PROJECT MANUAL
CDB 805-030-020
DESCRIPTION Correct Water Infiltration – Academic Building
LOCATION Illinois Mathematics and Science Academy
Aurora (Kane County), Illinois
AGENCY NAME Illinois Mathematics and Science Academy
Aurora (Kane County), Illinois
BUILDING NO. CP078
CONTRACT: General, Plumbing, Ventilation, Electrical

State of Illinois

CAPITAL DEVELOPMENT BOARD
CHICAGO, IL

USING AGENCY: ILLINOIS BOARD OF HIGHER EDUCATION

BY: Globetrotters Engineering Corporation
300 South Wacker Drive, Suite 400
Chicago, IL 60606
DPR Design Firm Registration No. 184.001267

DATE: December 12, 2014
50% Bid Documents Submittal

License Expiration Date: ________________
Signature: ________________
Date Signed: ________________
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# Project Manual

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## Supplementary Conditions

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*State of Illinois,*

**CAPITAL DEVELOPMENT BOARD**

Globetrotters Engineering Corporation  
300 South Wacker Drive, Suite 400  
Chicago, Illinois 60606  
(312) 922-640 (312) 922-6558 (Fax)

**PROJECT MANUAL FOR**

CDB-805-030-020

Correct Water Infiltration – Academic Building  
Illinois Mathematics and Science Academy  
Aurora, Kane County, Illinois

**DATE:** December 12, 2014 (50% Bid Documents Submittal)
# General Requirements

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## Technical Requirements

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### SPECIFIERS:

- **General/Architectural:**
  - Steven Steffens, ALA
  - (312) 697-3682
  - (312) 922-5169 (Fax)
  - steven.steffens@gec-group.com

- **General/Structural:**
  - Thakor Bhagwakar, SE
  - (312) 697-3534
  - thakor.bhagwakar@gec-group.com

- **Plumbing and Ventilation:**
  - Phil Peterson, PE
  - (312) 697-3647
  - philip.peterson@gec-group.com

- **Electrical:**
  - Paul Rogas, PE
  - (312) 697-3528
  - paul.rogas@gec-group.com

END 00 01 10
G000  COVER SHEET
G001  ROOF AREA KEY PLAN, GENERAL NOTES AND LEGENDS

S101  PARTIAL ROOF FRAMING PLAN - SOUTH

AD101  PARTIAL ROOF DEMOLITION PLAN – SOUTH
AD102  PARTIAL ROOF DEMOLITION PLAN – NORTH
A101  PARTIAL REMODELED ROOF PLAN – SOUTH
A102  PARTIAL REMODELED ROOF PLAN – NORTH
A201  MONITOR ELEVATIONS
A301  PARTIAL BUILDING SECTIONS
A501  TYPICAL MONITOR DETAILS
A502  DETAILS
A503  DETAILS

P001  GENERAL PLUMBING NOTES, SYMBOLS & ABBREVIATIONS
PD101  PARTIAL ROOF DEMOLITION PLUMBING PLAN – SOUTH
PD102  PARTIAL ROOF DEMOLITION PLUMBING PLAN – NORTH
P101  PARTIAL ROOF NEW WORK PLUMBING PLAN – SOUTH
P102  PARTIAL ROOF NEW WORK PLUMBING PLAN – NORTH
P501  PLUMBING DETAILS AND SCHEDULE

V001  GENERAL VENTILATION NOTES, SYMBOLS & ABBREVIATIONS
VD101  PARTIAL ROOF DEMOLITION VENTILATION PLAN – SOUTH
VD102  PARTIAL ROOF DEMOLITION VENTILATION PLAN – NORTH
V101  PARTIAL ROOF NEW WORK VENTILATION PLAN – SOUTH
V102  PARTIAL ROOF NEW WORK VENTILATION PLAN – NORTH
V501  DETAILS AND SCHEDULES

E001  GENERAL ELECTRICAL NOTES, SYMBOLS & ABBREVIATIONS
ED101  ROOF DEMOLITION ELECTRICAL PLAN – SOUTH
ED102  ROOF DEMOLITION ELECTRICAL PLAN – NORTH
E101  ROOF ELECTRICAL PLAN – SOUTH
E102  ROOF ELECTRICAL PLAN – NORTH
E201  ELECTRICAL EXISTING CONDITIONS

All Drawings dated: 12/12/2014

END 00 01 15.
The State of Illinois, Capital Development Board (CDB) will receive sealed bids for:

CDB PROJECT #: 805-030-020  
TITLE: Correct Water Infiltration – Academic Building  
LOCATION: Illinois Math and Science Academy, 1500 W. Sullivan Road, Aurora, IL 60506  
USING AGENCY: Illinois Math and Science Academy (IMSA)  
COUNTY: Kane County

PROJECT DESCRIPTION: Correct water infiltration in the Academic Building, including replacing approximately 97,000 square feet of roofing system, repairing approximately 14,000 square feet of roofing system, replacing monitor windows, removing/reinstalling and upgrading roof-mounted ventilating systems and associated ductwork, tuckpointing and exterior envelope improvements.

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BID LOCATION:

ILLINOIS CAPITAL DEVELOPMENT BOARD
JAMES R. THOMPSON CENTER
100 WEST RANDOLPH STREET
SUITE 14-600, 14TH FLOOR
CHICAGO, IL 60601

Minority, Female & Veteran Business Subcontractor/Supplier Participation is applicable.

Obtain Plans From: Globetrotters Engineering Corporation  
300 South Wacker Drive, Suite 400  
Chicago, Illinois 60606  
(312) 922-6400

Refundable Plan Deposit: $200.00

Pre-Bid Meeting: (Date, time, location TO BE DETERMINED)

INFORMATION TO BIDDERS:

A. Prequalification. Bidders must be prequalified with CDB; allow 45 days for application processing. For an application and a copy of CDB’s Standard Documents for Construction (applicable to this project), visit CDB’s Website www.cdb.state.il.us or phone 217/782-6152 (TDD 217/524-4449).

CDB-00 11 13 June 20, 2014  
CDB 805-030-020  
Correct Water Infiltration
Bidding & Contract Requirements

00 11 13 – Advertisement for Bids

B. MBE/FBE/VBE. MBE/FBE/VBE firms must be certified or registered with CMS as an MBE, FBE, or VBE prior to bidding.

C. Prevailing Wage. Contractor shall not pay less than the prevailing rates of wages to all laborers, workmen, and mechanics performing work under this contract, and shall comply with the requirements of the Illinois Wages of Employees on Public Works Act (820 ILCS 130/1-12).

D. Registration with the Illinois Procurement Gateway (IPG). Vendors may pre-register with the IPG and receive a vendor registration number. The IPG is a web based system that serves as the primary location for entering, organizing, and reviewing vendor information. The IPG allows prospective vendors to provide disclosures, registrations, and other documentation needed to do business with the State in advance of any particular procurement. Registration in the Illinois Procurement Gateway is optional.

E. Certifications and Disclosures. Vendors must have an approved Illinois Procurement Gateway registration number, or submit the Standard Certifications and Disclosure Form(s) with bid at time of submittal. Failure to provide standard certifications and financial disclosure, or be registered with the Illinois Procurement Gateway, will result in rejection of bid.

F. Subcontractors. You are also required to submit disclosure forms and standard certifications for subcontractors whose contracts will be valued over $50,000 within 20 days of execution of your contract with CDB or execution of the contract between you and your subcontractor, whichever is later. A valid IPG registration number can be provided in lieu of hard copies of the standard certifications and financial disclosure forms. (See D. above.) Subcontractors must receive an Authorization to Proceed prior to performance of any work.

G. Supplement to SDC. Bidders are advised to review Article 01 11 01, Supplement to SDC, for any revisions to the Standard Documents for Construction.

H. Progress Payments. Progress payments will normally be issued by the Illinois Comptroller within 30 business days after CDB receives and approves an Invoice-Voucher.

CAPITAL DEVELOPMENT BOARD

Jim Underwood
Executive Director

John Nalis
Project Manager
(312) 814-1603
John.nalis@illinois.gov
RETURN WITH BID

NAME OF FIRM: ________________________________

CDB FIRM ID NO: ________________________________

FOR GENERAL WORK

BID FOR: CDB PROJECT NUMBER: 805-030-020

PROJECT TITLE: Correct Water Infiltration – Academic Building, Illinois Math and Science Academy ("IMSA").

BID TO: State of Illinois, Capital Development Board

THE BIDDER ACKNOWLEDGES THE FOLLOWING ADDENDA: (Failure to acknowledge may cause bid rejection.)

NO._____ DATED _____ NO._____ DATED _____ NO._____ DATED _____

NO._____ DATED _____ NO._____ DATED _____ NO._____ DATED _____

EACH BID SHALL INCLUDE:

A. BID FORM (00 41 00)
B. SUBCONTRACTOR/SUPPLIER REQUIREMENTS (00 41 01)
C. ILLINOIS OFFICE AFFIDAVIT (00 41 02)
D. DHR PC-2 FORM (00 41 04)
E. MBE/FBE/VBE FORM (00 41 05)
F. BID SECURITY (00 41 06)
G. PRODUCT SUBSTITUTION FORM (at Bidder's option) (00 41 07)
H. Standard Business Terms and Conditions (00 41 08)
I. Forms A CERTIFICATIONS AND DISCLOSURES or Forms B (00 41 09)

UNIT PRICES:

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</table>

SUM OF ALL UNIT PRICE COST EXTENSIONS (TO BE INCLUDED IN THE BASE BID PRICE) = $_____

BASE BID: THE BIDDER AGREES TO PERFORM ALL WORK FOR THE ABOVE TRADE, EXCLUSIVE OF ALTERNATE BIDS, FOR THE SUM OF:

____________________________________________________ DOLLARS ($_______)

(*ALTERNATE BID NO.): (*ADD TO)(*DEDUCT FROM) THE BASE BID THE SUM OF:

____________________________________________________ DOLLARS ($_______)
RETURN WITH BID

Note: Any qualifying or conditional statements included on the bid form or attached to the bid form may result in rejection of the bid unless rescinded by the bidder.

PRODUCT SUBSTITUTION FORM ATTACHED (00 41 07): □

Duration of Bids: The bidders shall hold their bids open for 60 calendar days after the bid opening.

By signing below, the Bidder agrees to perform all work in accordance with the terms and conditions of the bidding documents and enter into and execute a contract with CDB, if awarded, on the basis of this bid for the sum indicated herein:

BIDDER (show Company name and DBA):

Signature of authorized representative:__________________________ FEIN #:

Printed Name: ___________________________________ Date: ______________________

Title: __________________________________ Address: ____________________________

Telephone: __________________ Fax: __________________ Email: __________________

For Corporations only: Attest By: ______________________ (Corporate Secretary)
RETURN WITH BID

NAME OF FIRM: ________________________________

CDB FIRM ID NO: ________________________________

FOR PLUMBING WORK

BID FOR: 

CDB PROJECT NUMBER: 805-030-020

PROJECT TITLE: Correct Water Infiltration – Academic Building, Illinois Math and Science Academy ("IMSA").

BID TO: State of Illinois, Capital Development Board

THE BIDDER ACKNOWLEDGES THE FOLLOWING ADDENDA: (Failure to acknowledge may cause bid rejection.)

NO., DATED

NO., DATED

NO., DATED

EACH BID SHALL INCLUDE:

A. BID FORM (00 41 00)
B. SUBCONTRACTOR/SUPPLIER REQUIREMENTS (00 41 01)
C. ILLINOIS OFFICE AFFIDAVIT (00 41 02)
D. DHR PC-2 FORM (00 41 04)
E. MBE/FBE/VBE FORM (00 41 05)
F. BID SECURITY (00 41 06)
G. PRODUCT SUBSTITUTION FORM (at Bidder's option) (00 41 07)
H. Standard Business Terms and Conditions (00 41 08)
I. Forms A CERTIFICATIONS AND DISCLOSURES or Forms B (00 41 09)

UNIT PRICES:

<table>
<thead>
<tr>
<th>ITEM DESCRIPTION</th>
<th>UNIT OF COST</th>
<th>ESTIMATED QUANTITY</th>
<th>UNIT PRICE</th>
<th>COST EXTENSION</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td>x $</td>
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<tr>
<td>2.</td>
<td></td>
<td>x $</td>
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SUM OF ALL UNIT PRICE COST EXTENSIONS
(TO BE INCLUDED IN THE BASE BID PRICE) = $_____

BASE BID: THE BIDDER AGREES TO PERFORM ALL WORK FOR THE ABOVE TRADE, EXCLUSIVE OF ALTERNATE BIDS, FOR THE SUM OF:

__________________________________________________________________________ DOLLARS ($_______)

(*ALTERNATE BID NO.): (*ADD TO)(*DEDUCT FROM) THE BASE BID THE SUM OF:

__________________________________________________________________________ DOLLARS ($_______)
RETURN WITH BID

Note: Any qualifying or conditional statements included on the bid form or attached to the bid form may result in rejection of the bid unless rescinded by the bidder.

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Duration of Bids: The bidders shall hold their bids open for 60 calendar days after the bid opening.

By signing below, the Bidder agrees to perform all work in accordance with the terms and conditions of the bidding documents and enter into and execute a contract with CDB, if awarded, on the basis of this bid for the sum indicated herein:

BIDDER (show Company name and DBA):

Signature of authorized representative: ____________________________

Printed Name: ____________________________ FEIN #: ____________________________

Title: ____________________________ Date ____________________________

Address: ____________________________

Telephone: ____________________________ Fax: ____________________________ Email: ____________________________

For Corporations only: Attest By: ____________________________ (Corporate Secretary)
RETURN WITH BID

NAME OF FIRM: ____________________________________________
CDB FIRM ID NO: __________________________________________

FOR VENTILATION WORK

BID FOR: CDB PROJECT NUMBER: 805-030-020


BID TO: State of Illinois, Capital Development Board

THE BIDDER ACKNOWLEDGES THE FOLLOWING ADDENDA: (Failure to acknowledge may cause bid rejection.)

NO.____, DATED _____ NO.____, DATED _____ NO.____, DATED _____
NO.____, DATED _____ NO.____, DATED _____ NO.____, DATED _____

EACH BID SHALL INCLUDE:

A. BID FORM (00 41 00)
B. SUBCONTRACTOR/SUPPLIER REQUIREMENTS (00 41 01)
C. ILLINOIS OFFICE AFFIDAVIT (00 41 02)
D. DHR PC-2 FORM (00 41 04)
E. MBE/FBE/VBE FORM (00 41 05)
F. BID SECURITY (00 41 06)
G. PRODUCT SUBSTITUTION FORM (at Bidder's option) (00 41 07)
H. Standard Business Terms and Conditions (00 41 08)
I. Forms A CERTIFICATIONS AND DISCLOSURES or Forms B (00 41 09)

| UNIT PRICES: |
| ITEM DESCRIPTION | UNIT OF COST | ESTIMATED QUANTITY | UNIT PRICE | COST EXTENSION |
| 1. | | | x $ = $ |
| 2. | | | x $ = $ |

SUM OF ALL UNIT PRICE COST EXTENSIONS
(TO BE INCLUDED IN THE BASE BID PRICE) = $_____

BASE BID: THE BIDDER AGREES TO PERFORM ALL WORK FOR THE ABOVE TRADE, EXCLUSIVE OF ALTERNATE BIDS, FOR THE SUM OF:

____________________________________________ DOLLARS ($_______)

(*ALTERNATE BID NO.): (*ADD TO)(*DEDUCT FROM) THE BASE BID THE SUM OF:

____________________________________________ DOLLARS ($_______)
RETURN WITH BID

Note: Any qualifying or conditional statements included on the bid form or attached to the bid form may result in rejection of the bid unless rescinded by the bidder.

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Duration of Bids: The bidders shall hold their bids open for 60 calendar days after the bid opening.

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BIDDER (show Company name and DBA):

Signature of authorized representative:_____________________________

Printed Name:____________________ FEIN #:____________________

Title:_________________________ Date ______________________

Address:_____________________________________________________

Telephone:________________ Fax:________________ Email:__________

For Corporations only: Attest By:_________________________ (Corporate Secretary)
RETURN WITH BID

NAME OF FIRM: ____________________________
CDB FIRM ID NO: ____________________________

FOR ELECTRICAL WORK

BID FOR: CDB PROJECT NUMBER: 805-030-020


BID TO: State of Illinois, Capital Development Board

THE BIDDER ACKNOWLEDGES THE FOLLOWING ADDENDA: (Failure to acknowledge may cause bid rejection.)

