechanical Officials.
20.	IEEE	Institute of Electrical and Electronics Engineers.
21.	ISA	Instrument Society of America.
22.	MCA	Mechanical Contractors Association.
23.	MICA	Midwest Insulation Contractors Association.
24.	MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
25.	NBS	National Bureau of Standards.
26.	NEC	National Electric Code.
27.	NEMA	National Electrical Manufacturers Association.
28.	NFPA	National Fire Protection Association.
29.	NSF	National Sanitation Foundation.
30.	PDI	Plumbing and Drainage Institute.
31.	SMACNA	Sheet Metal and Air Conditioning Contractors' National Association. Inc.
32.	STI	Steel Tank Institute.
33.	UL	Underwriters Laboratories Inc.

B. Standards referenced in this section:

1.	ACI 614	Recommended Practice for Measuring, Mixing and Placing of Concrete.
2.	ASTM D1557	Standard Test Method for Moisture-Density Relations of Soils.
3.	ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4.	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials.
5.	D.O.T.	Standard Specifications for Road and Bridge Construction, State of Minnesota Dept. of Transportation.
6.	UL1479	Fire Tests of Through-Penetration Firestops.
7.	UL723	Surface Burning Characteristics of Building Materials.

1.04 LEAD FREE REQUIREMENTS

A. All materials that contact potable water shall be lead free. Lead free refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content ≤0.25% per the Federal Safe Drinking Water Act as amended January 4th 2011 Section 1417.

B. This requirement applies to all of the subsequent Plumbing Specification Sections and Plumbing Drawings and supersedes any part or model number that may conflict with this requirement.

1.05 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Section 01 25 13 - Product Substitution Procedures.

B. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

C. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the intended performance from the system into which these items are placed.

1.06 CONTINUITY OF EXISTING SERVICES

A. Do not interrupt or change existing services without prior written approval from the Owner's Project Representative. When interruption is required, coordinate scheduling of down-time with the Owner to minimize disruption to his activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

1.07 PROTECTION OF FINISHED SURFACES

A. Refer to Division 1, General Requirements, Protection of Finished Surfaces.

1.08 SLEEVES AND OPENINGS

A. Refer to Division 1, General Requirements, Sleeves and Openings.

1.09 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between piping, etc. and the sleeve or structural opening shall be the responsibility of the Contractor whose work penetrates the opening. The Contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

1.10 CODES

A. Comply with requirements of Minnesota Code.

1.11 REQUEST AND CERTIFICATION FOR PAYMENT

A. Refer to Division 1, General Conditions.

1.12 CERTIFICATES AND INSPECTIONS

A. Refer to Division 1, General Conditions, Permits, Regulations, Utilities and Taxes.

1.13 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Shop drawing submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.

1.14 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

B. In addition to the general content specified under Section 01 78 23 - Operation and Maintenance Data supply the following additional documentation:
   1. Records of tests performed to certify compliance with system requirements.
   2. Manufacturer's wiring diagrams for electrically powered equipment.
   3. Certificates of inspection by regulatory agencies.
   4. Valve schedules.
   5. Lubrication instructions, including list/frequency of lubrication.
   6. Parts list for fixtures, equipment, valves and specialties.
   7. Manufacturer’s installation, operation and maintenance recommendations for fixtures, equipment, valves and specialties.
   8. Additional information as indicated in the technical specification sections.

1.15 RECORD DRAWINGS

A. Refer to Division 1, General Requirements, Record Drawings.

PART 2 PRODUCTS

2.01 IDENTIFICATION

A. Stencils:
   1. Not less than 1 inch high letters/numbers for marking pipe and equipment.

B. SNAP-AROUND PIPE MARKERS:
   1. One-piece, preformed, vinyl construction, snap-around or strap-around pipe markers with applicable labeling and flow direction arrows, 3/4" min. size for lettering. Provide nylon ties on each end of pipe markers.
   2. Manufacturers:
      a. Seton Setmark: www.seton.com.
      b. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

C. UNDERGROUND WARNING TAPE:
   1. Detectable underground warning tape, 5.0 mil overall thickness, 6" width, .0035" thick aluminum foil core with polyethylene jacket bonded to both sides. Color code tape and print caution along with name of buried service in bold letters on face of tape.
   2. Manufacturers:
      a. Thor Enterprises Magnatec: www.thor-global.com.
      b. Carlton: www.carltonusa.com.
      c. MSI Marking Services: www.msipackinginc.com.
      d. Seton: www.seton.com.
      e. Brimar Industries, Inc.: www.pipemarker.com.
      f. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

D. UNDERGROUND TRACER WIRE:
   1. All underground non-metallic sewers/mains and water services/mains shall be provided with tracer wire installations. Tracer wire shall be continuous solid copper or steel plastic coated with split bolt or compression-type connectors.

2.02 BEDDING AND BACKFILL

A. Bedding up to a point 12" inches above the top of the pipe shall be thoroughly compacted sand or crushed stone chips meeting the following gradations:

Gradation for Bedding Sand		Gradation for Crushed Stone Chip Bedding	
Sieve Size	% Passing (by Wt)	Sieve Size	% Passing (by Wt)
1 inch	100	1/2 inch	100
No. 16	45 - 80	No. 4	75 - 100
No. 200	2 – 10	No. 100	10 - 25

B. Backfill above the bedding in lawn areas shall be thoroughly compacted excavated material free of large stones, organic, perishable, and frozen materials.

C. Backfill above the bedding under existing and future utilities, paving, sidewalks, curbs, roads and buildings shall be granular materials, pit run sand, gravel, or crushed stone, free from large stones, organic, perishable, and frozen materials.

2.03 SEALING AND FIRESTOPPING

A. FIRE AND/OR SMOKE RATED PENETRATIONS:
1. Manufacturers:
   a. 3M: www.3m.com.
   b. Hilti: www.hilti.com.
   c. Rectorseal: www.rectorseal.com.
   d. STI/SpecSeal: www.stifirestop.com.
   e. Tremco: www.tremcosealants.com.
   f. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.
2. All firestopping systems shall be provided by the same manufacturer.
3. Fire stop systems shall be UL listed or tested by an independent testing laboratory.
4. Submittals: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.
5. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
6. Use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop blocks, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.

B. NON-RATED PENETRATIONS:
1. At pipe penetrations of non-rated interior partitions, floors and exterior walls, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.

PART 3 EXECUTION

3.01 DEMOLITION

A. Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the Owner to minimize disruption to the existing building occupants.

B. All pipe, fixtures, equipment, wiring and associated conduit, insulation and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor except as specifically noted otherwise. All designated equipment is to be turned over to the Owner for their use at a place and time so designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

3.02 EXCAVATION AND BACKFILL

A. Perform all excavation and backfill work necessary to accomplish indicated plumbing systems installation. Excavate to bottom of pipe and structure bedding, 4" in stable soils, 6" in rock or wet trenches and 8" in unstable soil. Finish bottoms of excavations to true, level surface.

B. Tunnel or remove sidewalk and curb in areas of excavation to the nearest joint. Remove pavements, curbs and gutters to neat and straight lines to the limits of removal. Make saw cut lines parallel to existing joints, or parallel or perpendicular to pavement edges to form a neat patch. Carefully remove remaining pavement within the saw cut area. Leave existing base materials between the area disturbed by the work and the saw cut line undisturbed by the saw cutting, pavement removal, or pavement replacement processes.

C. Strip topsoil from area to be excavated, free from subsoil and debris, and store for later re-spreading.

D. At no time place excavated materials where they will impede surface drainage unless such drainage is being safely rerouted away from the excavation.

E. Excavate whatever materials are encountered as required to place at the elevations shown, all pipe, manholes, and other work. Remove debris and rubbish from excavations before placing bedding and backfill material.

F. Remove surplus excavated materials from site.

G. Verify the locations of any water, drainage, gas, sewer, electric, telephone or steam lines which may be encountered in the excavation. Underpin and support all lines. Cut off service connections encountered which are to be removed at the limits of the excavation and cap.

H. Provide and maintain all fencing, barricades, signs, warning lights, and/or other equipment necessary to keep all excavation pits and trenches and the entire subgrade area safe under all circumstances and at all times. No excavation shall be left unattended without adequate protection.

I. Elevations shown on the plans are subject to such revisions as may be necessary to fit field conditions. No adjustment in compensation will be made for adjustments up to two (2) feet above or below the grades indicated on the plans.

J. Install lines passing under foundations with minimum of 1-1/2 inch clearance to concrete and ensure there is no disturbance of bearing soil.

K. Bed pipe up to a point 12" above the top of the pipe. Take care during bedding, compaction and backfill not to disturb or damage piping.

L. Mechanically compact bedding and backfill to prevent settlement. The initial compacted lift to not exceed 24" compacted to 95% density per Modified Proctor Test (ASTM D-1557). Subsequent lifts under pavements, curbs, walks and structures are not to exceed 12" and be compacted to 95% density per Modified Proctor Test. In all other areas where construction above the excavation is not anticipated within 2 years, mechanically compact backfill in lifts not exceeding 24" to 90% density per Modified Proctor Test. Route the equipment over each lift of the material so that the compaction equipment contacts all areas of the surface of the lift.

3.03 SHEETING, SHORING AND BRACING

A. Provide shoring, sheet piling and bracing in conformance with the Minnesota Administrative Code to prevent earth from caving or washing into the excavation. Shore and underpin to properly support adjacent or adjoining structures. Abandon in place shoring, sheet piling and underpinning below the top of the pipe, or, if approved in advance by the engineer, maintained in place until other permanent support approved by the Engineer is provided.

3.04 ROCK EXCAVATION

A. Remove rock encountered in the excavation to a minimum dimension of six (6) inches outside the pipe. Rock excavation includes all hard, solid rock in ledges, bedded deposits and unstratified masses, all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock; which material is so hard or so firmly cemented that in the opinion of the Engineer it is not practical to excavate and remove same with a power shovel except after thorough and continuous drilling and blasting. Rock excavation includes rock boulders of 1/2 cubic yard or more in volume.

B. Rock excavation will be computed on the basis of the depth of rock removed and a trench width two (2) feet larger than the outside diameter of the pipe where one (1) pipe is laid in the trench and three (3) feet larger than the combined outside diameter where two (2) pipes are laid in the trench. Include 6" pipe and structure bedding in rock excavation. Include rock excavation shown on the plans in the Base Bid.

3.05 SURFACE RESTORATION

A. Completely restore the surface of all disturbed areas to a like condition of the surface prior to the work. Level off all waste disposal areas and clean up all areas used for the storage of materials or the temporary deposit of excavated earth. Remove all surplus material, tools and equipment.

B. Lawns: Topsoil with 4" of clean, friable, fertile topsoil conforming to D.O.T. Section 625, free from debris, lumps, rocks, roots, plants and seeds. Grade surfaces to match adjacent elevations. Rake smooth, free of lumps and debris. Sod with good quality nursery sod conforming to D.O.T. Section 631, be uniform, dense, free from weeds and consist of approximately 60% Kentucky blue grass and the balance perennial rye, fescue and white clover. Place sod with joints staggered and abutting. Maintain lawn areas for one month after installation. Contractor will be responsible for necessary watering and mowing. Do necessary weeding, repair, reseeding or re-sodding until uniform catch is obtained.

3.06 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance or removal of all apparatus. When the building access was not previously arranged and must be provided by this Contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.07 EQUIPMENT ACCESS

A. Install all piping, conduit and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Plumbing Contractor and installed by the General Contractor.

3.08 COORDINATION

A. Coordinate all work with other Contractors prior to installation. Any work that is not coordinated and that interferes with other Contractor's work shall be removed or relocated at the installing Contractor's expense.

B. Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

3.09 IDENTIFICATION

A. Identify interior piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both side of the partition where accessible piping passes through walls or floors. Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a light background or white enamel against a dark background.

B. Identify all exterior buried piping for entire length with underground warning tape except for sewer piping which is routed in straight lines between manholes or cleanouts. Place tape 6"-12" below finished grade along entire length of pipe. Extend tape to surface at building entrances, meters, hydrants and valves. Where existing underground warning tape is broken during excavation, replace with new tape identifying appropriate service and securely spliced to ends of existing tape.

3.10 SLEEVES

A. Provide galvanized sheet metal sleeves for pipe penetrations through interior and exterior walls to provide a backing for sealant or firestopping. Patch wall around sleeve to match adjacent wall construction and finish. Grout area around sleeve in masonry construction. In finished spaces where pipe penetration through wall is exposed to view, sheet metal sleeve shall be installed flush with face of wall. In existing poured concrete walls where penetration is core drilled, pipe sleeve is not required.

B. Pipe sleeves are not required in interior non-rated drywall, plaster or wood partitions and sleeves are not required in existing poured concrete walls where penetrations are core drilled.

C. Pipe sleeves in new poured concrete construction shall be schedule 40 steel pipe (sized to allow insulated pipe to run through sleeve), cast in place.

D. In all piping floor penetrations, fire rated and non-fire rated, top of sleeve shall extend 1 inch above the adjacent finished floor. In existing floor penetrations, core drill sleeve opening large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting, non-shrink grout. If the pipe penetrating the sleeve is supported by a pipe clamp resting on the sleeve, weld a collar or struts to the sleeve that will transfer weight to existing floor structure.

E. For floor penetrations through existing floors in mechanical and wet locations listed below, core drill opening and provide 1-1/2” x 1-1/2” x 1/8” galvanized steel angles fastened to floor surrounding the penetration or group of penetrations to prevent water from entering the penetration. Provide urethane caulk between angles and floor and fasten angles to floor a minimum of 8” on center. Seal corners water tight with urethane caulk. Or, core drill sleeve openings large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting non-shrink grout/cement.

F. Pipe sleeves are not required in cored floor pipe penetrations through existing floors that are not located in mechanical rooms, food service areas or wet locations listed above.

3.11 SEALING AND FIRESTOPPING

A. FIRE AND/OR SMOKE RATED PENETRATIONS:

1. Install approved product in accordance with the manufacturer's instructions where a pipe penetrates a fire/smoke rated surface. When pipe is insulated, use a product which maintains the integrity of the insulation and vapor barrier.
2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support substantial weight.

B. NON-RATED PARTITIONS:
1. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

END OF SECTION

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SECTION 22 05 02

PLUMBING DEMOLITION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Special Conditions and Division-1 Specification sections, apply to work specified in this section.

1.02 JOB CONDITIONS

A. Perform all demolition as needed to accomplish new work.

B. Refer to Demolition Section of specifications and to the Drawings for areas and equipment being remodeled.

C. This Contractor is responsible for all charges, fees etc. incurred as a result of the plumbing portion of the demolition.

D. Prior to demolition or alteration of structures, the following shall be accomplished:
1. Coordinate sequencing with Owner and other Contractors.
2. Coordinate means to separate construction zones from non-renovated zones to prevent the spread of dust, fumes and debris.
3. Coordinate means to provide exhaust and makeup air to maintain the construction zone at an adequate negative pressure to contain all construction dust and fumes.
4. Except as noted otherwise, remove from the premises, all materials and equipment removed in the demolition work.
5. Equipment noted to be removed and turned over to the Owner, shall be delivered to the Owner at a place and time he so designates.
6. Where the materials are to be turned over to the Owner or reused and installed by the Contractor, it shall be the Contractor's responsibility to maintain the condition of the materials and equipment equal to that existing before work began. Damaged materials or equipment shall be repaired or replaced at no additional cost to the Owner.
7. Survey and record condition of existing facilities to remain in place that may be affected by demolition operations. After demolition operations are completed, survey conditions again and restore existing facilities to their pre-demolition condition, at no additional cost to Owner.
8. Salvage equipment scheduled for reuse in new work or scheduled to be delivered to Owner's storage facility.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 DEMOLITION

A. Existing plumbing equipment in conflict with new construction shall be removed and/or relocated as indicated on the drawings, as directed or needed. This Contractor shall remove all plumbing equipment released from service as a result of construction, and no equipment removed shall be reused, except as specifically directed on the drawings or elsewhere herein. Except for ductwork and miscellaneous hardware, all plumbing equipment shall remain the property of the Owner and shall be stored on the site for removal by the Owner. Properly dispose or remove from site any piping, hangers, or other items not retained by Owner.

B. Where materials are to be turned over to the Owner or reused and installed by the Contractor, it shall be the Contractor's responsibility to maintain the condition of the materials and equipment equal to that existing before work began. Damaged materials or equipment shall be repaired or replaced at no additional cost to the Owner.

C. Any existing services or equipment not shown on the drawings and which are logically expected to be continued in service and which may be interrupted or disturbed during construction, shall be reconnected in an approved manner. Provide temporary ducts, pipes, controls, etc., as needed to prevent interruption of service to occupied areas caused by demolition operations. In addition, any ductwork, piping or equipment which may require relocation or rerouting as a result of construction, shall be considered a part of the work of this section and shall be done by this Contractor with no additional compensation, provided that the referenced relocation is discernable from the pre-bid review of the site, and associated documents.

D. This Contractor shall remove all ductwork, piping, straps, and existing equipment, being discontinued or removed due to construction. Abandoned or removed services shall be disconnected and capped at the perimeter of the project or as required elsewhere in the documents.

E. The existing building is to remain in operation during construction. This Contractor shall coordinate all work that will interfere with the present operation of the facility with the Owner and Construction Manager.

F. All existing equipment that is to remain shall be cleaned. Touch up paint equipment in exposed areas.

G. Ductwork systems indicated to remain shall be cleaned inside and out.

H. Existing ductwork in remodeled area that is not being removed shall be sealed as necessary to comply with SMACNA standards and requirements of ductwork section of the specifications.

I. All core drilling that is required for plumbing work shall be done by this Contractor.

J. All cutting and patching required for plumbing work shall be by this Contractor.

K. This Contractor shall provide required additional support for existing ductwork and piping in remodeled area that is not being removed and is not properly supported in accordance with Specification Section 22 10 06.

L. When existing ductwork, piping, or related equipment in remodeled areas prevents the installation of other work, remove and reinstall existing materials, making necessary modifications and transitions to coordinate with other trades.

M. Maintain construction zone at adequate negative pressure by providing exhaust by mechanical means until all work which creates dust or fumes is completed.

3.02 TESTING

A. Existing equipment shall be tested before demolition begins to determine existing operating conditions and capacities. Upon completion of all new work, the existing equipment shall be rebalanced to serve the new areas and maintain existing capacities in existing areas.

END OF SECTION

SECTION 22 05 14

PLUMBING SPECIALTIES

PART 1 GENERAL

1.01 SCOPE

A. This section includes specifications for floor drains, roof drains, cleanouts, backflow preventers, water hammer arrestors and other miscellaneous plumbing specialties.
   1. PART 1 – GENERAL.
      a. Scope.
      b. Reference.
      c. Reference Standards.
      d. Quality Assurance.
      e. Shop Drawings.
      f. Operation and Maintenance Data.
   2. PART 2 – PRODUCTS.
      a. Floor Drains.
      b. Trap Guards.
      c. Cleanouts.
   3. PART 3 – EXECUTION.
      a. Installation.

1.02 REFERENCE

A. Applicable provisions of Division 1 shall govern work under this section.

1.03 REFERENCE STANDARDS

A. ANSI A112.21.1 - Floor Drains.

1.04 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Section 01 33 00 - Submittal Procedures.

B. Plumbing products requiring approval by the State of Minnesota must be approved or have pending approval at the time of shop drawing submission.

1.05 SHOP DRAWINGS

A. Refer to Section 01 30 00 – Administrative Requirements, for submittal procedures.

B. Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

1.06 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 FLOOR DRAINS

A. Manufacturer:
   1. Josam: www.josam.com.
   2. Smith: www.jrsmith.com.
   3. Wade: www.wadedrains.com.
   4. Watts: www.watts.com.
   5. Zurn: www.zurn.com.
   6. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. FD-1: 2" min. enameled cast iron two piece body with double drainage flange, weep holes, reversible clamping adjustable collar, adjustable round polished nickel-bronze strainer with threaded collar, bottom outlet. Zurn Z-415B.

2.02 TRAP GUARDS

A. Manufacturer: ProSet Systems Trap Guard or approved equal.

B. Flexible elastomeric PVC construction diaphragm trap guard for installation in new and existing floor drains, hub drains, and trench drains. Trap guard to prevent trap evaporation and waste backflow. Size as applicable to the drain outlet size, up to 4” size.

2.03 CLEANOUTS

A. Manufacturer:
   1. Josam: www.josam.com.
   2. Smith: www.jrsmith.com.
   3. Wade: www.wadedrains.com.
   4. Watts: www.watts.com.
   5. Zurn: www.zurn.com.
   6. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. INTERIOR CONCRETE FLOOR AREAS: Enameled cast iron body with round adjustable scoriated polished nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400- / ZN-1400-T.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate location and setting of plumbing specialties with adjacent construction. Install in accordance with manufacturers recommendations.

B. Set floor drains, roof drains, trench drains and cleanouts level and plumb adjusted to finished floor elevation, roof elevation or finished wall location. Locate where serviceable. Allow minimum of 18" clearance around cleanouts for rodding. Lubricate threaded cleanout plugs with graphite and oil, teflon tape or waterproof grease. Install trap primer connections where indicated. Provide deep seal traps on floor drains and hub drains installed in mechanical rooms, penthouses or rooms with excessive positive or negative pressure.

C. Floor drains and hub drains installed in public restrooms, locker rooms, seldom used rooms, and areas with minute drainage flow shall have installations of combination trap evaporation/backflow preventer diaphragm installations.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING AND PIPING EQUIPMENT

PART 1 GENERAL

1.01 SCOPE

A. This section includes specifications for supports of all plumbing equipment and materials as well as piping system anchors. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Quality Assurance.
      f. Description.
      g. Shop Drawings.
      h. Design Criteria.
   2. PART 2 – PRODUCTS.
      a. Manufacturers.
      b. Pipe Hangers and Supports.
      c. Pipe Hanger Rods.
      d. Concrete Inserts.
      e. Anchors.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Hanger and Support Spacing.
      c. Concrete Inserts and Continuous Insert Channels.
      d. Anchors.

1.02 RELATED WORK

A. Section 22 07 00 - Plumbing Insulation for insulation protection at support devices.

1.03 REFERENCE

A. Applicable provisions of Division 1 shall govern work under this section.

1.04 REFERENCE STANDARDS

A. MSS SP-58.

B. MSS SP-69.

1.05 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Section 01 25 13 - Product Substitution Procedures.

1.06 DESCRIPTION

A. Provide all supporting devices as required for the installation of mechanical equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for building piping.

B. Do not hang any mechanical item directly from a metal deck or run piping so its rests on the bottom chord of any truss or joist.

C. Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

D. Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

E. Protect insulation at all hanger points; see Related Work above.

1.07 SHOP DRAWINGS

A. Refer to Section 01 33 00 - Submittal Procedure.

B. Schedule of all hanger and support devices indicating attachment methods and type of device for each pipe size and type of service.

1.08 DESIGN CRITERIA

A. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 and SP-69 unless noted otherwise.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Anvil: www.anvilintl.com.

B. B-Line: www.bline.com.

C. Pate: www.patecurbs.com.

D. Piping Technology: www.pipingtech.com.

E. Roof Products & Systems: www.commercialproductsgroup.com.

F. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.02 PIPE HANGERS AND SUPPORTS

A. HANGERS FOR PIPE SIZES 1/2" THROUGH 2":
   1. Carbon steel, adjustable swivel ring. B-Line B3170NF, Anvil 69 or 70.
   2. Carbon steel, adjustable clevis, standard. B-Line B3100, Anvil 260.

B. HANGERS FOR PIPE SIZES 2" AND LARGER:
   1. Carbon steel, adjustable clevis, standard. B-Line B3100, Anvil 260.

C. MULTIPLE OR TRAPEZE HANGERS:
   1. Steel channels with welded spacers and hanger rods.

D. WALL SUPPORT:
   1. Carbon steel welded bracket with hanger. B-Line 3068 Series, Anvil 194 Series.

2. Perforated, epoxy painted finish, 16-12 gauge, min., steel channels securely anchored to wall structure, with interlocking, split-type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-2000 series clamps, Anvil type PS 200 H with PS 1200 clamps. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Anvil PS 1400 series.

E. FLOOR SUPPORT:
1. Carbon steel pipe saddle, stand and bolted floor flange. B-Line B3088T/B3093.

F. COPPER PIPE SUPPORTS:
1. All supports, fasteners, clamps, etc. directly connected to copper piping shall be copper plated or polyvinylchloride coated. Where steel channels are used, provide isolation collar between supports/clamps/fasteners and copper piping.

2.03 PIPE HANGER RODS

A. STEEL HANGER RODS:
1. Threaded both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.
2. Size rods for individual hangers and trapeze support as indicated in the following schedule.
3. Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8
2710	3/4
3770	7/8
4960	1
8000	1-1/4

2.04 CONCRETE INSERTS

A. POURED IN PLACE:
1. MSS SP-69 Type 18 wedge type to be constructed of a black carbon steel body with a removable malleable iron nut that accepts threaded rod to 7/8 inch diameter. Wedge design to allow the insert to be held by concrete in compression to maximize the load carrying capacity. B-Line B2505, Anvil 281.
2. MSS SP-69 Type 18 universal type to be constructed of black malleable iron body with a removable malleable iron nut that accepts threaded rod to 7/8 inch diameter. B-Line B3014N, Anvil 282.

B. DRILLED FASTENERS:
1. Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor.
2. Manufacturers:
   a. Hilti: www.hilti.com.
   b. Rawl: www.rawl.com.
   c. Redhead: www.ramset-redhead.com.
   d. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.05 ANCHORS

A. Use welding steel shapes, plates, and bars to secure piping to the structure.

PART 3 EXECUTION

3.01 INSTALLATION

A. Size, apply and install supports and anchors in compliance with manufacturers recommendations.

B. Install supports to provide for free expansion of the piping system. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

C. Coordinate hanger and support installation to properly group piping of all trades.

D. Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes or continuous insert channels for the supporting steel. Where continuous insert channels are used, pipe supporting devices made specifically for use with the channels may be substituted for the specified supporting devices provided that similar types are used and all data is submitted for prior approval.

E. Size and install hangers and supports, except for riser clamps, for installation on the exterior of piping insulation. Where a vapor barrier is not required, hangers may be installed either on the exterior of pipe insulation or directly on piping.

F. Perform welding in accordance with standards of the American Welding Society.

3.02 HANGER AND SUPPORT SPACING

A. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

B. Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

C. Use hangers with 1-1/2 inch minimum vertical adjustment.

D. Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

E. Support riser piping independently of connected horizontal piping.

F. Adjust hangers to obtain the slope specified in the piping section of these specifications.

G. Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Horiz. Spacing	Max. Vert. Spacing
Copper	1/2" through 3/4"	5'-0"	10'-0"
Copper	1" through 1-1/4"	6'-0"	10'-0"
Steel	1/2" through 1-1/4"	7'-0"	15'-0"
Steel	1-1/2" through 6"	10'-0"	15'-0"
Plastic	Drain and Vent	4'-0"	10'-0"

3.03 CONCRETE INSERTS AND CONTINUOUS INSERT CHANNELS

A. Select size based on the manufacturer's stated load capacity and weight of material that will be supported. Locate continuous insert channels on 6'-0" maximum centers and 2'-0" from corners. Furnish inserts to the General Contractor for placement in concrete formwork. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inch size. Where concrete slabs form finished ceiling, provide inserts that are flush with the slab surface.

3.04 ANCHORS

A. Install where indicated on the drawings and details. Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

END OF SECTION

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SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe Markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2001 (Reapproved 2007).

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Piping: Pipe markers.

2.02 PIPE MARKERS

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com.
   2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
   3. MIFAB, Inc.: www.mifab.com.
   4. Seton Identification Products: www.seton.com.
   5. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

F. Color code as follows:
   1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.
   2. Fire Quenching Fluids: Red with white letters.
   3. Toxic and Corrosive Fluids: Orange with black letters.
   4. Flammable Fluids: Yellow with black letters.
   5. Combustible Fluids: Brown with white letters.
   6. Compressed Air: Blue with white letters.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 91 00 for stencil painting.

3.02 INSTALLATION

A. Install plastic pipe markers in accordance with manufacturer's instructions.

B. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

C. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

D. Use tags on piping 3/4 inch diameter and smaller.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 22 07 00

PLUMBING INSULATION

PART 1 GENERAL

1.01 SCOPE

A. This section includes insulation specifications for plumbing piping and equipment. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference Standards.
      d. Quality Assurance.
      e. Description.
      f. Definitions.
      g. Shop Drawings.
      h. Operation and Maintenance Data.
   2. PART 2 – PRODUCTS.
      a. Materials.
      b. Insulation & Jackets.
      c. Accessories.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Piping, Valve and Fitting Insulation.

1.02 RELATED WORK

A. Section 22 05 00 - Common Work Results for Plumbing.

B. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. ASTM B209 Aluminum and Aluminum Alloy Sheet and Plate.

B. ASTM C165 Test Method for Compressive Properties of Thermal Insulations.

C. ASTM C177 Heat Flux and Thermal Transmission Properties.

D. ASTM C195 Mineral Fiber Thermal Insulation Cement.

E. ASTM C240 Cellular Glass Insulation Block.

F. ASTM C302 Density of Preformed Pipe Insulation.

G. ASTM C303 Density of Preformed Block Insulation.

H. ASTM C449 Mineral Fiber Hydraulic Setting Thermal Insulation Cement.

I. ASTM C518 Heat Flux and Thermal Transmission Properties.

J. ASTM C533 Calcium Silicate Block and Pipe Thermal Insulation.

K. ASTM C534 Preformed Flexible Elastomeric Thermal Insulation.

L. ASTM C547 Mineral Fiber Preformed Pipe Insulation.

M. ASTM C552 Cellular Glass Block and Pipe Thermal Insulation.

N. ASTM C553 Mineral Fiber Blanket and Felt Insulation.

O. ASTM C578 Preformed, Block Type Cellular Polystyrene Thermal Insulation.

P. ASTM C591 Preformed Rigid Cellular Polyurethane Thermal Insulation.

Q. ASTM C610 Expanded Perlite Block and Thermal Pipe Insulation.

R. ASTM C612 Mineral Fiber Block and Board Thermal Insulation.

S. ASTM C921 Properties of Jacketing Materials for Thermal Insulation.

T. ASTM C1136 Flexible Low Permeance Vapor Retarders for Thermal Insulation.

U. ASTM E84 Surface Burning Characteristics of Building Materials.

V. MICA National Commercial & Industrial Insulation Standards.

W. NFPA 225 Surface Burning Characteristics of Building Materials.

X. UL 723 Surface Burning Characteristics of Building Materials.

1.05 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

1.06 DESCRIPTION

A. Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:
   1. Pipe Insulation.
   2. Equipment Insulation.

B. Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the Owner.

1.07 DEFINITIONS

A. Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

1.08 SHOP DRAWINGS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

1.09 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials or accessories containing asbestos will not be accepted.

B. Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions:
   1. Insulation which is not located in an air plenum shall have a flame spread rating not over 25 and a smoke developed rating no higher than 150.

2.02 INSULATION AND JACKETS

A. Manufacturers:
   1. Armstrong: www.armstronginternational.com.
   2. Certainteed: www.certainteed.com.
   3. Manson: www.imanson.com.
   4. Childers: fosterproducts.com.
   5. Dow: www.dow.com.
   6. Extol: www.extol.com.
   7. Halstead: www.rembco.com.
   8. H.B. Fuller: www.hbfuller.com
   9. Imcoa: www.nomacoinsulation.com.
   10. Knauf: www.knaufusa.com.
   11. Owens-Corning: www.owenscorning.com.
   12. Pittsburgh Corning: www.foamglasinsulation.com.
   13. Rubatex: www.rubatex.com.
   14. Johns-Mansville: www.jm.com.
   15. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

C. RIGID FIBERGLASS INSULATION:
   1. Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.
   2. White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

2.03 ACCESSORIES

A. All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.

B. Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

C. Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.

D. Tack fasteners to be stainless steel ring grooved shank tacks.

E. Staples to be clinch style.

F. Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

G. Finishing cement to be ASTM C449.

H. Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.

I. Bedding compounds to be non-shrinking and permanently flexible.

J. Vapor barrier coatings to be non-flammable, fire resistant, polymeric resin.

K. Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install insulation, jackets and accessories in accordance with manufacturer instructions and under ambient temperatures and conditions recommended by manufacturer. Surfaces to be insulated must be clean and dry.

B. Do not insulate systems or equipment which is specified to be pressure tested or inspected, until testing, inspection and any necessary repairs have been successfully completed.

C. Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Cover and seal exposed fiberglass insulation when insulation is terminated, no raw fiberglass insulation is allowed. Provide neat and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates. Install with longitudinal joints facing wall or ceiling.

D. Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

E. Use full-length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

F. Insulation shall be continuous through sleeves and openings. Vapor barriers shall be maintained continuous through all penetrations.