NO. _____, DATED _____  NO. _____, DATED _____  NO. _____, DATED _____

NO. _____, DATED _____  NO. _____, DATED _____  NO. _____, DATED _____

EACH BID SHALL INCLUDE:

A. BID FORM (00 41 00)
B. SUBCONTRACTOR/SUPPLIER REQUIREMENTS (00 41 01)
C. ILLINOIS OFFICE AFFIDAVIT (00 41 02)
D. DHR PC-2 FORM (00 41 04)
E. MBE/FBE/VBE FORM (00 41 05)
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UNIT PRICES:

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<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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<td>x $</td>
<td></td>
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</tr>
<tr>
<td>2.</td>
<td></td>
<td>x $</td>
<td></td>
<td>$</td>
</tr>
</tbody>
</table>

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BASE BID: THE BIDDER AGREES TO PERFORM ALL WORK FOR THE ABOVE TRADE, EXCLUSIVE OF ALTERNATE BIDS, FOR THE SUM OF:

__________________________________________________________________________ DOLLARS ($__________)

(*ALTERNATE BID NO.): (*ADD TO)(*DEDUCT FROM) THE BASE BID THE SUM OF:

__________________________________________________________________________ DOLLARS ($__________)

CDB-00 41 00 June 20, 2014
CDB 805-030-020  00 41 00 - 1  Correct Water Infiltration
RETURN WITH BID

Note: Any qualifying or conditional statements included on the bid form or attached to the bid form may result in rejection of the bid unless rescinded by the bidder.

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BIDDER (show Company name and DBA):

Signature of authorized representative:

Printed Name: ____________________________ FEIN #: ____________________________

Title: ____________________________ Date ____________________________

Address: ____________________________

Telephone: __________ Fax: __________ Email: __________

For Corporations only: Attest By: ____________________________ (Corporate Secretary)
A. Subcontractor/Supplier Requirements

Pursuant to requirements under 30 ILCS 500/20-120(a), the contract shall state whether the services of a subcontractor/supplier will or may be used. Furthermore, the contract shall include names and addresses of all known subcontractors/suppliers with subcontracts with an annual value of more than $50,000 and the expected amount of money each will receive under the contract. Financial and Conflict of Interest disclosures and standard certifications of each subcontractor/supplier over $50,000 must be submitted to CDB by the contractor prior to the subcontractor/supplier performance of work.

Please check the applicable option:

The services of a subcontractor/supplier will or may be used: YES ☐ NO ☐
If YES: Then list known subcontractors/suppliers, including firms listed on Document 00 41 05.

<table>
<thead>
<tr>
<th>Name &amp; Address of Subcontractor/supplier</th>
<th>Over $50,000 (Yes/No)</th>
<th>Total Expected Value</th>
<th>CDB Registration No.</th>
<th>TIN (FEIN or SSN)</th>
<th>Trade Performed or Supply Provided</th>
<th>Description / Scope of Work</th>
</tr>
</thead>
<tbody>
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<td>10</td>
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</tr>
</tbody>
</table>

(Use additional sheets if necessary.)
RETURN WITH BID

AFFIDAVIT

STATE OF ______________
COUNTY OF ____________
CDB Project No. ___________
CDB Contract No. ___________

Before me this day personally appeared __________________, who, being duly sworn, deposes and says:

(Please print name)

Bidder will maintain an Illinois office as the primary place of employment for persons employed in the construction authorized by the contract in accordance with 30 ILCS 500/30-22(8). I am duly authorized to make this affidavit.

______________________
Illinois Office Location:
______________________
Signature

______________________
Printed Name
______________________
Bidder Name
______________________
Address

I, __________________________, a Notary Public of the County and State aforesaid, hereby certify that __________________________ personally known to me to be the affiant in the foregoing affidavit, personally appeared before me this day and having been by me duly sworn deposes and says that the facts set forth in the above affidavit are true and correct.

Witness my hand and official seal this the _________ day of __________, ________.

(SEAL)

________________________
Notary Public

My Commission expires:

___/___/_______

CDB-00 41 02 January 2014
CDB 805-030-020
00 41 02 - 1 Correct Water Infiltration
RETURN WITH BID

THIS PAGE INTENTIONALLY LEFT BLANK
BIDDER’S EMPLOYEE UTILIZATION FORM

SAMPLE:

(Note: A/E needs to obtain the proper PC-2 form from CDB PM/FEP)

All bidders shall complete the DHR Form PC-2 per 00 43 38.1 of the Standard Documents For Construction (SDC) and as identified by trade category. Failure to complete may result in rejection of the bid per 00 43 38.1 of the SDC.

(Option #1) Workforce projections are for work performed on the project being bid. Workforce projections shall include any subcontractor(s’) workforce. The bidder, if awarded a contract, shall be responsible for ensuring the subcontractor(s) meet minority/female workforce goals.

CDB’s acceptance of the Bidder’s PC-2 projection is a condition of contract award. CDB will notify the bidder if the projection is unacceptable. The bidder shall be given the opportunity to negotiate an acceptable projection with the CDB. Failure to reach an acceptable workforce projection may result in rejection of the contract award.

GOALS

The following workforce hiring goals are in effect for each trade. These goals represent a minimum of total workforce hours.

<table>
<thead>
<tr>
<th>Trade</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheetmetal</td>
<td>25%</td>
</tr>
<tr>
<td>Equipment operators</td>
<td>20%</td>
</tr>
<tr>
<td>Mechanics</td>
<td>12%</td>
</tr>
<tr>
<td>Ironworkers/Boilermakers</td>
<td>20%</td>
</tr>
<tr>
<td>Carpenters</td>
<td>25%</td>
</tr>
<tr>
<td>Acoustical Tilers</td>
<td>20%</td>
</tr>
<tr>
<td>Ceramic Tile Setters</td>
<td>12%</td>
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<tr>
<td>Brick Masons/Tuckpointers</td>
<td>15%</td>
</tr>
<tr>
<td>Cement Masons</td>
<td>15%</td>
</tr>
<tr>
<td>Lathers (Metal/Wood)</td>
<td>15%</td>
</tr>
<tr>
<td>Tapers</td>
<td>15%</td>
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<tr>
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<td>15%</td>
</tr>
<tr>
<td>Painters</td>
<td>20%</td>
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<tr>
<td>Glaziers</td>
<td>15%</td>
</tr>
<tr>
<td>Roofers</td>
<td>25%</td>
</tr>
<tr>
<td>Metal Deck Roofers</td>
<td>15%</td>
</tr>
<tr>
<td>Pipefitters</td>
<td>25%</td>
</tr>
<tr>
<td>Plumbers</td>
<td>25%</td>
</tr>
<tr>
<td>Insulators</td>
<td>12%</td>
</tr>
<tr>
<td>Temperature Control</td>
<td>12%</td>
</tr>
<tr>
<td>Laborers</td>
<td>33%</td>
</tr>
<tr>
<td>Electricians</td>
<td>25%</td>
</tr>
<tr>
<td>Fencing, Guard Rails</td>
<td>15%</td>
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<tr>
<td>Landscaping</td>
<td>20%</td>
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<tr>
<td>Truck Drivers</td>
<td>20%</td>
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<tr>
<td>Air Test &amp; Balancing</td>
<td>0%</td>
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<tr>
<td>Sandblast/Waterproofing/Caulkers</td>
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<td>Asbestos Workers</td>
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<td>Terrazzo</td>
<td>12%</td>
</tr>
</tbody>
</table>

INSTRUCTIONS

for Project:

Trade:

Under “Total Employees”, project the total number of employees to be used in the performance of the contract work by your firm and your subcontractors. Include within the projections, separate numbers for Journeyman and Apprentices by the letters “J” and “A”.

(See next page)

Contact Person _________________________
Firm Name ____________________________
Address _______________________________
Telephone Number _______________________
Fax Number ____________________________
Email Address __________________________
DHR # ________________________________

DHR Expiration Date: _________________
CDB Project Number : 805-030-020

### BIDDING & CONTRACT REQUIREMENTS

Document 00 41 04-Bid Form-DHR Form PC-2

<table>
<thead>
<tr>
<th>Contract/Trade Bid</th>
<th>FEP Tech</th>
<th>Monitored/Non-Monitored</th>
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<th>Trade Codes</th>
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</tbody>
</table>

**NOTE:** Bidder’s failure to complete DHR Form PC-2 may result in rejection of the bid. Bidder shall set forth a total projection of the total workforce to be allocated for this contract. Approval of the workforce hiring projection is a post-award requirement.
GENERAL CONTRACT REQUIREMENTS FOR MINORITY/ FEMALE/VETERANS BUSINESS PARTICIPATION

A. This project has goals for participation by minority and female owned businesses as first and second tier (level) subcontractors or suppliers in accord with the Business Enterprise for Minorities, Females, and Persons with Disabilities Act.

GOALS: The MBE/FBE goal for this contract is 15 percent of the amount of the contract awarded by CDB.

B. This project has goals for participation by veteran owned businesses as first and second tier (level) subcontractors or suppliers in accord with 30 ILCS 500/45-57.

GOALS: The VBE goal for this contract is (*) percent of the amount of the contract awarded by CDB.

C. The contract award is defined as a Base Bid plus all alternates. Only MBE/FBE/VBE firms certified or registered with the Illinois Department of Central Management Services are acceptable. NOTE: MBE/FBE/VBE goals are in addition to those specified for workforce projections (DHR Form PC-2 Form).

INSTRUCTIONS: When Goals are established, the Bidder shall include below the names of certified minority/female/veteran owned business enterprises which will perform at least the percentage of the work specified in the Goals statement (see above) and the proposed dollar value of subcontract (percentage values are not acceptable). If the Bidder needs assistance in identifying subcontractors or suppliers, contact CDB’s FEP Unit prior to submitting the bid and assistance will be provided in accordance with the MBE/FBE/VBE requirements in the Standard Documents for Construction. Efforts to comply with these requirements will be considered in evaluating whether the bid is responsive. If the percentage of the work (Base Bid plus all Alternates) is less than the specified goals, bidder is required to submit within 7 (seven) calendar days after the bid opening written evidence of its good faith efforts to achieve the goals.

❖ Firms cannot be identified after the bid opening.
❖ Failure to identify firms will result in rejection of bid.
❖ Firms shall be certified or registered with CMS as an MBE/FBE/VBE prior to bid opening.
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❖ See the 2009 Standard Documents for Construction Supplement 00 43 09 .10 - MBE/FBE supplier participation of regular dealers.

BIDDER’S MBE/FBE/VBE SUBCONTRACTOR/SUPPLIER FIRMS, INCLUDING ADDRESS AND TELEPHONE NUMBER, TO BE UTILIZED IN REGARD TO THIS CONTRACT (Include base bid below and each alternate on next page(s)).
(Attach additional sheet if necessary)
# BIDDING & CONTRACT REQUIREMENTS

Document 00 41 05 – Minority/Female/Veterans Business Enterprise Program Requirements

## RETURN WITH BID

CDB PROJECT NO. 805-030-020

### NAME OF BIDDER:

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1. Each of the subcontractors and suppliers listed is certified by Central Management Services under the provisions and definitions of the Minority/Female/Veterans Business Enterprise Program Acts as a minority, female or veteran owned business.
2. The subcontract(s) which will be executed by the Bidder for the first level subcontractors and suppliers if the bidder is awarded this contract by CDB will meet or exceed the specified MBE/FBE goals, and will comply with all provisions of the Minority/Female Business Enterprise Program Act.
3. The subcontract(s) which will be executed by the Bidder for the first level subcontractors and suppliers if the bidder is awarded this contract by CDB will meet or exceed the specified VBE goals, and will comply with all provisions of 30 ILCS 500/45/57.

Bidder agrees to the contractual requirements specified in CDB’s Standard Documents for Construction in regard to the Minority/Female/Veterans Business Enterprise Program Acts.

_________________________________      ____________
Signature, Title          Date

SIGNATURE IS REQUIRED
PLUMBING CONTRACT REQUIREMENTS FOR MINORITY/FEMALE/VETERANS BUSINESS PARTICIPATION

A. This project has goals for participation by minority and female owned businesses as first and second tier (level) subcontractors or suppliers in accord with the Business Enterprise for Minorities, Females, and Persons with Disabilities Act.

GOALS: The MBE/FBE goal for this contract is 15 percent of the amount of the contract awarded by CDB.

B. This project has goals for participation by veteran owned businesses as first and second tier (level) subcontractors or suppliers in accord with 30 ILCS 500/45-57.

GOALS: The VBE goal for this contract is (*INSERT PERCENT HERE) percent of the amount of the contract awarded by CDB.

C. The contract award is defined as a Base Bid plus all alternates. Only MBE/FBE/VBE firms certified or registered with the Illinois Department of Central Management Services are acceptable. NOTE: MBE/FBE/VBE goals are in addition to those specified for workforce projections (DHR Form PC-2 Form).

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BIDDER’S MBE/FBE/VBE SUBCONTRACTOR/SUPPLIER FIRMS, INCLUDING ADDRESS AND TELEPHONE NUMBER, TO BE UTILIZED IN REGARD TO THIS CONTRACT (Include base bid below and each alternate on next page(s)).
(Attach additional sheet if necessary)
BIDDING & CONTRACT REQUIREMENTS
Document 00 41 05 – Minority/Female/Veterans Business Enterprise Program Requirements

RETURN WITH BID

CDB PROJECT NO. 805-030-020

Name of Bidder: __________________________

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### BIDDING & CONTRACT REQUIREMENTS

**Document 00 41 05 – Minority/Female/Veterans Business Enterprise Program Requirements**

**RETURN WITH BID**

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Bidder agrees to the contractual requirements specified in CDB’s Standard Documents for Construction in regard to the Minority/Female/Veterans Business Enterprise Program Acts.

_________________________________      ____________  
Signature, Title          Date

SIGNATURE IS REQUIRED
VENTILATION CONTRACT REQUIREMENTS FOR MINORITY/ FEMALE/ VETERANS BUSINESS PARTICIPATION

A. This project has goals for participation by minority and female owned businesses as first and second tier (level) subcontractors or suppliers in accord with the Business Enterprise for Minorities, Females, and Persons with Disabilities Act.

GOALS: The MBE/FBE goal for this contract is 15 percent of the amount of the contract awarded by CDB.

B. This project has goals for participation by veteran owned businesses as first and second tier (level) subcontractors or suppliers in accord with 30 ILCS 500/45-57.

GOALS: The VBE goal for this contract is (*INSERT PERCENT HERE) percent of the amount of the contract awarded by CDB.

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RETURN WITH BID

CDB PROJECT NO. 805-030-020

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_________________________________      ____________
Signature, Title          Date

SIGNATURE IS REQUIRED
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GOALS: The MBE/FBE goal for this contract is 15 percent of the amount of the contract awarded by CDB.

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❖ Firms cannot be identified after the bid opening.
❖ Failure to identify firms will result in rejection of bid.
❖ Firms shall be certified or registered with CMS as an MBE/FBE/VBE prior to bid opening.
❖ Firms can only be used to satisfy one goal, MBE, FBE, or VBE – not multiple goals.
❖ See the 2009 Standard Documents for Construction Supplement 00 43 09 .10 - MBE/FBE supplier participation of regular dealers.

BIDDER’S MBE/FBE/VBE SUBCONTRACTOR/SUPPLIER FIRMS, INCLUDING ADDRESS AND TELEPHONE NUMBER, TO BE UTILIZED IN REGARD TO THIS CONTRACT (Include base bid below and each alternate on next page(s)).
(Attach additional sheet if necessary)
BIDDING & CONTRACT REQUIREMENTS
Document 00 41 05 – Minority/Female/Veterans Business Enterprise Program Requirements

RETURN WITH BID
CDB PROJECT NO. 805-030-020

Name of Bidder: ___________________________

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<tr>
<th>BASE BID:</th>
<th>Name of MBE/FBE/VBE Firm</th>
<th>Proposed $ Value of Subcontract</th>
<th>Telephone Number</th>
<th>MBE/FBE/VBE Designation And Certifying Agency</th>
<th>Trade Performed or Supply Provided</th>
<th>Description / Scope of Work</th>
<th>CDB Use Only CMS Expiration Date</th>
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**RETURN WITH BID**

**CDB-00 41 05 June 20, 2014**

**CDB 805-030-020**

**00 41 05 - 3**

**Correct Water Infiltration**
The Bidder represents to CDB that, to the best of its knowledge and belief:

1. Each of the subcontractors and suppliers listed is certified by Central Management Services under the provisions and definitions of the Minority/Female/Veterans Business Enterprise Program Acts as a minority, female or veteran owned business.

2. The subcontract(s) which will be executed by the Bidder for the first level subcontractors and suppliers if the bidder is awarded this contract by CDB will meet or exceed the specified MBE/FBE goals, and will comply with all provisions of the Minority/Female Business Enterprise Program Act.