G. Provide a complete vapor barrier for insulation on the following systems:
1. Cold water (potable and non-potable).
2. Storm Water.
3. Equipment piping with a surface temperature below 65 degrees F.

3.02 PIPING, VALVE, AND FITTING INSULATION

A. GENERAL:

1. Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2” lap on jacket seams and 2” tape on butt joints, firmly cemented with lap adhesive. Additionally secure with staples along seams and butt joints. Coat staples with vapor barrier mastic on systems requiring vapor barrier.
2. Water supply piping insulation shall be continuous throughout the building and installed adjacent to and within building walls to a point directly behind the fixture that is being supplied.
3. Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of insulation. Where a vapor barrier is not required, hangers and supports shall be attached directly to piping with insulation completely covering hanger or support and jacket sealed at support rod penetration. Where riser clamps are required to be attached directly to piping requiring vapor barrier, extend insulation and vapor barrier jacketing/coating around riser clamp.

B. INSULATION INSERTS AND PIPE SHIELDS:
1. Provide insulation inserts and pipe shields at all hanger and support locations. Inserts shall be omitted on 3/4” and smaller copper piping provided 12” long 22 gauge pipe shields are used.

C. FITTINGS AND VALVES:
1. Fittings, valves, unions, flanges, couplings and specialties shall be insulated with factory molded or built up insulation of the same thickness as adjoining insulation. Cover insulation with fabric reinforcing and mastic or where temperatures do not exceed 150 degrees, PVC fitting covers. Secure PVC fitting covers with tack fasteners and 1-1/2” band of mastic over ends, throat, seams or penetrations. On systems requiring vapor barrier, use vapor barrier mastic.

D. PIPE INSULATION SCHEDULE:
1. Provide insulation on new and existing remodeled piping as indicated in the following schedule:

Service	**Insulation Types**	**Insulation Thickness by Pipe Size**				
		1" and smaller	**1-1/4" to 2"**	**2-1/2" to 4"**	**5" to 6"**	**8" and larger**
Hot Water Supply	Rigid Fiberglass	1"	1"	1.5"	1.5"	1.5"
Cold Water	Rigid Fiberglass	0.5”	0.5”	1”	1”	1”

E. The following piping and fittings are not to be insulated:
1. Chrome plated exposed supplies and stops (except where specifically noted).
2. Water hammer arrestors.
3. Piping unions and flanges for systems not requiring a vapor barrier.

END OF SECTION

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SECTION 22 10 05

PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Gas.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

C. Section 22 07 00 - Plumbing Insulation.

1.03 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 1999, and addenda A&B (R2004).

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2012 (ANSI B16.18).

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2010).

D. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV; The American Society of Mechanical Engineers; 2011.

E. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; The American Society of Mechanical Engineers; 2011.

F. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; The American Society of Mechanical Engineers; 2007.

G. ASME B31.2 - Fuel Gas Piping; The American Society of Mechanical Engineers; 1968.

H. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2008 (ANSI/ASME B31.9).

I. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2009.

J. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2011.

K. ASTM B32 - Standard Specification for Solder Metal; 2008.

L. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2010.

M. ASTM B68 - Standard Specification for Seamless Copper Tube, Bright Annealed; 2011.

N. ASTM B75 - Standard Specification for Seamless Copper Tube; 2002 (Reapproved 2010).

O. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2009.

P. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2008.

Q. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes; 2007.

R. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2006.

S. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2006.

T. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2004 (Reapproved 2009).

U. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2010.

V. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping; 2001 (Reapproved 2009).

W. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

X. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).

Y. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2008.

Z. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40; 2009.

AA. ASTM F439 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2009.

BB. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2011 and errata.

CC. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.

DD. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2010.

EE. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2012.

FF. NFPA 58 - Liquefied Petroleum Gas Code; National Fire Protection Association; 2011.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.05 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.
   1. Fittings: Cast iron.
   2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

C. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. PVC Pipe: ASTM D2729.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

D. PVC Pipe: ASTM D2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, annealed.
   1. Fittings: ASME B16.26, cast bronze.
   2. Joints: Flared.

B. PE Pipe: ASTM D2239, or ASTM D2447 Schedule 40.
   1. Fittings: ASTM D2609, PE.
   2. Joints: Mechanical with stainless steel clamp.

C. PE Pipe: AWWA C901.

2.05 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, annealed.
   1. Fittings: ASME B16.26, cast bronze.
   2. Joints: Flared.

B. PE Pipe: ASTM D2239, or ASTM D2447 Schedule 40.
   1. Fittings: ASTM D2609, PE.
   2. Joints: Mechanical with stainless steel clamp.

2.06 WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L .
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Fittings: Cast iron, coated.
   3. Joints: ASTM B32, alloy Sn95 solder.
   4. Joints: Grooved mechanical couplings.

2.07 PROPANE GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: NFPA 58, threaded or welded to ASME B31.1.

2.08 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:
   1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.09 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
      a. Cold and Hot Pipe Sizes 6 Inches and Over: Double hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.

4. Vertical Pipe Support: Steel riser clamp.
5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
6. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
    a. Bases: High density polypropylene.
    b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
    c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
    d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
    e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.
    f. Manufacturers:
        1) PHP Systems/Design; PHP Pipe Supports: www.phpsd.com.
        2) Substitutions: Refer to Refer to Section 01 25 13 - Product Substitution Procedures.

B. Plumbing Piping - Drain, Waste, and Vent:
1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, split ring.
2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
4. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:
1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, split ring.
2. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron pipe roll, double hanger.
5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
7. Wall Support for Hot Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
10. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
11. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
6. Other Types: As required.
7. Manufacturers:
    a. Powers Fasteners, Inc: www.powers.com.
    b. Substitutions: Refer to Refer to Section 01 25 13 - Product Substitution Procedures.

2.10 BALL VALVES

A. Manufacturers:
   1. Tyco Flow Control: www.tycoflowcontrol.com.
   2. Conbraco Industries: www.conbraco.com.
   3. Nibco, Inc: www.nibco.com.
   4. Milwaukee Valve Company: www.milwaukeevalve.com.
   5. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder; or threaded ends with union.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Provide support for utility meters in accordance with requirements of utility companies.

K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 91 00.

L. Install bell and spigot pipe with bell end upstream.

M. Install valves with stems upright or horizontal, not inverted.

N. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

O. Install water piping to ASME B31.9.

P. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

Q. Sleeve pipes passing through partitions, walls and floors.

R. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above; flush with top of; or recessed into and grouted flush with slab.

S. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9; ASTM F708; and MSS SP-89.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

3.04 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

3.05 SCHEDULES

A. Pipe Hanger Spacing:
1. Metal Piping:
   a. Pipe size: 1/2 inches to 1-1/4 inches:
      1) Maximum hanger spacing: 6.5 ft.
      2) Hanger rod diameter: 3/8 inches.
   b. Pipe size: 1-1/2 inches to 2 inches:
      1) Maximum hanger spacing: 10 ft.
      2) Hanger rod diameter: 3/8 inch.
   c. Pipe size: 2-1/2 inches to 3 inches:
      1) Maximum hanger spacing: 10 ft.
      2) Hanger rod diameter: 1/2 inch.
2. Plastic Piping:
   a. All Sizes:
      1) Maximum hanger spacing: 6 ft.
      2) Hanger rod diameter: 3/8 inch.

END OF SECTION

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SECTION 22 42 00

COMMERCIAL PLUMBING FIXTURES

PART 1 GENERAL

1.01 SCOPE

A. This section includes specifications for plumbing fixtures, faucets and trim.
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Quality Assurance.
      e. Shop Drawings.
      f. Operation and Maintenance Data.
      g. Design Criteria.
   2. PART 2 – PRODUCTS.
      a. Plumbing Fixtures.
   3. PART 3 – EXECUTION.
      a. Installation.

1.02 RELATED WORK

A. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.

1.03 REFERENCE

A. Applicable provisions of Division 1 shall govern work under this section.

1.04 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Plumbing products requiring approval by the State of Minnesota Dept. of Safety and Professional Services must be approved or have pending approval at the time of shop drawing submission.

1.05 SHOP DRAWINGS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Include data concerning sizes, utility sizes, rough in-dimensions, capacities, materials of construction, ratings, weights, trim, finishes, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

1.06 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.07 DESIGN CRITERIA

A. ANSI A112.6.1M-88 - Supports for Off-the Floor Plumbing Fixtures for Public Use.

B. ANSI A112.18.1-94 - Finished and Rough Brass Plumbing Fixture Fittings.

C. ANSI A112.19.1-90 - Enameled Cast Iron Plumbing Fixtures.

D. ANSI A112.19.2M-82 - Vitreous China Plumbing Fixtures.

E. ANSI A112.19.5-79(R1990) - Trim for Water Closet Bowls, Tanks and Urinals.

PART 2 PRODUCTS

2.01 PLUMBING FIXTURES

A. Manufacturers: Fixture descriptions establish fixture type, quality, materials, features and size. Products of the following manufacturers determined to be equal by the Engineer will be accepted.

1. Water Closets:
   a. American Standard: www.americanstandard-us.com.
   b. Kohler: www.kohler.com.
   c. Zurn: www.zurn.com.
   d. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.
2. Water Closet Seats:
   a. Bemis: www.bemisseats.com.
   b. Beneke: www.unique-toilet-seat.com.
   c. Centoco: www.centoco.com.
   d. Olsonite Sperzel: www.olsonite.com.
   e. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.
3. Urinals:
   a. American Standard: www.americanstandard-us.com.
   b. Kohler; www.kohler.com.
   c. Zurn, www.zurn.com.
   d. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.
4. Lavatories:
   a. American Standard: www.americanstandard-us.com.
   b. Kohler: www.kohler.com.
   c. Zurn: www.zorn.com.
   d. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.
5. Faucets:
   a. Chicago Faucet: www.chicagofaucet.com.
   b. Kohler: www.kohler.com.
   c. Speakman: www.speakmancompany.com.
   d. Symmons: www.symmons.com.
   e. Zurn: www.zurn.com.
   f. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.
6. Drains:
   a. Chicago Faucet: www.chicagofaucet.com.
   b. Engineered Brass Co.: www.justmfg.com.
   c. Kohler: www.kohler.com.
   d. McGuire: www.mcguiremfg.com.
   e. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.
7. Stops and Supplies (Heavy Duty Type Only):
   a. Chicago Faucet Co.: www.chicagofaucet.com.
   b. T&S Brass: www.tsbrass.com.
   c. McGuire: www.mcguiremfg.com.
   d. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.
8. Flush Valves:
   a. Coyne & Delany: www.delanyproducts.com.
   b. Sloan Royal: www.sloanvalve.com.
   c. Zurn AV: www.zurnproducts.com.
   d. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.
9. Traps (17 gauge Min.):

a. Kohler: www.kohler.com.
b. McGuire: www.mcguiremfg.com.
c. Dearborn: www.dearbornbrass.com.
d. Engineered Brass Co.: www.justmfg.com.
e. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

10. Carriers and Supports:
a. Josam: www.josam.com.
b. Smith: www.jrsmith.com.
c. Wade: www.wadedrains.com.
d. Watts Drainage: www.watts.com.
e. Zurn: www.zurn.com.
f. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

11. Mop Basins:
a. Fiat: www.fiat.ca.
b. Mustee: www.mustee.com.
c. Stern-Williams: www.sternwilliams.com.
d. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. WATER CLOSETS:
1. WC-1 - Floor mount bottom outlet white vitreous china jet close coupled tank type water closet with elongated bowl, 2-1/4" passageway, 16-1/2" barrier free height, and 1.28 gallon flush. ADA compliable.
a. Fixture: Kohler K-3658.
b. Seat: Bemis 1655-SS/C white solid plastic open front seat.
c. Supply & Stop: Chicago Faucet Co. No. 1013-CP w/ 3/8" closet riser.

C. LAVATORIES:
1. L-1 - Wall mount white vitreous china lavatory drilled for concealed arm carrier with 4" on center faucet openings.
a. Fixture: Kohler K-2005.
b. Faucet: Sloan ETF-600.
c. Drain: Kohler K-7715 perforated strainer and 1-1/4" tailpiece.
d. Trap: 1-1/4"x1-1/2" 17 ga. cast brass trap and tubular wall bend. With C.O. plug.
e. Supplies & Stops: Chicago Faucet No. 1017CP.
f. Carrier: Smith floor mounted concealed arm carrier adjusted for 34" height rim ht.

D. MOP BASINS:
1. MS-1 - Floor mounted mop basin, 24"x24", with 3" drain and stainless steel strainer.
a. Fixture: Fiat MSB-2424.
b. Faucet: Chicago Faucet No.897-CP with Watts 8BC vacuum breaker.
c. Hose: Fiat 832-AA.
d. Stops: (Integral with faucet).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing fixtures in accordance with manufacturer's instructions. Set level and plumb. Secure in place to counters, floors and walls providing solid bearing and secure mounting. Bolt fixture carriers to floor and wall. Secure rough-in fixture piping to prevent movement of exposed piping.

B. Install each fixture with trap easily removable for servicing and cleaning. Install fixture stops in readily accessible location for servicing.

C. Install barrier free fixtures in compliance with IBC 1108 and 3408, COMM 52, 69 and Federal ADA Accessibility Guidelines. Install barrier free lavatory traps parallel and adjacent to wall and supplies and stops elevated to 27" above floor to avoid contact by wheelchair users.

D. Each fixture shall have a stop valve installation to control the fixture. Stop valves shall be heavy duty type with brass stems and screwed or sweat inlet connections. Compression type inlets are not acceptable.

E. Cover pipe penetrations with escutcheons. Exposed traps, stops, piping and escutcheons to be chrome plated brass, same items in concealed locations may be of rough brass finish.

F. Set floor mounted water closets, floor mounted service sinks; counter mounted lavs and sinks; lav and sink faucets and drains with full setting bed of flexible non-staining plumber's putty. Cover exposed water closet bolts with bolt covers.

G. Set mop basins to floor and wall with grout or silicone sealant.

H. Seal openings between walls, floors and fixtures with mildew-resistant silicone sealant same color as fixture.

I. Test fixtures to demonstrate proper operation. Replace malfunctioning units or components. Adjust valves for intended water flow rate to fixtures without splashing, noise or overflow. Adjust self-closing lavatory faucets to 15 second cycle. Adjust shower valve temperature limit stops to 110 degree maximum outlet temperature.

J. Protect fixtures during construction. At completion clean plumbing fixtures and trim using manufacturer's recommended cleaning methods and materials.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.01 RELATED WORK

A. Section 07 84 00 - Firestopping.

B. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

C. Section 23 33 00 - Air Duct Accessories.

1.02 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.03 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in other sections are as follows:

1.	AABC	Associated Air Balance Council.
2.	ADC	Air Diffusion Council.
3.	AGA	American Gas Association.
4.	AMCA	Air Movement and Control Association.
5.	ANSI	American National Standards Institute.
6.	AHRI	Air-Conditioning, Heating and Refrigeration Institute.
7.	ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers.
8.	ASME	American Society of Mechanical Engineers.
9.	ASTM	American Society for Testing and Materials.
10.	EPA	Environmental Protection Agency.
11.	MCA	Mechanical Contractors Association.
12.	MICA	Midwest Insulation Contractors Association.
13.	MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
14.	NBS	National Bureau of Standards.
15.	NEBB	National Environmental Balancing Bureau.
16.	NEMA	National Electrical Manufacturers Association.
17.	NFPA	National Fire Protection Association.
18.	SMACNA	Sheet Metal and Air Conditioning Contractors' National Association. Inc.
19.	UL	Underwriters Laboratories Inc.
20.	ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
21.	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials.
22.	UL1479	Fire Tests of Through-Penetration Firestops.
23.	UL723	Surface Burning Characteristics of Building Materials.

1.04 QUALITY ASSURANCE

A. Refer to Division 1, General Requirements.

1.05 CONTINUITY OF EXISTING SERVICES

A. Do not interrupt or change existing services without prior written approval from the Owner Project Representative. When interruption is required, coordinate the down-time with the user agency to

minimize disruption to their activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

1.06 PROTECTION OF FINISHED SURFACES

A. Refer to Division 1, General Requirements.

1.07 SLEEVES AND OPENINGS

A. Refer to Division 1, General Requirements.

1.08 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between ductwork, piping, etc. and the sleeve, structural or partition opening shall be the responsibility of the Contractor whose work penetrates the opening. The Contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

B. Firestopping shall be UL listed and labeled for the actual application.

1.09 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Submittals must be reviewed, and approved by submitting Contractor.

C. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents.

D. Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the motor starter schedule on the electrical drawings. Include a statement on the shop drawing transmittal to the Engineer that the equipment submitted and the motor starter schedule is in agreement or indicate any discrepancies.

E. Include wiring diagrams of electrically powered equipment.

1.10 CERTIFICATES AND INSPECTIONS

A. Refer also to Division 1, General Conditions.

1.11 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Refer to Division 1, General Requirements.

B. Assemble material in three ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:
   1. Copies of all approved shop drawings.
   2. Manufacturer's wiring diagrams for electrically powered equipment.
   3. Records of tests performed to certify compliance with system requirements.
   4. Certificates of inspection by regulatory agencies.
   5. Temperature control record drawings and control sequences.
   6. Parts list for manufactured equipment.
   7. Valve schedules.
   8. Lubrication instructions, including list/frequency of lubrication done during construction.

9. Warranties.
10. Additional information as indicated in the technical specification sections.

C. Provide a PDF file copy of all Operation and Maintenance (O&M) Manuals.

PART 2 PRODUCTS

2.01 ACCESS PANELS AND DOORS

A. Lay-in Ceilings:
1. Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Section 09 51 23 are sufficient; no additional access provisions are required unless specifically indicated.

B. Concealed Spline Ceilings:
1. Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under Section 09 51 23.

C. Plaster Walls and Ceilings:
1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

2.02 IDENTIFICATION

A. Stencils:
1. Not less than 1 inch high letters/numbers for marking pipe and equipment.

B. Snap-On Pipe Markers:
1. Cylindrical self-coiling plastic sheet that snaps over piping insulation and is held tightly in place without the use of adhesive, tape or straps. Not less than 1 inch high letters/numbers and flow direction arrows for piping marking. W. H. Brady, Seton, Marking Services, or equal.

C. Engraved Name Plates:
a. White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite-Style EIP by EMED Co., or equal by Marking Services, Brimar Industries, Inc. or W. H. Brady.

D. Valve Tags:
1. Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains or brass "S" hooks around the valve stem, available from EMED Co., Seton Name Plate Company, Marking Services, Brimar Industries, Inc. or W. H. Brady.

2.03 SEALING AND FIRESTOPPING

A. Refer to Section 07 84 00 - Firestopping.

B. Fire and/or Smoke Rated Penetrations:
1. Manufacturers:
a. 3M: www.3m.com.
b. Hilti: www.hilti.com.
c. Rectorseal: www.rectorseal.com.

d. STI/SpecSeal: www.stifirestop.com.
e. Tremco: www.tremcosealants.com.
f. Substitutions: See Section 01 25 13 - Product Substitution Procedures.

2. All firestopping systems shall be provided by the same manufacturer.

C. Submittals:
1. Refer to Section 01 33 00 - Submittal Procedures.
2. Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.

D. Product:
1. Fire stop systems shall be UL listed or tested by an independent testing laboratory.
2. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
3. Contractor shall use firestop putty, caulk sealant, intumescent wrap strips, intumescent firestop collars, firestop blocks, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail. Do not use intumescent materials at fire damper, or smoke damper penetrations.

E. Non-Rated Penetrations:
1. Pipe Penetrations:
a. At pipe penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.
2. Duct Penetrations:
a. Annular space between duct (with or without insulation) and the non-rated partition or floor opening shall not be larger than 2 inch. Where existing openings have an annular space larger than 2 inch, the space shall be patched to match existing construction to within 2 inch around the duct.
b. Where shown or specified, pack annular space with fiberglass batt insulation or mineral wool insulation. Provide 4 inch sheet metal escutcheon around duct on both sides of partition or floor to cover annular space.

PART 3 EXECUTION

3.01 DEMOLITION

A. Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe or duct is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the Owner to minimize disruption to the existing building occupants.

B. All pipe, wiring and associated conduit, insulation, ductwork, and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor. All piping and ductwork specialties are to be removed from the site by the Contractor unless they are dismantled and removed or stored by the Owner. All designated equipment is to be turned over to the Owner for their use at a place and time so designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

3.02 CUTTING AND PATCHING

A. Refer to Division 1, General Requirements.

3.03 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this Contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.04 EQUIPMENT ACCESS

A. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Mechanical Contractor and installed by the General Contractor.

3.05 COORDINATION

A. Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, diffusers, register, grilles, and recessed or semi recessed heating and/or cooling terminal units installed in/on architectural surfaces.

B. Coordinate all work with other Contractors prior to installation. Any installed work that is not coordinated and that interferes with other Contractor's work shall be removed or relocated at the installing Contractor's expense.

C. Cooperate with the test and balance agency in ensuring Section 23 05 93 specification compliance. Verify system completion to the test and balance agency (flushing, pressure testing, chemical treatment, filling of liquid systems, proper pressurization and air venting of hydronic systems, clean filters, clean strainers, duct and pipe systems cleaned, controls adjusted and calibrated, controls cycled through their sequences, etc.), ready for testing, adjusting and balancing work. Install dampers, shutoff and balancing valves, flow measuring devices, gauges, temperature controls, etc., required for functional and balanced systems. Demonstrate the starting, interlocking and control features of each system so the test and balance agency can perform its work.

3.06 IDENTIFICATION

A. Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion. Do not label equipment such as cabinet heaters and ceiling fans in occupied spaces.

B. Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

C. Identify piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both side of the partition where exposed piping passes through walls, floors or roofs. Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a light background or white enamel against a dark background for stenciling, or provide snap-on pipe markers as specified in Part 2 - Products.

D. Identify valves with brass tags bearing a system identification and a valve sequence number. Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device or located in another room not visible from the terminal unit. Provide a typewritten valve schedule indicating the valve number and the equipment or areas supplied by each valve; locate schedules in each mechanical room and in each Operating and Maintenance manual. Schedules in mechanical rooms to be framed under clear plastic.

E. Use engraved name plates to identify control equipment.

3.07 SLEEVES

A. Pipe Sleeves:
1. Provide galvanized sheet metal sleeves for pipe penetrations through interior and exterior walls to provide a backing for sealant or firestopping. Patch wall around sleeve to match adjacent wall construction and finish. Grout area around sleeve in masonry construction. In finished spaces where pipe penetration through wall is exposed to view, sheet metal sleeve shall be installed flush with face of wall.
2. Pipe sleeves are not required in interior non-rated drywall, plaster or wood partitions and sleeves are not required in existing poured concrete walls where penetrations are core drilled.
3. Pipe sleeves in new poured concrete construction shall be schedule 40 steel pipe (sized to allow insulated pipe to run through sleeve), cast in place.
4. Extend the top of sleeve 1 inch above the adjacent floor in piping floor penetrations located in the mechanical rooms and wet locations listed below. In finished areas sleeves shall be flush with rough floor.

B. Duct Sleeves:
1. Duct sleeves are not required in non-rated partitions or floors.
2. Provide sleeve required for fire dampers in fire-rated partitions and floors. Reference fire damper details on drawings.
3. For duct penetrations through mechanical room floors and wet locations listed below, provide 1-1/2" x 1-1/2" x 1/8" galvanized steel angles fastened to floor around the perimeter of the duct opening to prevent water from getting to floor opening. Provide urethane caulk between angles and floor and fasten angles to floor 8" on center. Seal corners water tight with urethane caulk.

3.08 SEALING AND FIRESTOPPING

A. Fire and/or Smoke Rated Penetrations:
1. Install approved product in accordance with the manufacturer's instructions where pipes penetrate a fire/smoke rated surface. When pipe is insulated, use a product which maintains the integrity of the insulation and vapor barrier. Provide a UL label at each penetration.
2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.

B. Non-Rated Partitions:
1. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.
2. Duct penetrations through non-rated partitions shall require sheet metal escutcheons with fiberglass or mineral wool insulation fill for spaces that include laboratories, clean rooms, animal rooms, kitchens, cart wash rooms, janitor closets, cart wash rooms, toilet rooms, mechanical rooms, conference rooms, private consultation rooms, and where noted on drawings elsewhere.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SCOPE

A. This section includes specifications for supports of all HVAC equipment and materials as well as piping system anchors. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Quality Assurance.
      f. Description.
      g. Shop Drawings.
      h. Design Criteria.
   2. PART 2 – PRODUCTS.
      a. Pipe Hanger and Support Manufacturers.
      b. Structural Supports.
      c. Pipe Hangers and Supports.
      d. Wood Structure Supports.
      e. Beam Clamps.
      f. Concrete Inserts.
      g. Pipe Penetrations through Roof.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Hanger and Support Spacing.
      c. Pipe Penetration through Roof.

1.02 RELATED WORK

A. Section 23 07 00 - HVAC Insulation.

1.03 REFERENCE

A. Applicable provisions of Division 1 shall govern work under this section.

1.04 REFERENCE STANDARDS

A. MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture.

B. MSS SP-59 Pipe Hangers and Supports - Selection and Application.

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.06 DESCRIPTION

A. Provide all supporting devices as required for the installation of mechanical equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for pressure piping.

B. Do not hang any mechanical item directly from a metal deck or run piping so it rests on the bottom chord of any truss or joist.

C. Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

D. Protect insulation at all hanger points; see Related Work above.

1.07 SHOP DRAWINGS

A. Refer to Section 01 33 00 - Submittal Procedures.

1.08 DESIGN CRITERIA

A. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 and SP-69 unless noted otherwise.

B. Piping flexible connections and vibration isolation supports are required for piping connected to coils that are in a fan assembly where the entire assembly is mounted on vibration supports; the vibration isolation supports are required for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Piping flexible connection and vibration isolation supports are not required when the fan section is separately and independently isolated by means of vibration supports and duct flexible connections. Standard pipe hangers/supports as specified in this section are required when there are no vibration isolation devices in the piping and beyond the 100 pipe diameter/3 support distance.

C. Piping supported by laying on the bottom chord of joists or trusses will not be accepted.

D. Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

E. Allow sufficient space between adjacent pipes and ducts for insulation, valve operation, routine maintenance, etc.

PART 2 PRODUCTS

2.01 PIPE HANGER AND SUPPORT MANUFACTURERS

A. Anvil, B-Line, Fee and Mason, Kindorf, Michigan Hanger, Unistrut, or approved equal. Anvil figure numbers are listed below; equivalent material by other manufacturers is acceptable.

2.02 STRUCTURAL SUPPORTS

A. Provide all supporting steel required for the installation of mechanical equipment and materials, whether or not it is specifically indicated or sized, including angles, channels, beams, etc. to suspend or floor support tanks and equipment.

2.03 PIPE HANGERS AND SUPPORTS

A. Hangers For Steel Pipe Sizes 1/2” Through 2”:
   1. Carbon steel, adjustable, clevis, black finish. Anvil figure 65 or 260.

B. Multiple or Trapeze Hangers:
   1. Steel channels with welded spacers and hanger rods if calculations are submitted.

C. Wall Support:
   1. Welded steel bracket with hanger. B-Line 3068 Series, Anvil 194 Series.

2. Perforated epoxy painted finish, 16-12 gauge min., steel channels securely anchored to wall structure with interlocking, split type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-2000 series clamps, Anvil type AS200 H with AS 1200 clamps. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Anvil cushion clamp assembly.

D. Floor Support for Pipe Sizes through 4":
1. Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

E. Copper Pipe Support:
1. Carbon steel ring, adjustable, copper plated or polyvinylchloride coated.

F. Insulation Protection Shields:
1. Galvanized carbon steel of not less than 18 gauge for use on insulated pipe 2-1/2 inch and larger. Minimum shield length is 12 inches. Equal to Anvil figure 167.

G. Steel Hanger Rods:
1. Threaded both ends, threaded one end, or continuous threaded, black finish.
2. Size rods for individual hangers and trapeze support as indicated in the following schedule.
3. Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8
2710	3/4
3770	7/8
4960	1
8000	1-1/4

4. Provide rods complete with adjusting and lock nuts.

2.04 WOOD STRUCTURE SUPPORTS

A. Carbon steel pipe short strap for piping 1/2" through 2". Fastened with two No. 24 x 2 (minimum size) wood screws. Anvil Figure 262.

B. Carbon steel coach screw rods machine threaded on opposite ends, minimum 3/8" diameter. Anvil Figure 142.

C. Carbon steel side beam bracket with minimum 3/8" rod size and fastened with minimum 1/2" x 3" lag screws. Anvil Figure 207

2.05 BEAM CLAMPS

A. MSS SP-69 Type 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick for single threaded rods of 3/8, 1/2, and 5/8 inch diameter, for use with pipe sizes 4 inch and less. Furnish with a hardened steel cup point set screw. Anvil figure 86.

B. MSS SP-69 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter but limited in application to pipe sizes 8 inch and less without prior approval. Anvil figure 228.

2.06 CONCRETE INSERTS

A. Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor. Hilti, Rawl, Redhead.

2.07 PIPE PENETRATIONS THROUGH ROOF

A. Multiple Pipe Penetrations:
   1. Refer to acceptable Equipment Curb types listed above for curb specifications. An 8" high (minimum) curb height is required. The coping cap shall be constructed from laminated acrylic clad thermoplastic (ABS) with graduated step boots to accommodate various size pipes, stainless steel fastening screws for cover, stainless steel band clamps for securing boots around the pipe, and stainless steel band clamp or mechanical locking seal for securing boots around the ABS coping cap flanges.

B. Single Pipe Penetrations:
   1. A stack flashing penetration may be utilized for single pipe penetrations through built up roofs and single ply membrane roofs. Utilize high temperature sealant for all high temperature applications. This includes but is not limited to steam condensate vent piping, steam safety relief piping, and flues.
   2. A single pre-manufactured boot may be utilized for single pipe penetrations through single ply membrane roofs only.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install supports to provide for free expansion of the piping and duct system. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

B. Piping shall be supported independently from ductwork and all other trades.

C. Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes for the supporting steel.

D. Perform all welding in accordance with standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding. Welds shall show uniform section, smoothness of weld metal and freedom from porosity and clinkers. Where necessary to achieve smooth connections, joints shall be dressed smooth.

3.02 HANGER AND SUPPORT SPACING

A. Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

B. Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

C. Support riser piping independently of connected horizontal piping.

D. Adjust hangers to obtain the slope specified in the piping section of this specification.

E. Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Spacing
Steel	1/2" through 1-1/4"	6'-6"
Steel	1-1/2" through 6"	10'-0"
Steel	8" through 12"	14'-0"
Steel	14" and over	20'-0"
Thermoplastic	All sizes	6'-0"
Copper	1/2" through 1-1/4"	5'-0"
Copper	1-1/2" and larger	8'-0"

3.03 PIPE PENETRATION THROUGH ROOF

A. Install at points where pipes penetrate roof. Install as shown on the drawings, as detailed and according to the manufacturer's installation instructions. Flashing and counter flashing by the General Contractor.

END OF SECTION

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SECTION 23 05 93

TESTING, ADJUSTING AND BALANCING FOR HVAC

1.01 SCOPE

A. This section includes air and water testing, adjusting and balancing for the entire project. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Description.
      f. Quality Assurance.
      g. Pre-Installation Meeting and Scheduling.
      h. Submittals.
   2. PART 2 – PRODUCTS.
      a. Instrumentation.
   3. PART 3 – EXECUTION.
      a. Preliminary Procedures.
      b. Performing Testing, Adjusting and Balancing.
      c. Deficiencies.

1.02 RELATED WORK

A. Section 23 05 00 - Common Work Results for HVAC.

B. Section 23 07 00 - HVAC Insulation.

C. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

1.03 REFERENCE

A. Applicable provisions of the General Conditions, Supplementary General Conditions and General Requirements in Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. AABC — National Standards for Total System Balance, Sixth Edition, 2002.

B. ASHRAE — ASHRAE Handbook, 2007 HVAC Applications, Chapter 37, Testing Adjusting and Balancing.

C. NEBB — Procedural Standards for Testing Adjusting Balancing of Environmental Systems, Seventh Edition, 2005.

1.05 DESCRIPTION

A. The Contractor will separately contract with an independent test and balance agency to perform all testing, adjusting, and balancing of air and hydronic systems required for this project. Work related to the testing, adjusting, and balancing that must be performed by the installing mechanical Contractor is specified in other section of these specifications.

B. Provide total mechanical systems testing, adjusting and balancing. Requirements include the balance of air and water distribution, adjustment of new and existing systems and equipment to provide design requirements indicated on the drawings, electrical measurement and verification of

performance of all mechanical equipment, all in accordance with standards published by AABC or NEBB.

C. Test, adjust and balance all air and hydronic systems so that each room, piece of equipment or terminal device meets the design requirements indicated on the drawings and in the specifications.

D. Accomplish testing, adjusting and balancing work in a timely manner that allows partial occupancy of major buildings, occupancy of one building when the project involves many buildings, and completion of the entire project in the time stated in the Instruction to Bidders and in accordance with the completion schedule established for this project.

E. Verify that provisions are being made to accomplish the specified testing, adjusting and balancing work. If problems are found, handle as specified in Part 3 under Deficiencies.

1.06 QUALITY ASSURANCE

A. Qualifications:
1. An independent Firm specializing in the Testing and Balancing of HVAC systems for a minimum of 3 years. A Firm not engaged in the commerce of furnishing or providing equipment or material generally related to HVAC work other than that specifically related to installing Testing and Balancing components necessary for work in this section such as, but not limited to sheaves, pulleys, and balancing dampers.
2. A certified member of AABC or certified by NEBB in the specific area of work performed. Maintain certification for the entire duration of the project. If certification of firm or any staff performing work is terminated or expires during the duration of the project, contact Owner immediately.
3. Technicians on this project must have satisfactorily completed work on a minimum of (3) three projects of at least 50% in size, and of similar complexity.
4. Submit Qualifications of firm and project staff to Owner upon request.

1.07 PRE-INSTALLATION MEETING AND SCHEDULING

A. The test and balance agency is required to attend a pre-installation meeting with all other project Contractors before the construction process is started. The test and balance agency shall give the Lead Contractor a detailed schedule of testing and balancing tasks for incorporation into the project schedule. Reference General Conditions Article 12 for Lead Contractor responsibilities for scheduling.

1.08 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures. See also Related Work in this section.

B. Submit testing, adjusting and balancing reports bearing the seal and signature of the NEBB or AABC Certified Test and Balance Supervisor. The reports certify 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 and are operating; and are an accurate record of all final quantities measured to establish normal operating values of the systems.

C. Submission:
1. Distribute electronic copies of the Report to the Contractor, the Lead Contractor, the Owner, and the Prime Engineer.

D. Enter a RFI, with a copy of the Testing and Balancing Report Summary as an upload, indicating that the Testing and Balancing Report is posted on the Overview page and requesting review of the report.
1. Format: Cover page identifying project name, project number and descriptive title of contents. Divide the contents of the report into the below listed divisions:
a. General Information.

b. Summary.
c. Air Systems.
d. Hydronic Systems.
e. Special Systems.

2. Contents: Provide the following minimum information, forms and data:
   a. General Information: Inside cover sheet identifying Test and Balance Agency, Contractor, Architect, Engineer, Project Name and Project Number. Include addresses, contact names and telephone numbers. Also include a certification sheet containing the seal and signature of the Test and Balance Supervisor.
   b. Summary: Provide summary sheet describing mechanical system deficiencies. Describe objectionable noise or drafts found during testing, adjusting and balancing. Provide recommendations for correcting unsatisfactory performances and indicate whether modifications required are within the scope of the contract, are design related or installation related. List instrumentation used during testing, adjusting and balancing procedures.
   c. The remainder of the report to contain the appropriate standard NEBB or AABC forms for each respective item and system. Fill out forms completely. Where information cannot be obtained or is not applicable indicate same.

PART 2 PRODUCTS

2.01 INSTRUMENTATION

A. Provide all required instrumentation to obtain proper measurements. Application of instruments and accuracy of instruments and measurements to be in accordance with the requirements of NEBB or AABC Standards and instrument manufacturer's specifications.

B. All instruments used for measurements shall be accurate, and calibration histories for each instrument to be available for examination by Owner upon request. Calibration and maintenance of all instruments to be in accordance with the requirements of NEBB or AABC Standards

PART 3 EXECUTION

3.01 PRELIMINARY PROCEDURES

A. Review preconstruction meeting report, applicable construction bulletins, applicable change orders and approved shop drawings of equipment, outlets/inlets and temperature controls.

B. Check filters for cleanliness, dampers and valves for correct positioning, equipment for proper rotation and belt tension, temperature controls for completion of installation and hydronic systems for proper charge and purging of air.

C. Notify Owner's Project Representative on a daily basis during balancing. Identify deficiencies preventing completion of testing, adjusting and balancing procedures. Do not proceed until systems are fully operational with all components necessary for complete testing, adjusting and balancing. Installing Contractors are required to provide personnel to check and verify system completion, readiness for balancing and assist Balancing Agency in providing specified system performance.

3.02 PERFORMING TESTING, ADJUSTING AND BALANCING

A. Perform testing, adjusting and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards except as may be modified below.

B. Unless specifically instructed in writing, all work in this specification section is to be performed during the normal workday.

C. In areas containing ceilings, remove ceiling tile to accomplish balancing work; replace tile when work is complete and provide new tile for any tile that are damaged by this procedure. If the ceiling construction is such that access panels are required for the work of this section and the panels have not been provided, inform the Owner's Project Representative.

D. Cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary for adequate performance of procedures. Patch using materials identical to those removed, maintaining vapor barrier integrity and pressure rating of systems.

E. In air systems employing filters, blank off sufficient filter area to simulate a pressure drop that is midway between that of a clean filter and that of a dirty filter.

F. Measure and record system measurements at the fan and/or pump to determine total flow. Adjust equipment as required to yield specified total flow at terminals. Proceed taking measurements in mains and branches as required for final terminal balancing. Perform terminal balancing to specified flows balancing branch dampers, deflectors, extractors and valves prior to adjustment of terminals.

G. Measure and record static air pressure conditions across fans, coils and filters. Indicate in report if cooling coil measurements were made on a wet or dry coil and if filter measurements were made on a clean or dirty filter. Spot check static air pressure conditions directly ahead of terminal units.

H. Adjust outside air, return air and relief air dampers for design conditions at both the minimum and maximum settings and record both sets of data. Balance modulating dampers at extreme conditions and record both sets of data. Balance variable air volume systems at maximum air flow rate, full cooling, and minimum flow rate, full heating; record all data.

I. Adjust register, grille and diffuser vanes and accessories to achieve proper air distribution patterns and uniform space temperatures free from objectionable noise and drafts within the capabilities of the installed system.

J. Provide fan and motor drive sheave adjustments necessary to obtain design performance. Provide drive changes specifically noted on drawings, if any. If work of this section indicates that any drive or motor is inadequate for the application, advise the Owner's project representative by giving the representative properly sized motor/drive information (in accordance with manufacturers original service factor and installed motor horsepower requirements); Confirm any change will keep the duct/piping system within its design limitations with respect to speed of the device and pressure classification of the distribution system. Required motor/drive changes not specifically noted on drawings or in specifications will be considered an extra cost and will require an itemized cost breakdown submitted to Owner's project representative. Prior authorization is needed before this work is started.

K. Areas or rooms designed to maintain positive, negative or balanced air pressures with respect to adjacent spaces, as indicated by the design air quantities, require special attention. Adjust fan drives, distribution dampers, terminals and controls to maintain indicated pressure relationship.

L. Final air system measurements to be within the following range of specified cfm:

1.	Fans	0% to +10%.
2.	Supply grilles, registers, diffusers	0% to +10%.
3.	Return/exhaust grilles, registers	0% to -10%.
4.	Room pressurization air	-5% to +5%.

M. Contact the temperature control Contractor for assistance in operation and adjustment of controls during testing, adjusting and balancing procedures. Cycle controls and verify proper operation and setpoints. Include in report description of temperature control operation and any deficiencies found.

N. Permanently mark equipment settings, including damper and valve positions, control settings, and similar devices allowing settings to be restored. Set and lock memory stops.

O. Leave systems in proper working order, replacing belt guards, closing access doors and electrical boxes, and restoring temperature controls to normal operating settings.

P. Coordinate air handling unit minimum outside air set points with the Temperature Control Contractor.

3.03 DEFICIENCIES

A. Division 23 Contractor to correct any installation deficiencies found by the test and balance agency that were specified and/or shown on the Contract Documents to be performed as part of that division of work. Test and balance agency will notify the Owner's Project Representative of these items and instructions will be issued to the Division 23 Contractor for correction of the deficient work. All corrective work to be done at no cost to the Owner. Retest mechanical systems, equipment, and devices once corrective work is complete as specified.

END OF SECTION

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SECTION 23 07 00

HVAC INSULATION

PART 1 GENERAL

1.01 SCOPE

A. This section includes insulation specifications for heating, ventilating and air conditioning piping, ductwork and equipment. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference Standards.
      d. Quality Assurance.
      e. Description.
      f. Definitions.
      g. Shop Drawings.
      h. Operation and Maintenance Data.
      i. Environmental Requirements.
   2. PART 2 – PRODUCTS.
      a. Materials.
      b. Insulation Types.
      c. Accessories.
   3. PART 3 – EXECUTION.
      a. Examination.
      b. Installation.
      c. Piping, Valve and Fitting Insulation.
      d. Pipe Insulation Schedule.
      e. Duct Insulation.
      f. Duct Insulation Schedule.

1.02 RELATED WORK

A. Section 23 05 00 - Common Work Results for HVAC.

B. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

C. Section 23 31 00 - HVAC Ducts and Casings.

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. ASTM B209 Aluminum and Aluminum Alloy Sheet and Plate.

B. ASTM C165 Test Method for Compressive Properties of Thermal Insulations.

C. ASTM C177 Heat Flux and Thermal Transmission Properties.

D. ASTM C195 Mineral Fiber Thermal Insulation Cement.

E. ASTM C240 Cellular Glass Insulation Block.

F. ASTM C302 Density of Preformed Pipe Insulation.

G.	ASTM C303	Density of Preformed Block Insulation.
H.	ASTM C355	Test Methods for Test for Water Vapor Transmission of Thick Materials.
I.	ASTM C449	Mineral Fiber Hydraulic Setting Thermal Insulation Cement.
J.	ASTM C518	Heat Flux and Thermal Transmission Properties.
K.	ASTM C533	Calcium Silicate Block and Pipe Thermal Insulation.
L.	ASTM C534	Preformed Flexible Elastomeric Thermal Insulation.
M.	ASTM C547	Mineral Fiber Preformed Pipe Insulation.
N.	ASTM C552	Cellular Glass Block and Pipe Thermal Insulation.
O.	ASTM C553	Mineral Fiber Blanket and Felt Insulation.
P.	ASTM C578	Preformed, Block Type Cellular Polystyrene Thermal Insulation.
Q.	ASTM C591	Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
R.	ASTM C610	Expanded Perlite Block and Thermal Pipe Insulation.
S.	ASTM C612	Mineral Fiber Block and Board Thermal Insulation.
T.	ASTM C921	Properties of Jacketing Materials for Thermal Insulation.
U.	ASTM C1136	Flexible Low Permeance Vapor Retarders for Thermal Insulation.
V.	ASTM D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers Tension.
W.	ASTM D1000	Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications.
X.	ASTM D1621	Standard Test Method for Compressive Properties Of Rigid Cellular Plastics.
Y.	ASTM D1622	Standard Test Method for Apparent Density of Rigid Cellular Plastics.
Z.	ASTM D1940	Method of Test for Porosity of Rigid Cellular Plastics.
AA.	ASTM D2126	Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
BB.	ASTM D2240	Standard Test Method for Rubber Property—Durometer Hardness.
CC.	ASTM E84	Surface Burning Characteristics of Building Materials.
DD.	ASTM E814	Standard Test Method for Fire Tests of Penetration Firestop Systems.
EE.	ASTM E2336	Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.
FF.	MICA	National Commercial & Industrial Insulation Standards.
GG.	NFPA 225	Surface Burning Characteristics of Building Materials.
HH.	UL 723	Surface Burning Characteristics of Building Materials.

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions.

B. Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

C. Insulation systems shall be applied by experienced Contractors. Within the past five (5) years, the Contractor shall be able to document the successful completion of a minimum of three (3) projects of at least 50% of the size and similar scope of the work specified in this section.

1.06 DESCRIPTION

A. Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:
   1. Pipe Insulation.
   2. Duct Insulation.
   3. Equipment Insulation.

B. Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the Owner Project Representative.

1.07 DEFINITIONS

A. Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

1.08 SHOP DRAWINGS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

1.09 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not store insulation materials on grade or where they are at risk of becoming wet. Do not install insulation products that have been exposed to water.

B. Protect installed insulation work with plastic sheeting to prevent water damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manufacturers:
   1. Armacell: www.armacell.com.
   2. Certainteed: www.certainteed.com.
   3. Manson: www.imanson.com.

4. Fibrex: www.fibrexinsulations.com.
5. H.B. Fuller: www.hbfuller.com.
6. Imcoa: www.nomaco.com.
7. Johns Manville: www.johnsmanville.com.
8. Knauf: www.knaufusa.com.
9. Owens-Corning: www.insulation.owens-corning.com.
10. Rubatex: www.rubatex.com.
11. VentureTape: www.venturetape.com.
12. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Materials or accessories containing asbestos will not be accepted.

C. Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions:
1. Pipe insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 50 when tested in accordance with UL 723 and ASTM E84.

2.02 INSULATION TYPES

A. Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

B. Flexible Fiberglass Insulation:
1. Minimum nominal density of 0.75 lbs. per cu. ft., and thermal conductivity of not more than 0.3 at 75 degrees F, rated for service to 250 degrees F.

C. Rigid Fiberglass Insulation:
1. Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.

D. Semi-Rigid Fiberglass Insulation:
1. Minimum nominal density of 3 lbs. per cu. ft., thermal conductivity of not more than 0.28 at 75 degrees F, minimum compressive strength of 125 PSF at 10% deformation, rated for service to 450 degrees F. Insulation fibers perpendicular to jacket and scored for wrapping cylindrical surfaces.

E. Elastomeric Insulation:
1. Flexible closed cell, minimum nominal density of 5.5 lbs. per cu. ft., thermal conductivity of not more than 0.27 at 75 degrees F, minimum compressive strength of 4.5 psi at 25% deformation, maximum water vapor permeability of 0.17 perm inch, maximum water absorption of 6% by weight, rated for service range of -20 degrees F to 220 degrees F on piping and 180 degrees F where adhered to equipment.

F. Polyolefin Insulation:
1. Flexible closed cell, minimum nominal density of 1.5 lbs. per cu. ft., thermal conductivity of not more than 0.24 at 75 degrees F, minimum compressive strength of 5 psi at 25% deformation, maximum water vapor permeability of 0.0 perm inch, maximum water absorption of 0% by weight and volume, rated for service range of -165 degrees F to 210 degrees F.

G. Phenolic Insulation:
1. Rigid closed cell, minimum nominal density of 2.2 lbs. per cu. ft., thermal conductivity of not more than 0.13 at 75 degrees F, minimum compressive strength of 31 psi parallel and 18 psi perpendicular, maximum water vapor permeability 0.117 perm inch, maximum water absorption of .5% by volume, rated for service range of -290 degrees F to 250 degrees F.

H. Extruded Polystyrene Insulation:
   1. Rigid closed cell, minimum nominal density of 1.6 lbs. per cu. ft., thermal conductivity of not more than 0.285 at 75 degrees F, minimum compressive strength of 20 psi, maximum water vapor permeability of 1.5 perm inch, maximum water absorption of .5 % by volume, rated for service range of -290 degrees F to 165 degrees F.

I. Polyisocyanurate Insulation:
   1. Rigid closed cell polyisocyanurate, minimum nominal density of 2.0 lbs. per cu. ft., thermal conductivity of not more than 0.19 at 75 degrees F aged 180 days, minimum compressive strength of 24 psi parallel and 13 psi perpendicular, maximum water vapor permeability of 4 perm inch, maximum water absorption of 2% by volume, rated for service range of -290 degrees F to 300 degrees F.

J. Cellular Glass Insulation:
   1. Rigid closed cell, minimum nominal density of 8.5 lbs. per cu. ft., thermal conductivity of not more than 0.36 at 50 degrees F, minimum compressive strength of 100 psi, maximum water vapor permeability of 0.0 perm inch, maximum water absorption of .2% by volume, rated for service range of -450 degrees F to 900 degrees F.

K. Pipe insulation shall be pre-formed in two (2) half cylinder sections. Cut V-groove sheet insulation is not acceptable. Provide three (3) stainless steel bands for each section of insulation.

2.03 ACCESSORIES

A. All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.

B. Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

C. Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.

D. Tack fasteners to be stainless steel ring grooved shank tacks.

E. Staples to be clinch style.

F. Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

G. Finishing cement to be ASTM C449.

H. Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.

I. Bedding compounds to be non-shrinking and permanently flexible.

J. Vapor barrier coatings to have maximum applied water vapor permeance of .05 perms.

K. Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that all piping, equipment, and ductwork are tested and approved prior to installing insulation. Do not insulate systems until testing and inspection procedures are completed.

B. Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

3.02 INSTALLATION

A. All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards. Do not install products when the ambient temperature or conditions are not consistent with the manufacturer's recommendations. Surfaces to be insulated must be clean and dry.

B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.

C. Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Provide neatly beveled and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates.

D. Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

E. Use full length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

F. All pipe and duct insulation shall be continuous through walls, ceiling or floor openings and through sleeves except where firestop or firesafing materials are required. Vapor barriers shall be maintained continuous through all penetrations.

G. Provide a continuous unbroken moisture vapor barrier on insulation applied to systems noted below. Attachments to cold surfaces shall be insulated and vapor sealed to prevent condensation.

H. Provide a complete vapor barrier for insulation on the following systems:
   1. Refrigerant.
   2. Insulated Duct.
   3. Equipment, ductwork or piping with a surface temperature below 65 degrees F.

3.03 PIPING, VALVE, AND FITTING INSULATION

A. General:
   1. Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2 inch lap on jacket seams and 2 inch tape on butt joints, firmly cemented with lap adhesive unless otherwise noted. Additionally secure with staples along seams and butt joints. Coat staples, longitudinal and transverse seams with vapor barrier mastic on systems requiring vapor barrier.
   2. Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of insulation. Where a vapor barrier is not required or where roller hangers are not being used, hangers and supports may be attached directly to piping with insulation completely covering hanger or support and jacket sealed at support rod penetration. Where riser clamps are required to be attached directly to piping requiring vapor barrier, extend insulation and vapor barrier jacketing/coating around riser clamp.
   3. Where insulated piping is installed on hangers and supports, the insulation shall be installed continuous through the hangers and supports. High density inserts shall be provided as required to prevent the weight of the piping from crushing the insulation. Pipe shields are required at all support locations. The insulation shall not be notched or cut to accommodate the supporting channels.

B. Insulation Inserts and Pipe Shields:
   1. Provide pipe shields at all hanger and support locations. Rigid insulation inserts shall be installed between the pipe and the insulation shields. Quantity and placement of inserts shall be according to the manufacturer's installation instructions; however the inserts shall be no less than 12 inches in length. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required for system.

2. Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4 inch and smaller copper piping provided 12 inch long 22 gauge pipe shields are used.

C. Fittings and Valves:
1. Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up insulation of the same thickness as adjoining insulation. Where the ambient temperature exceeds 150 degrees F, cover insulation with fabric reinforcing and mastic. Where the ambient temperatures do not exceed 150 degrees, furnish and install PVC fitting covers.

D. Closed Cell Elastomeric Thermal Insulation:
1. Flexible closed cell, thermal conductivity 0.245, water vapor transmission of 0.03 perm inch, UV resistance minimal change ASTM G 7 and ASTM G 90, fire rating will not contribute significantly to fire (simulated end-use testing), recommended service temperature range is -297 degrees F to 257 degrees, designed for installation above and below ground.
2. Flame spread rating of 25 or less and a smoke developed rating of 50 or less as tested by ASTM E 84 “Surface Burning Characteristics of Building Materials”.
3. Two step sealing system to insure a permanent seal. Step 1 an acrylic adhesive seam seal on the inside of the longitudinal joint. Step 2 EPDM flap that utilizes a cellular fusion adhesive that closes across the top of the longitudinal seam. This adhesive chemistry bonds the EPDM to the tube ensuring a seal for the life of the system. Butt joints and other seams are to be sealed with contact adhesive. Fittings can be fabricated from straight tubing or sheet. Larger diameter, curved, or flat surfaces can be insulated by adhering properly fabricated sheet sections to them.

E. Elastomeric and Polyolefin:
1. Where practical, slip insulation on piping during pipe installation when pipe ends are open. Miter cut fittings allowing sufficient length to prevent stretching. Completely seal seams and joints for vapor tight installation. For elastomeric insulation, apply full bed of adhesive to both surfaces. For polyeolefin, seal factory pre-glued seams with roller and field seams and joints with full bed of hot melt polyolefin glue to both surfaces. Cover elastomeric insulation on systems operating below 40 degrees F with vapor barrier mastic.

F. Extruded Polystyrene and Polyisocyanurate:
1. Fittings, valves, unions, flanges, couplings and specialties shall be insulated with factory molded insulation of the same thickness as adjoining insulation. Secure insulation sections with two wraps of nylon filament tape 9”-12” on center. On single insulation layer systems and on the outer layer of double insulation layer systems, apply a thin coat of elastomeric joint sealant rated for system operating temperatures to all longitudinal and butt insulation joints covering entire face of joint. Allow sealant to fully cure before applying protective covering. For piping service below 0^{o}F, use two layers of insulation with inner and outer butt and longitudinal joints staggered and offset 90 degrees. Where two layers of insulation are used, do not use sealant on the inner layer or adhere the inner layer to the outer layer. Apply vapor stop bead of joint sealant between pipe and insulation on both sides of valves, expansion/contraction joints, flanges, thermometers/gauges, attached vent and drain lines. Insulate attached non-circulated lines, control lines, vents, etc. for a minimum distance of 6 inches from pipe. Cover insulation with a protective jacket as specified below. Do not penetrate protective covering or insulation with mechanical fasteners.

3.04 PIPE INSULATION SCHEDULE

A. Provide insulation on new and existing remodeled piping as indicated in the following schedule:

Service	Insulation	Jacket	Insulation Thickness By Pipe Size				
			≤ 1-1/4”	1-1/2”	2” to < 4”	4” to 6”	8” and Larger
Refrigerant Suction:							
>40°F	Elast./Polyol	None	0.5”	1”	1.5”	1.5”	1.5”
40°F to 20°F	Elast./Polyol	None	1”	1.5”	1.5”	1.5”	1.5”
20°F to -20°F	Ext Poly/Polyiso	VRJ or SAJ	1.5”	2”	2”	2”	2.5”
-20°F to -60°F	Ext Poly/Polyiso	VRJ or SAJ	2”	2”	2.5”	2.5”	3”
Cold Water Piping	Rigid Fiberglass	ASJ	0.5”	0.5”	1”	1”	1”
Cooling Coil	Rigid Fiberglass	ASJ	0.5”	0.5”	1”	1”	1”

B. For systems with fluid temperatures 65° F or less, furnish and install removable elastomeric insulation covers, plugs or caps for all mechanical equipment and devices that require access by balancing Contractors or service and maintenance personnel. Examples include but are not limited to: flow sensing devices, circuit setters, manual ball valve air vents, drain valves, blowdown valves, pressure/temperature test plugs, grease fittings, pump bearing caps, equipment labels, etc. Covers shall be tight fitting to ensure a complete vapor barrier.

3.05 DUCT INSULATION

A. General:
1. Secure flexible duct insulation on sides and bottom of ductwork over 24 inch wide and all rigid duct insulation with weld pins. Space fasteners 18 inch on center or less as required to prevent sagging.
2. Secure rigid board insulation to ductwork with weld pins. Apply insulation with joints firmly butted as close as possible to the equipment surface. Pins shall be located a maximum of 3 inches from each edge and spaced no greater than 12 inch on center.
3. Install weld pins without damage to the interior galvanized surface of the duct. Clip pins back to washer and cover penetrations with tape of same material as jacket. Firmly butt seams and joints and cover with 4 inch tape of same material as jacket. Seal tape with plastic applicator and secure with staples. All joints, seams, edges and penetrations to be fully vapor sealed.
4. Stop and point insulation around access doors and damper operators to allow operation without disturbing insulation or jacket material.
5. External supply duct insulation is not required where ductwork contains continuous 1 inch acoustical liner. Provide 4 inch overlap of external insulation over ends of acoustically lined sections.
6. Where insulated ductwork is supported by trapeze hangers, the insulation shall be installed continuous through the hangers. Drop the supporting channels required to facilitate the installation of the insulation. Where rigid board or flexible insulation is specified, install high density inserts to prevent the weight of the ductwork from crushing the insulation.
7. Where insulated low temperature (below 45ºF) ductwork is supported by steel metal straps or wire ropes that are secured directly to the duct, the straps or ropes shall be completely covered with insulation and sealed to provide a complete vapor barrier.
8. Where insulated duct risers are supported by steel channels secured directly to the duct, extend the insulation and vapor barrier jacketing to encapsulate the support channels.

3.06 DUCT INSULATION SCHEDULE

A. Provide duct insulation on new and existing remodeled ductwork in the following schedule:

Service	Insulation Type	Jacket	Insulation Thickness
Outside air ducts	Rigid Fiberglass	FSJ	3”
Mixed air ducts	Rigid Fiberglass	FSJ	3”
Exhaust & relief ducts downstream of motorized back-draft dampers	Rigid Fiberglass	FSJ	2”

END OF SECTION

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SECTION 23 09 13

INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SCOPE

A. This section includes the end devices required for stand-alone control. Included in this section are the following topics:

1. PART 1 – GENERAL.
   a. Scope.
   b. Related Work.
   c. Reference.
   d. Quality Assurance.
   e. Reference Standards.
   f. Submittals.
   g. Design Criteria.
   h. Operation and Maintenance Data.
   i. Material Delivery and Storage.
2. PART 2 – PRODUCTS.
   a. Manufacturers.
   b. Control Dampers.
   c. Control Valves.
   d. Electric/Electronic Thermostats.
   e. Time Clocks.
3. PART 3 – EXECUTION.
   a. Installation.
   b. Control Valves.
   c. Electric/Electronic Room Thermostats.
   d. Time Clocks.

1.02 RELATED WORK

A. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC – Coordination.

B. Section 23 33 00 - Ductwork Accessories - for control damper installation.

C. Division 23 - HVAC - Equipment provided to be controlled or monitored.

D. Division 26 - Electrical - Installation requirements & Equipment provided to be controlled or monitored.

E. Division 28 - Electronic Safety and Security.

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 QUALITY ASSURANCE

A. Installing Contractor must be a manufacturer's branch office or an authorized representative of the control equipment manufacturer that provides engineering and commissioning of the manufacturers control equipment, submit written confirmation of such authorization from the manufacturer. Indicate in letter of authorization that installing Contractor has successfully completed all necessary

training required for engineering, installation, and commissioning of equipment and systems to be provided for the project, and that such authorization has been in effect for a period of not less than three years.

1.05 REFERENCE STANDARDS

A. ANSI B16.22 - Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings.

B. ANSI/ASTM B32 - Specification for Solder Metal.

C. ASTM B75 - Seamless Copper Tube.

D. ASTM D1693 - Environmental Stress-Cracking of Ethylene Plastics.

E. ASTM D 635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

F. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

G. AMCA 500-D - Laboratory Method of Testing Dampers for Rating.

1.06 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Include the following information:
   1. Manufacturer's data sheets indicating model number, pressure/temperature ratings, capacity, methods and materials of construction, installation instructions, and recommended maintenance. General catalog sheets showing a series of the same device is not acceptable unless the specific model is clearly marked.

1.07 DESIGN CRITERIA

A. Size all control apparatus to properly supply and/or operate and control the apparatus served.

B. When devices are identical the product shall be from one manufacturer.

C. Provide all required components not specifically indicated or specified but necessary for a completely functioning system.

D. Use only UL labeled products that comply with NEMA Standards. Electrical components and installation to meet all requirements of the electrical sections (Division 26) of project specifications.

1.08 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.09 MATERIAL DELIVERY AND STORAGE

A. Provide factory shipping cartons for each piece of equipment and control device. This Contractor is responsible for storage of equipment and materials inside and protected from the weather.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Johnson Controls, Inc.: www.johnsoncontrols.com.

B. Honeywell: www.honeywell.com.

C. Siemens: www.siemens.com.

D. Invensys: www.invensys.com.

E. Trane: www.trane.com.

F. Kreuter: www.kreuter.com.

G. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.02 CONTROL DAMPERS

A. Provide control dampers shown on the plans and as required to perform the specified functions. Dampers shall be rated for velocities that will be encountered at maximum system design and rated for pressure equal or greater than the ductwork pressure class as specified in Section 23 31 00 of the ductwork where the damper is installed.

B. Use only factory fabricated dampers with mechanically captured replaceable resilient blade seals, stainless steel jamb seals and with entire assembly suitable for the maximum temperature and air velocities encountered in the system.

C. Dampers in galvanized ductwork shall be constructed of galvanized steel and/or aluminum.

D. All dampers, unless otherwise specified, to be rated at a minimum of 180 ºF working temperature. Leakage testing shall be certified to be based on latest edition of AMCA Standard 500-D and all dampers, unless otherwise specified, shall have leakage ratings as follows:

Damper Class	Differential Pressure	Leakage
Class IA	1” w.g.	≤3 CFM/ft^2
Class I	4” w.g.	≤8 CFM/ft^2
Class I	8” w.g.	≤11 CFM/ft^2
Class I	12” w.g.	≤14 CFM/ft^2

E. Leakage rate dampers for differential pressures that they will encounter at maximum system design pressures.

F. Steel framed dampers: Nailor models 2010 & 2020; Greenheck models VCD-33 & VCD-42; Johnson Controls model V-1330; Ruskin Models CD60 & CD40; other approved equal.

G. Aluminum frame and blade dampers: Nailor models 2010EAF & 202EAF; Greenheck model VCD-43; Ruskin model CD50; Arrow model AFD-20; other approved equal.

H. Dampers used for directed mixing of airstreams, i.e. outside air and return air, to be parallel blade type and sized for an air velocity of 1800 to 2000 fpm with the damper blades shall be arranged so that the air streams are directed at one another to facilitate mixing. Dampers used for throttling or modulating applications other than air stream mixing to be opposed blade type. Two position dampers may be parallel or opposed blade type.

I. Dampers used for isolation on the discharge of centrifugal fans shall have damper blades perpendicular to the fan shaft to minimize system effect. Dampers mounted with blades vertically shall be designed for vertical blade orientation.

J. Dampers for applications other than fume exhaust to have frames of not less than 16 gauge galvanized steel or 12 gauge extruded aluminum. Blades to be two-ply steel airfoil of not less than 2 x 20 gauge galvanized steel (14 gauge equivalent) or extruded aluminum airfoil, with stainless steel, acetal, Celcon, bronze, or nylon bearings. Maximum allowable blade width is 8 inches. Use plated steel linkage hardware.

K. Maximum damper width is 48 inches; where required width exceeds 48 inches, use multiple damper sections. Inside frame free area shall be a minimum of 90% of total inside duct area.

L. Multiple width damper sections shall utilize jack shaft linkages unless noted below. Sections over 144 inches wide shall be actuated from two locations on the jack shaft. Double width damper sections for two-position operation may be actuated without jack shafts if each damper section is actuated separately. Dampers that have multiple width and multiple vertical sections shall have a jackshaft for each vertically stacked set of dampers and be provided with crossover linkages between jack shafts to transfer uneven loading.

M. Jack shafts shall be extended outside of the ductwork for external actuator mounting. Provide bearings on the point of exit for support of damper shafts to prevent wear on the shaft and the ductwork. If locating actuators out of the air stream is impossible, obtain mounting location approval from the designer unless the contract documents indicate in air stream mounting is acceptable. In no cases shall damper actuators for fume exhaust systems be located in the air stream or require entering the air stream to service an actuator.

N. Size operators for smooth and positive operation of devices served, and with sufficient torque capacity to provide tight shutoff against system temperatures and pressure encountered. For two-position electric actuation use 120 VAC actuators for hardwire interlocking. All electric actuators will be provided with overload protection to prevent motor from damage when stall condition is encountered. Equip operators with spring return or stored energy fail-safe return for applications involving fire, freeze protection, moisture protection or specified normally open/closed operation.

O. All power required for electric actuation shall be provided by this Contractor.

P. Provide operators with linkages and brackets for mounting on device served.

2.03 CONTROL VALVES

A. Provide all control valves as shown on the plans/details and as required to perform functions specified.

B. Size operators to allow smooth and positive operation of devices served and to provide sufficient torque capacity for tight shutoff against system temperatures and pressure encountered. For two-position electric actuation use 120 VAC actuators for hardwire interlocking. Electric actuators, for applications other than terminal units, shall be provided with a manual override capability.

C. All power required for electric actuation shall be provided by this Contractor.

D. Provide operators that are two-position, as required for specified sequence of operation. Provide spring-return for applications involving fire, freeze protection, moisture protection or specified normally open/closed operation. Valves shall move to their fail positions on loss of electrical power to the actuator.