3. The subcontract(s) which will be executed by the Bidder for the first level subcontractors and suppliers if the bidder is awarded this contract by CDB will meet or exceed the specified VBE goals, and will comply with all provisions of 30 ILCS 500/45/57.

Bidder agrees to the contractual requirements specified in CDB’s Standard Documents for Construction in regard to the Minority/Female/Veterans Business Enterprise Program Acts.

_________________________________      ____________
Signature, Title          Date

SIGNATURE IS REQUIRED
as Principal, and
as Surety, are held and firmly bound unto the State of Illinois, acting by and through the Capital Development Board, as Obligee, in the amount of ten percent (10%) of the amount of the base bid for the payment of which Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, to this agreement.

Principal has submitted to Obligee a bid to enter into a written contract, for

CDB Project Number: Division of Work:
in accordance with bidding documents for the project, which contract is by reference made a part hereof and is hereinafter referred to as "the Contract".

THE CONDITION OF THIS OBLIGATION is that if Principal, upon acceptance by Obligee of its bid within the period of time specified for acceptance, shall comply with all post award requirements as required by the terms of the bid within the time specified after date of the Notice of Award, or in the event of the failure to comply with all post award requirements, if Principal shall pay Obligee (1) for all costs of procuring the work which exceeds the amount of its bid, or (2) shall pay Obligee the amount of this bond as liquidated damages in the event Principal is a sole bidder and after an attempt to secure other bids by readvertising none can be obtained, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

Surety hereby agrees that its obligation shall not be impaired by any extensions of time for Obligee's acceptance or compliance with post award requirements. Surety hereby waives notice of such extensions.

Signed and sealed this __________________ day of ________________________, 20__.  

________________________________________  ____________________________
CONTRACTOR                                           SURETY

BY  _________________________________  BY  _________________________________
SIGNATURE                                      OFFICER OF THE SURETY

Title  _________________________________  Title  _________________________________

ATTEST:

CORPORATE SECRETARY (Corporations only)

________________________________________
JURAT (Notary's Statement Authenticating Signature)

STATE OF  _________________________________
COUNTY OF  _________________________________

I, _________________________________, a Notary Public in and for said county, do hereby certify that _________________________________

(Insert Name of Attorney-In-Fact for SURETY)

who is personally known to me to be the same person whose name is subscribed to the foregoing instrument on behalf of SURETY, appeared before me this day in person and acknowledged respectively, that he/she signed, sealed, and delivered said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Given under my hand and notarial seal this __________________ day of ____________ A.D. 20__

My commission expires __________________

Notary Signature  _______________________________________

CDB-00 41 06 April 2011  
CDB 805-030-020  
00 41 06 - 1  
Correct Water Infiltration
RETURN WITH BID

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The Bidder should include this form with the Bid Forms if a material substitution is offered at that time. See Article 00 43 25 of the Standard Documents for Construction.

The Base Bid and Alternate Bids include only those products specified in the bidding documents. Following is a list of substitute products which bidder proposes to furnish on this project, with the difference in price being deducted from the Base Bid or Alternate Bids.

NOTE: CDB WILL NOT ACCEPT SUBSTITUTIONS FOR SPECIFIED MEMBRANE ROOF SYSTEM(S).

Bidder understands that acceptance of any proposed substitution is at CDB's option. Approval or rejection of any substitutions listed below will be indicated prior to executing the Contract.

<table>
<thead>
<tr>
<th>MANUFACTURER'S NAME AND PRODUCT</th>
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EVALUATION. Contract award will be made in accord with the Standard Documents for Construction. Only the lowest responsible bidder's Proposed Product Substitution Form will be evaluated.

BIDDER'S NAME: __________________________________________

TRADE: __________________________________________
RETURN WITH BID

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RETURN WITH BID

State Required Ethical Standards Governing Contract Procurement:

Article 50 of the Illinois Procurement Code establishes the duty of all State chief procurement officers, State purchasing officers, and their designees to maximize the value of the expenditure of public moneys in procuring goods, services, and contracts for the State of Illinois and to act in a manner that maintains the integrity and public trust of State government. In discharging this duty, they are charged by law to use all available information, reasonable efforts, and reasonable actions to protect, safeguard, and maintain the procurement process of the State of Illinois.

In order to comply with the provisions of Article 50 and to carry out the duty established therein, all bidders are to adhere to ethical standards established for the procurement process, and to make such assurances, disclosures and certifications required by law. The bidder indicates that each certification is made and understood, and that each disclosure requirement has been understood and completed.

In addition to all other remedies provided by law, failure to comply with any assurance, failure to make any disclosure or the making of a false certification shall be grounds for the chief procurement officer to void the contract, or subcontract, and may result in the suspension or debarment of the bidder or subcontractor.

The requirements of this certification and disclosure are a material part of the contract, and the contractor shall require this certification provision to be included in all subcontracts.

THE BIDDER MAKES THE FOLLOWING REPRESENTATIONS:

A. The Bidder certifies that it is aware of the requirements of Public Act 95-635, 820 ILCS 265, and that, if awarded a contract, it is or will be in full compliance with the law prior to beginning work, including the requirement to file with CDB a written substance abuse plan which meets or exceeds the requirements of the Act.

B. The Bidder certifies that it is aware of the requirements of Public Act 97-0590 which was effective August 26, 2011. This Public Act requires a fee of $15 to cover expenses related to the administration of the Minority Contractor Opportunity Initiative. Any Vendor awarded a contract of $1,000 or more from this solicitation is required to pay a fee of $15. The Comptroller shall deduct the fee from the first check issued to the Vendor under the contract and deposit the fee in the Comptroller’s Administrative Fund.

C. Apprenticeship and Training Certification

In accordance with the provisions of Section 30-22 (6) of the Illinois Procurement Code, the bidder certifies that it is a participant, either as an individual or as part of a group program, in the approved apprenticeship and training programs applicable to each type of work or craft that the bidder will perform with its own forces. The bidder further certifies for work that will be performed by subcontract that each of its subcontractors either (a) is, at the time of such bid, participating in an approved, applicable apprenticeship and training program; or (b) will, prior to commencement of performance of work pursuant to this contract, begin participation in an approved apprenticeship and training program applicable to the work of the subcontract.

The bidder shall include with this bid package the official Certificate of Registration or a verification letter from the US Department of Labor (USDOL) certified group program sponsor for the USDOL certified apprenticeship and training program of which the bidder is a member for each of the types of work or crafts that will be performed with the bidder’s forces and for each of the types of work or crafts that will be performed by the subcontractor(s) (if the subcontractor is participating in an approved program at the time of bid).
D. STANDARD BUSINESS TERMS AND CONDITIONS

1. AVAILABILITY OF APPROPRIATION (30 ILCS 500/20-60): This contract is contingent upon and subject to the availability of funds. The State, at its sole option, may terminate or suspend this contract, in whole or in part, without penalty or further payment being required, if (1) the Illinois General Assembly or the federal funding source fails to make an appropriation sufficient to pay such obligation, or if funds needed are insufficient for any reason, (2) the Governor decreases the Department’s funding by reserving some or all of the Department’s appropriation(s) pursuant to power delegated to the Governor by the Illinois General Assembly; or (3) the Department determines, in its sole discretion or as directed by the Office of the Governor, that a reduction is necessary or advisable based upon actual or projected budgetary considerations. Contractor will be notified in writing of the failure of appropriation or of a reduction or decrease.

2. AUDIT/RETENTION OF RECORDS (30 ILCS 500/20-65): Vendor and its subcontractors shall maintain books and records relating to the performance of the contract or subcontract and necessary to support amounts charged to the State under the contract or subcontract. Books and records, including information stored in databases or other computer systems, shall be maintained by the Vendor for a period of three years from the later of the date of final payment under the contract or completion of the contract, and by the subcontractor for a period of three years from the later of final payment under the term or completion of the subcontract. If federal funds are used to pay contract costs, the Vendor and its subcontractors must retain its records for five years. Books and records required to be maintained under this section shall be available for review or audit by representatives of: the procuring Agency, the Auditor General, the Executive Inspector General, the Chief Procurement Officer, State of Illinois internal auditors or other governmental entities with monitoring authority, upon reasonable notice and during normal business hours. Vendor and its subcontractors shall cooperate fully with any such audit and with any investigation conducted by any of these entities. Failure to maintain books and records required by this section shall establish a presumption in favor of the State for the recovery of any funds paid by the State under the contract for which adequate books and records are not available to support the purported disbursement. The Vendor or subcontractors shall not impose a charge for audit or examination of the Vendor’s books and records.

3. TIME IS OF THE ESSENCE: Time is of the essence with respect to Vendor’s performance of this contract. Vendor shall continue to perform its obligations while any dispute concerning the contract is being resolved unless otherwise directed by the State.

4. NO WAIVER OF RIGHTS: Except as specifically waived in writing, failure by a Party to exercise or enforce a right does not waive that Party’s right to exercise or enforce that or other rights in the future.

5. FORCE MAJEURE: Failure by either Party to perform its duties and obligations will be excused by unforeseeable circumstances beyond its reasonable control and not due to its negligence including acts of nature, acts of terrorism, riots, labor disputes, fire, flood, explosion, and governmental prohibition. The non-declaring Party may cancel the contract without penalty if performance does not resume within 30 days of the declaration.

6. CONFIDENTIAL INFORMATION: Each Party, including its agents and subcontractors, to this contract may have or gain access to confidential data or information owned or maintained by the other Party in the course of carrying out its responsibilities under this contract. Vendor shall presume all information received from the State or to which it gains access pursuant to this contract is confidential. Vendor information, unless clearly marked as confidential and exempt from disclosure under the Illinois Freedom of Information Act, shall be considered public. No confidential data collected, maintained, or used in the course of performance of the contract shall be disseminated except as authorized by law and with the written consent of the disclosing Party, either during the period of the contract or thereafter. The receiving Party must return any and all data collected, maintained, created or used in the course of the performance of the contract, in whatever form it is maintained, promptly at the end of the contract, or earlier at the request of the disclosing Party, or notify the disclosing Party in writing of its destruction. The foregoing obligations shall not apply to confidential data or information lawfully in the receiving Party’s possession prior to its acquisition from the disclosing Party; received in good faith from a third-party not subject to any confidentiality obligation to the disclosing Party; now is or later becomes publicly known through no breach of confidentiality obligation by the receiving Party; or is independently developed by the receiving Party without the use or benefit of the disclosing Party’s confidential information.
7. **USE AND OWNERSHIP:** All work performed or supplies created by Vendor under this contract, whether written documents or data, goods or deliverables of any kind, shall be deemed work-for-hire under copyright law and all intellectual property and other laws, and the State of Illinois is granted sole and exclusive ownership to all such work, unless otherwise agreed in writing. Vendor hereby assigns to the State all right, title, and interest in and to such work including any related intellectual property rights, and/or waives any and all claims that Vendor may have to such work including any so-called "moral rights" in connection with the work. Vendor acknowledges the State may use the work product for any purpose. Confidential data or information contained in such work shall be subject to confidentiality provisions of this contract.

8. **INDEPENDENT CONTRACTOR:** Vendor shall act as an independent contractor and not an agent or employee of, or joint venturer with the State. All payments by the State shall be made on that basis.

9. **SOLICITATION AND EMPLOYMENT:** Vendor shall not employ any person employed by the State during the term of this contract to perform any work under this contract. Vendor shall give notice immediately to the Agency’s director if Vendor solicits or intends to solicit State employees to perform any work under this contract.

10. **COMPLIANCE WITH THE LAW:** The Vendor, its employees, agents, and subcontractors shall comply with all applicable federal, state, and local laws, rules, ordinances, regulations, orders, federal circulars and all license and permit requirements in the performance of this contract. Vendor shall be in compliance with applicable tax requirements and shall be current in payment of such taxes. Vendor shall obtain at its own expense, all licenses and permissions necessary for the performance of this contract.

11. **BACKGROUND CHECK:** Whenever the State deems it reasonably necessary for security reasons, the State may conduct, at its expense, criminal and driver history background checks of Vendor’s and subcontractors officers, employees or agents. Vendor or subcontractor shall reassign immediately any such individual who, in the opinion of the State, does not pass the background checks.

12. **APPLICABLE LAW:** This contract shall be construed in accordance with and is subject to the laws and rules of the State of Illinois. The Department of Human Rights’ Equal Opportunity requirements (44 Ill. Adm. Code 750) are incorporated by reference. Any claim against the State arising out of this contract must be filed exclusively with the Illinois Court of Claims (705 ILCS 505/1). The State shall not enter into binding arbitration to resolve any contract dispute. The State of Illinois does not waive sovereign immunity by entering into this contract. The official text of cited statutes is incorporated by reference (An unofficial version can be viewed at http://www.ilga.gov/legislation/ilcs/ilcs.asp). In compliance with the Illinois and federal Constitutions, the Illinois Human Rights Act, the U. S. Civil Rights Act, and Section 504 of the federal Rehabilitation Act and other applicable laws and rules the State does not unlawfully discriminate in employment, contracts, or any other activity.

13. **ANTI-TRUST ASSIGNMENT:** If Vendor does not pursue any claim or cause of action it has arising under federal or state antitrust laws relating to the subject matter of the contract, then upon request of the Illinois Attorney General, Vendor shall assign to the State rights, title and interest in and to the claim or cause of action.

14. **CONTRACTUAL AUTHORITY:** The Agency that signs for the State of Illinois shall be the only State entity responsible for performance and payment under the contract. When the Chief Procurement Officer or authorized designee signs in addition to an Agency, they do so as approving officer and shall have no liability to Vendor. When the Chief Procurement officer or authorized designee signs a master contract on behalf of State agencies, only the Agency that places an order with the Vendor shall have any liability to Vendor for that order.

15. **NOTICES:** Notices and other communications provided for herein shall be given in writing by registered or certified mail, return receipt requested, by receipted hand delivery, by courier (UPS, Federal Express or other similar and reliable carrier), by e-mail, or by fax showing the date and time of successful receipt. Notices shall be sent to the individuals who signed the contract using the contact information following the signatures. Each such notice
RETURN WITH BID

shall be deemed to have been provided at the time it is actually received. By giving notice, either Party may change the contact information.

16. MODIFICATIONS AND SURVIVAL: Amendments, modifications and waivers must be in writing and signed by authorized representatives of the Parties. Any provision of this contract officially declared void, unenforceable, or against public policy, shall be ignored and the remaining provisions shall be interpreted, as far as possible, to give effect to the Parties’ intent. All provisions that by their nature would be expected to survive, shall survive termination. In the event of a conflict between the State’s and the Vendor’s terms, conditions and attachments, the State’s terms, conditions and attachments shall prevail.

17. PERFORMANCE RECORD / SUSPENSION: Upon request of the State, Vendor shall meet to discuss performance or provide contract performance updates to help ensure proper performance of the contract. The State may consider Vendor’s performance under this contract and compliance with law and rule to determine whether to continue the contract, suspend Vendor from doing future business with the State for a specified period of time, or to determine whether Vendor can be considered responsible on specific future contract opportunities.

18. FREEDOM OF INFORMATION ACT: This contract and all related public records maintained by, provided to or required to be provided to the State are subject to the Illinois Freedom of Information Act notwithstanding any provision to the contrary that may be found in this contract.

Signature: ___________________________ Date: ______________

Printed Name: _______________________

Title: ______________________________

Phone Number: ______________________

Email Address: ______________________
Effective July 1, 2014 – BIDDERS NOW HAVE TWO OPTIONS FOR PROVIDING THE REQUIRED CERTIFICATIONS AND DISCLOSURES:

1. FORMS A – THE STANDARD PAPER METHOD OF REQUIRED DOCUMENTS AND INFORMATION.

2. FORMS B AND AN ILLINOIS PROCUREMENT GATEWAY (IPG) REGISTRATION NUMBER WHICH ALLOWS FOR REDUCED DOCUMENTATION WHEN USING AN APPROVED IPG REGISTRATION NUMBER.

The Illinois Procurement Gateway is located at https://ipg.vendorreg.com.

The IPG is a web based system that serves as the primary location for entering, organizing, and reviewing vendor information. The IPG allows vendors to provide disclosures, registrations, and other documentation needed to do business with a State agency or university in advance of any particular procurement, thereby reducing the number of documents needed to be submitted with a bid.

The State reviews information submitted through the IPG to register vendors in advance of submitting bids and offers for contracts. Upon satisfactory registration, vendors receive a registration number that may be used when submitting the required forms. Reviews may exceed two weeks when information submitted is incomplete or inaccurate.

**PLEASE SELECT ONE:**

☐ I am submitting this bid using the Forms A Option.

OR

☐ I am submitting this bid using the Forms B Option.