E. Two-position shut-off valves shall be sized for a maximum pressure drop of 2 PSI at design flow and shall be a minimum of line size.

2.04 ELECTRIC/ELECTRONIC THERMOSTATS

A. ELECTRIC THERMOSTATS: (On/Off or two-position control)

1. For single setpoint applications 55 ˚F to 85 ˚F, provide line or low voltage electric type suitable for heating or heating and cooling as required. Provide the required number of heating and/or cooling stages required for the application. For line voltage ventilation applications utilizing fans and where otherwise specified in the sequence of operations, provide an integral manual On/Off/Auto selector switch. Minimum contact rating shall be equal to electrical load of device being controlled. Provide on UL listed devices rated for the application.

B. LOW VOLTAGE ELECTRONIC THERMOSTATS: (Stand-alone modulating control)
   1. Manufacturers:
      a. Honeywell: www.honeywell.com.
      b. Johnson Controls: www.johnsoncontrols.com.
      c. White Rogers: www.whiterogers.com.
      d. Siemens: www.siemens.com.
      e. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.
   2. Where unoccupied setpoints are specified, provide electronic programmable type with seven day setup/setback scheduling with a minimum of two occupied and unoccupied schedules per day through keypad entry on front of unit. For heating and cooling applications, provide automatic heating/cooling switchover. For applications that control fans, provide fan override switch. For ventilation or packaged economizer applications provide a dry contact for ventilation damper or economizer initiation. For thermostat control of economizer, provide a 0-10VDC modulated output for economizer damper control.
   3. For applications that require integration to the building automation system, provide a BACnet communication interface.

2.05 TIME CLOCKS

A. UL listed, digital, 7-day, minimum of 10 on/off programs per day, holiday programming, automatic daylight savings switchover, and minimum of seven-day battery back-up.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install system with trained mechanics and electricians employed by the control equipment manufacturer or an authorized representative of the manufacturer. Where Installing Contractor is an authorized representative of the control manufacturer, such authorization shall have been in effect for a period of no less than three years.

B. Install all control equipment, accessories, wiring, and piping in a neat and workmanlike manner. All control devices must be installed in accessible locations. This Contractor shall verify that all control devices furnished under this Section are functional and operating the mechanical equipment as specified.

C. Mounting of electrical or electronic devices shall be protected from weather if the building is not completely enclosed. This Contractor shall be solely responsible for replacing any equipment that is damaged by water that infiltrates the building if equipment is installed prior to the building being enclosed.

D. Provide all electrical relays and wiring, line and low voltage, for control systems, devices and components. Install all high voltage and low voltage wiring (includes low voltage cable) in metal conduit, Electrical Non-metallic Tubing (ENT), or Electrical Metallic Tubing (EMT), as scheduled below and hereafter referred to generically as conduit. See Wire and Air Piping Conduit Installation Schedule below for specific conduit or tubing to be used. All conduit must be installed in accordance with electrical sections (Division 26) of this specification and the National Electrical code.

E. Conduit shall be a minimum of 1/2 inch for low voltage control provided the pipe fill does not exceed 40%.

F. Minimum low voltage wiring gauge to be 18 AWG for outputs and 20 AWG for inputs. All low voltage wiring to be stranded.

G. Low voltage wiring can be run without conduit above accessible lay-in tile ceilings. All wiring in mechanical rooms, above inaccessible hard ceilings, exterior locations, and in any exposed areas, and in all other locations should be in conduit.

H. Wire for wall sensors must be run in conduit.

I. Wiring shall not be attached to existing cabling, existing tubing, plumbing or steam piping, ductwork, ceiling supports or electrical or communications conduit.

J. All electrical wiring are to be permanently tagged or labeled within one inch of terminal strip with a numbering system to correspond with the "Record Drawings".

3.02 CONTROL VALVES

A. All temperature control valves furnished by the control manufacturer are to be installed by the Mechanical Contractor under the coordinating control and supervision of the Control Contractor in locations shown on plans or where required to provide specified sequence of control.

3.03 ELECTRIC / ELECTRONIC ROOM THERMOSTATS

A. Check and verify location of thermostats with plans and room details before installation. Locate room thermostats 48 inches above floor for all adjustable devices. Align with light switches. For drywall installations, thermostat mounting shall use a back-box attached to a wall stud, drywall anchors are not acceptable.

B. Any room thermostats mounted on an exterior wall shall be mounted on a thermally insulated sub-base. Subbase to provide a minimum of one half inch of insulation.

C. Where thermostats or sensors are mounted on exterior walls or in any location where air transfer will affect the measured temperature or humidity seal the conduit and any other opening that will affect the measurement.

3.04 TIME CLOCKS

A. Program time clocks in accordance with the sequence of operation or intended use. Provide documentation at the device of the initial settings and the manufacturer’s instructions for making changes.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 GENERAL

1.01 SCOPE

A. This section contains specifications for all Refrigerant piping for this project. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Shop Drawings.
      f. Quality Assurance.
      g. Delivery, Storage, and Handling.
      h. Design Criteria.
   2. PART 2 – PRODUCTS.
      a. Refrigerant Piping.
      b. Refrigerant Piping Accessories.
   3. PART 3 – EXECUTION.
      a. Preparation.
      b. Erection.
      c. Refrigerant Piping.
      d. Refrigerant Piping Accessories.

1.02 RELATED WORK

A. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

B. Section 23 07 00 - HVAC Insulation.

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings.

B. ASTM B88 Seamless Copper Water Tube.

C. ASTM B280 Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

D. ASHRAE 15 Safety Code for mechanical Refrigeration.

1.05 SHOP DRAWINGS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.

C. Copper Tube:
   1. Statement from manufacturer on his letterhead that the pipe furnished meets the ASTM specification contained in this section.

1.06 QUALITY ASSURANCE

A. Order all copper refrigeration tube with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier; with soft straight lengths or coils identified with a tag indicating that the product was manufactured in accordance with ASTM B280; and with each hard temper straight length identified throughout its length by a blue colored marking not less than 3/16 inch in height and a legend at intervals of not greater than three feet that includes the designation "ACR" and pipe outside diameter.

B. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

B. Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. If end caps are not present on tube bearing the "ACR" designation, clean and re-cap in accordance with ASTM B280. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

C. Offsite storage agreements will not relieve the Contractor from using proper storage techniques.

D. Storage and protection methods must allow inspection to verify products.

1.08 DESIGN CRITERIA

A. Use only new material, free of defects and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

B. Where ASTM B88, type L hard temper copper tubing is specified, ASTM B88, type K hard temper copper tubing may be substituted at Contractor's option.

PART 2 PRODUCTS

2.01 REFRIGERANT PIPING

A. ASTM B88 type L hard drawn copper tube, cleaned and capped in accordance with ASTM B280, and marked "ACR", with ANSI B16.22 wrought copper or forged brass solder-type fittings.

2.02 REFRIGERANT PIPING ACCESSORIES

A. Provide all refrigerant piping specialties with a maximum working pressure of full vacuum to 450 psig and a maximum working temperature of 225 deg F. For systems using R-410A, provide all refrigerant piping specialties with a maximum working pressure of full vacuum to 850 psig and a maximum working temperature of 225 deg F.

B. Flexible pipe connectors: Double braided bronze hose flexible pipe connectors with solder end connections.

C. Filter Dryers: For circuits 15 tons and over provide angle pattern filter dryers with replaceable core. For circuits below 15 tons provide straight pattern filter dryers without replaceable core.

D. Charging Valves: Provide 1/4" SAE brass male flare access ports with finger tight, quick seal caps. Provide 2-inch long copper extension sections.

E. Check valves: Spring loaded type with bronze body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove all foreign material from interior and exterior of pipe and fittings.

3.02 ERECTION

A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

B. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

C. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

3.03 REFRIGERANT PIPING

A. Refrigeration piping to be installed by firms who are experienced in installation of such piping.

B. All solder joints to be ASTM Grade 4 or 5 and have a melting point of approximately 1250 degrees F. Solder impurities shall not exceed 0.15%. Tubing to be new and delivered to the job site with the original mill end caps in place. Clean and polish all joints before soldering. Avoid prolonged heating and burning during soldering. Purge all lines with nitrogen during soldering. Provide manual shut-off and check valves as required.

C. No refrigerant is to be vented directly to the atmosphere except that which may escape through leaks in the system during leak testing. During evacuation procedures, use equipment designed to recover and allow recycling of the refrigerant.

D. Leak test the system by charging the system to a pressure of 10 psig with an HFC refrigerant, with the compressor suction and discharge valves closed and with all other system valves open. Increase pressure to 300 psig with dry nitrogen. Rap all joints with a mallet and check for leaks with an electric leak detector having a certified sensitivity of at least one ounce per year. Seal any leaks that may be found and retest.

E. After completion of the leak test, evacuate the system with a vacuum pump to an absolute pressure not exceeding 1500 microns while the system ambient temperature is above 60°F. Break the vacuum to 2 psig with the refrigerant to be used in the system. Repeat the evacuation process, again breaking the vacuum with refrigerant. Install a drier of the required size in the liquid line, open the compressor suction and discharge valves, and evacuate to an absolute pressure not exceeding 500 microns. Leave the vacuum pump running for not less than two hours without interruption. Raise the system pressure to 2 psig with refrigerant and remove the vacuum pump.

F. Charge refrigerant directly from original drums through a combination filter-drier. Each drier may be used for a maximum of three cylinders of refrigerant and then must be replaced with a fresh drier. Charge the system by means of a charging fitting in the liquid line. Weigh the refrigerant drum before charging so that an accurate record can be kept of the weight of refrigerant put in the system. If refrigerant is added to the system through the suction side of the compressor, charge in vapor form only.

3.04 REFRIGERANT PIPING ACCESSORIES

A. Install accessories in accordance with the manufacturer's written instructions and recommendations.

END OF SECTION

SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SCOPE

A. This section includes specifications for all duct systems used on this project. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Quality Assurance.
      f. Shop Drawings.
      g. Design Criteria.
      h. Delivery, Storage and Handling.
   2. PART 2 – PRODUCTS.
      a. General.
      b. Ductwork Pressure Class.
      c. Materials.
      d. Low Pressure Ductwork (Maximum 2 inch pressure class).
      e. Duct Sealant.
      f. Gaskets.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Ductwork Support.
      c. Low Pressure Duct (Maximum 2 inch pressure class).
      d. Cleaning.
      e. Leakage Test.
   4. APPENDIX.
      a. Duct Leakage Test Report.

1.02 RELATED WORK

A. Section 23 33 00 - Air Duct Accessories.

B. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this Section.

1.04 REFERENCE STANDARDS

A. ASTM A90 Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.

B. ASTM A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

C. ASTM A623 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

D. ASTM A527 Specification for General Requirements for Steel Sheet, Zinc- Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.

E. ASTM 924 Standard Specification for General Requirements for Sheet Steel, Metallic-coated by the Hot-dip Method.

F. ASTM C 411 Test Method for Hot Surface Performance of High Temperature Thermal Insulation.

G. ASTM E 84 Test Method for Surface Burning Characteristics of Building Materials.

H. ASTM C 1338 Test Method for Determining Fungal Resistance of Insulation Materials and Facings.

I. ASTM G 21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

J. ASTM C 916 Standard Specification for Adhesives for Duct Thermal Insulation NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems.

K. UL 181 Standard for Safety for Factory Made Air Ducts and Air Connectors.

L. NAIMA Fibrous Glass Duct Liner Standard.

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Requirements.

1.06 SHOP DRAWINGS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Include manufacturer's data and/or Contractor data for the following:
1. Schedule of duct systems including material of construction, gauge, pressure class, system class, method of reinforcement, joint construction, fitting construction, and support methods, all with details as appropriate.
2. Duct sealant and gasket material.
3. Duct liner including data on thermal conductivity, air friction correction factor, and limitation on temperature and velocity.

1.07 DESIGN CRITERIA

A. Construct all ductwork to be free from vibration, chatter, objectionable pulsations and leakage under specified operating conditions.

B. Use material, weight, thickness, gauge, construction and installation methods as outlined in the following SMACNA publications, unless noted otherwise:
1. HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005.
2. HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012.
3. HVAC Systems - Duct Design, 4th Edition, 2006.
4. Rectangular Industrial Duct Construction Standard, 2nd Edition, 2004.
5. Round Industrial Duct Construction Standards, 2nd Edition, 1999.
6. Thermoplastic Duct (PVC) Construction Manual, 2nd Edition, 1995.

C. Use products which conform to NFPA 90A, possessing a flame spread rating of not over 25 and a smoke developed rating no higher than 50.

1.08 DELIVERY, STORAGE AND HANDLING

A. Promptly inspect shipments to ensure that Ductwork is undamaged and complies with the specification.

B. Protect Ductwork against damage.

C. Protect Ductwork by storing inside or by durable, waterproof, above ground packaging. Do not store material on grade. Protect Ductwork from dirt, dust, construction debris and foreign material. Where end caps/packaging is provided, take precautions so caps/packaging remain in place and free from damage.

PART 2 PRODUCTS

2.01 GENERAL

A. All sheet metal used for construction of duct shall be 24 gauge or heavier except for round and spiral ductwork and spiral duct take-offs 12" and below may be 26 gauge where allowed in SMACNA HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005.

B. Duct sizes indicated on plans are net inside dimensions; where duct liner is specified, dimensions are net, inside of liner.

2.02 DUCTWORK PRESSURE CLASS

A. Minimum acceptable duct pressure class, for all ductwork except transfer ductwork, is 2 inch W.G. positive or negative, depending on the application. Transfer ductwork minimum acceptable duct pressure class is 1 inch W.G. positive or negative, depending on the application. Duct system pressure classes not indicated on the drawings to be as follows:

Supply duct	1 in. calc. S.P.	2 in. pressure class
Exhaust ducts	1 in. calc. S.P.	2 in. pressure class
Return ducts	1 in. calc. S.P.	2 in. pressure class

2.03 MATERIALS

A. Galvanized Steel Sheet:
1. Use ASTM A 653 galvanized steel sheet of lock forming quality. Galvanized coating to be 1.25 ounces per square foot, both sides of sheet, G90 in accordance with ASTM A90. Provide "Paint Grip" finish for ductwork that will be painted.

2.04 LOW PRESSURE DUCTWORK (MAXIMUM 2 INCH PRESSURE CLASS)

A. Fabricate and install ductwork in sizes indicated on the drawings and in accordance with SMACNA recommendations, except as modified below.

B. Construct so that all interior surfaces are smooth. Use slip and drive or flanged and bolted construction when fabricating rectangular ductwork. Use spiral lock seam construction when fabricating round spiral ductwork. Sheet metal screws may be used on duct hangers, transverse joints and other SMACNA approved locations if the screw does not extend more than 1/2 inch into the duct.

C. Use elbows and tees with a center line radius to width or diameter ratio of 1.5 wherever space permits. When a shorter radius must be used due to limited space, install single wall sheet metal splitter vanes in accordance with SMACNA publications, Type RE 3. Where space will not allow and the C value of the radius elbow, as given in SMACNA publications, exceeds 0.31, use rectangular elbows with turning vanes as specified in Section 23 33 00. Square throat-radius heel elbows will not be acceptable. Straight taps or bullhead tees are not acceptable.

D. Where rectangular elbows are used, provide turning vanes in accordance with Section 23 33 00.

E. Provide expanded take-offs or 45 degree entry fittings for branch duct connections with branch ductwork airflow velocities greater than 700 fpm. Square edge 90-degree take-off fittings or straight taps will not be accepted.

F. Round ducts may be substituted for rectangular ducts if sized in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission of the Engineer.

G. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

2.05 DUCT SEALANT

A. Manufacturer:
1. 3M 800: www.3m.com.
2. 3M 900: www.3m.com.
3. H.B. Fuller/Foster: www.hbfuller.com.
4. Hardcast: www.hardcast.com.
5. Hardcast Peal & Seal: www.hardcast.com.
6. Lockformer cold sealant: www.lockformer.com.
7. Mon-Eco Industries: www.mon-ecoindustries.com.
8. United Sheet Metal: www.unitedsheetmetal.com.
9. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Silicone sealants are not allowed in any type of ductwork installation.

C. Install sealants in strict accordance with manufacturer's recommendations, paying special attention to temperature limitations. Allow sealant to fully cure before pressure testing of ductwork, or before startup of air handling systems.

2.06 GASKETS

A. 2 inch pressure class and lower:
1. Soft neoprene or butyl gaskets in combination with duct sealant for flanged joints.

B. 3 inch pressure class and higher:
1. Butyl gaskets.

C. Fume Hood Exhaust:
1. Butyl gaskets.

PART 3 EXECUTION

3.01 INSTALLATION

A. Verify dimensions at the site, making field measurements and drawings necessary for fabrication and erection. Check plans showing work of other trades and consult with Architect in the event of any interference.

B. Make allowances for beams, pipes or other obstructions in building construction and for work of other Contractors. Transform, divide or offset ducts as required, in accordance with SMACNA HVAC Duct Construction Standards, Figure 4-7, except do not reduce duct to less than six inches in any dimension and do not exceed an 8:1 aspect ratio. Where it is necessary to take pipes or similar obstructions through ducts, construct easement as indicated in SMACNA HVAC Duct

Construction Standards, Figure 4-8, Fig. E. In all cases, seal to prevent air leakage. Pipes or similar obstructions may not pass through high pressure or fume exhaust ductwork.

C. Test openings for test and balance work will be provided under Section 23 05 93.

D. Provide frames constructed of angles or channels for coils, filters, dampers or other devices installed in duct systems, and make all connections to such equipment including equipment furnished by others. Secure frames with gaskets and screws or nut, bolts and washers.

E. Install duct to pitch toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.

F. Where two different metal ducts meet, the joint shall be installed in such a manner that metal ducts do not contact each other by using proper seal or compound.

G. Install all motor operated dampers and connect to or install all equipment furnished by others. Blank off all unused portions of louvers, as indicated on the drawings, with 1-1/2 inch board insulation with galvanized sheet metal backing on both sides.

H. Do not install ductwork through dedicated electrical rooms or spaces unless the ductwork is serving this room or space.

I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

J. Provide adequate access to ductwork for cleaning purposes.

K. Provide temporary capping of ductwork openings to prevent entry of dirt, dust and foreign material.

L. Protect diffusers, registers and grilles with plastic wrap or some other approved form of protection to maintain dirt and dust free and to prevent entry of dirt, dust and foreign material into the ductwork.

M. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.02 DUCTWORK SUPPORT

A. Support ductwork in accordance with SMACNA HVAC Duct Construction Standards, Figure 5-5, except supporting ductwork with secure wire method is not allowed.

B. Support with 3/32 inch, 7 x 7, stainless steel air-craft cable, with matching fastener rated for 50% of actual load, will be allowed on round ductwork under 12 inches if installed as detailed, with cable double looped on duct and at point of support.

3.03 LOW PRESSURE DUCT (MAXIMUM 2 INCH PRESSURE CLASS)

A. Seal all duct, with the exception of transfer ducts, in accordance with SMACNA seal class "A"; all seams, joints, and penetrations shall be sealed.

B. Install a manual balancing damper in each branch duct and for each diffuser or grille. The use of splitter dampers, extractors, or grille face dampers will not be accepted for balancing dampers.

C. Hangers must be wrapped around bottom edge of duct and securely fastened to duct with sheet metal screws or pop rivets. Trapeze hangers may be used at Contractor's option.

3.04 CLEANING

A. Remove all dirt and foreign matter from the entire duct system and clean diffusers, registers, grilles and the inside of air-handling units before operating fans.

B. Clean duct systems with high power vacuum machines where systems have been used for temporary heat, air-conditioning, or ventilation purposes during construction. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning.

3.05 LEAKAGE TEST

A. Test all ductwork in accordance with test methods described in Section 5 of SMACNA HVAC Air Duct Leakage Test Manual. Do not insulate ductwork until it has been successfully tested. Test pressure shall be equal to the duct pressure class.

B. If excessive air leakage is found locate leaks, repair the duct in the area of the leak, seal the duct, and retest.

C. Leakage rate shall not exceed more than 5% of the system air quantity for low pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.

D. Submit a signed report to the Owner's Construction Representative, indicating test apparatus used, results of the leakage test, and any remedial work required to bring duct systems into compliance with specified leakage rates.

DUCT LEAKAGE TEST REPORT

Project Number:_____

Date Submitted:_____

Project **Name:**_____

Location:_____

Contractor:_____

System Data

Fan No:_____

Fan Design CFM:_____

Leakage Class (C_L):_____

Duct Pressure Class (P_C):_____

Test Pressure (P_T):_____

Test Equipment

Manufacturer:_____ **Model No:**_____ **Serial No:**_____

For large systems, use the reverse side for a simple sketch of the entire duct system. Then use letter designations to indicate the various duct sections being tested at one time. Also use the reverse side for test comments.

Note that due to normal construction sequencing it is usually necessary to test risers separately prior to enclosing chases.

Design Data					Field Test Data							
			Allowable Leakage		Diameter		Pressure (in. wc.)					
Duct Section	Duct Shape	Duct Surface (Ft^2)	Leakage Factor ($P^{.65}C_L$)	CFM for Section	Tube (D_1)	Orifice (D_2)	In Duct (P)	Across Orifice (P_{drop})	Date	Performed By	Observed By	Actual CFM
TOTAL												

END OF SECTION

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SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SCOPE

A. This section includes accessories used in the installation of duct systems. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Quality Assurance.
      f. Shop Drawings.
      g. Operation and Maintenance Data.
   2. PART 2 – PRODUCTS.
      a. Manual Volume Dampers.
      b. Turning Vanes.
      c. Fire Dampers.
      d. Control Dampers.
      e. Access Doors.
      f. Duct Flexible Connections.
      g. Louvers.
   3. PART 3 – EXECUTION.
      a. Manual Volume Dampers.
      b. Turning Vanes.
      c. Fire Dampers.
      d. Control Dampers.
      e. Access Doors.
      f. Duct Flexible Connections.
      g. Louvers.

1.02 RELATED WORK

A. Section 23 05 29 - Hanger and Supports for HVAC Piping and Equipment.

B. Section 23 31 00 - HVAC Ducts and Casings.

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this Section.

1.04 REFERENCE STANDARDS

A. NFPA 90A Standard for Installation of Air Conditioning and Ventilating Systems.

B. SMACNA HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, 2005.

C. UL 214 Standard for Factory-Made Air Ducts and Air Connectors.

D. UL 555 (6^{th} edition) Standard for Fire Dampers and Ceiling Dampers.

E. UL 555S (4^{th} edition) Leakage Rated Dampers for Use in Smoke Control Systems.

F. ACMA 610-10 Certified Ratings Program – Product Rating Manual for Airflow Measurement Stations.

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Requirements.

1.06 SHOP DRAWINGS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Submit for all accessories and include dimensions, capacities, ratings, installation instructions, and appropriate identification.

C. Include certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance of sound attenuators.

D. Submit manufacturer's color charts where finish color is specified to be selected by the Engineer.

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 MANUAL VOLUME DAMPERS

A. Manufacturers:
1. Ruskin: www.ruskin.com.
2. Vent Products: www.ventproducts.com.
3. Air Balance: www.airbalance.com.
4. Pottorff: www.pottorff.com.
5. United Enertech: www.unitedenertech.com.
6. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Dampers must be constructed in accordance with SMACNA Fig. 2-12, Fig. 2-13, and notes relating to these figures, except as modified below.

C. Reinforce all blades to prevent vibration, flutter, or other noise. Construct dampers in multiple sections with mullions where width is over 48 inches. Use rivets or tack welds to secure individual components; sheet metal screws will not be accepted. Provide operators with locking devices and damper position indicators for each damper; use an elevated platform on insulated ducts. Provide end bearings or bushings for all volume damper rods penetrating ductwork constructed to a 3" w.c. pressure class or above.

2.02 TURNING VANES

A. Manufacturers:
1. Aero Dyne: www.aero-dyne.net.
2. Anemostat: www.anemostat.com.
3. Barber-Colman: www.barber-colman.com.
4. Hart & Cooley: www.hartandcooley.com.
5. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Construct turning vanes and runners for square elbows in accordance with SMACNA Fig. 4-2 and Fig. 4-3 except use only airfoil type vanes. Construct turning vanes for short radius elbows and elbows where one dimension changes in the turn in accordance with SMACNA Fig. 4-4 and Fig. 4-9.

2.03 FIRE DAMPERS

A. Manufacturers:
1. Air Balance: www.airbalance.com.
2. Advanced Air: www.advancedair.net.
3. American Warming and Ventilating: www.awv.com.
4. Greenheck: www.greenheck.com.
5. Phillips-Aire: www.drillspot.com.
6. Prefco: www.prefco-hvac.com.
7. Ruskin: www.ruskin.com.
8. Safe-Air: www.safe-air-corp.com.
9. Pottorff: www.pottorff.com.
10. United Enertech: www.unitedenertech.com.
11. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Static Fire Dampers:
1. Static fire damper assemblies must be UL 555 (6th edition) listed and labeled for static applications (where air systems do not operate during a fire) and meet requirements of NFPA 90A. Damper must be type B curtain type with blades out of the air stream; dampers with blades in the air stream will not be accepted. Damper fire rating to be compatible with the rating of the building assembly in which the damper is used.

2.04 CONTROL DAMPERS

A. Control dampers are specified in section 23 09 13.

2.05 ACCESS DOORS

A. Access door to be designed and constructed for the pressure class of the duct in which the door is to be installed. Doors in exposed areas shall be hinged type with cam sash lock. Hinges shall be steel full length continuous piano type. Doors in concealed spaces may be secured in place with cam sash latches. For both hinged and non-hinged doors provide sufficient number of camp sash latches to provide air tight seal when door is closed. Do not use hinged doors in concealed spaces if this will restrict access. Use minimum 1” deep 24 gauge galvanized steel double wall access doors with minimum 24 gauge galvanized steel frames. For non-galvanized ductwork, use minimum 1” deep double wall access door with frame that shall use materials of construction identical to adjacent ductwork. Provide double neoprene gasket that shall provide seals from the frame to the door and frame to the duct. When access doors are installed in insulated ductwork or equipment provide insulated doors with insulation equivalent to what is provided for adjacent ductwork or equipment. Access doors constructed with sheet metal screw fasteners will not be accepted.

B. Use insulated 1-1/2 hour UL 1978 listed and labeled access doors in kitchen exhaust ducts.

2.06 DUCT FLEXIBLE CONNECTIONS

A. Material to be fire retardant, be UL 214 listed, and meet the requirements of NFPA 90A.

B. Connections to be a minimum of 3 inches wide, crimped into metal edging strip, and air tight. Connections to have adequate flexibility and width to allow for thermal expansion/contraction, vibration of connected equipment, and other movement.

C. Use coated glass fiber fabric for all applications. Material for inside applications other than corrosive environments, fume exhaust, or kitchen exhaust to be double coated with neoprene, air and water tight, suitable for temperatures between -10°F and 200°F, and have a nominal weight of 30 ounces per square yard. Material used for outdoor applications other than corrosive environments, fume exhaust, or kitchen exhaust to be double coated with Hypalon, air and water tight, suitable for temperatures between -10°F and 250°F, and have a nominal weight of 26 ounces per square yard.

2.07 LOUVERS

A. Louver shall meet FEMA 361 requirements.

B. Manufacturers:
1. Ruskin: www.ruskin.com.
2. Greenheck: www.greenheck.com.
3. Pottorff: www.pottorff.com.
4. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

PART 3 EXECUTION

3.01 MANUAL VOLUME DAMPERS

A. Install manual volume dampers in each branch duct and for each grille, register, or diffuser as far away from the outlet as possible while still maintaining accessibility to the damper. Install so there is no flutter or vibration of the damper blade(s).

3.02 TURNING VANES

A. Install turning vanes in all rectangular, mitered elbows in accordance with SMACNA standards and/or manufacturer's recommendations.

B. Install double wall, airfoil, 2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity less than 2000 fpm. Install double wall, airfoil, 4-1/2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity 2000 fpm or greater.

C. If duct size changes in a mitered elbow, use single wall type vanes with a trailing edge extension. If duct size changes in a radius elbow or if short radius elbows must be used, install sheet metal turning vanes in accordance with SMACNA Figure 2-5 and Figure 2-6.

3.03 FIRE DAMPERS

A. Install dampers in strict accordance with manufacturer's installation instructions. Install damper sleeves with retaining angles on both sides of rated partition. Connections of ductwork to fire damper assemblies to be as specified on the installation instructions. Where it is necessary to set dampers out from the rated wall, install a sleeve extension encased in two hour rated fire proofing insulation. Install an access door at each fire damper, located to permit resetting the damper replacing the fusible link.

B. Manually test each fire damper for proper operation by removing the fusible link. Repair or replace any fire damper that does not close completely. Re-install fusible link after test.

3.04 CONTROL DAMPERS

A. Install dampers in locations indicated on the drawings, as detailed, and according to the manufacturer's instructions. Install blank-off plates or transitions where required for proper mixing of airstreams in mixing plenums. Provide adequate operating clearance and access to the operator. Install an access door adjacent to each control damper for inspection and maintenance.

3.05 ACCESS DOORS

A. Install access doors where specified, indicated on the drawings, and in locations where maintenance, service, cleaning or inspection is required. Examples include, but are not limited to motorized dampers, fire and smoke dampers, smoke detectors, fan bearings, heating and cooling coils, filters, valves, and control devices needing periodic maintenance.

B. Size and numbers of duct access doors to be sufficient to perform the intended service. Minimum access door size shall be 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, or other size as indicated. Install access doors on both inlet and outlet sides of reheat coils as well as other duct mounted coils.

3.06 DUCT FLEXIBLE CONNECTIONS

A. Install at all duct connections to rotating or vibrating equipment, including air handling units (unless unit is internally isolated), fans, or other motorized equipment in accordance with SMACNA Figure 2-19. Install thrust restraints to prevent excess strain on duct flexible connections at fan inlets and outlets; see Related Work.

B. For applications in corrosive environments or fume exhaust systems, use a double layer of the Teflon coated fabric when making the connector.

3.07 LOUVERS

A. Louvers are furnished and installed by this Contractor.

B. Furnish louvers to the General Contractor for mounting in exterior walls. Connect outside air intake duct to the louver, sealing all connections air and water tight.

C. Provide bird screen on outside of active louver area where none is provided with louvers. Where louvers are equipped with inside bird screen, remove screen at all locations where duct connections are not made.

D. Install insulated metal panel on unused portion of louver. Panels must be sealed weather tight to louver assembly with flashing as required for proper drainage to outside of building. Paint outside surface of panel to match louver prior to installation. Where ductwork is visible through louver when viewed from outside the building, paint inside of duct to match louver color.

END OF SECTION

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SECTION 23 37 13

DIFFUSERS, REGISTERS AND GRILLES

PART 1 GENERAL

1.01 SCOPE

A. This section includes specifications for air terminal equipment. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Quality Assurance.
      f. Submittals.
      g. Design Criteria.
   2. PART 2 – PRODUCTS.
      a. Manufacturers.
      b. Side-Wall Registers and Grilles.
      c. Spiral Duct Mounted Diffuser.
   3. PART 3 – EXECUTION.
      a. Installation.

1.02 RELATED WORK

A. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

B. Section 23 31 00 - HVAC Ducts and Casings.

C. Section 23 33 00 - Air Duct Accessories.

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

B. UL 181 - Factory-Made Air Ducts and Connectors.

C. ARI-ADC Standard 880.

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Requirements.

1.06 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Furnish submittal information including, but not limited to, the following:
   1. Manufacturer's name and model number.
   2. Identification as referenced in the documents.
   3. Capacities/ratings.

4. Materials of construction.
5. Sound ratings.
6. Dimensions.
7. Finish.
8. Color selection charts where applicable.
9. Manufacturer's installation instructions.
10. All other appropriate data.

1.07 DESIGN CRITERIA

A. All performance data shall be based on tests conducted in accordance with Air Diffusion Council (ADC) Test Code 1062 GRD 84.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carnes: www.carnes.com.

B. Krueger: www.krueger-hvac.com.

C. Titus: www.titus-hvac.com.

D. Metal-Aire: www.metalaire.com.

E. E.H. Price: www.price-hvac.com.

F. United Sheet Metal: www.unitedsheetmetalinc.com.

G. Tuttle & Bailey: www.tuttleandbailey.com.

H. Raymon Donco: www.raymon-hvac.com.

I. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

J. Acceptable manufacturers for specific products are listed under each item.

2.02 SIDE-WALL REGISTERS AND GRILLES

A. Steel unless otherwise indicated, with frame type appropriate to installation.

B. Single deflection type blade supply registers and supply grilles allow deflection adjustment in all direction.

C. Opposed blade volume control damper supply registers, operable from face.

D. Fixed blade 45 degree core return and exhaust registers and grilles.

E. Opposed blade volume control damper return registers, operable from face.

F. Register and grille sizes as shown on drawings and/or as scheduled.

G. White, baked enamel finish or powder coat finish, unless otherwise indicated.

H. Screw holes on surface counter sunk to accept recessed type screws.

I. Manufacturers:
1. Titus; Series 300 (supply) and series 350 (return/exhaust): www.titus-hvac.com.
2. Carnes; Model R series: www.carnes.com.

3. Price; Model 520 (Supply) Or 530 (return/exhaust): www.price-hvac.com.
4. Metal Aire; Series V4000 or H4000: www.metalaire.com.
5. Krueger; Series 880: www.krueger-hvac.com.
6. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.03 SPIRAL DUCT MOUNTED DIFFUSER

A. Extruded aluminum with individually adjustable blades..

B. White, baked enamel finish or powder coat finish, unless otherwise indicated.

C. Manufacturers:
1. Krueger: www.krueger-hvac.com.
2. Metal Aire: www.metalaire.com.
3. Price: www.price-hvac.com.
4. Tuttle & Bailey: www.tuttleandbailey.com.
5. Titus; S300FL: www.titus-hvac.com.
6. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install grilles, registers and diffusers as shown on drawings and according to manufacturer's instructions.

B. Furnish diffusers with equalizing grids where it is not possible to maintain minimum 2 duct diameter straight duct into diffuser. Equalizing grids shall consist of individually adjustable vanes designed for equalizing airflow into diffuser neck and providing directional control of airflow.

C. Unless otherwise indicated, size ductwork drops to diffusers or grilles to match unit collar size.

D. Seal connections between ductwork drops and diffusers/grilles airtight.

E. Blank off unused portion of linear slot diffusers and linear bar diffusers and grilles.

F. Where diffusers, registers and grilles cannot be installed to avoid seeing inside duct, paint inside of duct with flat black paint to reduce visibility.

G. In clean rooms and animal holding rooms, caulk space between diffuser or grille and ceiling or wall to be air and watertight. User clear, non-hardening silicone sealant compatible with ceiling or wall surfaces. Sealant shall be resistant to microbiological growth.

END OF SECTION

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SECTION 23 54 00

GAS FIRED FURNACES

PART 1 GENERAL

1.01 SCOPE

A. This section includes specifications for gas fired furnaces. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Reference.
      c. Reference Standards.
      d. Quality Assurance.
      e. Submittals.
      f. Operation and Maintenance Data.
   2. PART 2 – PRODUCTS.
      a. Furnaces.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Furnaces.

1.02 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.03 REFERENCE STANDARDS

A. AGA American Gas Association.

B. ANSI Z21.64 Direct Vent Central Furnaces.

C. GAMA Gas Appliance Manufacturers Association.

D. NEC National Electrical Code.

1.04 QUALITY ASSURANCE

A. Refer to Division 1, General Requirements.

1.05 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Include specific manufacturer and model numbers, equipment identification corresponding to project drawings and schedules, dimensions, capacities, materials of construction, ratings, weights, power requirements and wiring diagrams, filter information and information for all accessories.

1.06 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 FURNACES

A. Manufacturers:
   1. Bryant: www.bryant.com.
   2. Carrier: www.carrier.com.
   3. Lennox: www.lennox.com.
   4. Trane: www.trane.com.
   5. York: www.york.com.
   6. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Direct vent, sealed combustion, condensing type AGA certified for use with propane gas. Minimum annual fuel utilization efficiency (A.F.U.E.) of 91. All ratings are to be certified by GAMA. All wiring shall comply with the National Electrical Code.

C. 22 gauge steel casing with baked enamel finish or pre-painted galvanized steel. Insulate casing back and side panels with foil faced fiberglass insulation.

D. Construct primary heat exchanger of aluminized steel. Construct secondary heat exchanger of stainless steel with aluminum fins or of polypropylene laminated steel. Aluminized steel multi-port in-shot burner with hot surface or electronic spark ignition, approved for vertical or sidewall venting.

E. AGA listed gas controls including manual main shut-off valve, double automatic gas valves for redundancy and gas pressure regulator.

F. Centrifugal type blower fan statically and dynamically balanced with multiple speed, direct drive or belt drive fan motor. Provide low energy induced draft blower for heat exchanger prepurge and combustion gas venting.

G. Provide unit with 2” thick 30% efficient disposable type panel air filter and filter holding rack.

H. Provide solid state integral control unit with all necessary controls and relays including but not limited to:
   1. Pressure switch for airflow of flue products through furnace and out vent system.
   2. Rollout switch with manual reset to prevent over temperature in burner area.
   3. Electronic flame sensor.
   4. Blower access safety interlock.
   5. Timed blower start after main burners ignite.
   6. Factory installed 24 v transformer for controls and thermostat.
   7. LED’s to indicate status and to aid in troubleshooting.

I. Provide unit with matching cased "A" configuration cooling coil for upflow units, "V" configuration cooling coil for downflow units, and vertical flat face configuration cooling coil for horizontal units.

J. Minimum 1/2" OD seamless copper tubing mechanically bonded to heavy ripple edged aluminum fins with thermal expansion valve, holding charge and copper tube stubs for field piping.

K. Non-corrosive stainless steel or polymer drain pan with 3/4" NPT drain connection.

L. 20 gauge steel Coil casing with baked enamel finish and fiberglass insulation.

M. This Contractor shall provide all temperature control and interlocking necessary to perform the specified control sequence. All wiring is to be in conduit in accordance with Division 26 - Electrical. All relays, transformers and controls are to be in enclosures.

N. Provide a 7 day programmable thermostat with 2 occupied periods per day, automatic changeover, separate heating and cooling set points for both occupied and unoccupied modes. Provide auxiliary controls on sub-base to open minimum outside air damper during occupied mode. Equal to Honeywell model T7300 with Q7300 sub-base.

O. Provide lockable thermostat guards in public spaces.

P. During occupied mode run the supply fan continuously, open the outside air damper and cycle the cooling or heating as required to maintain occupied space temperature cooling or heating set point. During unoccupied mode close the outside air damper and cycle the supply fan and cooling or heating as required to maintain unoccupied cooling or heating space temperature set point.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install units as detailed and according to the manufacturer's installation instructions.

B. Pipe vents from gas regulator to outside where regulators are provided.

C. Install remote panels and thermostats where indicated on the drawings. Provide all wiring between remote panels/thermostats and the gas fired item.

D. MC to provide and install plastic, lockable thermostat/CO2 covers.

3.02 FURNACES

A. Install on concrete housekeeping pad, steel stand or suspend unit from structure as indicated on the drawings. Pipe condensate to floor drain.

B. Provide schedule 40 PVC, ASTM D1785 combustion air and vent piping and fittings with solvent welded joints as indicated on the drawings. Terminate as recommended by the furnace manufacturer.

END OF SECTION

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SECTION 23 62 13

PACKAGED AIR-COOLED REFRIGERANT COMPRESSOR AND CONDENSING UNITS

PART 1 GENERAL

1.01 SCOPE

A. This section includes specifications for air cooled condensing units for use with split system type air conditioning. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference.
      d. Reference Standards.
      e. Quality Assurance.
      f. Submittals.
      g. Operation and Maintenance Data.
      h. Delivery, Storage and Handling.
   2. PART 2 – PRODUCTS.
      a. Units up to 5 Tons.
      b. Refrigerant Piping Specialties.
      c. Refrigerant Piping Accessories.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Startup.

1.02 RELATED WORK

A. Section 23 05 00 - Common Work Results for HVAC.

1.03 REFERENCE

A. Applicable provisions of Division 1 shall govern work under this section.

1.04 REFERENCE STANDARDS

A.	AHRI 210/240	Unitary Air Conditioning and Heat Pump Equipment.
B.	AHRI 365	Commercial and Industrial Unitary Air Conditioning Condensing Units.
C.	ASHRAE 15	Safety Standard for Refrigeration Systems.
D.	ASHRAE 90.1	(2004 edition)Energy Standard for Buildings Except Low Rise Residential Buildings.
E.	NEC	National Electrical Code.
F.	ASTM B117	Standard Practice for Operating Salt Spray (fog) Apparatus.
G.	UL	Underwriters Laboratory.

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Requirements.

B. Unit Energy Efficiency Ratio (EER), Coefficient of Performance (COP) and Integrated Part Load Value (IPLV) shall meet the minimum applicable requirements of ASHRAE 90.1(2004 edition). Units that are labeled ENERGY STAR® will be acceptable.

C. Rate unit performance in accordance with the latest edition of AHRI Standard 365 or AHRI Standard 210/240, whichever is applicable for the equipment.

D. Construct units in accordance with ASHRAE 15, UL standards and the NEC. Units shall carry the UL label.

E. Factory run test units to see that each control device operates properly. Pressure test, evacuate, charge with holding charge of refrigerant and full oil charge prior to shipping from the factory.

1.06 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Submit air cooled condensing unit shop drawings including the following information: specific manufacturer and model numbers, dimensional and weight data, required clearances, materials of construction, capacities and ratings, stages of unloading capacity achievable without hot gas bypass (and with hot gas bypass if applicable), refrigerant type and charge, component information, size and location of piping connections, electrical connections, wiring diagrams and information for all specialties and accessories.

C. Submit manufacturer's installation and startup instructions, maintenance data, troubleshooting guide, parts lists, controls and accessories.

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.08 DELIVERY, STORAGE AND HANDLING

A. Comply with manufacturer's instructions for storing, rigging, unloading, and transporting units. Protect units from physical damage. Leave factory-shipping covers in place until installation.

B. Ship units to jobsite fully assembled.

PART 2 PRODUCTS

2.01 UNITS UP TO 5 TONS

A. Manufacturers:
1. Carrier: www.carrier.com.
2. Trane: www.trane.com.
3. York: www.york.com.
4. Daikin: www.daikinapplied.com.
5. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

B. Provide factory assembled, outdoor mounted, air-cooled condensing unit suitable for on grade or rooftop installation. Include compressor, air cooled condenser, refrigerant, lubrication system, interconnecting wiring, safety and operating controls, motor starting components and additional features as specified herein or required for safe, automatic operation. Capacity and steps of unloading as indicated in the equipment schedule. Refrigerant is to be R-410.

C. CABINET:
   1. Construct cabinet of heavy gauge, galvanized steel coated with weather resistant paint. Provide removable access panels to facilitate full access to the compressor, fan and control components.

D. COMPRESSOR:
   1. Provide hermetic reciprocating or scroll type compressor with built in motor winding temperature and current protection, liquid and suction service valves, gage ports, sight glass and liquid line filter dryer. Provide crankcase heater with reciprocating type compressors. Mount compressors on vibration isolators.

E. CONDENSER:
   1. Provide condenser coils with aluminum alloy plate fins mechanically fastened to seamless copper tubing with integral subcooler. Construct coils with design working pressure suitable for the refrigerant.

F. Provide direct-drive statically and dynamically balanced propeller type fans with vertical or horizontal discharge as indicated on the drawings and guards constructed of heavy gage PVC coated wire or galvanized steel.

G. POWER WIRING:
   1. Provide factory installed 24-volt control circuit with fusing; control power transformer and all associated internal wiring. Provide a single point power connection to the unit(s). Provide factory installed magnetic contactors for compressor and condenser motors.
   2. Electrical characteristics shall be as indicated in the equipment schedule.

H. CONTROLS:
   1. Provide high/low refrigerant pressure cutouts with manual reset and anti-short cycle compressor timer.

2.02 REFRIGERANT PIPING SIZING

A. The unit manufacturer shall verify the *final refrigeration pipe sizing* process to ensure conformance to specific unit requirements such as max lengths, refrigerant velocities, unloading considerations and proper oil return. This Contractor shall provide refrigeration piping drawings from the field which details the way the piping will actually be installed.

2.03 REFRIGERANT PIPING ACCESSORIES

A. Provide all refrigerant piping specialties with a maximum working pressure of full vacuum to 450 psig and a maximum working temperature of 225 deg F. For systems using R-410A, provide all refrigerant piping specialties with a maximum working pressure of full vacuum to 850 psig and a maximum working temperature of 225 deg F.

B. Flexible pipe connectors: Double braided bronze hose flexible pipe connectors with solder end connections.

C. Filter Dryers: For circuit's 15 tons and over provide angle pattern filter dryers with replaceable core. For circuits below 15 tons provide straight pattern filter dryers without replaceable core.

D. Sight glasses: Two piece brass construction with solder end connections. Include color indicator for sensing moisture.

E. Solenoid Valves: Two way normally closed with two piece brass body, full port, stainless steel plug, stainless steel spring, teflon diaphragm and solder end connections. Provide replaceable coil assembly.

F. Hot Gas Bypass Valves: Provide with integral solenoid valve, external equalizer connection and adjustable pilot assembly.

G. Thermostatic Expansion Valves: Brass body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.

H. Charging Valves: Provide 1/4 inch SAE brass male flare access ports with finger tight, quick seal caps. Provide 2 inch long copper extension sections.

I. Check valves: Spring loaded type with bronze body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install units, piping and accessories in accordance with the manufacturer's written instructions and recommendations. Mount unit(s) on a poured concrete pad on grade as indicated on the drawings.

B. Maintain adequate service access and airflow clearances for all components as recommended by the manufacturer and as indicated on the drawings.

C. Charge unit(s) with full oil charge and refrigerant charge based on the entire refrigeration system pipe size and length.

D. Coordinate power wiring requirements with the electrical trade.

3.02 STARTUP

A. Adjust units for maximum operating efficiency, adjust all controls to required final settings and demonstrate that all components are functioning properly. Submit four copies of a written startup report following the initial startup. Include in the report: work done to the system, all readings taken, a statement certifying that the refrigeration system(s) are leak free and a statement certifying that the unit(s) have been placed in proper running condition as recommended by the manufacturer and as intended in the drawings and specifications.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The electrical work included in all other Divisions is the responsibility of the Contractor performing the Division 26 work unless noted otherwise.

1.02 PROJECT OVERVIEW

A. Provide lighting, power, and communication for a safe room addition. Work shall include demolition in preparation for new construction. Work includes an engine generator and special door security and revisions to existing service.

1.03 SCOPE

A. The work under this section includes basic electrical requirements, which are applicable to all Division 26 sections. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:

1. PART 1 – GENERAL.
    a. Project Overview.
    b. Scope.
    c. Related Work.
    d. Reference Standards.
    e. Regulatory Requirements.
    f. Quality Assurance.
    g. Continuity of Existing Services and Systems.
    h. Approved Electrical Testing Laboratories.
    i. Sleeves and Openings.
    j. Sealing and Firestopping.
    k. Intent.
    l. Omissions.
    m. Submittals.
    n. Project/Site Conditions.
    o. Work Sequence and Scheduling.
    p. Work by Other Trades.
    q. Offsite Storage.
    r. Request and Certificate for Payment.
    s. Salvage Materials.
    t. Certificates and Inspections.
    u. Operating and Maintenance Data.
    v. Record Drawings.
2. PART 2 – PRODUCTS.
    a. Access Panels and Doors.
    b. Identification.
    c. Sealing and Firestopping.
3. PART 3 – EXECUTION.
    a. Excavation and Backfill.
    b. Concrete Work.
    c. Cutting and Patching.
    d. Building Access.
    e. Equipment Access.

f. Coordination.
g. Sleeves.
h. Sealing and Firestopping.
i. Housekeeping and Clean Up.
j. Owner Training.

1.04 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.05 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:
1. ANSI American National Standards Institute.
2. ASTM American Society for Testing and Materials.
3. EPA Environmental Protection Agency.
4. ETL Electrical Testing Laboratories, Inc.
5. IEEE Institute of Electrical and Electronics Engineers.
6. IES Illuminating Engineering Society.
7. ISA Instrument Society of America.
8. NBS National Bureau of Standards.
9. NEC National Electric Code.
10. NEMA National Electrical Manufacturers Association.
11. NESC National Electrical Safety Code.
12. NFPA National Fire Protection Association.
13. UL Underwriters Laboratories Inc.

1.06 REGULATORY REQUIREMENTS

A. All work and materials are to conform in every detail to applicable rules and requirements of the State of Minnesota Electrical Code the National Electrical Code (ANSI/NFPA 70), other applicable National Fire Protection Association codes, the National Electrical Safety Code, and present manufacturing standards (including NEMA).

B. All Division 26 work shall be done under the direction of a currently certified State of Minnesota Certified Master Electrician.

1.07 QUALITY ASSURANCE

A. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the performance from the system into which these items are placed.

B. Manufacturer references used herein are intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply. Where two or more manufacturers are specified and no reference is made to “or equal” other manufacturers, other manufacturers will be considered for prior approval with ten day prior approval submittals.

C. All materials shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards, if available, applicable, and approved by Owner, shall apply and such items shall bear those labels. Where one of the approved electrical testing laboratories has an applicable system listing and label, the entire system shall be so labeled.

1.08 CONTINUITY OF EXISTING SERVICES AND SYSTEMS

A. No outages shall be permitted on existing systems except at the time and during the interval specified by the Owner Project Representative. The Owner may require written approval. Any outage must be scheduled when the interruption causes the least interference with normal schedules and business routines. No extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours.

B. This Contractor shall restore any circuit interrupted as a result of this work to proper operation as soon as possible. Note that Owner operations are on a seven-day week schedule, unless otherwise specified.

1.09 APPROVED ELECTRICAL TESTING LABORATORIES

A. The following laboratories are approved for providing electrical product safety testing and listing services as required in these specifications:
   1. Underwriters Laboratories Inc.
   2. Electrical Testing Laboratories, Inc.

1.10 SLEEVES AND OPENINGS

A. Conduit Penetrations.

1.11 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between conduits, cable trays, wireways, troughs, cablebus, busduct, etc. and the structural or partition opening shall be the responsibility of the Contractor whose work penetrates the opening. The Contractor responsible shall hire individuals skilled in such work to do the sealing and firestopping. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

1.12 INTENT

A. The Contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the electrical equipment and systems installation herein specified, except such parts as are specifically exempted herein.

B. If an item is either called for in the specifications or shown on the plans, it shall be considered sufficient for the inclusion of said item in this contract. If a conflict exists within the Specifications or exists within the Drawings, the Contractor shall furnish the item, system, or workmanship, which is the highest quality, largest, or most closely fits the Owner's intent (as determined by the Owner / Project Manager). Refer to the General Conditions of the Contract for further clarification.

C. It must be understood that the details and drawings are diagrammatic. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. All sizes as given are minimum except as noted.

E. Materials and labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall be subject at all times to the Owner's and/or Architect/Engineer's inspections, tests and approval from the commencement until the acceptance of the completed work.

F. Whenever a particular manufacturer's product is named, it is intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply.

1.13 OMISSIONS

A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the Owner to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.14 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.

C. On request from the Owner or Architect/Engineer, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.

D. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.

E. The submittals must be approved before fabrication is authorized.

1.15 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Owner before proceeding.

C. Tools, materials and equipment shall be confined to areas designated by the Owner.

D. Integrity of safe room construction shall take precedence.

1.16 WORK SEQUENCE AND SCHEDULING

A. Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate electrical schedule and operations with Owner's Construction Representatives.

1.17 WORK BY OTHER TRADES

A. Every attempt has been made to indicate in this trade's specifications and drawings all work required of this Contractor. However, there may be additional specific paragraphs in other trade specifications and addenda, and additional notes on drawings for other trades which pertain to this Trade's work, and thus those additional requirements are hereby made a part of these specifications and drawings.

B. Electrical details on drawings for equipment to be provided by others are based on preliminary design data only. This Contractor shall lay out the electrical work and shall be responsible for its correctness to match equipment actually provided by others.

1.18 OFFSITE STORAGE

A. If payment will be requested for approved offsite stored material, then the Contractor shall complete an "Off-site Storage Agreement" which the Owner will consider on a case by case basis. Prior approval by Owner personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.

1.19 REQUEST AND CERTIFICATE FOR PAYMENT

A. Refer to the Division 1, General Conditions of the Contract for all payment request requirements.

1.20 SALVAGE MATERIALS

A. No materials removed from this project shall be reused except as specifically noted below. All materials removed shall become the property of and shall be disposed of by the Contractor.

1.21 CERTIFICATES AND INSPECTIONS

A. Refer to Division 1, General Conditions.

B. This Contractor is responsible for coordination of Owner electrical inspection. Inspection requirements will be issued at a pre-installation meeting, arranged by this Contractor and the Electrical Inspector having jurisdiction.

1.22 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

B. In addition to the general content specified under Section 01 78 23 - Operation and Maintenance Data supply the following additional documentation:
   1. Manufacturer’s wiring diagrams for electrically powered equipment.

1.23 RECORD DRAWINGS

A. The Contractor shall maintain at least one copy each of the specifications and drawings on the job site at all times.

B. The Engineer will provide the Contractor with a suitable set of contract drawings on which daily records of changes and deviations from contract shall be recorded. Dimensions and elevations on the record drawings shall locate all buried or concealed piping, conduit, or similar items.

C. The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups will be permitted.

D. At completion of the project, the Contractor shall submit the marked-up record drawings to the Owner prior to final payment.

PART 2 PRODUCTS

2.01 ACCESS PANELS AND DOORS

A. Lay-in Ceilings:
   1. Removable lay-in ceiling tiles in 2 x 2 foot or 2 x 4 foot configuration provided under other divisions are sufficient; no additional access provisions are required unless specifically indicated.

2.02 IDENTIFICATION

A. See Electrical Section 26 05 53 – Identification for Electrical Systems.

2.03 SEALING AND FIRESTOPPING

A. Fire and/or Smoke Rated Penetrations:
   1. Whenever possible, avoid penetrations of fire and smoke rated partitions. When they cannot be avoided, verify that sufficient space is available for the penetration to be effectively fire and smoke stopped.

B. Manufacturers:
   1. 3M: www.3m.com.
   2. STI/SpecSeal: www.stifirestop.com.
   3. Tremco: www.tremcosealants.com.
   4. Hilti: www.hilti.com.
   5. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

C. All firestopping systems shall be by the same manufacturer.

D. Submittals:

E. Refer to Section 01 33 00 - Submittal Procedures.
   1. Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.

F. Product:
   1. Firestop systems shall be UL listed or tested by an independent testing laboratory approved by the Department of Commerce.

G. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.

H. Contractor shall use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.

I. Non-Rated Penetrations:
   1. Conduit Penetrations Through Below Grade Walls:
      a. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated conduit and the cored opening or a water-stop type wall sleeve.
   2. Conduit and Cable Tray Penetrations:
      a. At conduit and cable tray penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

PART 3 EXECUTION

3.01 EXCAVATION AND BACKFILL

A. Perform all excavation and backfill work to accomplish indicated electrical systems installation in accordance with Section 31 23 00 - Excavation and Fill. Blasting will not be allowed without written permission of the Owner.

3.02 CONCRETE WORK

A. The Division 3 Contractor will perform all cast-in-place concrete unless noted otherwise elsewhere. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for the support of electrical equipment.

3.03 CUTTING AND PATCHING

A. Refer to Division 1, General Requirements, Cutting and Patching.

3.04 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this Contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.05 EQUIPMENT ACCESS

A. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Where access is required in plaster or drywall walls or ceilings, furnish the access doors to the General Contractor and reimburse the General Contractor for installation of those access doors.

3.06 COORDINATION

A. The Contractor shall cooperate with other trades and Owner's personnel in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

B. The Contractor shall verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to light fixtures, panelboards, devices, etc. and recessed or semi-recessed heating units installed in/on architectural surfaces.

C. Coordinate all work with other Contractors prior to installation. Any installed work that is not coordinated and that interferes with other Contractor's work shall be removed or relocated at the installing Contractor's expense.

D. Cooperate with the testing consultant in ensuring specification Section 26 05 04 compliance. Verify system completion to the testing consultant. Demonstrate the starting, interlocking and control features of each system so the testing Contractor can perform its work.

3.07 SLEEVES

A. Pipe sleeves for conduits 6" in diameter and smaller, in new poured concrete construction, shall be schedule 40 steel pipe, plastic removable sleeve or sheet metal sleeve, all cast in place.

B. In wet area floor penetrations, top of sleeve to be 2 inches above the adjacent floor. In existing wet area floor penetrations, core drill sleeve openings large enough to insert schedule 40 sleeve and grout the area around the sleeve. If a pipe clamp resting on the sleeve supports the pipe penetrating the sleeve, weld a collar or struts to the sleeve that will transfer weight to the existing floor structure. Wet areas for this paragraph are rooms or spaces containing air handling unit coils, converters, pumps, chillers, boilers, and similar waterside equipment.

C. Pipe penetrations in existing concrete floors that are not in wet areas may omit the use of schedule 40 sleeve and use the core drilled opening as the sleeve.

3.08 SEALING AND FIRESTOPPING

A. Fire and/or Smoke Penetrations:
   1. Install approved product in accordance with the manufacturer's instructions where a pipe (i.e. cable tray, bus, cable bus, conduit, wireway, trough, etc.) penetrates a fire rated surface.

B. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.

C. Non-Rated Surfaces:
   1. When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.
   2. Install escutcheons or floor/ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.
   3. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, in accordance with the manufacturer's instructions. Install so that the bolts used to tighten the seal are accessible from the interior of the building or vault.
   4. At interior partitions, conduit penetrations are required to be sealed for all clean rooms, laboratories, and most hospital spaces, computer rooms, dormitory rooms, tele/data/com rooms and similar spaces where the room pressure or odor transmission must be controlled. Apply sealant to both sides of the penetration in such a manner that the annular space between the conduit sleeve and the conduit is completely filled.

3.09 HOUSEKEEPING AND CLEAN UP

A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

3.10 OWNER TRAINING

A. All training provided for the Owner shall comply with the format, general content requirements and submission guidelines specified under General Conditions.

B. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 4 hours.

END OF SECTION

SECTION 26 05 04

CLEANING, INSPECTION, AND TESTING OF ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes the required cleaning, repair, adjustment, calibration, maintenance and testing of electrical equipment, as specified herein. This applies only to new electrical and existing electrical equipment being furnished, modified, worked on or serviced by this Contractor for this project. Included are the following topics:

1. PART 1 – GENERAL.
   a. Scope.
   b. Related Work.
2. PART 2 – PRODUCTS.
   a. Not Used.
3. PART 3 – EXECUTION.
   a. General Inspection and Cleaning of all Equipment.
   b. Grounding Systems.
   c. Cables.
   d. Panelboards.
   e. Light Fixtures.
   f. Occupancy Sensors.
   g. Battery Pack Emergency Lighting.
   h. Generators.
   i. Automatic Transfer Switches.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 GENERAL INSPECTION AND CLEANING OF ALL ELECTRICAL EQUIPMENT

A. Inspect for physical damage and abnormal mechanical and electrical conditions.

B. Any item found to be out of tolerance, or in any other way defective as a result of the required testing, shall be reported to the Engineer and Owner. Procedure for repair and/or replacement will be outlined. After appropriate corrective action is completed the item shall be re-tested.

C. Compare equipment nameplate information with the latest single line diagram and report any discrepancies.

D. Verify proper auxiliary device operation and indicators.

E. Check tightness of accessible bolted electrical joints. Use torque wrench method.

F. Make a close examination of equipment and remove any shipping brackets, insulation, packing, etc. that may not have been removed during original installation.

G. Make a close examination of equipment and remove any dirt or other forms of debris that may have collected in existing equipment or in new equipment during installation.

H. Clean All Equipment:
   1. Vacuum inside of panelboards, switchboards, fire alarm panels, comm/data, security panel, etc.
   2. Loosen attached particles and vacuum them away.
   3. Wipe all insulators with a clean, dry, lint free rag.
   4. Clean insulator grooves.
   5. Re-vacuum inside surfaces as directed by the Owner's Construction Representative or Inspector.

I. Inspect equipment anchorage.

J. Inspect equipment and bus alignment.

K. Check all heater elements for operation and control.

L. Lubricate nonelectrical equipment per manufacturer's recommendations.

3.02 GROUNDING SYSTEMS

A. Inspect the ground system for adequate termination at all devices.

3.03 CABLES

A. Visual and Mechanical Inspections:
   1. Inspect exposed sections for physical damage.
   2. Verify cable is supplied and connected in accordance with single line diagram.
   3. Inspect for shield grounding, cable support and termination.
   4. If cables are terminated through window type C.T.'s make an inspection to verify that neutrals and grounds are properly terminated for normal operation of protective devices.
   5. Inspect for visual jacket and insulation condition.
   6. Visible cable bends shall be checked against ICEA or manufacturer's minimum allowable bending radii -- 12 times the diameter for tape shielded cables.
   7. Inspect for proper fireproofing in common cable areas.
   8. There shall be NO tests performed on existing cable without specific direction from the Consulting Engineer.

B. Electrical Tests -- Below 600 Volts:
   1. All secondary cables from the substation transformers to the secondary switchboards shall be subjected to insulation tests using a 500 vdc megger.
   2. Visually inspect cables, lugs, connectors and all other components for physical damage and proper connections.
   3. Check all cable connectors for tightness (with a torque wrench) and clearances. Torque test conductor and bus terminations to manufacturer's recommendations.
   4. Check for proper grounding resistance at all services and at transformers. Resistance shall be 2 ohms maximum.
      a. Above 600 volts:
         1) Above 600 volt testing will be performed under a separate contract.

3.04 PANELBOARDS

A. Torque all the connections per the manufacturers spec. Verify phase wires, color coding, separate neutral and mechanical bonding. Verify circuit breaker operation. Verify the directory.

3.05 LIGHT FIXTURES

A. Check the bonding and proper lamping. Verify that recessed fixtures are installed with hold down clips. Confirm operation of the fixture with the proper switch or sensor.

3.06 OCCUPANCY SENSORS

A. Confirm operation of the sensor per the manufacturers spec.

3.07 BATTERY PACK EMERGENCY LIGHTING

A. Verify the operation per the manufacturers spec and run all of the diagnostic steps. Confirm proper grounding and location.

3.08 GENERATORS

A. Run the generator through the standard tests as recommended by the manufacturer including the load bank test. Test the automatic start circuits and run the full diagnostic tests. Verify the fuel and the tank. Check for fuel and coolant leaks.

B. Provide full load testing utilizing a portable test bank for four hours continuous, minimum. During the first two hours, step increase the load from 0% to 100% in at least six equal steps. At the end of two hours, continue running test at 100% load. Record the following in 20 minute intervals throughout the four hour test: kilowatts, amperes, voltage, coolant temperature, room temperature, generator frequency (Hz), oil pressure, fuel consumption.

C. After the generator has cooled down from the four hour test, shut it down and then simulate a power failure including operation of the transfer switch, automatic cycle, and automatic shutdown and return to normal.

3.09 AUTOMATIC TRANSFER SWITCHES

A. Coordinate with the generator and the subsequent tests.

END OF SECTION

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SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes furnishing and installing required wiring and cabling systems including pulling, terminating and splicing. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. References.
      d. Submittals.
      e. Project Conditions.
   2. PART 2 – PRODUCTS.
      a. General.
      b. Building Wire.
      c. Underground Wire for Exterior Work.
      d. Wiring Connectors.
   3. PART 3 – EXECUTION.
      a. General Wiring Methods.
      b. Wiring Installation In Raceways.
      c. Wiring Connections and Terminations.
      d. Field Quality Control.
      e. Wire Color.
      f. Branch Circuits.
      g. Emergency Circuits.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

B. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

C. Section 26 05 53 – Identification for Electrical Systems.

1.03 REFERENCES

A. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Submit product data: Provide for each cable assembly type.

C. Submit factory test reports: Indicate procedures and values obtained.

D. Submit shop drawings for modular wiring system including layout of distribution devices, branch circuit conduit and cables, circuiting arrangement, and outlet devices.

E. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.05 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 PRODUCTS

2.01 GENERAL

A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.

B. All conductors shall be copper.

C. Aluminum conductors shall not be used.

2.02 BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Insulation: Type THHN/THWN, XHHW-2 insulation for feeders and branch circuits.

2.03 UNDERGROUND WIRE FOR EXTERIOR WORK

A. Description: Stranded single or multiple conductor insulated wire.

B. Insulation: Type XHHW-2 or USE.

C. This wiring shall be used in all underground applications, except when run in a concrete-encased ductbank.

2.04 WIRING CONNECTORS

A. Split Bolt Connectors: Not acceptable.

B. Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to equipment pads or terminals. Not approved for splicing.

C. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.

D. All wire connectors used in underground or exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations.

E. Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.

F. Compression (crimp) Connectors: Long barrel; seamless, tin-plated electrolytic copper tubing; internally beveled barrel ends. Connector shall be clearly marked with the wire size and type and proper number and location of crimps. Connector shall be irreversible type meeting IEEE Standard 837-2002, UL Listed.