    My approved IPG registration is:

    Firm Name     Illinois Procurement Gateway Registration Number
RETURN WITH BID

FORMS A

*This Forms A section shall be used if you are not using IPG (Illinois Procurement Gateway) Registration #.
RETURN WITH BID

Forms A

A vendor responding to a solicitation by the State of Illinois must return the information requested within this section with their bid or offer if they are not registered in the Illinois Procurement Gateway (IPG). Failure to do so may render their bid or offer non-responsive and result in disqualification.

Please read this entire FORMS A section and provide the requested information as applicable and per the instructions. All forms and signature areas contained in this FORMS A section must be completed in full and submitted along with the bid in an Invitation for Bid; and completed in full and submitted along with the technical response and price proposal, which combined will constitute the Offer, in a Request for Proposal.

<table>
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<tr>
<th>Vendor Name:</th>
<th>Phone:</th>
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<tbody>
<tr>
<td>Street Address:</td>
<td>Email:</td>
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<tr>
<td>City, State Zip:</td>
<td>Vendor Contact:</td>
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## OUTLINE

**FORMS A Section**

Complete this section if you are **not** using IPG (Illinois Procurement Gateway) Registration #

<table>
<thead>
<tr>
<th><strong>Document Title</strong></th>
<th><strong>Section</strong></th>
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<tbody>
<tr>
<td>Authorized to Do Business in Illinois</td>
<td>1</td>
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<tr>
<td>Standard Certifications</td>
<td>2</td>
</tr>
<tr>
<td>State Board of Elections</td>
<td>3</td>
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<tr>
<td>Disclosure of Business Operations in Iran</td>
<td>4</td>
</tr>
<tr>
<td>Financial Disclosures and Conflicts of Interest</td>
<td>5</td>
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<tr>
<td>Taxpayer Identification Number</td>
<td>6</td>
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RETURN WITH BID

1. EVIDENCE OF BEING AUTHORIZED TO DO BUSINESS IS THE SECRETARY OF STATE’S CERTIFICATE OF GOOD STANDING
2. Vendor acknowledges and agrees that compliance with this subsection in its entirety for the term of the contract and any renewals is a material requirement and condition of this contract. By executing this contract Vendor certifies compliance with this subsection in its entirety, and is under a continuing obligation to remain in compliance and report any non-compliance.

This subsection, in its entirety, applies to subcontractors used on this contract. Vendor shall include these Standard Certifications in any subcontract used in the performance of the contract using the Standard Certification form provided by the State.

If this contract extends over multiple fiscal years, including the initial term and all renewals, Vendor and its subcontractors shall confirm compliance with this section in the manner and format determined by the State by the date specified by the State and in no event later than July 1 of each year that this contract remains in effect.

If the Parties determine that any certification in this section is not applicable to this contract it may be stricken without affecting the remaining subsections.

2.1 As part of each certification, Vendor acknowledges and agrees that should Vendor or its subcontractors provide false information, or fail to be or remain in compliance with the Standard Certification requirements, one or more of the following sanctions will apply:

- the contract may be void by operation of law,
- the State may void the contract, and
- the Vendor and it subcontractors may be subject to one or more of the following: suspension, debarment, denial of payment, civil fine, or criminal penalty.

Identifying a sanction or failing to identify a sanction in relation to any of the specific certifications does not waive imposition of other sanctions or preclude application of sanctions not specifically identified.

2.2 Vendor certifies it and its employees will comply with applicable provisions of the United States Civil Rights Act, Section 504 of the Federal Rehabilitation Act, the Americans with Disabilities Act, and applicable rules in performance of this contract.

2.3 Vendor, if an individual, sole proprietor, partner or an individual as member of a LLC, certifies he/she is not in default on an educational loan. 5 ILCS 385/3.

2.4 Vendor, if an individual, sole proprietor, partner or an individual as member of a LLC, certifies he/she has not received (i) an early retirement incentive prior to 1993 under Section 14-108.3 or 16-133.3 of the Illinois Pension Code or (ii) an early retirement incentive on or after 2002 under Section 14-108.3 or 16-133.3 of the Illinois Pension Code. 30 ILCS 105/15a; 40 ILCS 5/14-108.3; 40 ILCS 5/16-133.

2.5 Vendor certifies that it is a legal entity authorized to do business in Illinois prior to submission of a bid, offer, or proposal. 30 ILCS 500/1-15.80, 20-43.

2.6 To the extent there was a current Vendor providing the services covered by this contract and the employees of that Vendor who provided those services are covered by a collective bargaining
RETURN WITH BID agreement, Vendor certifies (i) that it will offer to assume the collective bargaining obligations of the prior employer, including any existing collective bargaining agreement with the bargaining representative of any existing collective bargaining unit or units performing substantially similar work to the services covered by the contract subject to its bid or offer; and (ii) that it shall offer employment to all employees currently employed in any existing bargaining unit who perform substantially similar work to the work that will be performed pursuant to this contract. This does not apply to heating, air conditioning, plumbing and electrical service contracts. 30 ILCS 500/25-80.

2.7 Vendor certifies it has neither been convicted of bribing or attempting to bribe an officer or employee of the State of Illinois or any other State, nor made an admission of guilt of such conduct that is a matter of record. 30 ILCS 500/50-5.

2.8 If Vendor has been convicted of a felony, Vendor certifies at least five years have passed after the date of completion of the sentence for such felony, unless no person held responsible by a prosecutor’s office for the facts upon which the conviction was based continues to have any involvement with the business. 30 ILCS 500/50-10.

2.9 If Vendor or any officer, director, partner, or other managerial agent of Vendor has been convicted of a felony under the Sarbanes-Oxley Act of 2002, or a Class 3 or Class 2 felony under the Illinois Securities Law of 1953, Vendor certifies at least five years have passed since the date of the conviction. Vendor further certifies that it is not barred from being awarded a contract and acknowledges that the State shall declare the contract void if this certification is false. 30 ILCS 500/50-10.5.

2.10 Vendor certifies it is not barred from having a contract with the State based upon violating the prohibitions related to either submitting/writing specifications or providing assistance to an employee of the State of Illinois by reviewing, drafting, directing, or preparing any invitation for bids, a request for proposal, or request of information, or similar assistance (except as part of a public request for such information). 30 ILCS 500/50-10.5(e), amended by Pub. Act No. 97-0895 (August 3, 2012).

2.11 Vendor certifies that it and its affiliates are not delinquent in the payment of any debt to the State (or if delinquent has entered into a deferred payment plan to pay the debt), and Vendor and its affiliates acknowledge the State may declare the contract void if this certification is false or if Vendor or an affiliate later becomes delinquent and has not entered into a deferred payment plan to pay off the debt. 30 ILCS 500/50-11, 50-60.

2.12 Vendor certifies that it and all affiliates shall collect and remit Illinois Use Tax on all sales of tangible personal property into the State of Illinois in accordance with provisions of the Illinois Use Tax Act and acknowledges that failure to comply may result in the contract being declared void. 30 ILCS 500/50-12.

2.13 Vendor certifies that it has not been found by a court or the Pollution Control Board to have committed a willful or knowing violation of the Environmental Protection Act within the last five years, and is therefore not barred from being awarded a contract. 30 ILCS 500/50-14.

2.14 Vendor certifies it has neither paid any money or valuable thing to induce any person to refrain from bidding on a State contract, nor accepted any money or other valuable thing, or acted upon the promise of same, for not bidding on a State contract. 30 ILCS 500/50-25.
RETURN WITH BID

2.15 Vendor certifies it is not in violation of the “Revolving Door” provisions of the Illinois Procurement Code. 30 ILCS 500/50-30.

2.16 Vendor certifies that it has not retained a person or entity to attempt to influence the outcome of a procurement decision for compensation contingent in whole or in part upon the decision or procurement. 30 ILCS 500/50-38.

2.17 Vendor certifies that if it has hired a person required to register under the Lobbyist Registration Act to assist in obtaining any State contract, that none of the lobbyist’s costs, fees, compensation, reimbursements, or other remuneration were billed to the State. 30 ILCS 500/50-38.

2.18 Vendor certifies it will report to the Illinois Attorney General and the Chief Procurement Officer any suspected collusion or other anti-competitive practice among any bidders, offerors, contractors, proposers, or employees of the State. 30 ILCS 500/50-40, 50-45, 50-50.

2.19 Vendor certifies steel products used or supplied in the performance of a contract for public works shall be manufactured or produced in the United States, unless the executive head of the procuring Agency/University grants an exception. 30 ILCS 565.

2.20 Drug Free Workplace

4.20.1. If Vendor employs 25 or more employees and this contract is worth more than $5,000, Vendor certifies it will provide a drug free workplace pursuant to the Drug Free Workplace Act.

4.20.2. If Vendor is an individual and this contract is worth more than $5000, Vendor certifies it shall not engage in the unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance during the performance of the contract. 30 ILCS 580.

2.21 Vendor certifies that neither Vendor nor any substantially owned affiliate is participating or shall participate in an international boycott in violation of the U.S. Export Administration Act of 1979 or the applicable regulations of the United States. Department of Commerce. 30 ILCS 582.

2.22 Vendor certifies it has not been convicted of the offense of bid rigging or bid rotating or any similar offense of any state or of the United States. 720 ILCS 5/33 E-3, E-4.

2.23 Vendor certifies it complies with the Illinois Department of Human Rights Act and rules applicable to public contracts, which include providing equal employment opportunity, refraining from unlawful discrimination, and having written sexual harassment policies. 775 ILCS 5/2-105.

2.24 Vendor certifies it does not pay dues to or reimburse or subsidize payments by its employees for any dues or fees to any “discriminatory club.” 775 ILCS 25/2.

2.25 Vendor certifies that no foreign-made equipment, materials, or supplies furnished to the State under the contract have been or will be produced in whole or in part by forced labor or indentured labor under penal sanction. 30 ILCS 583.

2.26 Vendor certifies that no foreign-made equipment, materials, or supplies furnished to the State under the contract have been produced in whole or in part by the labor of any child under the age of 12. 30 ILCS 584.
2.27 Vendor certifies that any violation of the Lead Poisoning Prevention Act, as it applies to owners of residential buildings, has been mitigated. 410 ILCS 45.

2.28 Vendor warrants and certifies that it and, to the best of its knowledge, its subcontractors have and will comply with Executive Order No. 1 (2007). The Order generally prohibits Vendors and subcontractors from hiring the then-serving Governor’s family members to lobby procurement activities of the State, or any other unit of government in Illinois including local governments if that procurement may result in a contract valued at over $25,000. This prohibition also applies to hiring for that same purpose any former State employee who had procurement authority at any time during the one-year period preceding the procurement lobbying activity.

2.29 Vendor certifies that information technology, including electronic information, software, systems and equipment, developed or provided under this contract comply with the applicable requirements of the Illinois Information Technology Accessibility Act Standards as published at (www.dhs.state.il.us/itaa) 30 ILCS 587.

2.30 Vendor certifies that it has read, understands, and is in compliance with the registration requirements of the Elections Code (10 ILCS 5/9-35) and the restrictions on making political contributions and related requirements of the Illinois Procurement Code. 30 ILCS 500/20-160 and 50-37. Vendor will not make a political contribution that will violate these requirements. In accordance with section 20-160 of the Illinois Procurement Code, Vendor certifies as applicable:

- **Vendor is not required to register as a business entity with the State Board of Elections.**

or

- **Vendor has registered with the State Board of Elections.** As a registered business entity, Vendor acknowledges a continuing duty to update the registration as required by the Act.

2.31 Vendor certifies that if it is awarded a contract through the use of the preference required by the Procurement of Domestic Products Act, then it shall provide products pursuant to the contract or a subcontract that are manufactured in the United States. 30 ILCS 517.

2.32 A person (other than an individual acting as a sole proprietor) must be a duly constituted legal entity and authorized to do business in Illinois prior to submitting a bid or offer. 30 ILCS 500/20-43. If you do not meet these criteria, then your bid or offer will be disqualified.

Vendor must make one of the following four certifications by checking the appropriate box. If C or D is checked, then Vendor must attach to this form the requested documentation.

- **A.** Vendor certifies it is an individual acting as a sole proprietor and is therefore not subject to the requirements of section 20-43 of the Procurement Code.

- **B.** Vendor certifies that it is a legal entity, and was authorized to do business in Illinois as of the date for submitting this bid or offer. The State may require Vendor to provide evidence of compliance before award.
C. □ Vendor certifies it is a legal entity, and is a foreign corporation performing activities that do not constitute transacting business in Illinois as defined by Illinois Business Corporations Act (805 ILCS 5/13.75). A vendor claiming exemption under the Act must include a detailed explanation of the legal basis for the claim with its bid or offer and must provide additional detail upon request. If Vendor fails to provide the mandatory documentation with the bid or offer, or does not provide additional detail upon request within the timeframe specified in said request, then the State may deem the Vendor as being non-responsive or not responsible and may disqualify the Vendor.

D. □ Vendor certifies it is a legal entity, and is an entity otherwise recognized under Illinois law as eligible for a specific form of exemption similar to those found in the Illinois Business Corporation Act (805 ILCS 5/13.75). A vendor claiming exemption under a specific law must provide a detailed explanation of the legal basis for the claim with its bid or offer and must provide additional detail upon request. If Vendor fails to provide the mandatory documentation with the bid or offer, or does not provide additional detail upon request within the timeframe specified in said request, then the State may deem the Vendor as being non-responsive or not responsible and may disqualify the Vendor.

2.33 Vendor certifies that, for the duration of this contract it will:

- post its employment vacancies in Illinois and border states on the Department of Employment Security’s IllinoisJobLink.com website or its successor system; or
- will provide an online link to these employment vacancies so that this link is accessible through the IllinoisJobLink.com website it successor system; or
- is exempt from 20 ILCS 1005/1005-47 because the contract is for construction-related services as that term is defined in section 1-15.20 of the Procurement Code; or the contract is for construction and vendor is a party to a contract with a bona fide labor organization and performs construction. (20 ILCS 1005/1005-47).
RETURN WITH BID

3. Section 50-37 of the Illinois Procurement Code prohibits political contributions of certain vendors, bidders and offerors. Additionally, section 9-35 of the Illinois Election Code governs provisions relating to reporting and making contributions to state officeholders, declared candidates for State offices and covered political organizations that promote the candidacy of an officeholder or declared candidate for office. The State may declare any resultant contract void if these Acts are violated.

Generally, if a vendor, bidder, or offeror is an entity doing business for profit (i.e. sole proprietorship, partnership, corporation, limited liability company or partnership, or otherwise) and has contracts with State agencies that annually total more than $50,000 or whose aggregate pending bids or proposals and current State contracts that total more than $50,000, the vendor, bidder, or offeror is prohibited from making political contributions and must register with the State Board of Elections. 30 ILCS 500/20-160.

EVIDENCE OF REGISTRATION WITH THE STATE BOARD OF ELECTIONS IS THE CERTIFICATE OF REGISTRATION

![Certificate of Registration](image-url)
4. In accordance with 30 ILCS 500/50-36, each bid, offer, or proposal submitted for a State contract, other
than a small purchase defined in Section 20-20 of the Illinois Procurement Code, shall include a
disclosure of whether or not the bidder, offeror, or proposing entity, or any of its corporate parents or
subsidiaries, within the 24 months before submission of the bid, offer, or proposal had business
operations that involved contracts with or provision of supplies or services to the Government of Iran,
companies in which the Government of Iran has any direct or indirect equity share, consortiums or
projects commissioned by the Government of Iran and:

- more than 10% of the company’s revenues produced in or assets located in Iran involve oil-
  related activities or mineral-extraction activities; less than 75% of the company’s revenues
  produced in or assets located in Iran involve contracts with or provision of oil-related or mineral
  – extraction products or services to the Government of Iran or a project or consortium created
  exclusively by that Government; and the company has failed to take substantial action; or

- the company has, on or after August 5, 1996, made an investment of $20 million or more, or any
  combination of investments of at least $10 million each that in the aggregate equals or exceeds
  $20 million in any 12- month period that directly or significantly contributes to the enhancement
  of Iran’s ability to develop petroleum resources of Iran.

A bid, offer, or proposal that does not include this disclosure shall not be considered responsive. We
may consider this disclosure when evaluating the bid, offer, or proposal or awarding the contract.

☐ There are no business operations that must be disclosed to comply with the above cited law.

☐ The following business operations are disclosed to comply with the above cited law:
RETURN WITH BID

5. **Disclosures and Conflicts of Interest**

   A. The disclosures hereinafter made by the bidder and its’ subcontractors, as applicable, are each a material representation of fact upon which reliance is placed should the Department enter into the contract with the bidder. The bidder further certifies that the Department has received the disclosure forms for each bid.