PART 3 EXECUTION

3.01 GENERAL WIRING METHODS

A. All wire and cable shall be installed in conduit.

B. Do not use wire smaller than 12 AWG for power and lighting circuits.

C. All conductors shall be sized to prevent excessive voltage drop at rated circuit ampacity. As a minimum use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 100 feet (30 m), and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet (61 m).

D. Make conductor lengths for parallel conductors equal.

E. Splice only in junction or outlet boxes.

F. No conductor less than 10 AWG shall be installed in exterior underground conduit.

G. Identify ALL low voltage, 600v and lower, wire per section 26 05 53.

H. Neatly train and lace wiring inside boxes, equipment, and panelboards.

3.02 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling 4 AWG and larger wires and for other conditions when necessary.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Completely and thoroughly swab raceway system before installing conductors.

D. Place all conductors of a given circuit (this includes phase wires, neutral (if any), and ground conductor) in the same raceway. If parallel phase and/or neutral wires are used, then place an equal number of phase and neutral conductors in same raceway or cable.

E. VFD Installations: Install VFD input wiring and output wiring in separate conduit systems. Do not mix VFD input power and output power, or control wiring in a common raceway.

3.03 WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible junction boxes.

B. Wire splices and taps shall be made firm, and adequate to carry the full current rating of the respective wire without soldering and without perceptible temperature rise.

C. All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.

D. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.

E. Use mechanical or compression connectors for wire splices and taps, 8 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.

F. Thoroughly clean wires before installing lugs and connectors.

G. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

3.04 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 26 05 04.
   1. Additional testing as follows shall be performed if aluminum conductors are used:
      a. Equipment terminated with aluminum conductors shall be tested with a thermal imager and recorded.
      b. Conductors shall be closely checked for loose or poor connections, and for signs of overheating or corrosion.
      c. Test procedures shall meet NETA guidelines.
      d. Test results and report shall be provided to the engineer.
      e. Contractor shall correct all deficiencies reported in the test report.

3.05 WIRE COLOR

A. General:
   1. For wire sizes 10 AWG and smaller - Wire shall be colored as indicated below.
   2. For wire sizes 8 AWG and larger – Use colored wire, or identify wire with colored tape at all terminals, splices and boxes. Colors to be as indicated below.
   3. In existing facilities, use existing color scheme.
   4. In new facilities, use black and red for single phase circuits at 120/240 volts, use Phase A black, Phase B red and Phase C blue for circuits at 120/208 volts single or three phase, and use Phase A brown, Phase B orange and Phase C yellow for circuits at 277/480 volts single or three phase. Note: This includes fixture whips except for Listed whips mounted by the fixture manufacturer on the fixture and Listed as a System.
   5. All switch legs shall be the same color as their associated circuit. Traveler conductors run between 3 and 4 way switches shall be colored pink or purple.

B. Neutral Conductors: White for 120/208V and 120/240V systems, Gray for 277/480V systems. Where there are two or more neutrals in one conduit, each shall be individually identified with a different stripe.

C. Branch Circuit Conductors: Three or four wire home runs shall have each phase uniquely color coded.

D. Feeder Circuit Conductors: Each phase shall be uniquely color coded.

E. Ground Conductors: Green for 6 AWG and smaller. For 4 AWG and larger, identify with green colored wire, or with green tape at both ends and at all access points, such as panelboards, motor starters, disconnects and junction boxes. When isolated grounds are required, Contractor shall provide green with yellow tracer.

3.06 BRANCH CIRCUITS

A. The use of single-phase, multi-wire branch circuits with a common neutral is not permitted. All branch circuits shall be furnished and installed with an individual accompanying neutral, sized the same as the phase conductors.

3.07 EMERGENCY CIRCUITS

A. All emergency system wiring (level 1 and level 2) shall be installed in separate raceways after their associated transfer switches. The wiring shall be separate from each other and from all normal system wiring.

END OF SECTION

SECTION 26 05 23

CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes furnishing and installing required remote control and signal cabling. Included are the following topics:
   1. PART 1 - GENERAL.
      a. Scope.
      b. Related Work.
      c. References.
      d. Submittals.
      e. Project Conditions.
   2. PART 2 - PRODUCTS.
      a. General.
      b. Remote Control and Signal Cable.
      c. Wiring Connectors.
   3. PART 3 - EXECUTION.
      a. General Wiring Methods.
      b. Wiring Installation In Raceways.
      c. Free-Air Cable Installation.
      d. Wiring Connections and Terminations.
      e. Field Quality Control.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

B. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems.

1.03 REFERENCES

A. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Submit product data: Provide for each cable assembly type.

C. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.05 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 PRODUCTS

2.01 GENERAL

A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.

B. All conductors shall be copper.

C. Insulation shall have a 600 volt rating.

D. All conductors must be suitable for the application intended. Conductors #12 and smaller may be solid or stranded with the following requirements or exceptions:
1. All conductors terminated with crimp type devices must be stranded.
2. Stranded conductors may only be terminated with UL OR ETL Listed type terminations or methods: e.g. stranded conductors may not be wrapped around a terminal screw but must be terminated with a crimp type device or must be terminated in an approved back wired method.

2.02 REMOTE CONTROL AND SIGNAL CABLE

A. Refer to Section 28 31 00 for requirements for cable to be used on fire alarm systems.

B. All other systems cabling shall meet the requirements of NEC Article 725 and the following:
1. Control Cable for Class 1 Remote Control and Signal Circuits: 600 volt insulation, individual conductors twisted together, shielded, and covered with an overall PVC jacket. Cable shall be Listed, temperature rated, and plenum or non-plenum rated for the application as required in the National Electrical Code.
2. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits shall be constructed, Listed, temperature rated, and plenum or non-plenum rated for the application as required in the NEC Article 725.

2.03 WIRING CONNECTORS

A. Split Bolt Connectors: Not acceptable.

B. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.

C. All wire connectors used in underground or exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations.

PART 3 EXECUTION

3.01 GENERAL WIRING METHODS

A. Low voltage control and signal cables shall be installed in conduit. However, they may be installed without conduit above accessible ceilings if the cable meets NEC requirements for the application, unless specified to be in conduit in other sections of the specifications. See requirements for free-air cabling installation below.

B. Control cables for controlling HVAC and lighting equipment connected to emergency power shall be routed in raceway.

C. Do not use wire smaller than 14 AWG for control wiring greater than 60 volts, or 18 AWG for voltages less than 60 volts, all sizes subject to NEC 725 requirements.

D. Splice only in junction boxes.

E. Identify wire per section 26 05 53.

F. Neatly train and lace wiring inside boxes, and equipment.

3.02 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling conditions when necessary.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Completely and thoroughly swab raceway system before installing conductors.

3.03 FREE-AIR CABLE INSTALLATION

A. When permitted in exposed ceiling areas, 'Free-Air' wiring runs shall avoid areas of high traffic (i.e. aisle way), shall be run as close as possible to outlining walls and shall be a minimum of ten (10) feet above finished floor.

B. Cabling shall be neatly run at right angles and be kept clear of other trades work.

C. Cabling shall be supported at a maximum of 4-foot intervals utilizing 'bridal-type' mounting rings anchored to ceiling concrete, piping supports or structural steel beams. If cable sag at mid-span exceeds 12-inches, another support shall be provided. Mounting rings shall be designed to maintain cables bend to larger than the minimum bed radius (typically 4 x cable diameter).

D. Cabling shall not be attached to or supported by existing cabling, plumbing or steam piping, ductwork, suspended ceiling supports or electrical conduit. Additionally, cabling shall not be laid directly on the ceiling grid.

E. To reduce or eliminate Electro-Magnetic Interference (EMI), the following minimum separation distances for 'Free-Air' cabling installations shall be adhered to:
   1. Twelve (12) inches from power lines of less than 5kV.
   2. Thirty-nine (39) inches from power lines of 5kV or greater.
   3. Eighteen (18) inches from lighting fixtures.
   4. Thirty-nine (39) inches from transformers and motors.

F. A coil of 2 feet in each cable shall be placed in the ceiling at each 'free-air' wired device. These coils shall be secured (wire tied) at the last cable support before the cable reaches the device and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.

G. All cable shall be free of tension at both ends. Nylon strain relief connectors shall be provided at each device and junction box where cables enter. In cases where the cable must bear some stress, Kellum type grips may be used to spread the strain over a longer length of cable.

H. Cable manufacturers minimum bend radius shall be observed in all instances. Care should be taken in the use of cable ties to secure and anchor the station cabling. Ties should not be over tightened as to compress the cable jacket. No sharp burrs should remain where excess length of the cable tie has been cut.

I. All exposed vertical cable extensions to devices located below the finished ceiling shall be in conduit.

J. Provide protection for exposed cables where subject to damage.

K. Use suitable cable fittings and connectors.

3.04 WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible junction boxes.

B. All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.

C. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.

D. Thoroughly clean wires before installing lugs and connectors.

E. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

3.05 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 26 05 04.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes grounding electrodes and conductors, equipment grounding conductors, and bonding. Included are the following topics:

1. PART 1 - GENERAL.
   a. Scope.
   b. Related Work.
   c. References.
   d. Performance Requirements.
   e. Submittals.
   f. Project Record Documents.
   g. Regulatory Requirements.
2. PART 2 - PRODUCTS.
   a. Rod Electrode.
   b. Mechanical Connectors.
   c. Compression Connectors.
   d. Exothermic Connections.
   e. Wire.
   f. Bus.
3. PART 3 - EXECUTION.
   a. Examination.
   b. General.
   c. Less Than 600 Volt System Grounding.
   d. Field Quality Control.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.03 REFERENCES

A. NFPA 70 - National Electrical Code.

B. ANSI/IEEE 142 (Latest edition) - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

1.04 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 2 ohms maximum at building service entrance.

B. Testing of grounding system resistance is to be witnessed by the Engineer / Owner Representative. Provide test report of grounding system resistance in final O&M manuals.

1.05 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Product Data: Provide data for grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

D. Manufacturer's Instructions: Include instructions for preparation, installation and examination of exothermic connectors.

1.06 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of grounding electrodes.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 ROD ELECTRODE

A. Material: Copper-clad steel.

B. Diameter: 3/4 inch (19 mm) minimum.

C. Length: 10 feet (3.5 m) minimum. Rod shall be driven at least 9' 6" deep.

2.02 MECHANICAL CONNECTORS

A. The mechanical connector bodies shall be manufactured from high strength; high conductivity cast copper alloy material. Bolts, nuts, washers and lock washers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.

B. Split bolt connector types are NOT allowed. Exception: The use of split bolts is acceptable for grounding of wire-basket type cable tray, and for cable shields/straps of medium voltage cable.

C. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

2.03 COMPRESSION CONNECTORS

A. The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99% by IACS standards.

B. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.

C. The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.

D. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.

E. Each connector shall be factory filled with an oxide-inhibiting compound.

2.04 EXOTHERMIC CONNECTIONS

A. Manufacturers:
1. Cadweld: www.Cadweld.com.

2.05 WIRE

A. Material: Stranded copper (aluminum not permitted).

B. Grounding Electrode Conductor: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger.

C. Foundation Electrodes: As shown on drawings.

D. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both are used on the same facility.

2.06 BUS

A. Material: Copper (aluminum not permitted).

B. Size: 1/4" X 2" minimum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 GENERAL

A. Install Products in accordance with manufacturer's instructions.

B. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.

C. Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.

D. Attach grounds permanently before permanent building service is energized.

E. All grounding electrode conductors shall be installed in PVC conduit, in exposed locations.

3.03 LESS THAN 600 VOLT SYSTEM GROUNDING

A. Supplementary Grounding Electrode: Use driven ground rod on exterior of building. Use effectively grounded metal frame of the building as noted on drawings.

B. Provide code sized copper grounding electrode conductor from secondary switchboard ground bus, each separately derived system neutral, secondary service system neutral to street side of water meter, building steel, ground rod, and any concrete encased electrodes. Provide bonding jumper around water meter.

C. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

D. Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to under floor ground grid. Use #4 AWG bare copper conductor.

E. Equipment Grounding Conductor: Provide separate, insulated equipment grounding conductor within each raceway. Terminate each end on suitable lug, bus, enclosure or bushing. Provide a ground wire from each device to the respective enclosure.

F. Provide communications system grounding conductor at point of service entrance and connect to building common grounding electrode system.

3.04 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes conduit and equipment supports, straps, clamps, steel channel, etc, and fastening hardware for supporting electrical work. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Submittals.
      d. Quality Assurance.
   2. PART 2 – PRODUCTS.
      a. Material.
   3. PART 3 – EXECUTION.
      a. Installation.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.03 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Product Data: Provide data for support channel.

1.04 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 PRODUCTS

2.01 MATERIAL

A. Support Channel: Steel, Galvanized, Enameled or other corrosion resistant.

B. Hardware: Corrosion resistant.

C. Minimum sized threaded rod for supports shall be 3/8” for trapezes and single conduits 1-1/4” and larger, and 1/4” for single conduits 1” and smaller.

D. Conduit clamps, straps, supports, etc., shall be steel or malleable iron. One-hole straps shall be heavy duty type. All straps shall have steel or malleable backing plates when rigid steel conduit is installed on the interior or exterior surface of any exterior building wall.

PART 3 EXECUTION

3.01 INSTALLATION

A. Fasten hanger rods, conduit clamps, outlet, junction and pull boxes to building structure using pre-cast insert system, preset inserts, beam clamps, expansion anchors, or spring steel clips (interior metal stud walls only).

B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchors on concrete surfaces; sheet metal screws in sheet metal studs and wood screws in wood construction. If nail-in anchors are used, they must be removable type anchors.

C. **Powder-actuated fasteners and plastic wall anchors are not permitted.**

D. File and de-bur cut ends of support channel and spray paint with cold galvanized paint to prevent rusting.

E. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit. Do not fasten to suspended ceiling grid system.

F. Do not drill structural steel members unless approved by Owner.

G. Fabricate supports from galvanized structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

H. In wet locations, mechanical rooms and electrical rooms install free-standing electrical equipment on 3.5 inch concrete pads.

I. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch off wall (7/8” Uni-strut or 3/4” painted, fire-retardant plywood is acceptable).

J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

K. Furnish and install all supports as required to fasten all electrical components required for the project, including free standing supports required for those items remotely mounted from the building structure, catwalks, walkways etc.

END OF SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes conduits, surface raceways, multi-outlet assemblies, auxiliary gutters, wall duct, and boxes for electrical systems including wall and ceiling outlet boxes, floor boxes, and junction boxes. Included are the following topics:

1. PART 1 - GENERAL.
   a. Scope.
   b. Related Work.
   c. Submittals.
2. PART 2 - PRODUCTS.
   a. Rigid Metal Conduit and Fittings.
   b. Intermediate Metal Conduit (IMC) and Fittings.
   c. Electrical Metallic Tubing (EMT) and Fittings.
   d. Flexible Metal Conduit and Fittings.
   e. Liquidtight Flexible Metal Conduit and Fittings.
   f. Electrical Nonmetallic Tubing (ENT) and Fittings.
   g. Conduit Supports.
   h. Surface Metal Raceway.
   i. Multi-Outlet Assembly.
   j. Auxiliary Gutters (Wireways).
   k. Outlet Boxes.
   l. Floor Boxes.
   m. Pull and Junction Boxes.
   n. General.
3. PART 3 - EXECUTION.
   a. Conduit Sizing, Arrangement and Support.
   b. Conduit Installation.
   c. Conduit Installation Schedule.
   d. Surface Metal Raceway and Multi-Outlet Assembly Installation.
   e. Auxiliary Gutters (Wireways) Installation.
   f. Coordination of Box Locations.
   g. Outlet Box Installation.
   h. Pull and Junction Box Installation.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 27 26 - Wiring Devices.

D. Section 28 31 00 - Fire Detection and Alarm.

1.03 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Surface Raceway System - submit product data and catalog sheets for all components.

C. Boxes - provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

PART 2 PRODUCTS

2.01 RIGID METAL CONDUIT AND FITTINGS

A. Conduit: Heavy wall, galvanized steel, schedule 40, threaded.

B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.02 INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS

A. Conduit: Galvanized steel, threaded.

B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.03 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. Conduit: Steel, galvanized tubing.

B. Fittings: All steel, set screw, concrete tight. No push-on or indenter types permitted.

C. Conduit Bodies: All steel threaded conduit bodies.

2.04 FLEXIBLE METAL CONDUIT AND FITTINGS

A. Conduit: Steel, galvanized, spiral strip.

B. Fittings and Conduit Bodies: All steel, galvanized, or malleable iron (except as allowed in specification 26 51 13).

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

A. Conduit: Flexible, steel, galvanized, spiral strip with an outer Liquidtight, nonmetallic, sunlight-resistant jacket.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1, compression type. There shall be a metallic cover/insert on the end of the conduit inside the connector housing to seal the cut conduit end.

2.06 RIGID NONMETALLIC CONDUIT AND FITTINGS

A. Conduit: Schedule 40 PVC minimum, Listed, sunlight resistant, rated for 90 °C conductors.

B. Fittings and Conduit Bodies: NEMA TC 2, Listed.

2.07 CONDUIT SUPPORTS

A. See section 26 05 29.

2.08 SURFACE METAL RACEWAY

A. Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.

B. Size: As shown on Drawing.

C. Finish: Brown enamel.

D. Fittings: Couplings, elbows, and connectors designed for use with raceway system.

E. Boxes and Extension Rings: Designed for use with raceway systems.

2.09 SURFACE NONMETAL RACEWAY

A. Description: Nonmetallic channel with fitted cover, suitable for use as surface raceway.

B. Size: As shown on Drawing.

C. Color: Brown.

D. Fittings: Couplings, elbows, and connectors designed for use with raceway system.

E. Boxes and Extension Rings: Designed for use with raceway systems.

2.10 AUXILIARY GUTTERS (WIREWAYS)

A. Description: General purpose type wireway without knockouts.

B. Size: As indicated on Drawings; length as indicated on Drawings.

C. Cover: Hinged Screw applied cover.

D. Connector: Screw applied cover.

E. Fittings: Lay-in type with captive screws.

F. Finish: Rust inhibiting primer coat with gray enamel finish.

2.11 OUTLET BOXES

A. Sheet Metal Outlet Boxes: Galvanized steel, with stamped knockouts.

B. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.

C. Concrete Ceiling Boxes: Concrete type.

D. Cast Boxes: Cast ferroalloy, or aluminum type deep type, gasketed cover, threaded hubs.

2.12 PULL AND JUNCTION BOXES

A. Pull boxes and junction boxes shall be minimum 4 inch square by 2-1/8 inches deep for use with 1 inch conduit and smaller. On conduit systems using 1-1/4 inch conduit or larger, pull and junction boxes shall be sized per NEC but not less than 4-11/16 inch square.

B. For telecommunication, fiber optic, security, and other low voltage cable installations the NEC box size requirements shall apply. All boxes, used on telecommunication, security, other low voltage and fiber optic systems with conduits of 1-1/4 inch and larger, shall be sized per the NEC conduit requirements. For determining box size, the conduit is the determining factor not the wire size.

C. Sheet Metal Boxes: Code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.

D. Sheet Metal Boxes Larger than 12 inches in any dimension shall have a hinged cover or a chain installed between box and cover.

E. Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron or aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

F. Fiberglass or Concrete Handholes with weatherproof cover of non-skid finish shall be used for underground installations.

G. Box extensions and adjacent boxes within 48 inches of each other are not allowed for the purpose of creating more wire capacity.

H. Junction boxes 6" x 6" or larger size shall be without stamped knock-outs.

I. Wireways shall not be used in lieu of junction boxes.

2.13 GENERAL

A. All steel fittings and conduit bodies shall be galvanized.

B. No cast metal or split-gland type fittings permitted.

C. Mogul-type condulets larger than 2 inch not permitted except as approved or detailed.

D. All condulet covers must be fastened to the condulet body with screws and be of the same manufacturer.

E. Wireways, gutters and c-condulets shall not be used in lieu of pull boxes and condulets.

F. All boxes shall be of sufficient size to provide free space for all conductors enclosed in the box and shall comply with NEC requirements.

PART 3 EXECUTION

3.01 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

A. EMT is permitted to be used in sizes 4 inch and smaller for power and telecommunication systems. See CONDUIT INSTALLATION SCHEDULE below for other limitations for EMT and other types of conduit.

B. Size power conductor raceways for conductor type installed. Conduit size shall be 1/2 inch minimum except **all homerun conduits shall be 3/4 inch,** or as specified elsewhere. **Caution: Per the NEC, the allowable conductor ampacity is reduced when more than three current-carrying conductors are installed in a raceway. Contractor must take the NEC ampacity adjustment factors into account when sizing the raceway and wiring system.**

C. Size conduit for all other wiring, including but not limited to data, control, security, fire alarm, telecommunications, signal, video, etc. shall be sized per number of conductors pulled and their cross-section. 40% fill shall be maximum for all new conduit fills.

D. Arrange conduit to maintain headroom and present a neat appearance.

E. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.

F. Maintain minimum 6 inch clearance between conduit and piping. Maintain 12 inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

G. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized pipe straps, conduit racks (lay-in adjustable hangers), clevis hangers, or bolted split stamped galvanized hangers.

H. Group conduit in parallel runs where practical and use conduit rack (lay-in adjustable hangers) constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.

I. Do not fasten conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used for temporary conduit support during construction.

J. Support and fasten metal conduit at a maximum of 8 feet on center.

K. Supports shall be independent of the installations of other trades, e.g. ceiling support wires, HVAC pipes, other conduits, etc., unless so approved or detailed.

L. In general, all conduit shall be concealed except where noted on the drawings or approved by the Engineer. Contractor shall verify with Engineer all surface conduit installations except in mechanical rooms.

M. Changes in direction shall be made with symmetrical bends, cast steel boxes, stamped metal boxes or cast steel conduit bodies.

N. For indoor conduits, no continuous conduit run shall exceed 100 feet without a junction box.

O. All conduits installed in exposed areas shall be installed with a box offset before entering box.

3.02 CONDUIT INSTALLATION

A. Cut conduit square; de-burr cut ends.

B. Conduit shall not be fastened to the corrugated metal roof deck.

C. Bring conduit to the shoulder of fittings and couplings and fasten securely.

D. Use conduit hubs for fastening conduit to cast boxes. Use sealing locknuts or conduit hubs for fastening conduit to sheet metal boxes in damp or wet locations.

E. All conduit terminations (except for terminations into conduit bodies) shall use conduit hubs, or connectors with one locknut, or shall use double locknuts (one each side of box wall) and insulated bushing. Provide bushings for the ends of all conduit not terminated in box walls. Refer to Section 26 05 26 – Grounding and Bonding for Electrical Systems for grounding bushing requirements.

F. Install no more than the equivalent of three 90 degree bends between boxes.

G. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch (50 mm) size unless sweep elbows are required.

H. Conduit shall be bent according to manufacturer's recommendations. Torches or open flame shall not be used to aid in bend of PVC conduit.

I. Use suitable conduit caps or other approved seals to protect installed conduit against entrance of dirt and moisture.

J. Provide 1/8 inch (3 mm) nylon pull string in empty conduit, except sleeves and nipples.

K. Install expansion-deflection joints where conduit crosses building expansion joints. Note: expansion-deflection joints are not required where conduit crosses building control joints if the control joint does not act as an expansion joint. Install expansion fitting in PVC conduit runs as recommended by the manufacturer.

L. Avoid moisture traps where possible. Where moisture traps are unavoidable, provide junction boxes with drain fittings at conduit low points.

M. Where conduit passes between areas of differing temperatures such as into or out of cool rooms, freezers, unheated and heated spaces, buildings, etc., provide Listed conduit seals to prevent the passage of moisture and water vapor through the conduit.

N. Route conduit through roof openings for piping and ductwork where possible.

O. Conduit is not permitted in any slab topping of two inches or less.

P. Ground and bond conduit under provisions of Section 26 05 26.

3.03 CONDUIT INSTALLATION SCHEDULE

A. Conduit other than that specified below for specific applications shall not be used.

B. Underground Installations within Five Feet of Foundation Wall: Rigid steel conduit.

C. Underground Installations More than Five Feet from Foundation Wall: Rigid steel conduit. Plastic-coated rigid steel conduit. Schedule 40 PVC conduit.

D. Under Slab on Grade Installations: Schedule 40 PVC conduit.

E. Exposed Outdoor Locations: Rigid steel conduit.

F. Concealed in Concrete and Block Walls: Rigid steel conduit. Electrical metallic tubing. Schedule 40 PVC conduit.

G. Within Concrete Slab: Not allowed.

H. Concealed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

I. Exposed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

J. Motor and equipment connections: Flexible PVC coated metal conduit (all locations). Minimum length shall be one foot, maximum length shall be three feet. Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.

K. Light fixtures: Direct box or conduit connection for surface mounted and recessed fixtures. Flexible metal conduit from a J-box for recessed lay-in light fixtures. Conduit size shall be 3/8 inch minimum diameter and six foot maximum length. Conduit length shall allow movement of fixture for maintenance purposes.

L. Conduit is not allowed in safe room structure.

3.04 SURFACE METAL RACEWAY AND MULTI-OUTLET ASSEMBLY INSTALLATION

A. Use flat-head screws to fasten channel to surfaces every twenty-four (24) inches. Mount plumb and level.

B. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

C. Maintain grounding continuity between raceway components to provide a continuous grounding path under provisions of Section 26 05 26.

D. Fastener Option: Use clips and straps suitable for the purpose.

3.05 AUXILIARY GUTTERS (WIREWAYS) INSTALLATION

A. Bolt auxiliary gutter to wall using two-piece hangers or steel channels fastened to the wall or in self-supporting structure.

B. Gasket each joint in oil-tight gutter.

C. Mount rain-tight gutter in horizontal position only.

D. Maintain grounding continuity between raceway components to provide a continuous grounding path under provisions of Section 26 05 26.

3.06 COORDINATION OF BOX LOCATIONS

A. Boxes are not allowed in safe room structure.

B. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

C. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.

D. No outlet, junction, or pull boxes shall be located where it will be obstructed by other equipment, piping, lockers, benches, counters, etc.

E. Boxes shall not be fastened to the metal roof deck.

F. It shall be the Contractor's responsibility to study drawings pertaining to other trades, to discuss location of outlets with workmen installing other piping and equipment and to fit all electrical outlets to job conditions.

G. In case of any question or argument over the location of an outlet, the Contractor shall refer the matter to the Engineer and install outlet as instructed by the Engineer.

H. The proper location of each outlet is considered a part of this contract and no additional compensation will be paid to the Contractor for moving outlets which were improperly located.

I. Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and provide 18 inch by 24 inch access doors.

J. Locate and install to maintain headroom and to present a neat appearance.

K. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

3.07 OUTLET BOX INSTALLATION

A. Do not install boxes back-to-back in walls. Provide minimum 6 inch separation, except provide minimum 24 inch separation in acoustic-rated walls.

B. Power:
   1. Recessed (1/4” maximum) outlet boxes in masonry, concrete or tile construction shall be minimum 4 inch square, with device rings. Device covers shall be square-cut except rounded

corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.

C. Low Voltage:
   1. Recessed (1/4" maximum) outlet boxes in masonry, concrete or tile construction shall be minimum 4-11/16 inch square, 2-1/8 inch deep. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.

D. Provide knockout closures for unused openings.

E. Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches of box.

F. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide non-metallic barriers to separate wiring of different voltage systems.

G. Install boxes in walls without damaging wall insulation.

H. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

I. Ceiling outlets shall be 4 inch square, minimum 2-1/8 inch deep except that concrete boxes and plates will be approved where applicable. Position outlets to locate luminaires as shown on reflected ceiling plans.

J. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.

K. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.

L. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

M. Provide cast ferroalloy or aluminum outlet boxes in exterior and wet locations.

N. Surface wall outlets shall be 4 inch square with raised covers for one and two gang requirements. For three gang or larger requirements, use gang boxes with non-overlapping covers.

3.08 PULL AND JUNCTION BOX INSTALLATION

A. Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install Owner approved access panels in non-accessible ceilings where boxes are installed. All boxes are to be readily-accessible.

B. Support pull and junction boxes independent of conduit.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes the products and execution requirements relating to labeling of power, lighting, general wiring, signal, fire alarm, and telecommunications wire and cabling. Further, this section includes labeling of all terminations and related sub-systems, including but not limited to nameplates, stenciling, wire and cable marker labeling of all backbone fiber optic (inter-building, tie & riser) cables, terminating equipment and labeling of inner duct (fiber optic). Included are the following topics:

1. PART 1 - GENERAL.
    a. Scope.
    b. Related Work.
    c. Submittals.
2. PART 2 - PRODUCTS.
    a. Materials.
3. PART 3 - EXECUTION.
    a. General.
    b. Junction and Pullbox Identification.
    c. Power and Control Wire Identification.
    d. Wiring Device Identification.
    e. Nameplate Engraving.
    f. Panelboard Directories.

1.02 RELATED WORK

A. Applicable provisions of Division 1 shall govern work under this section.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26 05 23 - Control-Voltage Electrical Power Cables.

1.03 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Include schedule for nameplates and stenciling.

C. Prior to installation, the Contractor shall provide samples of all label types planned for the project. These samples shall include examples of the lettering to be used. Samples shall be mounted on 8-1/2” x 11” sheets annotated, explaining their purposed use.

PART 2 PRODUCTS

2.01 MATERIALS

A. Labels: All labels shall be permanent, and machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS ARE ALLOWED. Exception: Back side of device plates and junction boxes may use handwritten, legible labeling on box covers, unless specifically prohibited by other specification sections.

B. Cable label size shall be appropriate for the conductor or cable size(s), outlet faceplate layout and patch panel design. All labels shall be self-laminating, white/transparent vinyl and be wrapped around the cable or sheath. Labels for power conductors (600V and lower) shall be cloth-type. Flag type labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminate over the full extent of the printed area of the label.

C. Nameplates: Engraved three layer laminated plastic, black letters on a white background. Emergency system (level 1 and level 2) shall use white letters on red background.

D. Tape (phase identification only): Scotch #35 tape in appropriate colors for system voltage and phase.

E. Adhesive type labels not permitted except for phase and wire identification. Machine generated adhesive labels shall be permitted for device plates, 4-11/16 inch and smaller junction boxes, fire alarm and control devices.

PART 3 EXECUTION

3.01 GENERAL

A. All branch circuit and power panels must be identified with the same symbol used in circuit directory in main distribution center.

B. Clean all surfaces before attaching labels with the label manufacturer's recommended cleaning agent.

C. Install all labels firmly as recommended by the label manufacturer.

D. Labels shall be installed plumb and neatly on all equipment.

E. Install nameplates parallel to equipment lines.

F. Secure nameplates to equipment fronts using screws, rivets or manufacturer approved adhesive or cement.

G. Embossed tape will not be permitted for any application.

3.02 JUNCTION AND PULLBOX IDENTIFICATION

A. The following junction and pullboxes shall be identified utilizing spray painted covers:

System	Color(s)
Secondary Power – 208Y/120V, 240/120V	White
Fire Alarm	Red
Temperature Control	Green
Door Control and Door Monitoring System	Orange
Sound and Intercom Systems	Blue
Video Surveillance System/MATV	Yellow

B. Provide circuit numbers, and source panel designations for power wiring. Other system shall be identified as shown on details or approved shop drawings. Temperature control shall identify the source.

3.03 POWER AND CONTROL WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting

circuits, and with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.

B. All wiring shall be labeled within 2 to 4 inches of terminations. Each end of a wire or cable shall be labeled as soon as it is terminated including wiring used for temporary purposes.

3.04 WIRING DEVICE IDENTIFICATION

A. Wall switches, receptacles, occupancy sensors, wall dimmers, device plates and box covers, poke-through fittings, access floor boxes, photocells and time clocks shall be identified with circuit numbers and source. In exposed areas, identifications should be made inside of device covers, unless directed otherwise. Use machine-generated labels, or neatly hand-written permanent marker.

3.05 NAMEPLATE ENGRAVING

A. Provide nameplates of minimum letter height as scheduled below.

B. Panelboards: 1 inch; identify equipment designation. 1/2 inch (13 mm); identify voltage rating, source and room location of the source.

C. Equipment Enclosures: 1 inch; identify equipment designation.

D. Circuit Breakers, Switches, and Motor Starters in Panelboards or Switchboards or Motor Control Centers: 1/2 inch; identify circuit and load served, including location.

E. Individual Circuit Breakers, Disconnect Switches, Enclosed Switches, and Motor Starters: 1/2 inch; identify source and load served.

F. Junction boxes: 1 inch; identify system source(s) and load(s) served. Junction boxes may be neatly identified using a permanent marker.

3.06 PANELBOARD DIRECTORIES

A. Typed directories for panels must be covered with clear plastic, have a metal frame. Room number on directories shall be Owner's numbers, not Plan numbers unless Owner so specifies.

END OF SECTION

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SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes main, distribution and branch circuit panelboards. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Submittals.
      d. Operation and Maintenance Data.
      e. Spare Parts.
   2. PART 2 – PRODUCTS.
      a. Branch Circuit Panelboards.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Field Quality Control.
      c. Owner Training.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.03 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, and circuit breaker arrangement and sizes.

1.04 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.05 SPARE PARTS

A. Keys: Furnish 2 keys for each panelboard to Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Square D: www.squared.com.

B. Siemens: www.siemens.com.

C. General Electric: www.geindustrial.com.

D. Cutler Hammer: www.cutlerhammer.com.

E. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.02 BRANCH CIRCUIT PANELBOARDS

A. Lighting and Appliance Branch Circuit Panelboards: Circuit breaker type.

B. Enclosure: Type 1. Minimum cabinet size: 5-3/4 inches deep; 20 inches (508 mm) wide with 5 inch minimum gutter space top and bottom. Constructed of galvanized code gauge steel. Panel enclosure (back box) shall be of non-stamped type (without KO's) to avoid concentric break out problem.

C. Provide surface cabinet front with concealed trim clamps, concealed hinge and flush cylinder lock all keyed alike. Front cover shall be hinged to allow access to wiring gutters without removal of panel trim. Hinged trim shall be held in place with screw fasteners. Finish in manufacturer's standard gray enamel.

D. Provide metal directory holders with clear plastic covers.

E. Provide panelboards with copper bus (phase buses, bus fingers, etc., ratings as scheduled on Drawings. Provide ground bars in all panelboards. Neutral and ground bars can be dual rated ALCU9. All spaces shall have bus fully extended and drilled for the future installation of breakers.

F. Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings.

G. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers. Provide UL Class A ground fault interrupter circuit breakers where shown on Drawings. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

H. Do not use tandem circuit breakers.

I. Circuit breakers shall be bolt-on type with common trip handle for all poles. No handle ties of any sort will be approved.

J. All of the panelboards provided under this section shall be by the same manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. See section 26 05 29 for support requirements.

B. Install panelboards plumb with wall finishes.

C. Height: 6 feet to top.

D. Install a crimp type stud termination to stranded conductor when terminating on circuit breakers without a captive assembly rated for terminating stranded conductors.

E. Provide filler plates for unused spaces in panelboards.

F. See section 26 05 53 for identification requirements. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

G. Stub three (3) empty 3/4 inch conduits to accessible location above ceiling or below floor out of each recessed panelboard. Cap these conduits to prevent material from entering them.

3.02 FIELD QUALITY CONTROL

A. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections.

3.03 OWNER TRAINING

A. All training provided for Owner shall comply with the format, general content requirements and submission guidelines.

END OF SECTION

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SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes wall switches, receptacles, occupancy sensors, wall dimmers, device plates and box covers, poke-through service fittings, access floor boxes, photo cells and time clocks. Included are the following topics:

1. PART 1 – GENERAL.
   a. Scope.
   b. Related Work.
   c. Submittals.
   d. Operation and Maintenance Data.
2. PART 2 – PRODUCTS.
   a. Manufacturers.
   b. Wall Switches.
   c. Receptacles.
   d. Occupancy Sensors.
   e. Device Plates and Box Covers.
   f. Photo Cells.
3. PART 3 – EXECUTION.
   a. Installation.
   b. Field Quality Control.
   c. Occupancy Sensors.
   d. Adjusting.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.03 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Provide product data showing model numbers, configurations, finishes, dimensions, and manufacturer's instructions.

C. For occupancy sensor shop drawings, the manufacturer’s actual layout of occupancy sensors and the wiring diagrams shall be provided.

1.04 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cooper: www.cooperwiringdevices.com.

B. Hubbell: www.hubbell-wiring.com.

C. Pass and Seymour: www.passandseymour.com.

D. Leviton: www.leviton.com.

E. SensorSwitch: sensorswitch.com.
   1. Note: SenorSwitch makes occupancy sensors and photocells, not outlets and toggle switches.

F. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.02 WALL SWITCHES

A. Wall Switches for Lighting Circuits and Motor Loads Under 1/2 HP: Heavy duty use toggle switch, rated 20 amperes and 120/277 volts AC. Switches shall be UL20 Listed and meet Federal Specification WS-896. All switches shall be heavy duty Specification Grade with separate green ground screw.

B. All switches shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG. Switches shall be Leviton model 1221-S, Hubbell model CS1221, Pass & Seymour model CSB20, Cooper model CSB120, or approved equal.
   1. Handle: Brown made of nylon or high impact resistant material.

2.03 RECEPTACLES

A. Convenience and Straight-blade Receptacles: NEMA Type 5-20R, Brown nylon or high impact resistant face. Receptacles shall be UL498 Listed and meet Federal Specification WC-596. All duplex receptacles shall be heavy duty Specification Grade, 20 amp rated. All receptacles shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG, with a separate green ground screw. Receptacles shall be Leviton model 5362, Hubbell model HBL5362, Pass & Seymour model 5362A, or Cooper model AH5362.

B. Generally, all receptacles shall be duplex convenience type unless otherwise noted.

C. All receptacles installed in outdoor locations, in garages, within 6 feet of the outside edge of sinks, and in other damp or wet locations shall be GFCI type.

D. GFCI Receptacles: Duplex convenience receptacle, Specification Grade, with integral ground fault current interrupter meeting the requirements of UL standard 943 Class A and UL standard 498. GFCI receptacles shall be Leviton model 7899, Hubbell model GF20, Pass & Seymour model 2095, Cooper model VGF20 or approved equal.

E. All receptacles on emergency circuits shall have a red face.

F. All receptacles designated as isolated ground shall have an isolated ground triangle imprint on the face of the receptacle.

G. Locking-Blade Receptacles: As indicated on drawings.

H. Specific-use Receptacle Configuration: As indicated on drawings.

2.04 OCCUPANCY SENSORS

A. All occupancy sensors shall be hardwired type; battery type shall not be permitted.

B. Wall Mounted (Wall Switch Type):
   1. The sensor shall use either passive infrared or, if dual technology, passive infrared and passive acoustic sensing, or passive infrared and ultrasonic, for detecting room occupancy. The unit shall fit in/on a standard single gang switch box.

2. Rated capacity: 600 watts minimum at 120 volts, 60 Hz; 1000 watts minimum at 277 volts, 60 Hz.
3. Sensitivity shall be user adjustable or self-adjusting type.
4. The delay timer shall be adjusted within a range of 6 to 30 minutes by the Contractor in the field. The sensor shall have a test mode for performance testing.
5. The off switch shall have manual override for positive off and automatic on.
6. The test LED shall indicate motion.
7. The area of coverage shall be approximately 180 degrees by 35-40 feet.
8. The unit shall have a five year warranty.

C. Ceiling Mounted:
1. The sensor shall use either passive infrared or, if dual technology, passive infrared and passive acoustic sensing, or passive infrared and ultrasonic, for detecting room occupancy. The unit shall fit in/on a standard octagon box. All ceiling mounted sensors shall be installed to a box with ring and box support.
2. Rated capacity shall be 20 amps at 120 or 277 volts, for fluorescent lamps. Provide power pack as required for low voltage sensors.
3. Sensitivity shall be user adjustable or self-adjusting type.
4. The delay timer shall be adjusted within a range of 6 to 30 minutes by the Contractor in the field. The sensor shall have a test mode for performance testing.
5. The coverage area shall be 360 degrees by approximately 15 feet radius when mounted at 9 foot height. The sensor shall have provisions, such as masking, to block out problem areas.
6. Test LED to indicate motion.
7. The unit shall have a five year warranty.
8. See drawings for actual type of sensor.

2.05 DEVICE PLATES AND BOX COVERS

A. Decorative Cover Plate: Brown smooth thermoplastic nylon. Note requirement for red plates on emergency outlets.

B. Weatherproof Cover Plate: Gasketed metal with hinged device covers.

C. Surface Cover Plate: Raised galvanized steel.

2.06 PHOTO CELLS

A. The controller shall be rated 2000 watts tungsten at 120, 240 or 277 volts. The cell shall be cadmium sulfide, 1 inch diameter.

B. The enclosure shall be die cast zinc, gasketed for maximum weather proofing.

C. The enclosure shall include the positioning lug on the top of the enclosure.

D. The unit shall have a delay of up to two minutes to prevent false switching. ON/Off adjustment shall be done by moving a light selector with a range from 2 to 50 foot-candles.

E. Mounting shall be for a 1/2 inch conduit nipple.

F. The unit shall have a 5 year warranty.

G. The contacts shall be SPST normally closed.

H. The operational temperature range shall be -40 to 140 degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install wall switches 46 inches above floor to the center of device, OFF position down.

B. Install convenience receptacles 18 inches above floor, backsplash, grounding pole on bottom match existing.

C. Install specific-use receptacles at heights shown on Contract Drawings.

D. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

E. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

F. Install devices and wall plates flush and level.

G. Receptacles shall have a bonding conductor from grounding terminal to the metal conduit system. Self-grounding receptacles using mounting screws as bonding means are not approved.

3.02 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch and sensor with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

F. Owner personnel reserve the right to be present at all tests.

3.03 OCCUPANCY SENSORS

A. Power packs used in return air plenum ceiling areas shall be installed in an approved enclosure or UL listed for return air plenum.

B. Sensitivity Test: After the sensor has been energized for at least 15 minutes, walk to the middle of the room (if conference room) or sit at the normal desk position (if and office). Make no motion for 20 seconds. Move one arm up and down slowly. The test LED should blink.

C. Time Delay Test: Set the time delay for 10 minutes. Walk into the room to activate the sensor then leave room. Sensor must turn lights off at approximately 10 minutes. Walk into the room again to reactivate the lights. Lights should activate within 1 second.

D. For lights on emergency power without a remote transfer device, route the emergency circuit through a separate relay controlled by the occupancy sensor(s) in the respective area. For lights on emergency power with a remote transfer device, the emergency power does not get routed through the occupancy sensor relay, but the normal power does get routed through the occupancy sensor relay.

3.04 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Mark all conductors with the panel and circuit number serving the device with a machine generated label, at the device, and on the back of the device cover.

END OF SECTION

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SECTION 26 27 28

DISCONNECT SWITCHES

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes disconnect switches, fuses and enclosures. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Submittals.
      d. Operation and Maintenance Data.
   2. PART 2 – PRODUCTS.
      a. Manufacturers.
      b. Disconnect Switches.
      c. Fuses.
   3. PART 3 – EXECUTION.
      a. Installation.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.03 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Include outline drawings with dimensions, and equipment ratings for voltage, ampacity, horsepower, and short circuit.

1.04 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Square D: www.squared.com.

B. Siemens: www.siemens.com.

C. General Electric: www.geindustrial.com.

D. Cutler Hammer: www.cutlerhammer.com.

E. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.02 DISCONNECT SWITCHES

A. Fusible Switch Assemblies (use only when overcurrent protection is required): NEMA Type Heavy Duty; quick-make, quick-break, load interrupter, enclosed knife switch with externally operable

handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: Designed to accommodate Class R cartridge type fuses.

B. Nonfusible Switch Assemblies: NEMA Type Heavy Duty; quick-make, quick-break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

C. Enclosure: NEMA Type 1 as indicated on Drawings.

D. Provide manufacturer's equipment ground kit in all disconnect switches.

2.03 FUSES

A. Fuses 600 Amperes and Less: Dual element, time delay, 250 volt, UL Class RK 1. Interrupting Rating: 200,000 rms amperes.

B. Fuses 601 Amperes and Larger: Time delay, 600 volt, UL Class L. Interrupting Rating: 200,000 rms amperes.

C. **Provide three (3) spares of each size and type fuse. Provide enclosure for spare fuse.**

PART 3 EXECUTION

3.01 INSTALLATION

A. Install disconnect switches where indicated on Drawings.

B. Provide identification as specified in Section 26 05 53.

END OF SECTION

SECTION 26 32 00

PACKAGED GENERATOR ASSEMBLIES

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes providing a complete factory assembled packaged engine generator system with controls and startup testing. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. References.
      d. Permits.
      e. Submittals.
      f. Operation and Maintenance Data.
      g. Quality Assurance.
      h. Extra Materials.
   2. PART 2 – PRODUCTS.
      a. Manufacturers.
      b. System Ratings.
      c. Engine and Engine Equipment.
      d. Generator.
      e. Accessories.
   3. PART 3 – EXECUTION.
      a. Examination.
      b. Installation.
      c. Field Quality Control.
      d. Functional Performance Testing.
      e. Owner Training.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.
   1. Section 26 36 00 - Transfer Switches.

1.03 REFERENCES

A. NFPA110 – Standby Power Systems.

B. ANSI/NEMA MG 1 - Motors and Generators.

1.04 PERMITS

A. The Contractor shall be responsible for obtaining all necessary permits for the complete installation of the generator fuel system and related equipment. The Contractor shall arrange to have a certified tank installer supervise and certify the fuel system installation.

1.05 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Submit shop drawings showing plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical ratings and diagrams including schematic and interconnection diagrams.

C. Submit manufacturer's installation instructions.

1.06 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.07 QUALITY ASSURANCE

A. Manufacturer: Company specializing in packaged engine generator systems with minimum ten years documented experience.

B. Supplier: Authorized distributor of engine generator manufacturer with service facilities within 100 miles of project site.

1.08 EXTRA MATERIAL

A. Provide two additional sets of each fuel, oil, and air filter elements required for the engine generator system and one additional set of all required belts.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cummins: www.cummins.com.

B. Kohler: www.kohlerpower.com.

C. MTU: www.istate.com.

D. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.02 SYSTEM RATINGS

A. Generator Set Rating: 30 kW, 30 kVA, .8pf, 120/240, VAC, 1 phase, 4 wire, 60 Hz at 1,800 rpm. Standby power rated.

B. Motor starting KVA shall be 6 HP based on a sustained RMS voltage drop of no more than 35% of no load voltage with the specified kVA load at near zero power factor applied to the engine-generator set.

C. The generator set manufacturer shall verify the engine as capable of driving the generator with all accessories in place and operating at the nameplate rating after de-rating for the range of temperature expected in service and the altitude of the installation.

D. The engine-generator set shall be capable of picking up 100% of nameplate kW, less applicable derating factors, in one step with the engine-generator set at operating temperature.

E. Voltage regulation shall be ±1.0% of rated voltage for any constant load between no load and rated load. Random voltage variation with any steady state load from no load to full load shall not exceed ±1.0% of rated voltage.

F. Frequency regulation shall be ±0.5% from steady state no load to steady state rated load.

G. Harmonic distortion shall not exceed 5% total harmonic distortion at full linear load and no single harmonic shall exceed 3% of rated voltage.

H. Telephone Influence Factor: TIF shall be less than 50.

2.03 ENGINE AND ENGINE EQUIPMENT

A. Engine Type: Water-cooled, four cycle, internal combustion engine.

B. Fuel Type: No. 2 diesel fuel.

C. Engine Speed: 1,800 rpm.

D. Governor: Isochronous electronic type to maintain engine speed within 0.5 percent, steady state, and 1 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes.

E. Safety Devices: Engine shutdown on high water temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.

F. Include remote starting control circuit, with RUN-OFF-AUTO selector switch on engine generator control panel.

G. Engine Accessories: Include intake air filter, fuel filter, fuel priming pump, automatic electric fuel shutoff, fuel/water separator, gear-driven water pump, positive displacement mechanical full pressure lubrication oil pump, full flow lubrication oil filters with replaceable elements, dipstick oil level indicator, and oil drain valve with hose extension. Include engine mounted battery charging alternator with solid state voltage regulator. Include fuel pressure gauge, water temperature gauge, and lube oil pressure gauge on engine-generator control panel.

H. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F (32 degrees C). Heater voltage shall be as shown on the drawings.

I. Mounting: Provide unit with suitable spring-type vibration isolators and mount on structural steel base.

J. Cooling System: Unit mounted radiator using glycol coolant, with blower type fan, coolant pump and thermostat temperature control sized to maintain safe engine temperature in ambient temperature of 110 degrees F (43 degrees C). Radiator shall be provided with a duct adapter flange permitting the attachment of air discharge duct directing the discharge of radiator air through the wall. The equipment supplier shall provide 50% ethylene glycol antifreeze solution to fill engine cooling system.

K. Exhaust System:
   1. Provide critical grade silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, suitable for horizontal orientation, sized in accordance with engine manufacturer's instructions. Contractor shall mount muffler so its weight is not supported by the engine.
   2. Flexible exhaust connections shall be provided as required for connection between engine exhaust manifold and exhaust line, in compliance with applicable codes and regulations.
   3. Provide an exhaust condensation trap with manual drain valve to trap and drain off exhaust condensation and to prevent condensation from entering the engine. Provide drain line to drip pan.
   4. Provide a suitable rain cap at the stack outlet. Provide all necessary flanges and special fittings for proper installation.

5. Contractor shall mount and install all exhaust components as shown on drawings and as required to comply with applicable codes and regulations. All components shall be properly sized to assure proper operation without excessive back pressure when installed as shown on the drawings. Make provisions as required for pipe expansion and contraction.

L. Fuel System:
1. Provide 15 gallon day tank with rupture basin fuel tank, UL listed; Minnesota approved; fill and vent package; fuel gauge; low fuel and high fuel float switch; overflow alarm. The fuel tank shall be furnished with a bacteria inhibitor to prevent the buildup of bacteria in the diesel fuel tank. The fuel tank shall be pressure tested for a minimum of 2 hours to ensure its integrity.
2. Provide flexible supply and return line fittings and all connections for connecting fuel system to the engine in compliance with applicable codes and regulations. All fuel piping shall be pressure tested for minimum 2 hours.
3. Provide a high level alarm for fuel tank with spare contacts for remote indication.
4. Provide a float switch in the rupture basin for remote indication of fuel tank leak.
5. Provide vent piping as required by the fuel tank manufacturer, and local and state codes.
6. Provide thermostatically controlled fuel tank heater.

M. Batteries: Heavy duty, diesel starting type, lead-acid storage batteries. Provide a DC volt system with number of batteries and battery capacity as sized by the manufacturer adequate for (4) 30 second cranking periods (total of 2 minutes) along with all additional loads being run on the DC system.

N. Provide oil drip containment pan to contain leaking lubricating oil.

O. Provide all accessories required for cold weather operation.

2.04 GENERATOR

A. Insulation: ANSI/NEMA MG 1, Class H.

B. The generator shall be single bearing, self-aligning 4-pole, brushless, synchronous type, revolving field with amortisseur windings, and with direct driven centrifugal blower for proper cooling and minimum noise. No brushes will be allowed. Generator shall be directly connected to engine fly wheel housing and driven through a flexible coupling to ensure permanent alignment. Generator design shall prevent potentially damaging shaft currents.

C. The generator shall be 1-phase, broad-range, re-connectable and shall have 12 leads brought out to allow connection by user to obtain any of the available voltages for the unit.

D. The regulator design shall include torque-matching characteristics to allow the engine to use its fullest power producing capacity (without exceeding it or over compensating) at speeds lower than rated, to optimize motor starting capability and provide the fastest possible recovery from transient speed dips. Regulators which use a fixed volts per hertz characteristic are not acceptable.

E. Provide an exciter field automatic circuit breaker, mounted on the control panel, of the manual reset only type (cannot be used as a manual disconnect) for protection of exciter field and regulator.

F. The generator, exciter, and voltage regulator shall be designed and manufactured by the engine generator set manufacturer. The exciter shall be 1-phase, full wave, rectified with heavy duty silicone diodes mounted on the common rotor shaft and sized for maximum motor starting loads. Systems utilizing 3-wire, solid state control elements rotating in the rotor, will not be acceptable. The generator design shall be of the self-protecting type as demonstrated by the prototype short circuit test.

G. Provide a mainline molded case circuit breaker 125 amp, on generator output with integral thermal and instantaneous magnetic trip in each pole; number and rating as indicated. Include battery-voltage operated shunt trip, connection to open circuit breaker on engine failure. Mount unit in enclosure to meet ANSI/NEMA 250, Type 1 requirements.

H. Provide E-stop at unit with provisions for external connections.

2.05 ACCESSORIES

A. Provide the following accessories with the engine generator set.
1. Battery Heater: Thermostatically controlled battery blanket heater, 120 VAC.
2. Battery Tray: Plastic coated metal tray treated for electrolyte resistance, constructed to contain spillage of electrolyte.
3. Battery Charger: A 10-ampere voltage regulated battery charger shall be provided for the engine-generator set. Charger shall be equipped with float, taper and equalize charge settings. Charger shall include overload protection, voltage surge suppressor, DC voltmeter and fused AC input. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30 VDC for remote indication of:
   a. Loss of AC power-red light (no relay contact).
   b. Low battery voltage-red light.
   c. High battery voltage-red light (no relay contact).
   d. Charger fail-red light.
4. Engine-Generator Digital Control Panel: Top of control panel shall not be more than six (6) feet above finished floor (this may require remote mounting). NFPA - 110 and NFPA - 99, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators. Include the following features:
5. Engine run/off/auto selector switch.
6. Emergency stop “mushroom” switch.
7. Engine running time meter.
8. Oil pressure gauge.
9. Water temperature gauge.
10. Battery voltmeter.
11. Indicator lamps to include: Overcrank, low oil pressure, high engine temperature, overspeed, not-in-auto, system ready, low battery volts, battery charger fault, low fuel, pre-alarm high engine temp, pre-alarm low oil pressure, low water temp, auxiliary alarm, auxiliary pre-alarm.

B. The NEMA 1 enclosed control panel shall be mounted on the generator set with vibration isolators. The control shall include surge suppression for protection of solid state components. A front control panel illumination lamp with On/Off switch shall be provided. The engine-generator set starting batteries shall power the monitor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that required utilities are available in proper location and ready for use.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Generator set shall be anchored to the floor or concrete pad.

C. Contractor shall provide all required fuel during testing and a full tank of fuel at the time of Substantial Completion of the project.

3.03 FIELD QUALITY CONTROL

A. Provide full load testing utilizing a portable test bank for four hours continuous, minimum. During the first two hours, step increase the load from 0% to 100% in at least six equal steps. At the end of two hours, continue running test at 100% load. Record the following in 20 minute intervals throughout the four hour test: kilowatts, amperes, voltage, coolant temperature, room temperature, generator frequency (Hz), oil pressure, fuel consumption.

B. After the generator has cooled down from the four hour test, shut it down and then simulate a power failure including operation of the transfer switch, automatic cycle, and automatic shutdown and return to normal.

3.04 FUNCTIONAL PERFORMANCE TESTING

A. Contractor is responsible for utilizing the functional performance test procedures supplied under Division 1 in accordance with the procedures defined for functional performance test procedures.

3.05 OWNER TRAINING

A. All training provided for agency shall comply with the format, general content requirements and submission guidelines.

END OF SECTION

SECTION 26 36 00

TRANSFER SWITCHES

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes transfer switches (less than 600 V) for standby generator systems. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Quality Assurance.
      d. Submittals.
      e. Operation and Maintenance Data.
   2. PART 2 – PRODUCTS.
      a. Manufacturers
      b. Automatic Transfer Switch.
      c. Ratings.
      d. Automatic Sequence of Operation.
      e. Accessories.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Field Adjustments.
      c. Owner Training.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.
   1. Section 26 32 00 - Packaged Generator Assemblies.

1.03 QUALITY ASSURANCE

A. Manufacturer: Company specializing in automatic transfer equipment with five years documented experience.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Submit product data showing overall dimensions, electrical connections, electrical ratings, all specified accessories, interlock methods, and environmental requirements.

C. Submit manufacturer's installation instructions.

1.05 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

B. In addition to the general content specified under Section 01 78 23 - Operation and Maintenance Data supply the following additional documentation:
   1. Instructions for operating equipment under test and emergency conditions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cummins: www.cummins.com.

B. Kohler: www.kohlerpower.com.

C. Asco: www.asco.com.

D. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.02 AUTOMATIC TRANSFER SWITCH

A. Description: NEMA ICS 2; automatic transfer switch. In applications where the switch serves as the service entrance disconnect, the switch shall be rated as suitable for use as a service disconnecting means.

B. Configuration: The transfer switch shall be electrically operated and mechanically held. The electrical operation shall be by a solenoid mechanism operating from the same source to which the load is being transferred.

C. The switch shall be rated for continuous duty and be mechanically interlocked to be in either the normal or the emergency position.

D. The switch shall be controlled by electronic solid state components with printed circuit control boards, and industrial grade plug in control relays.

2.03 RATINGS

A. Voltage: 120/240, 1 phase, 3 wire.

B. Number of switched poles: 3.

C. Continuous amperage rating: 125.

D. Withstand amperage rating: 10,000 AIC.

E. Enclosure NEMA type: 1.

F. Ratings: As scheduled on drawings.

2.04 AUTOMATIC SEQUENCE OF OPERATION

A. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.

B. Time Delay to Start Alternate Source Engine Generator: 0 to 10 seconds, adjustable.

C. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.

D. Time Delay Before Transfer to Alternate Power Source: 0 to 60 seconds, adjustable.

E. Initiate Re-transfer Load to Normal Source: Upon permission by normal source monitor.

F. Time Delay Before Transfer to Normal Power: 0 to 30 minutes adjustable.

G. Time Delay Before Engine Shut Down: 0 to 30 minutes, adjustable, unloaded operation.

H. Operating transfer time of the switch in either direction shall not be greater than 1/6 of a second.

I. Engine Exerciser: Digital control, - start engine every 7 to 30 days adjustable; run for 0 to 120 minutes adjustable, before shutting down. Bypass exerciser control if normal source fails during exercising period. Provide HOA for engine exerciser.

2.05 ACCESSORIES

A. Indicating Lights: LED type. Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSITION.

B. Test Switch: Mount in cover of enclosure to simulate failure of normal source by interrupting the power signal to the normal source monitor.

C. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate to normal source.

D. Transfer Switch Auxiliary Contacts: Minimum 2 normally open; 2 normally closed.

E. Normal Source Monitor: Monitor each line of normal source voltage; adjustable set points; initiate transfer when voltage drops below 85 percent.

F. Alternate Source Monitor: Monitor alternate source voltage and frequency; adjustable set points; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 Hertz from rated nominal voltage.

G. The switch shall contain an in-phase monitor or adjustable time delay transition to inhibit closing of the switch into high levels of motor residual voltage.

H. A factory installed equipment ground bar shall be provided in each switch enclosure.

I. 3 pole 120/240, 1 phase, 3W transfer switches shall contain a factory installed fully rated solid neutral lug assembly.

J. Provide digital metering. Metering shall provide, at a minimum, measurement of voltage, current and kW demand for each phase on the load side of the switch.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Starting contacts for all transfer switches shall be wired in parallel to the generator starting circuit so that any transfer switch that senses a loss of normal power will start the generator. This includes contacts as part of the fire pump controller. This control wiring is not shown on the plans but is required to be provided by the electrical contractor.

3.02 FIELD ADJUSTMENTS

A. The Contractor shall field adjust all timing and voltage settings of the transfer switch as necessary for proper operation of the switch, related loads and sources.

3.03 OWNER TRAINING

A. All training provided for Owner shall comply with the format, general content requirements and submission guidelines as specified.

END OF SECTION

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SECTION 26 51 13

INTERIOR LIGHTING FIXTURES, LAMPS, AND BALLASTS

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes interior luminaires and accessories, exit signs, lamps, and ballasts. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Submittals.
      d. Operation and Maintenance Data.
      e. Project Closeout.
   2. PART 2 – PRODUCTS.
      a. Manufacturers.
      b. Interior Luminaires and Accessories.
   3. PART 3 – EXECUTION.
      a. Installation.
      b. Adjusting and Cleaning.
      c. Interface with Other Products.
      d. Field Quality Control.
      e. Field Testing Measurement and Verification.

1.02 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.03 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Include outline drawings, lamp and ballast data, support points, weights, accessory information and performance data for each luminaire type.

C. For each luminaire type, submit luminaire information in the following example table format, and submit catalog cuts with highlighted catalog numbers and required accessories.

LUMINAIRE		BALLAST	LAMP	ANSI INPUT WATTS
Type	Manufacturer and Catalog No.	Manufacturer, Quantity per Fixture, and Catalog No.	Manufacturer, Quantity per Fixture, and Catalog No.	

1.04 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

1.05 PROJECT CLOSEOUT

A. Perform egress lighting field test measurements as described in Part 3.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. As specified on Light Fixture Schedule on drawings.

2.02 INTERIOR LUMINAIRES AND ACCESSORIES

A. See the Lighting Fixture Schedule on the drawings, for type of fixtures and catalog numbers. Catalog numbers are shown on the drawings for quality and performance requirements only. Fixtures manufactured by others are equally acceptable provided they meet or exceed the performance of the indicated fixtures, and meet the intent of the design.

B. Provide fluorescent fixtures with quick-connect disconnecting means, similar to Thomas & Betts Sta-Kon.

C. All fixtures shall be LED.

D. Contractor shall coordinate rebate information with Rochester Public Utilities.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Heavy duty jack chain supports may be used where indicated on the fixture schedule. Provide pendant or chain length required to suspend luminaire at indicated height.

C. Support luminaires larger than 2 x 4 foot size independent of ceiling framing.

D. Locate ceiling luminaires as indicated on reflected ceiling plan.

E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

F. The Contractor shall install fixture supports as required. Fixture installations with fixtures supported only by insecure boxes will be rejected. It shall be the Contractor's responsibility to support all lighting fixtures adequately, providing extra steel work for the support of fixtures if required. Any components necessary for mounting fixtures shall be provided by the Contractor. No plastic, composition or wood type anchors shall be used.

G. Install recessed luminaires to permit removal from below.

3.02 ADJUSTING AND CLEANING

A. Align luminaires and clean lenses and diffusers at completion of Work. Clean paint splatters, dirt, and debris from installed luminaires.

B. Aim and adjust luminaires as indicated on Drawings or as directed by the Engineer.

C. Touch up luminaire finish at completion of work.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Interface with air handling accessories furnished and installed under Division 23.

3.04 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.05 FIELD TESTING MEASUREMENT AND VERIFICATION

A. Contractor shall conduct field test measurements of installed egress lighting:
   1. Test must be performed prior to occupancy.
   2. Test must be performed prior to sunrise or after sunset.

B. Testing Procedure:
   1. Obtain final egress lighting plan (Coordinate with engineer for plan at end of project).
   2. For rooms such as lobbies and atriums, testing shall be conducted in a grid spacing manner. Using 25 foot on-center spacing.
   3. For corridors testing shall be conducted at 15 foot on-center intervals along the center of the corridor.
   4. For stairways testing shall be conducted at the following points:
      a. Each landing.
      b. Each top step.
      c. 1/2 way between landings.
      d. Each bottom step.
      e. Test points shall be at 1/3 – center – 1/3 points on the nose of the tread.
   5. Test meter shall be located on the floor when testing all points.

C. Calculating Results (Example Corridor):
   1. Select the midpoint of the corridor.
   2. Add up the readings to the nearest exit discharge.
   3. Calculate results as follows:
      a. Average must = 1.0fc or greater.
      b. Minimum recorded measurement along that path must = 0.1fc or greater.
      c. Maximum to minimum measurement ratio along that path must = 40 (or less) : 1.

D. Results:
   1. Provide plan showing the following:
      a. Date and time testing was conducted.
      b. Personnel present at test.
      c. Measurement values and test points.
      d. Calculations from each corridor or room showing values for average, minimum level and maximum to minimum ratio.

END OF SECTION

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SECTION 28 05 14

CCTV (CLOSED CIRCUIT TV)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Closed Circuit TV.

1.02 SCOPE

A. The work under this section includes basic electrical requirements, which are applicable to all Division 26 sections. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:
   1. PART 1 – GENERAL.
      a. Scope.
      b. Related Work.
      c. Reference Standards.
      d. Owner Requirements.
      e. Submittals.
      f. Operating and Maintenance Data.
   2. PART 2 – PRODUCTS.
      a. Materials.
      b. Manufacturers.
   3. PART 3 – EXECUTION.
      a. General.
      b. Installation.
      c. Owner Coordination.

1.03 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

1.04 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:
   1. ANSI - American National Standards Institute.
   2. ASTM - American Society for Testing and Materials.
   3. EPA - Environmental Protection Agency.
   4. ETL - Electrical Testing Laboratories, Inc.
   5. IEEE - Institute of Electrical and Electronics Engineers.
   6. IES - Illuminating Engineering Society.
   7. ISA - Instrument Society of America.
   8. NBS - National Bureau of Standards.
   9. NEC - National Electric Code.
   10. NEMA - National Electrical Manufacturers Association.
   11. NESC - National Electrical Safety Code.
   12. NFPA - National Fire Protection Association.
   13. UL - Underwriters Laboratories Inc.