   The chief procurement officer may void the bid, contract, or subcontract, respectively, if it is later determined that the bidder or subcontractor rendered a false or erroneous disclosure. A contractor or subcontractor may be suspended or debarred for violations of the Procurement Code. Furthermore, the chief procurement officer may void the contract and the surety providing the performance bond shall be responsible for completion of the contract.

   B. **Financial Interests and Conflicts of Interest**

      1. Section 50-35 of the Illinois Procurement Code provides that all bids of more than $25,000 shall be accompanied by disclosure of the financial interests of the bidder. This disclosed information for the successful bidder, will be maintained as public information subject to release by request pursuant to the Freedom of Information Act, filed with the Procurement Policy Board, and shall be incorporated as a material term of the contract. Furthermore, pursuant to Section 5-5, the Procurement Policy Board may review a proposal, bid, or contract and issue a recommendation to void a contract or reject a proposal or bid based on any violation of the Procurement Code or the existence of a conflict of interest as provided in subsections (b) and (d) of Section 50-35.

         The financial interests to be disclosed shall include ownership or distributive income share that is in excess of 5%, or an amount greater than 60% of the annual salary of the Governor, of the bidding entity or its parent entity, whichever is less, unless the contractor or bidder is a publicly traded entity subject to Federal 10K reporting, in which case it may submit its 10K disclosure in place of the prescribed disclosure. If a bidder is a privately held entity that is exempt from Federal 10K reporting, but has more than 400 shareholders, it may submit the information that Federal 10K companies are required to report, and list the names of any person or entity holding any ownership share that is in excess of 5%. The disclosure shall include the names, addresses, and dollar or proportionate share of ownership of each person making the disclosure, their instrument of ownership or beneficial relationship, and notice of any potential conflict of interest resulting from the current ownership or beneficial interest of each person making the disclosure having any of the relationships identified in Section 50-35 and on the disclosure form. The current annual salary of the Governor is $177,412.00.

         In addition, all disclosures shall indicate any other current or pending contracts, proposals, leases, or other ongoing procurement relationships the bidding entity has with any other unit of state government and shall clearly identify the unit and the contract, proposal, lease, or other relationship.

      2. Disclosure Forms. Disclosure Form is attached for use concerning the individuals meeting the above ownership or distributive share requirements. Subject individuals should be covered each by a separate form. The forms must be included with each bid.
Financial Disclosures and Conflicts of Interest forms ("forms") must be accurately completed and submitted by the vendor, any parent entity(ies) and any subcontractors. There are nine steps to this form and each must be completed as instructed in the step heading, unless otherwise provided. A bid, offer, or proposal that does not include this form shall be considered non-responsive. The Agency/University will consider this form when evaluating the bid, offer, or proposal or awarding the contract.

The requirement of disclosure of financial interests and conflicts of interest is a continuing obligation. If circumstances change and the previously submitted form is no longer accurate, disclosing entities must provide an updated form.

Separate forms are required for the vendor, any parent entity(ies) and any subcontractors.

Subcontractor forms must be provided with a copy of the subcontract, if required, within 15 days after execution of the State contract or after execution of the subcontract, whichever is later, for all subcontracts with an annual value of more than $50,000.

This disclosure is submitted for:

- [ ] Vendor
- [ ] Vendor’s Parent Entity(ies) (100% ownership)
- [ ] Subcontractor(s) >$50,000 Annually
- [ ] Subcontractor’s Parent Entity(ies) > $50,000 Annually

<table>
<thead>
<tr>
<th>Project Name</th>
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<tbody>
<tr>
<td>Illinois Procurement Bulletin Number / CDB Project No.</td>
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<tr>
<td>Contract Number</td>
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<tr>
<td>Vendor Number</td>
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<tr>
<td>Doing Business As (DBA)</td>
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<tr>
<td>Disclosing Entity</td>
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<td>Disclosing Entity’s Parent Entity</td>
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<td>Subcontractor</td>
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<td>Instrument of Ownership or Beneficial Interest</td>
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<td>Sole Proprietorship</td>
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<td>Corporate Stock (C – Corporation, Professional Corporation, Service Corporation)</td>
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<tr>
<td>Limited Liability Company Membership Agreement (Series LLC, Low-Profit Limited Liability Company)</td>
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<tr>
<td>Partnership Agreement (General Partnership, Limited Partnership, Limited Liability Limited Partnership)</td>
</tr>
<tr>
<td>Not-for-Profit Corporation</td>
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<tr>
<td>Trust Agreement (Beneficiary Other - If you selected Other, please describe:</td>
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</table>
RETURN WITH BID

STEP 1
SUPPORTING DOCUMENTATION SUBMITTAL
(All vendors complete regardless of annual bid, offer, or contract value)
(Subcontractors with subcontract annual value of more than $50,000 must complete)

You must select one of the six options below and select the documentation you are submitting. You must provide the documentation the applicable section requires with this form.

- Option 1 – Publicly Traded Entities
  1.A. Complete Step 2, Option A for each qualifying individual or entity holding any ownership or distributive income share in excess of 5% or an amount greater than 60% ($106,447.20) of the annual salary of the Governor.
  OR
  1.B. Attach a copy of the Federal 10-K, and skip to Step 3.

- Option 2 – Privately Held Entities with more than 200 Shareholders
  2.A. Complete Step 2, Option A for each qualifying individual or entity holding any ownership or distributive income share in excess of 5% or an amount greater than 60% ($106,447.20) of the annual salary of the Governor.
  OR
  2.B. Complete Step 2, Option A for each qualifying individual or entity holding any ownership share in excess of 5% and attach the information Federal 10-K reporting companies are required to report under 17 CFR 229.401.

- Option 3 – All other Privately Held Entities, not including Sole Proprietorships
  3.A. Complete Step 2, Option A for each qualifying individual or entity holding any ownership or distributive income share in excess of 5% or an amount greater than 60% ($106,447.20) of the annual salary of the Governor.

- Option 4 – Foreign Entities
  4.A. Complete Step 2, Option A for each qualifying individual or entity holding any ownership or distributive income share in excess of 5% or an amount greater than 60% ($106,447.20) of the annual salary of the Governor.
  OR
  4.B. Attach a copy of the Securities Exchange Commission Form 20-F or 40-F and skip to Step 3.

- Option 5 – Not-for-Profit Entities
  - Complete Step 2, Option B.

- Option 6 – Sole Proprietorships
  - Skip to Step 3.
Complete either Option A (for all entities other than not-for-profits) or Option B (for not-for-profits). Additional rows may be inserted into the tables or an attachment may be provided if needed.

**OPTION A – Ownership Share and Distributive Income**

**Ownership Share** – If you selected Option 1.A., 2.A., 2.B., 3.A., or 4.A. in Step 1, provide the name and address of each individual or entity and their percentage of ownership if said percentage exceeds 5%, or the dollar value of their ownership if said dollar value exceeds $106,447.20.

☐ Check here if including an attachment with requested information in a format substantially similar to the format below.

**TABLE – X**

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Percentage of Ownership</th>
<th>$ Value of Ownership</th>
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**Distributive Income** – If you selected Option 1.A., 2.A., 3.A., or 4.A. in Step 1, provide the name and address of each individual or entity and their percentage of the disclosing vendor’s total distributive income if said percentage exceeds 5% of the total distributive income of the disclosing entity, or the dollar value of their distributive income if said dollar value exceeds $106,447.20.

☐ Check here if including an attachment with requested information in a format substantially similar to the format below.

**TABLE – Y**

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>% of Distributive Income</th>
<th>$ Value of Distributive Income</th>
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RETURN WITH BID

Please certify that the following statements are true.

I have disclosed all individuals or entities that hold an ownership interest of greater than 5% or greater than $106,447.20.

☐ Yes  ☐ No

I have disclosed all individuals or entities that were entitled to receive distributive income in an amount greater than $106,447.20 or greater than 5% of the total distributive income of the disclosing entity.

☐ Yes  ☐ No

OPTION B – Disclosure of Board of Directors (Not-for-Profits)

If you selected Option 5 in Step 1, list members of your board of directors. Please include an attachment if necessary.

TABLE – Z

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<th>Name</th>
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STEP 3

DISCLOSURE OF LOBBYIST OR AGENT

(Complete only if bid, offer, or contract has an annual value over $25,000)
(Subcontractors with subcontract annual value of more than $50,000 must complete)

☐ Yes  ☐ No. Is your company represented by or do you employ a lobbyist or other agent required to register under the Lobbyist Registration Act (lobbyist must be registered pursuant to the Act with the Secretary of State) or other agent who is not identified through Step 2, Option A above and who has communicated, is communicating, or may communicate with any State/Public University officer or employee concerning the bid or offer? If yes, please identify each lobbyist and agent, including the name and address below.

If you have a lobbyist that does not meet the criteria, then you do not have to disclose the lobbyist’s information.

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<tr>
<th>Name</th>
<th>Address</th>
<th>Relationship to Disclosing Entity</th>
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Describe all costs/fees/compensation/reimbursements related to the assistance provided by each representative lobbyist or other agent to obtain an Agency/University contract:  

______________________________
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STEP 4
PROHIBITED CONFLICTS OF INTEREST
(All vendors must complete regardless of annual bid, offer, or contract value)
(Subcontractors with subcontract annual value of more than $50,000 must complete)

Step 4 must be completed for each person disclosed in Step 2, Option A and for sole proprietors identified in Step 1, Option 6 above. Please provide the name of the person for which responses are provided: _____________________________

1. Do you hold or are you the spouse or minor child who holds an elective office in the State of Illinois or hold a seat in the General Assembly? □ Yes □ No

2. Have you, your spouse, or minor child been appointed to or employed in any offices or agencies of State government and receive compensation for such employment in excess of 60% ($106,447.20) of the salary of the Governor? □ Yes □ No

3. Are you or are you the spouse or minor child of an officer or employee of the Capital Development Board or the Illinois Toll Highway Authority? □ Yes □ No

4. Have you, your spouse, or an immediate family member who lives in your residence currently or who lived in your residence within the last 12 months been appointed as a member of a board, commission, authority, or task force authorized or created by State law or by executive order of the Governor? □ Yes □ No

5. If you answered yes to any question in 1-4 above, please answer the following: Do you, your spouse, or minor child receive from the vendor more than 7.5% of the vendor’s total distributable income or an amount of distributable income in excess of the salary of the Governor ($177,412.00)? □ Yes □ No

6. If you answered yes to any question in 1-4 above, please answer the following: Is there a combined interest of self with spouse or minor child more than 15% in the aggregate of the vendor’s distributable income or an amount of distributable income in excess of two times the salary of the Governor ($354,824.00)? □ Yes □ No

STEP 5
POTENTIAL CONFLICTS OF INTEREST RELATING TO PERSONAL RELATIONSHIPS
(Complete only if bid, offer, or contract has an annual value over $25,000)
(Subcontractors with subcontract annual value of more than $50,000 must complete)

Step 5 must be completed for each person disclosed in Step 2, Option A and for sole proprietors identified in Step 1, Option 6 above. Please provide the name of the person for which responses are provided: _____________________________

1. Do you currently have, or in the previous 3 years have you had State employment, including contractual employment of services? □ Yes □ No

2. Has your spouse, father, mother, son, or daughter, had State employment, including □ Yes □ No

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costal employment for services, in the previous 2 years?

3. Do you hold currently or have you held in the previous 3 years elective office of the State of Illinois, the government of the United States, or any unit of local government authorized by the Constitution of the State of Illinois or the statutes of the State of Illinois?

4. Do you have a relationship to anyone (spouse, father, mother, son, or daughter) holding elective office currently or in the previous 2 years?

5. Do you hold or have you held in the previous 3 years any appointive government office of the State of Illinois, the United States of America, or any unit of local government authorized by the Constitution of the State of Illinois or the statutes of the State of Illinois, which office entitles the holder to compensation in excess of expenses incurred in the discharge of that office?

6. Do you have a relationship to anyone (spouse, father, mother, son, or daughter) holding appointive office currently or in the previous 2 years?

7. Do you currently have or in the previous 3 years had employment as or by any registered lobbyist of the State government?

8. Do you currently have or in the previous 2 years had a relationship to anyone (spouse, father, mother, son, or daughter) that is or was a registered lobbyist?

9. Do you currently have or in the previous 3 years had compensated employment by any registered election or re-election committee registered with the Secretary of State or any county clerk in the State of Illinois, or any political action committee registered with either the Secretary of State or the Federal Board of Elections?

10. Do you currently have or in the previous 2 years had a relationship to anyone (spouse, father, mother, son, or daughter) who is or was a compensated employee of any registered election or reelection committee registered with the Secretary of State or any county clerk in the State of Illinois, or any political action committee registered with either the Secretary of State or the Federal Board of Elections?

STEP 6
EXPLANATION OF AFFIRMATIVE RESPONSES
(All vendors must complete regardless of annual bid, offer, or contract value)
(Subcontractors with subcontract annual value of more than $50,000 must complete)

If you answered “Yes” in Step 4 or Step 5, please provide on an additional page a detailed explanation that includes, but is not limited to the name, salary, State agency or university, and position title of each individual.
RETURN WITH BID

STEP 7
POTENTIAL CONFLICTS OF INTEREST
RELATING TO DEBARMENT & LEGAL PROCEEDINGS
(Complete only if bid, offer, or contract has an annual value over $25,000)
(Subcontractors with subcontract annual value of more than $50,000 must complete)

This step must be completed for each person disclosed in Step 2, Option A, Step 3, and for each entity and sole proprietor disclosed in Step 1.

Please provide the name of the person or entity for which responses are provided: ________________________________

1. Within the previous ten years, have you had debarment from contracting with any governmental entity? ☐ Yes ☐ No
2. Within the previous ten years, have you had any professional licensure discipline? ☐ Yes ☐ No
3. Within the previous ten years, have you had any bankruptcies? ☐ Yes ☐ No
4. Within the previous ten years, have you had any adverse civil judgments and administrative findings? ☐ Yes ☐ No
5. Within the previous ten years, have you had any criminal felony convictions? ☐ Yes ☐ No

If you answered “Yes”, please provide a detailed explanation that includes, but is not limited to the name, State agency or university, and position title of each individual.

STEP 8
DISCLOSURE OF CURRENT AND PENDING CONTRACTS
(Complete only if bid, offer, or contract has an annual value over $25,000)
(Subcontractors with subcontract annual value of more than $50,000 must complete)

If you selected Option 1, 2, 3, 4, or 6 in Step 1, do you have any contracts, pending contracts, bids, proposals, subcontracts, leases or other ongoing procurement relationships with units of State of Illinois government? ☐ Yes ☐ No.

If “Yes”, please specify below. Attach an additional page in the same format as provided below, if desired.

<table>
<thead>
<tr>
<th>Agency/University</th>
<th>Project Title</th>
<th>Status</th>
<th>Value</th>
<th>Contract Reference/P.O./Illinois Procurement Bulletin #</th>
</tr>
</thead>
</table>

Please explain the procurement relationship:
RETURN WITH BID

STEP 9
SIGN THE DISCLOSURE
(All vendors must complete regardless of annual bid, offer, or contract value)
(Subcontractors with subcontract annual value of more than $50,000 must complete)

This disclosure is signed, and made under penalty of perjury for all for-profit entities, by an authorized officer or employee on behalf of the bidder or offeror pursuant to Sections 50-13 and 50-35 of the Illinois Procurement Code. This disclosure information is submitted on behalf of:

Name of Disclosing Entity: __________________________

Signature: ______________________________________  Date: ____________

Printed Name:

Title:

Phone Number:

Email Address:
RETURN WITH BID

Taxpayer Identification Number

I certify that:

The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me), and

I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding, and

I am a U.S. person (including a U.S. resident alien).

- If you are an individual, enter your name and SSN as it appears on your Social Security Card.
- If you are a sole proprietor, enter the owner’s name on the name line followed by the name of the business and the owner’s SSN or EIN.
- If you are a single-member LLC that is disregarded as an entity separate from its owner, enter the owner’s name on the name line and the D/B/A on the business name line and enter the owner’s SSN or EIN.
- If the LLC is a corporation or partnership, enter the entity’s business name and EIN and for corporations, attach IRS acceptance letter (CP261 or CP277).
- For all other entities, enter the name of the entity as used to apply for the entity’s EIN and the EIN.

Name: __________________________
Business Name: __________________________
Taxpayer Identification Number: ______________
    Social Security Number: __________________________
    or
    Employer Identification Number: ______________

Legal Status (check one):

- Individual
- Sole Proprietor
- Partnership
- Legal Services Corporation
- Tax-exempt
- Corporation providing or billing medical and/or health care services
- Corporation NOT providing or billing medical and/or health care services
- Governmental
- Nonresident alien
- Estate or trust
- Pharmacy (Non-Corp.)
- Pharmacy/Funeral Home/Cemetery (Corp.)
- Limited Liability Company
    (select applicable tax classification)
    - D = disregarded entity
    - C = corporation
    - P = partnership

Signature of Authorized Representative: __________________________ Date: __________
RETURN WITH BID

FORMS B

*This Forms B section may be used when responding to an Invitation for Bid (IFB) or a Request for Proposal (RFP) using a current registration in the Illinois Procurement Gateway (IPG). If the bidder does not use Forms B, then Forms A shall be submitted with bid.
RETURN WITH BID

Forms B
Certifications and Disclosures

This FORMS B Section may be used when responding to an Invitation for Bid (IFB) or a Request for Proposal (RFP) and has a current registration in the Illinois Procurement Gateway (IPG).

If a vendor does not have a valid IPG registration number, then the vendor must complete and submit the FORMS A Section with their response. Failure to do so may render the submission non-responsive and result in disqualification.

Please read this entire section and provide the requested information as applicable. All parts in the FORMS B Section must be completed in full and submitted along with the vendor’s response.

1. Certification of Illinois Procurement Gateway Registration
   My business has registered with the Illinois Procurement Gateway (IPG). The State of Illinois Chief Procurement Office approved the registration and provided the IPG registration number disclosed in this FORMS B Section.
   IPG Registration #: ________________________ IPG Expiration Date: ________________________

2. Certification Timely to this Solicitation
   Vendor certifies it is not barred from having a contract with the State based upon violating the prohibitions related to either submitting/writing specifications or providing assistance to an employee of the State of Illinois by reviewing, drafting, directing, or preparing any invitation for bids, a request for proposal, or request of information, or similar assistance (except as part of a public request for such information). 30 ILCS 500/50-10.5(e), amended by Pub. Act No. 97-0895 (August 3, 2012).

   ☐ Yes ☐ No

3. Disclosure of Lobbyist or Agent (Complete only if bid, offer, or contract has an annual value over $25,000)
   Is your company or parent entity(ies) represented by or do you or your parent entity(ies) employ a lobbyist required to register under the Lobbyist Registration Act (lobbyist must be registered pursuant to the Act with the Secretary of State) or an agent who has communicated, is communicating, or may communicate with any State/Public University officer or employee concerning the bid or offer? If yes, please identify each lobbyist and agent, including the name and address below. ☐ Yes ☐ No

   If yes, please identify each lobbyist and agent, including the name and address below. If you have a lobbyist that does not meet the criteria, then you do not have to disclose the lobbyist’s information.

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Relationship to Disclosing Entity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
RETURN WITH BID

Describe all costs/fees/compensation/reimbursements related to the assistance provided by each representative lobbyist or other agent to obtain this Agency/University contract: ______

4. Disclosure of Current and Pending Contracts

Complete only if: (a) your business is for-profit and (b) the bid, offer, or contract has an annual value over $25,000. Do not complete if you are a not-for-profit entity.

☐ Yes  ☐ No. Do you have any contracts, pending contracts, bids, proposals, subcontracts, leases or other ongoing procurement relationships with units of State of Illinois government? If “Yes”, please specify below. Attach an additional page in the same format as provided below, if desired.

<table>
<thead>
<tr>
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</tbody>
</table>

5. Signature

As of the date signed below, I certify that:

- My business’ information and the certifications made in the Illinois Procurement Gateway are truthful and accurate.
- The certifications and disclosures made in this FORMS B Section are truthful and accurate.

This FORMS B Section is signed by an authorized officer or employee on behalf of the bidder, offeror, or vendor pursuant to Sections 50-13 and 50-35 of the Illinois Procurement Code, and the affirmation of the accuracy of the financial disclosures is made under penalty of perjury.

This disclosure information is submitted on behalf of:

Vendor Name: ___________________________ Phone: ___________________________
Street Address: ___________________________ Email: ___________________________
City, State, Zip: ___________________________ Vendor Contact: ___________________________
Signature: ___________________________ Date: ___________________________

Printed Name: ___________________________
Title: ___________________________

END 00 41 09
RETURN WITH BID

THIS PAGE INTENTIONALLY LEFT BLANK
1. PREVAILING WAGE ACT

   Contractor shall not pay less than the prevailing rates of wages to all laborers, workmen, and mechanics performing work under this contract, and shall comply with the requirements of the Illinois Wages of Employees on Public Works Act (820 ILCS 130/1-12).
BIDDING & CONTRACT REQUIREMENTS
00 43 43 - Prevailing Wage Act

CDB-00 43 43 July 2014
CDB 805-030-020

00 43 43- 2

Correct Water Infiltration


<table>
<thead>
<tr>
<th>Trade</th>
<th>Grade</th>
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<th>Overtime Rate</th>
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</tbody>
</table>

Legend:
- B (Base)
- T (Trade)
- C (Classification)
- S (Shift)
- P (Premium)
- F (Fairness)

Explanations

COOK COUNTY

The following list is considered as those days for which holiday rates of wages for work performed apply: New Years Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Christmas Day and Veterans Day in some classifications/counties. Generally, any of these holidays which fall on a Sunday is celebrated on the following Monday. This list makes work performed on that Monday payable at the appropriate overtime rate for holiday pay. Common practice in a given local may alter certain days of celebration. If in doubt, please check with IDOL.

TUCK DBR (WEST) - That part of the county West of Barrington Road.

EXPLANATION OF CLASSES

ASBESTOS - GENERAL - removal of asbestos material/mold and hazardous materials from any place in a building, including mechanical systems where those mechanical systems are to be removed. This includes the removal of asbestos materials/mold and hazardous materials from ductwork or pipes in a building when the building is to be demolished at the time or at same close future date.

ASBESTOS - MECHANICAL - removal of asbestos material from mechanical systems.
systems, such as pipes, ducts, and boilers, where the mechanical systems are to remain.

CERAMIC TILE FINISHER

The grouting, cleaning, and polishing of all classes of tile, whether for interior or exterior purposes, all burned, glazed or unglazed products; all composition materials, granite tiles, warning detectable tiles, cement tiles, epoxy composite materials, pavers, glass, mosaic, fiberglass, and all substitute materials, for tile made in tile-like units; all mixtures in tile like form of cement, metals, and other materials that are for and intended for use as a finished floor surface, stair treads, promenade roofs, walls, walls, ceilings, swimming pools, and all other places where tile is to form a finished interior or exterior. The mixing of all setting-mortars including but not limited to thin-set mortars, epoxies, wall mud, and any other sand and cement mixtures or adhesives when used in the preparation, installation, repair, or maintenance of tile and/or similar materials. The handling and unloading of all sand, cement, lime, tile, fixtures, equipment, adhesives, or any other materials to be used in the preparation, installation, repair, or maintenance of tile and/or similar materials. Ceramic Tile Finishers shall fill all joints and voids regardless of method on all tile work, particularly and especially after installation of said tile work. Application of any and all protective coverings to all types of tile installations including, but not be limited to, all soap compounds, paper products, tarps, and all polyethylene coverings, plywood, masonite, cardboard, and any new type of products that may be used to protect tile installations, Blasteq equipment, and all floor covering equipment used in preparing floors to receive tile. The clean up and removal of all waste and materials. All demolition of existing tile floors and walls to be re-tiled.

COMMUNICATIONS ELECTRICIAN

Installation, operation, inspection, maintenance, repair and service of radio, television, recording, voice sound vision production and reproduction, telephone and telephone interconnect, facsimile, data apparatus, coaxial, fibre optic and wireless equipment, appliances and systems used for the transmission and reception of signals of any nature, business, domestic, commercial, education, entertainment, and residential purposes, including but not limited to, communication and telephone, electronic and sound equipment, fibre optic and data communication systems, and the performance of any task directly related to such installation or service whether at new or existing sites, such tasks to include the placing of wire and cable and electrical power conduit or other raceway work within the equipment room and pulling wire and/or cable through conduit and the installation of any incidental conduit, such that the employees covered hereby can complete any job in full.

MARBLE FINISHER

Loading and unloading trucks, distribution of all materials (all stone, sand, etc.), stacking of floors with material, performing all rigging for heavy work, the handling of all material that may be needed for the installation of such materials, building of scaffolding, if needed, patching, waxing of material if damaged, pointing up, caulking, grouting and cleaning of marble.
BIDDING & CONTRACT REQUIREMENTS
00 43 43 - Prevailing Wage Act

Cook County Prevailing Wage for December 2014

holding water on diamond or Carbon Fiber blade or saw for setters
cutting, use of tub saw or any other saw needed for preparation of
material, drilling of holes for wires that anchor material out by
setters, mixing up of molding plaster for installation of material,
mixing up thin set for the installation of material, mixing up of sand
to cement for the installation of material and such other work as may
be required in helping a Marble Setter in the handling of all
material in the erection or installation of interior marble, slate,
travertine, art marble, serpentine, alabaster stone, blue stone,
granite and other stones (meaning as to stone any foreign or domestic
materials as are specified and used in building interiors and
exteriors and customarily known as stone in the trade), terrazzo,
sanctuary, vitrolite and similar opaque glass and the laying of all
marble tile, terrazzo tile, slate tile and precast tile, steps, sizers
threads, base, or any other materials that may be used as substitutes
for any of the aforementioned materials and which are used on interior
and exterior which are installed in a similar manner.

MATERIAL TESTER I: Hand coring and drilling for testing of materials;
field inspection of uncur concrete and asphalt.

MATERIAL TESTER II: Field inspection of welds, structural steel,
fireproofing, masonry, soil, facade, reinforcing steel, formwork,
cured concrete, and concrete and asphalt batch plants; adjusting
proportions of bituminous mixtures.

OPERATING ENGINEER - BUILDING

Class 1. Asphalt Plant; Asphalt Spreader; Autograder; Backhoes with
Caisson Attachment; Batch Plant; Beneto (requires two engineers);
Blower and Throttle Valve; Caisson Rigs; Central REDI-MLA Plant;
Combination Back Hoe from End Loader Machine; Compressor and Throttle
Valve; Concrete Breaker (Truck Mounted); Concrete Conveyor; Concrete
Pipe (Truck Mounted); Concrete Pump over 275 cu. ft.; Concrete
Pump over 275 cu. ft. and Order; Concrete Placer; Concrete Placing Boom;
Concrete Pump (Truck Mounted); Concrete Tower; Cranes, All; Cranes,
Hammerhead; Cranes, (GUI and similar Type); Creter Crane; Spider
Crane; Crusher, Stone, etc.; Derricks, All; Derricks, Traveling;
Formless Carb and Gutter Machines; Grader, Elevating; Grouting
Machines; Heavy Duty Self-Propelled Transporter or Trolley Kover;
High Lift Shovels or Front End Loader 2-1/4 yd. and over; Hoists;
Elevators, outside type rack and pinion and similar machines; Hoists,
One, Two and Three Drum; Hoists, Two Tugger One Floor; Hydraulic
Backhoe; Hydraulic Boom Trucks; Hydro Vac (and similar equipment);
Locomotives, All; Motor Patrol; Lubrication Technician; Manipulators;
Pile Drivers and Skid Rig; Post Hole Digger; Pre-Stress Machine; Pump
Crates (Two Cat.); Rent; Pump Crates; Squeeze Cramble-Screw Type Pump; Gymnasium
Booster and Pump; Raised and Sliding Hole Drill; Roto Mill Grinder;
Scops - Tractor Drawn; Slip-Slot Feeder; Straddle Buggies; Operation
of Tie Back Machines; Turning Mill; Tractor with Boom and Side Boom;
Trenching Machines.

Class 2. Boilers; Broom, All Power Propelled; Bulldozers; Concrete
Mixers (Two Bag and Over); Convoyor, Portable; Forklift Trucks;
High Lift Shovels or Front End Loaders under 2-1/4 yd.; Hoists,
Automatic; Hoists, Inside Elevators; Hoists, Sewer Dragging Machine;
Hoists, Tugger Single Drum; Laser Screed; Rock Drill (Self-Propelled);
Rock Drill (Truck Mounted); Rollers, All; Steam Generators; Tractors,


CDB-00 43 43  July 2014
CDB 805-030-020 00 43 43- 5
Correct Water Infiltration
All; Tractor Drawn Vibratory Roller; Winch Trucks with "A" Frame.

Class 3. Air Compressor; Combination Small Equipment Operator; Generators; Heaters, Mechanical, Hoists, Inside Elevators (remodeling or renovation work); Hydraulic Power Units (Pile Driving, Extracting, and Drilling); Pumps, over 3" (1 to 3 not to exceed a total of 360 ft.); Low Boys; Pumps, Well Points; Welding Machines (2 through 5); Winches, 4 Small Electric Drill Winches.

Class 4. Robot and/or other Skid Steer Loaders; Oilers; and Brick Forklift.

Class 5. Assistant Craft Foreman.

Class 6. Grader.

Class 7. Mechanics; Welders.

OPERATING ENGINEERS - HIGHWAY CONSTRUCTION

Class 1. Asphalt Plant; Asphalt Heater and Planer Combination; Asphalt Heater Scarifiers; Asphalt Spreader; Autograder/GO/GRAVCO or other similar type machines; ABB Paver; Backhoes with Caisson Attachment; Ballast Regulator; Salt Spreader; Caisson Rigs; Car Dumper; Central RED-MIX Plant; Combination Backhoe Front End Loader Machine, 1 cu. yd. Backhoe Bucket or over or with attachments; Concrete Breaker (Truck Mounted); Concrete Conveyor; Concrete Paver over 272 cu. ft.; Concrete Placers; Concrete Tub Floats; Cranes, all attachments; Cranes, Tower Cranes of all types; Crane; Diamond Crane; Crusher, Stone, etc.; Derricks, All; Derrick Boot; Derrick, Traveling; Dredges; Elevators, Outside Type Rock & Pinion and Similar Machinery; Formless Curb and Gutter Machine; Grader, Elevating; Grader, Motor Grader, Motor Patrol, Auto Patrol, Rear Grader, Pull Grader, Subgrader; Guard Rail Post Driver Truck Mounted; Hoists, One, Two and Three Drum; Heavy Duty Self-Propelled Transporter or Prime Mover; Hydraulic Backhoe; Backhoes with shear attachments up to 40' of boom reach; Lubrication Technician; Manipulators; Huckin Machine; Pile Drivers and Skid Rig; Pre-Stress Machine; Pump Cretes Dual Ram; Rock Drill - Crawler or Skid Rig; Rock Drill - Truck Mounted; Rock/Track Tamper; Roto Mill Grinder; Silo-Form Davor; Snow Melters; Soil Test Drill Rig (Truck Mounted); Straddle Buggies; Hydraulic Telescoping Boom (Tunnel); Operation of Timebank Machine; Tractor Drawn Belt Loaders; Tractor Drawn Belt Loaders (with attached pusher - two engineers); Tractor with Boom; Tractores with Attachments; Traffic Barrier Transfer Machine; Trenching; Truck Mounted Concrete Pump with Boom; Raised or Blind Hole Drills (Tunnel Shaft); Underground Boring and/or Mining Machines 5 ft. in diameter and over tunnel, etc; Underground Boring and/or Mining Machines under 5 ft. in diameter; Wheel Excavator; Widener (ARS600).

Class 2. Batch Plant; Bituminous Mixer; Boiler and Throttle Valve; Bulldozers; Car Loader Trailing Conveyors; Combination Backhoe Front End Loader Machine (Less than 1 cu. yd. Backhoe Bucket or over or with attachments); Compressor and Throttle Valve; Compressor, Common Receiver (3); Concrete Breaker or Hydro Hammer; Concrete Grinding Machine; Concrete Mixer or Paver 78 Series to and including 27 cu. ft.; Concrete Spreader; Concrete Curing Machine, Burlap Machine, Belting Machine and Sealing Machine; Concrete Wheel Saw, Conveyor Work Cars (Baglund or Similar Type); Drills, All; Finishing Machine -

BIDDING & CONTRACT REQUIREMENTS
00 43 43 - Prevailing Wage Act

Concrete; Highlift Shovels or Front EndLoader; Hoist - Sewer Dragging Machine; Hydraulic Boom Trucks (All Attachments); Hydro-Blaster; Hydro Excavating (including hose work); Laser Screed; All Locomotives, Dinky; Off-Road Diving Units (including articulating) Non-Self-Loading EJECTION DUMP; Pump Crates; Squeeze Crates - Screw Type Pumps; Gypsum Bailer and Pump; Roller, Asphalt; Rotary Snow Plows; Rototiller, Seaman, etc., self-propelled; Self-Propelled Compactor; Spreader - Chip - Stone, etc.; Scraper - Single/Twin Engine/Push and Pull Scraper - Prime Mover in Tandem (Regardless of Size); Tractors pulling actuators, Sheeps Foot, Dolly, Compactor, etc.; Tug Boats.