1.05 OWNER REQUIREMENTS

A. CCTV:
   1. The existing CCTV system shall be expanded and added to for coverage of the addition.

2. Minimum camera coverage shall include the following:
    a. Safe Room:
        1) Must be able to identify individual and others with the individual.

1.06 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under Section 01 78 23 - Operation and Maintenance Data.

B. In addition to the general content specified under Section 01 78 23 - Operation and Maintenance Data supply the following additional documentation:
    1. Manufacturer's wiring diagrams for electrically powered equipment.

PART 2 PRODUCTS

2.01 MATERIALS

A. Furnish and install cabling.

B. Furnish and install equipment.

C. Match existing equipment.

2.02 MANUFACTURERS

A. Match existing equipment.

B. Substitutions: Not permitted.

PART 3 EXECUTION

3.01 GENERAL

A. Install products per manufacturer's instructions.

3.02 INSTALLATION

A. Wiring: Conceal in new construction.

B. Surface mount to match existing in finished areas.

3.03 OWNER COORDINATION

A. Coordinate configuration of monitoring equipment with Owner.

B. All training provided for the Owner shall comply with the format, general content requirements and submission guidelines specified under General Conditions.

C. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system.

END OF SECTION

SECTION 28 13 00

DOOR SECURITY SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies a Door Access control system including the following components:
1. Special emergency operation center door access control.
2. Door Hardware Power Supply.
3. Control Program.
4. Door Contacts.
5. Magnetic Locks, Electric Strikes, Electric Latches, and Controls.
6. System Wire and Cable.

B. Related Sections:
1. Section 08 71 00 - Door Hardware.

1.03 SYSTEM DESCRIPTION

A. System shall perform the following functions:
1. Special emergency operation center door access control.
2. Provide interconnection to power door operators.
3. Provide emergency overrides for doors with magnetic locks within egress paths.
4. Wire and cable.
5. Initial system programming per Owner’s requirements.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes (including available colors) for each product indicated and describe features and operating sequences, both automatic and manual, for the following:
1. Control Unit.
2. Door Access Control Unit Power Supply.
3. Door Hardware Power Supply.
4. Control Program.
5. Equipment Enclosures and Back Boxes.
6. Accessory Components.

C. Shop Drawings:
1. Wiring diagrams to detail power, signal, control, and correction circuits. Identify terminals and wiring color-codes to facilitate installation, operation, and maintenance. Indicate recommended wire types and sizes, and circuiting arrangements for field-installed system wiring. Show protection from overcurrent, static discharge, and voltage surge.

D. Operation and Maintenance Data: For door access control to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of hardware from the same supplier.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 8 hours response time, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70 for components and installation.

1.06 PRODUCT DELIVERY

A. Mark each item as to contents and location in the building for which it is intended.

B. Ship prepaid the hardware templates and/or physical hardware, as required, to metal door and frame manufacturers and wood door manufacturers.

C. Deliver drawings, templates and directions for installation of shell housing for high security lock box when unit is to be recessed mounted in poured-in-place concrete or masonry walls.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Federal Warning Systems.
   2. Custom Alarms.
   3. Substitutions: Refer to Section 01 25 13 - Product Substitution Procedures.

2.02 DOOR ACCESS CONTROL UNIT POWER SUPPLY

A. Provide 120V input, 24V output power supplies rated to serve (2) Door Access Control Units.

2.03 DOOR HARDWARE POWER SUPPLY

A. Provide 120V input, 24V output power supplies rated to serve security devices on (8) doors.

2.04 CONTROL PROGRAM

A. Emergency Operation Center Door Access Control
   1. Provide a special receiver, relay, and time delay relay to operate a door strike and door operators.
   2. Door Strikes and door operators shall unlock the doors and allow passage upon activation by a radio signal from the County Emergency Operation Center.
   3. The Signal and operation shall coincide with the operation of the County Tornado Siren.
   4. The EOC operation of the door strike shall continue for 2 hours.
   5. A reset button shall return the door strike to normal operation.
   6. The door shall return to normal operation after 2 hours.

2.05 EXIT DEVICES

A. Exit devices will be provided with the doors, see hardware specifications.

B. Provide 24V power supply for Electric Latch Retraction to use in conjunction with automatic door operators.

2.06 DOOR CONTACTS

A. Provide door security contacts, see hardware specifications.

B. Security system supplier shall provide magnetic door contacts.

2.07 MAGNETIC LOCKS, ELECTRIC STRIKES, ELECTRIC LATCHES, AND CONTROLS

A. Supplied and installed by others, connection to security system by this Contractor. Coordinate with door hardware supplier and door hardware installer.

B. Provide 24V power supply to Magnetic locks, Electric strikes, and Electronic latches from Door Hardware Power Supply located on same floor.

2.08 MAGNETIC LOCK OVER RIDE

A. DPDT, Pushbutton, Maintained contact.

B. Shall interrupt power to magnetic lock (bypassing control system).

C. Provide reset button to return system to normal.

2.09 WARRANTEE

A. A two-year unconditional warranty for the controller electronics.

2.10 WIRE AND CABLE

A. Conductors: Insulated copper, with minimum sizes as recommended by the connected device manufacturer. Voltage drop for signal and control circuits shall not exceed 10 percent under peak load conditions.

B. 120-V AC and Class 1 Signal and Control Circuits: Stranded single conductors of size recommended by system manufacturer. Materials and installation requirements are specified in Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

C. Classes 2 and 3 Signal and Control Circuits: Single conductor or twisted-pair cable, shielded.

D. Data Circuits: Category 6 minimum, unshielded, twisted-pair cable, unless manufacturer recommends shielded cable.

E. Conductor Color-Coding: Uniformly identified and coordinated with wiring diagrams.

PART 3 EXECUTION

3.01 INSTALLATION

A. Wiring: Install 60-Hz wiring according to NFPA 70. Install number of conductors recommended by system manufacturer for functions indicated, and as follows:
   1. Conceal wiring except in unfinished and existing spaces.
   2. Wiring Method: Install wiring in raceways except for Classes 2 and 3 remote-control and signaling circuits, as defined in NFPA 70, if installed in accessible ceiling spaces and hollow gypsum-board partitions, where unenclosed wiring method may be used. Install listed plenum cable for Classes 2 and 3 wiring in environmental air spaces, including plenum ceilings.

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess; use lacing bars and distribution spools.

3.02 ELECTRICAL CONNECTIONS

A. Make splices, taps, and terminations on numbered terminal strips in junction, pull and outlet boxes, terminal cabinets, and equipment enclosures.

B. Ground equipment, and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

3.03 IDENTIFICATION

A. Comply with Section 26 05 53 - Identification for Electrical Systems.

B. Color-code wire and apply wire and cable marking tape to designate wires and cables so they are uniformly identified and coordinated with wiring diagrams throughout the system.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections **and to assist in programming and field testing**.

B. Perform the following field adjustments, tests, and inspections and prepare test reports:
   1. Perform operational-system tests to verify compliance with the Specifications and make adjustments to bring system into compliance.
   2. Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

C. Remove and replace malfunctioning units and retest as specified above.

3.05 PROGRAMMING AND ADJUSTMENTS

A. Program system according to Owner's requirements. Set system so signal devices operate on Owner-required schedules and are activated for durations selected by Owner. Program equipment-control output circuits to suit Owner's operating schedule for equipment controlled.

B. Adjust sound-output level of adjustable signal devices to suit Owner's requirements.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain door access control system components. Provide 3 hours of training.

END OF SECTION

SECTION 28 31 00

FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SCOPE

A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations associated with the installation of the new Fire Alarm System as shown on the drawings and as herein specified. Included are the following topics:

1. PART 1 – GENERAL.
    a. Scope.
    b. Related Requirements.
    c. Reference Standards.
    d. Submittals.
    e. Quality Assurance.
    f. Warranty.
2. PART 2 – PRODUCTS.
    a. Manufacturers.
    b. Fire Alarm System.
    c. Existing Components.
    d. Fire Safety Systems Interfaces.
    e. Components.
3. PART 3 – EXECUTION.
    a. Installation.
    b. Inspection and Testing for Completion.
    c. Owner Personnel Instruction.
    d. Closeout.
    e. Maintenance.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping: Materials and methods for work to be performed by this installer.

B. Section 08 71 00 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.

C. Section 23 33 00 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

1.03 REFERENCE STANDARDS

A. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits; 2002 (R2008).

B. NFPA 70 - National Electrical Code; 2008.

C. NFPA 72 - National Fire Alarm Code and Signaling Code; 2010.

D. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; 2009.

E. NFPA 601 - Standard for Security Services in Fire Loss Prevention; 2005.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures.

B. Proposal Documents: Submit the following with cost/time proposal:
   1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
   3. Certification by Contractor that the system design will comply with the contract documents.
   4. Proposed maintenance contract.

C. Drawings must be prepared using most recent version of AutoCAD.
   1. Owner will provide floor plan drawings for Contractor's use; verify all dimensions on Owner-provided drawings.

D. Evidence of designer qualifications.

E. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
   4. System zone boundaries and interfaces to fire safety systems.
   5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
   6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
   7. List of all devices on each signaling line circuit, with spare capacity indicated.
   8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
   9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
   10. Detailed drawing of graphic annunciator(s).
   11. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
   12. Certification by the manufacturer of the control unit that the system design complies with the contract documents.
   13. Certification by Contractor that the system design complies with the contract documents.
   14. Do not show existing components to be removed.

F. Submit all required documents to the appropriate agencies for plan approval/permitting along with fees.

G. Evidence of installer qualifications.

H. Evidence of instructor qualifications; training lesson plan outline.

I. Evidence of maintenance contractor qualifications, if different from installer.

J. Inspection and Test Reports:
   1. Submit inspection and test plan prior to closeout demonstration.
   2. Submit documentation of satisfactory inspections and tests.
   3. Submit NFPA 72 "Inspection and Test Form," filled out.

K. Operating and Maintenance Data: See Section 01 78 23 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:

1. Original copy of NFPA 72 with portions that are not relevant to this project neatly crossed out by hand; label with Quarry Hill Safe Room and date.
2. Complete set of specified design documents, as approved by authority having jurisdiction.
3. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
4. Contact information for firm that will be providing contract maintenance and trouble call-back service.
5. List of recommended spare parts, tools, and instruments for testing.
6. Replacement parts list with current prices, and source of supply.
7. Detailed troubleshooting guide and large scale input/output matrix.
8. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
9. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

L. Project Record Documents: See Section 01 70 00 for additional requirements; have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

M. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with his installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
3. Certificate of Occupancy.
4. Maintenance contract.
5. Report on training results.

N. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 78 23 - Operation and Maintenance Data, for additional provisions.
2. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
3. In addition to the items in quantities indicated in PART 2, furnish the following:
    a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
    b. One copy, on CD-ROM, of all software not resident in read-only-memory.
    c. Extra Fuses: Two for each installed fuse; store inside applicable control cabinet.

1.05 QUALITY ASSURANCE

A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to Owner upon completion.

B. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

C. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
   1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
   2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
   3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
   4. Contract maintenance office located within 50 miles of project site.
   5. Certified in the State in which the Project is located as fire alarm installer.

D. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

E. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

1.06 WARRANTY

A. See Section 01 78 33 - Warranties and Bonds, for additional warranty requirements.

B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

C. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Alarm Control Units - Basis of Design: Radionics D72 12.

B. Fire Alarm Control Units .

C. Initiating Devices, and Notification Appliances: Match existing.
   1. Provide all initiating devices and notification appliances made by the same manufacturer.

D. Substitutions: Not permitted.

2.02 FIRE ALARM SYSTEM

A. Fire Alarm System: Extend the existing system:
   1. Provide all components necessary, regardless of whether shown in the contract documents or not.
   2. Protected Premises: Entire building shown on drawings.
   3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
      a. The Americans With Disabilities Act (ADA).
      b. The requirements of the State Fire Marshal.
      c. Applicable local codes.
      d. The contract documents (drawings and specifications).
      e. NFPA 101.
      f. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.

4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
7. Staff Response Zones: For each smoke zone where occupants are not ambulatory, program notification zone as directed to notify staff in areas outside the normal notification zone and in other buildings, for response to assist in evacuation.
8. Program notification zones and voice messages as directed by Owner.
9. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
10. Master Control Unit (Panel): Existing, located as noted on drawings.
11. Combined Systems: Do not combine fire alarm system with other non-fire systems.

B. Supervising Stations and Fire Department Connections:
1. Public Fire Department Notification: Existing on-premises supervising station.

C. Circuits:
1. Initiating Device Circuits (IDC): Class B, Style A.
2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
3. Notification Appliance Circuits (NAC): Class B, Style W.

D. Spare Capacity:
1. Extend existing system for addition.
2. Master Control Unit: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.

2.03 EXISTING COMPONENTS

A. Existing Fire Alarm System: Extend existing system to new addition.

B. Existing Fire Alarm System: Remove existing components indicated and incorporate remaining components into new system, under warranty as if they were new; do not take existing portions of system out of service until new portions are fully operational, tested, and connected to existing system.

C. Clearly label components that are "Not In Service."

D. Remove unused existing components and materials from site and dispose of properly.

2.04 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
1. Sprinkler water control valves - existing.
2. Sprinkler water storage tank - existing.
3. Fire pump(s) - existing.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
1. Sprinkler water flow- existing.
2. Duct smoke detectors.

C. Doors:
   1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor.
   2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from.

2.05 COMPONENTS

A. General:
   1. Extend existing system for new addition.
   2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Initiating Devices:
   1. Smoke Detectors: Compatible with existing system.
      a. Provide 1 extra.
   2. Duct Smoke Detectors.
   3. Heat Detectors: Compatible with existing system.

C. Notification Appliances:
   1. Horn Strobes:
      a. Provide 1 extra.

D. Circuit Conductors: Copper; provide 200 feet extra; color code and label.

E. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
   1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
   2. Provide one for each control unit where operations are to be performed.
   3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
   4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Owner will provide the services of an independent fire alarm engineer or technician to observe all tests.

C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

D. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

E. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

F. Provide all tools, software, and supplies required to accomplish inspection and testing.

G. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

H. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

I. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
   1. Record all system operations and malfunctions.
   2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
   3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
   4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.03 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
   1. Initial Training: 1 session pre-closeout.
   2. Refresher Training: 1 session post-occupancy.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.
   2. Refresher Training: 1 session post-occupancy.

3.04 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

B. Occupancy of the project will not occur prior to Substantial Completion.

C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
   1. Specified diagnostic period without malfunction has been completed.
   2. Approved operating and maintenance data has been delivered.
   3. Spare parts, extra materials, and tools have been delivered.
   4. All aspects of operation have been demonstrated to Owner.
   5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
   6. Occupancy permit has been granted.
   7. Specified pre-closeout instruction is complete.

D. Perform post-occupancy instruction within 3 months after Substantial Completion.

3.05 MAINTENANCE

A. See Section 01 78 23 - Operation and Maintenance Data, for additional requirements relating to maintenance service.

B. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 2 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

C. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

D. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

E. Comply with Owner's requirements for access to facility and security.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 - Contract Conditions and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
   1. Remove existing construction, site work or property improvements as shown or required to complete the installation of new work and complete the project as shown or specified.
      a. See drawings for clearing work required.
      b. At any removed construction all mechanical, electrical and/or equipment within or on that construction shall be removed also, unless specifically noted as work of a particular trade.
         1) This Contractor shall employ any other trade required to completely and safely remove, disconnect and/or cap any demolished construction or utility.
   2. Remove trees, stumps and shrubs within the construction area and/or as indicated.
   3. Salvage:
      a. See Drawings for items to be removed by this section of work and delivered to the Owner at the project site.
      b. See Drawings for items to be removed and salvaged by this section of work. The items shall then be delivered to the installing Contractor to be stored, modified and re-installed in the new project under their respective section of work.
         1) Contractor shall be responsible to coordinate and determine the work required of each section (or trade), including Mechanical and Electrical.
         2) Improper or inadequate salvaging of materials shall be the responsibility of the Contractor. If he/she fails to inform and coordinate salvage methods, required accessories, quantities or other limiting factors relative to salvaging with the reinstalling trade, such failure shall make the Demolition Contractor responsible to provide new replacement material to complete the work.

C. Related Sections and Work
   1. Excavating, Stripping Topsoil, Filling, Grade: Section 31 23 00
   2. Selective Demolition: Section 02 41 19
   3. Capping of Mechanical and Electrical Items: coordinate with the proper local utility.
   4. Asbestos removal and abatement, if required: By Owner under a separate contract.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide all barricades, fences and warning lights as required to protect persons and property in accordance with all applicable codes and regulations.

B. Engineered Fill: On-site or imported granular fill capable of being compacted to meet the requirements of "Compaction" as specified in Part 3 of this section.
   1. Such fill material shall be verified and approved by a licensed Geotechnical Engineer.

PART 3 EXECUTION

3.01 INSPECTION

A. Prior to commencing the work under this section, examine the areas and conditions under which the work of this section will be performed. Notify the Architect, in writing, of unacceptable conditions that exist, prior to acceptance.
   1. Do not commence work until site is unoccupied, discontinued in use and conditions are acceptable to Architect and Owner.

B. Locate existing utilities in areas of work before starting operations under this section. If utilities are designated to remain, use all means necessary to provide protection from damage during construction operations.

C. Gopher State One Call
   1. **By law**, all excavators must contact the Gopher State One Call System Notification Center 48 hours, excluding Saturday, Sundays, and Holidays, prior to excavating in the State of Minnesota.
      a. The telephone number to call:
         1) Outside the seven county metro (Twin Cities) area: **1-800-252-1166**

D. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult Architect immediately for directions as to procedure. Cooperate with Owner and public and private utility companies in keeping services and facilities in operation. Repair damaged utilities to satisfaction of utility Owner.

3.02 CLEARING/PROCEDURE

A. In all activities, comply with pertinent regulations of governmental agencies having jurisdictions.

B. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors and to other work being performed on or near the site.

C. Break up and remove concrete slabs on grade and bituminous paving unless otherwise shown to remain. Such slabs on grade or paving that end up 24" (610 mm) or more under finish grade can remain but must be broken up to allow drainage before filling over.

D. Demolish and remove all below-grade wood and metal construction.

E. Shut-off, demolition, removal and capping of all utilities and services no longer necessary with the removal of buildings or improvements from the site.
   1. This Contractor shall employ any other trade or service required to completely and safely remove, disconnect and cap the abandoned utilities and services of the demolished structures.
   2. All such disconnected utilities and services shall be capped at locations and in a manner as directed by the governing public or private utility and/or governing authorities.
   3. Capped utilities or services shall be clearly marked (or identified) for locating in the future.

F. Prior to placement of Engineered Fill in the excavation and/or void left by the removal of buildings or site improvements, Contractor shall ensure that the areas to be filled are free of standing water, frozen materials, roots, organic matter, unstable soils, wood, metal, construction material, debris or trash of any kind.

G. Provide and fill the demolition excavation/void with Engineered fill as per specifications.

H. Pollution Control:

1. Provide water sprinkling, temporary enclosures and other suitable methods as may be required to limit the amount of dust and dirt rising and scattering in the air to the lowest level of air pollution practical for the work conditions.
2. Comply with all governing regulations.
3. Return all areas to conditions existing prior to the start of the work of this section.

I. Clearing and Grubbing:
1. Protect all trees and other plant life which are subject to damage during construction. Remove interfering branches without injury to trees and paint scars with tree wound paint.
2. Remove all trees, shrubs from building, paving, sidewalk areas and elsewhere shown to limits of earth cut and fill.
3. Remove all stumps, roots, brush, rubbish from the site.
4. Cut back all roots a minimum of 12" (305 mm) from all concrete work, paving, structures and to a depth of not less than 12" (305 mm) below finish grade within project limits.
5. No burning on site permitted.

J. Compaction:
1. Control soil compaction during construction for compliance with the percentage of maximum density specified for each area classification.
2. Provide not less than the following percentages of maximum standard proctor density, ASTM D 698, of the same soil material compacted at optimum moisture content, for the actual density of each layer of soil material-in-place.
    a. Structures: Compact top 12" (305 mm) of subgrade and each layer of backfill or fill material at 95 percent maximum density.
    b. Building Slabs and Steps: Compact top 12" (305 mm) of subgrade and each layer of backfill or fill material at 95 percent maximum density.
    c. Walkways: Compact top 6" (150 mm) of subgrade and each layer of backfill or fill material at 95 percent maximum density.
    d. Pavements: Compact top 12" (305 mm) of subgrade and each layer of backfill or fill material at 100 percent maximum density.
3. Where the subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply the required amount of water to the surface of subgrade, or layer of soil material in such a manner as to prevent free water appearing on the surface during or subsequent to compaction operations.
4. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified percentage of maximum density.
5. When the existing ground surface has a density less than that specified under "Compaction" for the particular area classification, break up the ground surface, pulverize, moisture condition to the optimum moisture content and compact to the required depth and percentage of maximum density.
6. Where completed areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, re-shape and compact to the required density prior to further construction. Use hand tamping for recompaction over underground utilities, if any.
7. Compaction over ditches less than 3' - 0" (915 mm) in width and around perimeter of walls and columns for distance of 3' - 0" (915 mm) from the wall or column shall be done by the use of mechanical hand compactors such as a Jackson Compactor.

K. Disposal of Materials:
1. Materials scheduled for re-use shall be removed, handled, stored and installed with care to maintain them in like new condition. Replacement or repair of destroyed or damaged materials, because of improper care, shall be the responsibility of the Contractor.
2. All demolition material not scheduled for re-use or property of the Owner shall become property of the Contractor and shall be removed from the Owner's site by the Contractor. No prolonged accumulation of debris will be allowed.
    a. Remove all salvaged items from the site as removed. Storage or sale of removed items on the site will not be allowed.

L. Maintaining Traffic:

1. Ensure minimum interference with roads, streets, driveways, sidewalks and adjacent facilities.
2. Do not close or obstruct streets, sidewalks, alleys or passageways without permission from authorities having jurisdiction.
3. If required by governing authorities, provide alternate routes around closed or obstructed traffic ways.

3.03 CLEAN UP/ACCEPTANCE

A. Clean up trash and debris caused by clearing operations under this section, keeping premises, streets and adjacent property clean and neat at all times.

END OF SECTION

SECTION 31 23 00

EXCAVATION AND FILL

PART 1 GENERAL

1.01 SUMMARY

A. Drawings and all provisions of Division 00 - Contract Conditions and all provisions of Division 01 - General Requirements, apply to this section.

B. Section Includes:
   1. Trenching, backfilling and compacting for all underground utility lines and services including but not limited to the following:
      a. Sanitary Sewers
      b. Storm Sewers
      c. Water Lines
      d. Natural Gas Lines
      e. Electric Cables and Ducts
      f. Communication Cables and Ducts
      g. Appurtenances: Manholes, Catch Basins and similar items
   2. All excess material shall be removed from the site.
   3. Provide all additional material required to complete the work of this section as indicated or required.
   4. The work of this section shall be performed in conjunction with and compatible with the requirements and work of Section 31 00 00 - EARTHWORK.
   5. **Precaution: Contractor of this section of work and General Contractor take note and coordinate all work accordingly.**
      a. It shall be the Contractor's responsibility to provide weather sensitive grading and excavation, restricted and controlled construction traffic, placement of temporary coarse aggregate roadways, de-watering, placement of stabilization fill and/or other such means, and methods necessary to maintain the site soils stable for bearing of all project improvements and construction operations.
      b. Failure to maintain the soil stable shall require the Contractor to remove the unstable soils and provide the corrective measures as stated in the Geotechnical Evaluation or as recommended by the project Geotechnical Engineer without additional compensation.
   6. This Contractor shall provide and maintain all erosion and sediment controls, silt fencing and bale check required by governing authorities.
      a. Coordinate providing this work with all other excavation and earth moving sections of work.

C. Related Sections
   1. Stripping Topsoil, General Grading: Section 31 00 00
   2. Site and Subsurface Exploration: Section 00 31 32
   3. Cast-in-Place Concrete: Section 03 30 00

1.02 GOPHER STATE ONE CALL

A. **By law,** all excavators must contact the Gopher State One Call System Notification Center 48 hours, excluding Saturdays, Sundays and Holidays, prior to excavating in the state of Minnesota.
   1. The telephone numbers to call are:
      a. Outside the seven county metro (Twin Cities) area: **1-800-252-1166**

PART 2 PRODUCTS

2.01 MATERIALS

A. Fill and Backfill Materials: Provide soil materials free from organic matter and deleterious substances, containing no rocks or lumps over 6" (150 mm) in greatest dimension, and with not more than 15 percent of the rocks or lumps larger than 2-3/8" (60 mm) in their greatest dimension.
   1. Fill material is subject to the approval of the Geotechnical Engineer whether that material is removed from excavations or imported from off-site borrow areas. It shall be predominately granular, non-expansive soil free from roots and other deleterious matter.
   2. Do not permit rocks having a dimension greater than 1" (25 mm) in the upper 12" (300 mm) of fill.
   3. Cohesionless Material Used for Backfill: Provide sand free from organic material and other foreign matter, and as approved by the Geotechnical Engineer.

B. Other Materials: Provide all appurtenances and other materials, not specifically described, but required for a complete and proper installation, as selected by the contractor subject to the approval of the architect.

PART 3 EXECUTION

3.01 INSTALLATION

A. Utilities:
   1. Unless shown to be removed, protect active utility lines shown on the drawings or otherwise made known to the contractor prior to trenching. If damaged, repair or replace at no additional cost to the Owner.
   2. If active utility lines are encountered and are not shown on the drawings, or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
   3. If service is interrupted as a result of work under this section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
   4. If existing utilities are found to interfere with the permanent facilities being constructed under this section, immediately notify the Architect/Engineer and secure his instructions.
   5. Do not proceed with permanent relocation of utilities until written instructions are received from the architect.

B. Protection of Persons and Property:
   1. Barricade open holes and depressions occurring as part of the work, and post warning lights on property adjacent to or with public access.
   2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
   3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this sections.
   4. Provide and maintain fabric silt fence and bale check temporary erosion control as per the latest published State/DOT Specifications.

C. Dewatering:
   1. Remove all water, including rain water, encountered during trench and sub-structure work to an approved location by pumps, drains, and other approved methods.
   2. Keep trenches and site construction area free from water.

D. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

E. Maintain access to adjacent areas at all times.

F. Trenching:

1. Comply with pertinent provisions of Section 31 00 00 and the provisions of this section.
2. Provide sheeting and shoring necessary for protection of the work and for the safety of personnel.
    a. Prior to backfilling, remove all sheeting.
    b. Do not permit sheeting to remain in the trenches, except when in the opinion of the Architect, field conditions or the type of sheeting or methods of construction such as use of concrete bedding are such as to make removal of sheeting impracticable. In such cases, the Architect may permit portions of sheeting to be cut off and remain in the trench.
3. Open Cut:
    a. Excavate for utilities by open cut.
    b. If conditions at the site prevent such open cut and if approved by the architect, trenching may be used.
    c. Short sections of a trench may be tunneled if, in the opinion of the architect, the conductor can be installed safely and backfill can be compacted properly into such tunnel.
    d. Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove boulders or other interfering objects, backfill the voids remaining after removal of the objects as directed by the construction soil engineer.
    e. When the void is below the subgrade for the utility bedding, use suitable earth materials and compact to the relative density directed by the Geotechnical Engineer, but in no case to a density less than 90 percent of Standard Proctor Density (ASTM D698).
    f. When the void is in the side of the utility trench or open cut, use suitable earth or sand compacted or consolidated, as approved by the Geotechnical Engineer, but in no case to a relative density less than 80 percent.
    g. Remove boulders and other interfering objects, and backfill voids left by such removals at no additional cost to the Owner.
    h. Excavating for Appurtenances:
        1) Excavate for manholes and similar structures to a distance sufficient to leave at least 12" (300 mm) clear between outer surfaces and the embankment or shoring that may be used to hold and protect the banks.
        2) Overdepth excavation beyond such appurtenances that has not been directed will be considered unauthorized. Fill with sand, gravel, or lean concrete as directed by the Geotechnical Engineer, and at no additional cost to the Owner.
4. Trench to the minimum width necessary for proper installation of the utility, with sides as nearly vertical as possible. Accurately grade the bottom to provide uniform bearing for the utility.
5. Depressions:
    a. Dig bell holes and depressions for joints after the trench has been graded. Provide uniform bearing for the pipe on prepared bottom of the trench.
    b. Except where rock is encountered, do not excavate below the depth indicated or specified.
    c. Where rock is encountered, excavate rock to a minimum overdepth of 4" (100 mm) below the trench depth indicated or specified.
6. Where utility runs traverse public property or are subject to governmental or utility company jurisdiction, provide depth, bedding, cover, and other requirements as set forth by legally constituted authority having jurisdiction, but in no case less than the depth shown in the contract documents.
7. Where trenching occurs in existing lawns, remove turf in sections and keep damp. Replace turf upon completion of the backfilling.
8. Cover:
    a. Provide minimum trench depth indicated below to maintain a minimum cover over the top of the installed item below the finish grade or subgrade.
        1) Areas subject to vehicular traffic:
            a) Sanitary Sewers - 72" (1 800 mm)
        2) Areas not subject to vehicular traffic:
            a) Sanitary Sewers - 72" (1 800 mm)
        3) All areas:
            a) Water Lines - 84" (2 100 mm)

b) Natural Gas Lines - 30" (760 mm)

c) Electrical Cables - 42" (1 060 mm)

d) Electrical Ducts - 36" (900 mm)

b. Where minimum cover is not provided for water and sewer lines, furnish and install 2" (50 mm) expanded polystyrene in continuous 4' (1 220 mm) widths above lines.

c. Where the minimum cover is not provided, encase the pipes in concrete as indicated. Provide concrete with a minimum 28- day compressive strength of 2,500 psi (17 225 kPa).

G. Bedding: Provide bedding as indicated on the drawings.

H. Backfilling:

1. General:
   a. Do not completely backfill trenches until required pressure and leakage tests have been performed, and until the utilities systems as installed conform to the requirements specified in the pertinent sections of these specifications.
   b. Except as otherwise specified or directed for special conditions, backfill trenches to the ground surface with selected material approved by the Geotechnical Engineer.
   c. Re-open trenches which have been improperly backfilled, to a depth as required for proper compaction. Refill and compact as specified, or otherwise correct, to the approval of the Geotechnical Engineer.
   d. Do not allow or cause any of the work performed or installed to be covered up or enclosed by work of this section prior to required inspections, tests, and approvals.
   e. Should any of the work be so enclosed or covered up before it has been approved, uncover all such work and, after approvals have been made, refill and compact as specified, all at no additional cost to the Owner.
2. Lower Portion of Trench:
   a. Deposit approved backfill and bedding material in layers of 6" (150 mm) maximum thickness, and compact with suitable tampers to the density of the adjacent soil or grade, as specified herein, until there is a cover of not less than 24" (600 mm) over sewers and 12" (300 mm) over other utility lines.
   b. Take special care in backfilling and bedding operations to not damage pipe and pipe coatings.
3. Remainder of Trench:
   a. Except for special materials for pavements, backfill the remainder of the trench with material free from stones larger than 6" (150 mm) or half the layered thickness, whichever is smaller, in any dimension.
   b. Deposit backfill material in layers not exceeding the thickness specified, and compact each layer to the minimum density directed by the Geotechnical Engineer.
4. Adjacent to Buildings: Mechanically compact backfill within 10' (3 m) of buildings.
5. Consolidation of backfill by jetting with water may be permitted, when specifically approved by the Geotechnical Engineer, in areas other than building and pavement areas.

I. Test for Displacement of Sewers and Storm Drains:

1. Check sewers and storm drains to determine whether displacement has occurred after the trench has been backfilled to above the pipe and has been compacted as specified.
2. Flash a light between manholes, or if the manholes have not yet been constructed, between the locations of the manholes, by means of a flashlight or by reflecting sunlight with a mirror.
3. If the illuminated interior of the pipe line shows poor alignment, displaced pipes, or any other defects, correct the defects to the specified conditions and at no additional cost to the Owner.

3.02 FIELD QUALITY CONTROL

A. The Geotechnical Engineer/Engineer will inspect open cuts and trenches before installation of utilities, and will make the following tests:

1. Assure that trenches are not backfilled until all tests have been completed.
2. Check backfilling for proper layer thickness and compaction.
3. Verify that test results conform to the specified requirements, and that sufficient tests are

performed.

4. Assure that defective work is removed and properly replaced.

B. Finish Elevations and Lines:

1. Comply with pertinent provisions of Section 31 00 00.

3.03 CLEAN UP/ACCEPTANCE

A. Protect newly graded areas from traffic and erosion, and keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded and rutted areas to the specified tolerances.

C. Keep all travel routes free of tracked or spilled materials.

END OF SECTION