Class 3. Bolters; Brooms, All Power Propelled; Cement Supply Tender; Compressor, Common Receiver (2); Concrete Mixer (Two yard and over); Conveyor, Portable; Farm-Type Tractors Used for Moving, Seeding, etc.; Forklift Trucks; Grouting Machine; Hoists, Automatic; Hoists, All Elevators; Hoists, Tugger Single Drum; Jeep Diggers; Low Boys; Pipe Jacking Machines; Post-Hole Digger; Power Saw, Concrete Power Driver; Pug Mills; Rollers, other than Asphalt; Seed and Straw Blower; Steam Generators; Stump Machine; Winch Trucks with "A" Frame; Work Boats; Tamper-For-Motor Driven.

Class 4. Air Compressors; Combination - Small Equipment Operator; Directional Boring Machine; Generators; Heaters, Mechanical; Hydraulic Power Unit (Pile Driving, Extracting, or Drilling); Light Plants, All (1 through 5); Pumps, over 3" (1 to 3 not to exceed a total of 300 ft.); Pumps, Hall Pointers; Vacuum Trucks (Including Hose WORK); Welding Machines (2 through 5); Winch, 4 Small Electric Drill Winches.

Class 5. SkidSteer Loader (all); Brick Forklifts; Oilers.

Class 6. Field Mechanics and Field Welders

Class 7. Dowell Machine with Air Compressor; Grdall and machines of like nature.

OPERATING ENGINEER - FLOATING

Class 1. Craft Foreman; Master Mechanic; Driver/Ship Tender; Engineer; Engineer (Hydraulic Dredge)

Class 2. Crane/Backhoe Operator; Pontoon Operator with towing endorsement; Mechanic/Welder; Assistant Engineer (Hydraulic Dredge); Lowerman (Hydraulic Dredge); Driver Tender.

Class 3. Deck Equipment Operator, Machineryman, Maintenance of Crane (over 50 ton capacity) or Backhoe (115,000 lbs. or more); Tug/Launch Operator; Loader/Dozer and like equipment on Barge, Breakwater Wall, Slip/Dock, or Scow, Deck Machinery, etc.

Class 4. Deck Equipment Operator, Machineryman/Fireman (4 Equipment Units or More); Off Road Trucks; Deck Hand, Tug Engineer, Crane Maintenance (50 Ton Capacity and Under) or Backhoe Weighing (115,000 pounds or less); Assistant Tug Operator.

Class 5. Friction or Lattice Boom Cranes.

SURVEY WORKER - Operated survey equipment including data collectors, G.P.R. and robotic instruments, as well as conventional levels and transit.
TERRazzo FINISHER

The handling of sand, cement, marble chips, and all other materials that may be used by the Masonic Terrazzo Mechanic, and the mixing, grinding, grooving, cleaning and sealing of all Marble, Mosaic, and Terrazzo work, floors, base, stairs, and wainscoting by hand or machine, and in addition, assisting and aiding Marble, Masonic, and Terrazzo Mechanics.

TRAFFIC SAFETY

Work associated with barricades, horses and drums used to reduce lane usage on highway work, the installation and removal of temporary lane markings, and the installation and removal of temporary road signs.

TRUCK DRIVER - BUILDING, HEAVY AND HIGHWAY CONSTRUCTION - EAST & WEST

Class 1. Two or three Axle Trucks. A-frame Truck when used for transportation purpose; Air Compressors; and Welding Machines, including those pulled by cars, pick-up trucks and tractors; Ambulances; Batch Gate Loaders; Batch Hoppers; Car and Truck Washers; Carry-alls; Fork Lifts and Hoistets; Helpers; Mechanics Helpers and Greasers; Oil Distributors 2-man operation; Pavement Breakers; Pole Trailer, up to 40 feet; Power Mower Tractors; Self-propelled Chip Spreader; Skipper; Slurry Trucks, 2-man operation; Slurry Truck Conveyor Operation, 2 or 3 man; Steamers; Unskilled Dumpers and Truck Drivers hauling warming lights, barricades, and portable toilets on the job site.

Class 2. Four axle trucks; Dump Carts and Adgetors under 7 yards; Dumpsters, Track Trucks, Euclid, Hug Bottom Dump Turnples or Turntrailer when pulling other than self-loading equipment or similar equipment under 16 cubic yards; Mixer Trucks under 7 yards; Ready-mix Plant Hopper Operator, and Winch Trucks, 2 Axles.

Class 3. Five axle trucks; Dump Carts and Adgetors 7 yards and over; Dumpsters, Track Trucks, Euclid, Hug Bottom Dump Turntrailer or turnples when pulling other than self-loading equipment or similar equipment over 16 cubic yards; Explosives and/or Masonry Material Trucks; Mixer Trucks 7 yards or over; Mobile Cranes while in transit; OIL Distributors, 1-man operation; Pole Trailers, over 40 feet; Pole and Trafficable Trailers hauling material over 50 feet long; Slurry trucks, 1-man operation; Winch Trucks, 3 axles or more; Mechanics—Truck Welder and Truck Painter.

Class 4. Six axle trucks; Dual-purpose vehicles, such as mounted crane trucks with hoist and accessories; Foreman; Master Mechanic; Self-loading equipment like P.B. and trucks with scoops on the front.

Other Classifications of Work:

For definitions of classifications not otherwise set out, the Department generally has on file such definitions which are available. If a task to be performed is not subject to one of the classifications of pay set out, the Department will upon being contacted store which neighboring county has such a classification and provide such rate, such rate being deemed to exist by reference in this document. If no neighboring county rate applies to the task,
the Department shall undertake a special determination, such special determination being then deemed to have existed under this determination. If a project requires these, or any classification not listed, please contact IDOL at 217-782-1710 for wage rates or clarifications.

**LANDSCAPING**

Landscaping work falls under the existing classifications for laborer, operating engineer and truck driver. The work performed by landscape plantman and landscape laborer is covered by the existing classification of laborer. The work performed by landscape operators (regardless of equipment used or its size) is covered by the classifications of operating engineer. The work performed by landscape truck drivers (regardless of size of truck driven) is covered by the classifications of truck driver.

**MATERIAL TESTER & MATERIAL TESTER/INSPECTOR I AND II**

Notwithstanding the difference in the classification title, the classification entitled “Material Tester II” involves the same job duties as the classification entitled “Material Tester/Inspector I”. Likewise, the classification entitled “Material Tester II” involves the same job duties as the classification entitled “Material Tester/Inspector II”.

2. PROJECT LABOR AGREEMENT

Because of the size, duration, and important public purpose to be served by the Project, it is in the public interest to have the Project completed in the most timely, efficient, and orderly manner possible and without labor disputes or disruptions of any kind which might interfere with or delay the Project. Accordingly, the Contractor is required to enter into a Project Labor Agreement with the trade unions which have traditionally performed and have trade and geographic jurisdiction over such work. The Project Labor Agreement will be provided by CDB and executed by each Contractor, known Subcontractor and Trade Union within 10 days following the Notice of Award (NOA) with a copy provided to CDB. The agreement shall provide for, at a minimum, the following:

a. Contracting or subcontracting work to only those firms, persons, companies or entities that have, or agree to be bound by and operate under, for the life of the Project, current collective bargaining agreements with applicable trade unions.

b. No lockout, strikes, picketing or other work stoppage of any nature.

c. Trade unions agree to use their best efforts to prevent any acts described in paragraph 2, or those of a similar nature of effect, or, in the event such an act takes place, to cause an immediate cessation thereof.

d. The right to discharge or discipline an employee who violates the provisions of the agreement.

e. Coverage for the life of the Project.

f. Incorporation of the agreement into subcontracts.

g. Procedures for resolving disputes related to the agreement.

Submission of the executed Project Labor Agreement shall be a post-Award requirement.
BIDDING & CONTRACT REQUIREMENTS
00 43 43 - Prevailing Wage Act

Illinois Capital Development Board

PROJECT LABOR AGREEMENT

This Project Labor Agreement ("PLA" or "Agreement") is entered into this 10th day of December, 2013, by and between the Illinois Capital Development Board ("CDB" or "Board") in its proprietary capacity, and each relevant Illinois AFL-CIO Building Trades signatory hereto as determined by the Illinois AFL-CIO Statewide Project Labor Agreement Committee on behalf of each of its affiliated members (individually and collectively, the "Unions"). This PLA shall apply to Construction Work (as defined herein) to be performed by CDB's Prime Contractor(s) and all Subcontractors of whatever tier ("Subcontractor" or "Subcontractors") on Project No. 805-030-020, Illinois Math and Science Academy, Correct Water Infiltration - Academic Building - Aurora, Kane County, Illinois (hereinafter, the "Project").

ARTICLE 1 - INTENT AND PURPOSES

1.1 This PLA is entered into in accordance with the Project Labor Agreement Act ("Act", 30 ILCS 571). It is mutually understood and agreed that the terms and conditions of this PLA are intended to promote the public interest in obtaining timely and economical completion of the Project by encouraging productive and efficient construction operations; by establishing a spirit of harmony and cooperation among the parties; and by providing for peaceful and prompt settlement of any and all labor grievances or jurisdictional disputes of any kind without strikes, lockouts, slowdowns, delays, or other disruptions to the prosecution of the work. The parties acknowledge the obligations of the Contractors and Subcontractors to comply with the provisions of the Act. The parties will work with the Contractors and Subcontractors within the parameters of other statutory and regulatory requirements to implement the Act's goals and objectives.

1.2 As a condition of the award of the contract for performance of work on the Project, CDB's Prime Contractor(s) and all its Subcontractors shall execute a "Contractor Letter of Assent", in the form attached hereto as Exhibit A, prior to commencing Construction Work on the Project. The Prime Contractor(s) shall submit their Subcontractor's Contractor Letter of Assent to the Board prior to the Subcontractor's performance of Construction Work on the Project. Upon request copies of the applicable collective bargaining agreements will be provided by the appropriate signatory labor organization consistent with this Agreement and at the pre-job conference referenced in Article III, Section 3.1.

1.3 Each Union affiliate and separate local representing workers engaged in Construction Work on the Project in accordance with this PLA are bound to this agreement by the Illinois AFL-CIO Statewide Project Labor Agreement Committee which is the central committee established with full authority to negotiate and sign PLAs with the State on behalf of all respective crafts. Upon their signing the Contractor Letter of Assent, the Prime Contractor(s), each Subcontractor, and the individual Unions shall thereafter be deemed a party to this PLA. No party signatory to this PLA shall contract or subcontract, nor permit any other person, firm, company, or entity to contract or subcontract for the performance of Construction Work for the Project to any person, firm, company, or entity that does not agree in writing to become bound for the term of this Project by the terms of this PLA prior to commencing such work and to the applicable area-wide collective bargaining agreement(s) with the Union(s) signatory hereto.
1.4 It is understood that the Prime Contractor(s) and each Subcontractor will be considered and accepted by the Unions as separate employers for the purposes of collective bargaining, and it is further agreed that the employees working under this PLA shall constitute a bargaining unit separate and distinct from all others. The parties hereto also agree that this PLA shall be applicable solely with respect to this Project, and shall have no bearing on the interpretation of any other collective bargaining agreement or as to the recognition of any bargaining unit other than for the specific purposes of this Project.

1.5 In the event of a variance or conflict, whether explicit or implicit, between the terms and conditions of this PLA and the provisions of any other applicable national, area, or local collective bargaining agreement, the terms and conditions of this PLA shall supersede and control. For any work performed under the NTL Articles of Agreement, the National Stack/Chimney Agreement, the National Cooling Tower Agreement, the National Agreement of the International Union of Elevator Constructors, and for any instrument calibration work and loop checking performed under the UAW/BEW Joint National Agreement for Instrument and Control Systems Technicians, the preceding sentence shall apply only with respect to Articles II, IV, VI, and VII.

1.6 Subject to the provisions of paragraph 1.5 of this Article, it is the parties' intent to respect the provisions of any other collective bargaining agreements that may now or hereafter pertain, whether between the Prime Contractor and one or more of the Unions or between a Subcontractor and one or more of the Unions. Accordingly, except and to the extent of any contrary provision set forth in this PLA, the Prime Contractor(s) and all Subcontractors agree to be bound and abide by the terms of the following in order of precedence: (a) the applicable collective bargaining agreement between the Prime Contractor and one or more of the Unions made signatory hereto; (b) the applicable collective bargaining agreement between a Subcontractor and one or more of the Unions made signatory hereto; or (c) the current applicable area collective bargaining agreement for the relevant Union that is the agreement certified by the Illinois Department of Labor for purposes of establishing the Prevailing Wage applicable to the Project. The Union will provide copies of the applicable collective bargaining agreements pursuant to part (c) of the preceding sentence to the Prime Contractor. Assignments by the Contractors or Subcontractors amongst the trades shall be consistent with area practices; in the event of unresolved disagreements as to the propriety of such assignments, the provisions of Article VI shall apply.

1.7 Subject to the limitations of paragraphs 1.4 to 1.6 of this Article, the terms of each applicable collective bargaining agreement as determined in accordance with paragraph 1.6 are incorporated herein by reference, and the terms of this PLA shall be deemed incorporated into such other applicable collective bargaining agreements only for purposes of their application to the Project.

1.8 To the extent necessary to comply with the requirements of any fringe benefit fund to which the Prime Contractor or Subcontractor is required to contribute under the terms of an applicable collective bargaining agreement pursuant to the preceding paragraph, the Prime Contractor or Subcontractor shall execute all "Participation Agreements" as may be reasonably required by the Union to accomplish such purpose; provided, however, that such Participation Agreements shall, when applicable to the Prime Contractor or Subcontractor solely as a result of this PLA, be amended as reasonably necessary to reflect such fact. Upon written notice in the form of a lien of a Contractor's or Subcontractor's delinquency from any applicable fringe benefit fund, CDB will withhold from the Contractor's periodic pay request an
amount sufficient to extinguish any delinquency obligation of the Contractor or Subcontractor arising out of the Project.

1.9 In the event that the applicable collective bargaining agreement between a Prime Contractor and the Union or between the Subcontractor and the Union expires prior to the completion of this Project, the expired applicable contract’s terms will be maintained until a new applicable collective bargaining agreement is ratified. The wages and fringe benefits included in any new applicable collective bargaining agreement will apply on and after the effective date of the newly negotiated collective bargaining agreement, except to the extent wage and fringe benefit retroactivity is specifically agreed upon by the relevant bargaining parties.

**ARTICLE II — APPLICABILITY, RECOGNITION, AND COMMITMENTS**

2.1 The term Construction Work as used herein shall include all "construction, demolition, rehabilitation, renovation, or repair" work performed by a "laborer or mechanic" at the "site of the work" for the purpose of "building" the specific structures and improvements that constitute the Project. Terms appearing within quotation marks in the preceding sentence shall have the meaning ascribed to them pursuant to 29 CFR Part 5 and Illinois labor laws.

2.2 By executing the Letters of Assent, Prime Contractor(s) and all its Subcontractors recognizes the Unions signatory to this PLA as the sole and exclusive bargaining representatives for their craft employees employed on the job-site for this Project. Unions who are signatory to this PLA will have recognition on the Project for their craft.

2.3 The Prime Contractor and all its Subcontractors retains and shall be permitted to exercise full and exclusive authority and responsibility for the management of its operations, except as expressly limited by the terms of this PLA or by the terms and conditions of the applicable collective bargaining agreement.

2.4 Except to the extent contrary to an express provision of the relevant collective bargaining agreement, equipment or materials used in the Project may be pre-assembled or prefabricated, and there shall be no refusal by the Union to handle, transport, install, or connect such equipment or materials. Equipment or materials delivered to the job-site will be unloaded and handled promptly without regard to potential jurisdictional disputes; any such disputes shall be handled in accordance with the provisions of this PLA.

2.5 The parties are mutually committed to promoting a safe working environment for all personnel at the job-site. It shall be the responsibility of each employer to which this PLA applies to provide and maintain safe working conditions for its employees, and to comply with all applicable federal, state, and local health and safety laws and regulations.

2.6 The use or furnishing of alcohol or drugs and the conduct of any other illegal activity at the job-site is strictly prohibited. The parties shall take every practical measure consistent with the terms of applicable collective bargaining agreements to ensure that the job-site is free of alcohol and drugs.

2.7 All parties to this PLA agree that they will not discriminate against any employee based on race, creed, religion, color, national origin, Union activity, age, gender or sexual orientation and shall comply with all applicable federal, state, and local laws.

2.8 In accordance with the Act and to promote diversity in employment, CDB will establish, in cooperation with other parties, the apprenticeship hours which are to be performed by minorities and females on the Project. CDB shall consider the total hours to be performed.

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by these underrepresented groups, as a percentage of the workforce, and create aspirational
goals for each Project, based on the level of underutilization for the service area of the Project.
Pursuant to the Project Labor Agreement Act (30 ILCS 571) CDB shall provide a quarterly
report to the Illinois Department of Labor regarding the racial and gender composition of the
workforce on the Project.

Consistent with the Project Labor Agreement Act (30 ILCS 571) the parties agree that all
Prime Contractors and Subcontractors working on the Project shall be encouraged to utilize
the maximum number of apprentices as permitted under the terms of the applicable collective
bargaining agreements.

The Unions shall assist the Prime Contractors and each Subcontractor in efforts to satisfy
the aspirational goals. The application of this section shall be consistent with all local
Union collective bargaining agreements, and the hiring hall rules and regulations
established for the hiring of personnel, as well as the apprenticeship standards set forth by
each individual Union.

2.9 The parties hereto agree that engineering/architectural/surveying consultants’ materials
testing employees are subject to the terms of this PLA for Construction Work performed for a
Contractor or Subcontractor on this Project. These workers shall be fully expected to
objectively and responsibly perform their duties and obligations owed to the Board without
regard to the potential Union affiliation of such employees or of other employees on the Project.

ARTICLE III - ADMINISTRATION OF AGREEMENT

3.1 In order to assure that all parties have a clear understanding of the PLA, and to promote
harmony, at the request of the Unions a post-award pre-job conference will be held among
the Prime Contractor(s), all Subcontractors and Union representatives prior to the start of any
Construction Work on the Project. No later than the conclusion of such pre-job conference, the
parties shall, among other matters, provide to one another contact information for their
respective representatives (including name, address, phone number, facsimile number, e-
mail). Nothing herein shall be construed to limit the right of the Board to discuss or explain the
purpose and intent of this PLA with prospective bidders or other interested parties prior to or
following its award of the job.

3.2 Representatives of the Prime Contractor and the Unions shall meet as often as
reasonably necessary following award until completion of the Project to assure the effective
implementation of this PLA.

3.3 Any notice contemplated under Article VI and VII of this Agreement to a signatory labor
organization shall be made in writing to the Local Union with copies to the local Union’s
International Representative.

ARTICLE IV - HOURS OF WORK AND GENERAL CONDITIONS

41 The standard work day and work week for Construction Work on the Project shall be
consistent with the respective collective bargaining agreements. In the event Project site or
other job conditions dictate a change in the established starting time and/or a staggered
lunch period for portions of the Project or for specific crafts, the CDB, the Prime Contractor,
relevant Subcontractors and business managers of the specific crafts involved shall confer

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and mutually agree to such changes as appropriate. If proposed work schedule changes cannot be mutually agreed upon between the parties, the hours fixed at the time of the pre-job meeting shall prevail.

4.2 Shift work may be established and directed by the Prime Contractor or relevant Subcontractor as reasonably necessary or appropriate to fulfill the terms of its contract with the Board. If used, shift hours, rates and conditions shall be as provided in the applicable collective bargaining agreement.

4.3 The parties agree that chronic and/or unexcused absenteeism is undesirable and must be controlled in accordance with procedures established by the applicable collective bargaining agreement. Any employee disciplined for absenteeism in accordance with such procedures shall be suspended from all work on the Project for not less than the maximum period permitted under the applicable collective bargaining agreement.

4.4 Except as may be otherwise expressly provided by the applicable collective bargaining agreement, employment begins and ends at the Project site; employees shall be at their place of work at the starting time; and employees shall remain at their place of work until quitting time.

4.5 Except as may be otherwise expressly provided by the applicable collective bargaining agreement, there shall be no limit on production by workmen, no restrictions on the full use of tools or equipment, and no restrictions on efficient use of manpower or techniques of construction other than as may be required by safety regulations.

4.6 The parties recognize that specialized or unusual equipment may be installed on the Project. In such cases, the Union recognizes the right of the Prime Contractor or Subcontractor to involve the equipment supplier or vendor's personnel in supervising the setting up of the equipment, making modifications and final alignment, and performing similar activities that may be reasonably necessary prior to and during the start-up procedure in order to protect factory warranties. The Prime Contractor or Subcontractor shall notify the Union representatives in advance of any work at the job-site by such vendor personnel in order to promote a harmonious relationship between the equipment vendor's personnel and other Project employees.

4.7 For the purpose of promoting full and effective implementation of this PLA, authorized Union representatives shall have access to the Project job-site during scheduled work hours. Such access shall be conditioned upon adherence to all reasonable visitor and security rules of general applicability that may be established for the Project site at the pre-job conference or from time to time thereafter.

**ARTICLE V — GRIEVANCE PROCEDURES FOR DISPUTES ARISING UNDER A PARTICULAR COLLECTIVE BARGAINING AGREEMENT**

5.1 In the event a dispute arises under a particular collective bargaining agreement specifically not including jurisdictional disputes referenced in Article VI below, said dispute shall be resolved by the Grievance/Arbitration procedure of the applicable collective bargaining agreement. The resulting determination from this process shall be final and binding on all parties bound to its process.

5.2 Employers covered under this Agreement shall have the right to discharge or discipline any employee who violates the provisions of this Agreement. Such discharge or discipline by a contractor or subcontractor shall be subject to Grievance/Arbitration procedure of the applicable collective bargaining agreement only as to the fact of such violation of this agreement.
If such fact is established, the penalty imposed shall not be disturbed. Work at the Project site shall continue without disruption or hindrance of any kind as a result of a Grievance/Arbitration procedure under this Article.

5.3 In the event there is a deadlock in the foregoing procedure, the parties agree that the matter shall be submitted to arbitration for the selection and decision of an Arbitrator governed under paragraph 6.8.

ARTICLE VI — DISPUTES: GENERAL PRINCIPLES

6.1 This Agreement is entered into to prevent strikes, lost time, lockouts and to facilitate the peaceful adjustment of jurisdictional disputes in the building and construction industry and to prevent waste and unnecessary avoidable delays and expense, and for the further purpose of at all times securing for the employer sufficient skilled workers.

6.2 A panel of Permanent Arbitrators are attached as Exhibit (B) to this agreement. By mutual agreement between CDB and the Unions, the parties can open this section of the agreement as needed to make changes to the list of permanent arbitrators.

6.3 The PLA Jurisdictional Dispute Resolution Process ("Process") sets forth the procedures below to resolve jurisdictional disputes between and among Contractors, Subcontractors, and Unions engaged in the building and construction industry. Further, the Process will be followed for any grievance or dispute arising out of the interpretation or application of this PLA by the parties except for the prohibition on attorneys contained in 6.11. All decisions made through the Process are final and binding upon all parties.

DISPUTE PROCESS

6.4 Administrative functions under the Process shall be performed through the offices of the President and/or Secretary-Treasurer of the Illinois AFL-CIO, or their designated representative, called the Administrator. In no event shall any officer, employee, agent, attorney, or other representative of the Illinois AFL-CIO be subject to any subpoena to appear or testify at any jurisdictional dispute hearing.

6.5 There shall be no abandonment of work during any case participating in this Process or in violation of the arbitration decision. All parties to this Process release the Illinois AFL-CIO from any liability arising from its action or inaction and covenant not to sue the Illinois AFL-CIO, nor its officers, employees, agents or attorneys.

6.6 In the event of a dispute relating to trade or work jurisdiction, all parties, including the employers, Contractors or Subcontractors, agree that a final and binding resolution of the dispute shall be resolved as follows:

(a) Representatives of the affected trades and the Contractor or Subcontractor shall meet on the job-site within two (2) business days after receiving written notice in an effort to resolve the dispute. (In the event there is a dispute between local Unions affiliated with the same International Union, the decision of the General President, or his/her designee, as the internal jurisdictional authority of that International Union, shall constitute a final and binding decision and determination as to the jurisdiction of work.)

(b) If no settlement is achieved subsequent to the preceding Paragraph, the matter shall be
referred to the local area Building & Construction Trades Council, which shall meet with
the affected trades within two (2) business days subsequent to receiving written notice. In
the event the parties do not wish to avail themselves of the local Building & Construction
Trades Council, the parties may elect to invoke the services of their respective
International Representatives with no extension of the time limitations. An agreement
reached at this Step shall be final and binding upon all parties.

(c) If no settlement agreement is reached during the proceedings contemplated by
Paragraphs "a" or "b" above, the matter shall be immediately referred to the Illinois
Jurisdictional Dispute Process for final and binding resolution of said dispute. Said referral
submission shall be in writing and served upon the Illinois AFL-CIO, or the Administrator,
pursuant to paragraph 6.4 of this agreement. The Administrator shall, within three (3)
days, provide for the selection of an available Arbitrator to hear said dispute within this time
period. Upon good cause shown and determined by the Administrator, an additional three
(3) day extension for said hearing shall be granted at the sole discretion of the
Administrator. Only upon mutual agreement of all parties may the Administrator extend the
hearing for a period in excess of the time frames contemplated under this Paragraph.
Business days are defined as Monday through Friday, excluding contract holidays.

6.7 The primary concern of the Process shall be the adjustment of jurisdictional disputes
arising out of the Project. A sufficient number of Arbitrators shall be selected from list of
approved Arbitrators as referenced Sec. 6.2 and shall be assigned per Sec. 6.8.
Decisions shall be only for the Project and shall become effective immediately upon issuance
and complied with by all parties. The authority of the Arbitrator shall be restricted and
limited specifically to the terms and provisions of Article VI and generally to this Agreement as
a whole.

6.8 The Arbitrator chosen shall be randomly selected based on the list of Arbitrators in Sec.
6.2 and geographical location of the jurisdictional dispute and upon his/her availability, and
ability to conduct a Hearing within two (2) business days of said notice. The Arbitrator
may issue a "bench" decision immediately following the Hearing or he/she may elect to only
issue a written decision, said decision must be issued within two (2) business days
subsequent to the completion of the Hearing. Copies of all notices, pleadings, supporting
memoranda, decisions, etc. shall be provided to all disputing parties and the Illinois State
Federation of Labor.

Any written decision shall be in accordance with this Process and shall be final and binding
upon all parties to the dispute and may be a "short form" decision. Fees and costs of the
arbitrator shall be divided evenly between the contesting parties except that any party wishing
a full opinion and decision beyond the short form decision shall bear the reasonable fees and
costs of such full opinion. The decision of the Arbitrator shall be final and binding upon the
parties hereto, their members, and affiliates.

In cases of jurisdictional disputes or other disputes between a signatory labor
organization and another labor organization, both of which is an affiliate or member of the
same International Union, the matter or dispute shall be settled in the manner set forth by
their International Constitution and/or as determined by the International Union's General
President whose decision shall be final and binding upon all parties. In no event shall there
be an abandonment of work.

6.9 In rendering a decision, the Arbitrator shall determine:

(a) First, whether a previous agreement of record or applicable agreement, including a disclaimer
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agreement, between National or International Unions to the dispute or agreements between local Unions involved in the dispute, governs;

(b) Only if the Arbitrator finds that the dispute is not covered by an appropriate or applicable agreement of record or agreement between the crafts to the dispute, he shall then consider the established trade practice in the industry and prevailing practice in the locality. Where there is a previous decision of record governing the case, the Arbitrator shall give equal weight to such decision of record, unless the prevailing practice in the locality in the past ten years favors one craft. In that case, the Arbitrator shall base his decision on the prevailing practice in the locality. Except, that if the Arbitrator finds that a craft has improperly obtained the prevailing practice in the locality through raiding, the undercutting of wages or by the use of vertical agreements, the Arbitrator shall rely on the decision of record and established trade practice in the industry rather than the prevailing practice in the locality; and,

(c) Only if none of the above criteria is found to exist, the Arbitrator shall then consider that because efficiency, cost or continuity and good management are essential to the well being of the industry, the interests of the consumer or the past practices of the employer shall not be ignored.

(d) The Arbitrator is not authorized to award back pay or any other damages for a misassignment of work. Nor may any party bring an independent action for back pay or any other damages, based upon a decision of an Arbitrator.

6.10 The Arbitrator shall set forth the basis for his/her decision and shall explain his/her findings regarding the applicability of the above criteria. If lower ranked criteria are relied upon, the Arbitrator shall explain why the higher-ranked criteria were not deemed applicable. The Arbitrator's decision shall only apply to the Project. Agreements of Record, for other PLA projects, are applicable only to those parties signatory to such agreements. Decisions of Record are those that were either attested to by the former Impartial Jurisdictional Disputes Board or adopted by the National Arbitration Panel.

6.11 All interested parties, as determined by the Arbitrator, shall be entitled to make presentations to the Arbitrator. Any interested labor organization affiliated to the PLA Committee and party present at the Hearing, whether making a presentation or not, by such presence shall be deemed to accept the jurisdiction of the Arbitrator and to agree to be bound by its decision. In addition to the representative of the local labor organization, a representative of the labor organization's International Union may appear on behalf of the parties. Each party is responsible for arranging for its witnesses. In the event an Arbitrator's subpoena is required, the party requiring said subpoena shall prepare the subpoena for the Arbitrator to execute. Service of the subpoena upon any witness shall be the responsibility of the issuing party. Attorneys shall not be permitted to attend or participate in any portion of a Hearing. The parties are encouraged to determine, prior to Hearing, documentary evidence which may be presented to the Arbitrator on a joint basis.

6.12 The Order of Presentation in all Hearings before an Arbitrator shall be

I. Identification and Stipulation of the Parties
II. Unions(s) claiming the disputed work presents its case
III. Union(s) assigned the disputed work presents its case
IV. Employer assigning the disputed work presents its case
V. Evidence from other interested parties (i.e., general contractor, project manager, owner)
VI. Rebuttal by Union(s) claiming the disputed work
VII. Additional submissions permitted and requested by Arbitrator
VIII. Closing arguments by the parties

6.13 All parties bound to the provisions of this Process hereby release the Illinois AFL-CIO and CDB, their respective officers, agents, employees or designated representatives, specifically including any Arbitrator participating in said Process, from any and all liability or claim, of whatsoever nature, and specifically incorporating the protections provided in the Illinois Arbitration Act, as amended from time to time.

6.14 Neither the Process, as an arbitration panel, nor its Administrator, shall have any authority to undertake any action to enforce its decision(s). Rather, it shall be the responsibility of the prevailing party to seek appropriate enforcement of a decision, including findings, orders or awards of the Arbitrator or Administrator determining non-compliance with a prior award or decision.

6.15 If at any time there is a question as to the jurisdiction of the Illinois Jurisdictional Dispute Resolution Process, the primary responsibility for any determination of the arbitrariness of a dispute and the jurisdiction of the Arbitrator shall be borne by the party requesting the Arbitrator to hear the underlying jurisdictional dispute. The affected party or parties may proceed before the Arbitrator even in the absence or one or more stipulated parties with the issue of jurisdiction as an additional item to be decided by the Arbitrator. The Administrator may participate in proceedings seeking a declaration or determination that the underlying dispute is subject to the jurisdiction and process of the Illinois Jurisdictional Dispute Resolution Process. In any such proceedings, the non-prevailing party and/or the party challenging the jurisdiction of the Illinois Jurisdictional Dispute Resolution Process shall bear all the costs, expenses and attorneys' fees incurred by the Illinois Jurisdictional Dispute Resolution Process and/or its Administrator in establishing its jurisdiction.

ARTICLE VII - WORK STOPPAGES AND LOCKOUTS

7.1 During the term of this PLA, no Union or any of its members, officers, stewards, employees, agents or representatives shall instigate, support, sanction, maintain, or participate in any strike, picketing, walkout, work stoppage, slow down or other activity that interferes with the routine and timely prosecution of work at the Project site or at any other contractor's or supplier's facility that is necessary to performance of work at the Project site. Hand billing at the Project site during the designated lunch period and before commencement or following conclusion of the established standard workday shall not, in itself, be deemed an activity that interferes with the routine and timely prosecution of work on the Project.

7.2 Should any activity prohibited by paragraph 7.1 of this Article occur, the Union shall undertake all steps reasonably necessary to promptly end such prohibited activities.

(a) No Union complying with its obligations under this Article shall be liable for acts of employees for which it has no responsibility or for the unauthorized acts of employees it represents. Any employee who participates or encourages any activity prohibited by paragraph 7.1 shall be immediately suspended from all work on the Project for a period equal to the greater of (a) 60 days; or (b) the maximum disciplinary period allowed under the applicable collective bargaining agreement for engaging in comparable unauthorized or prohibited activity.

(b) Neither the PLA Committee nor its affiliates shall be liable for acts of employees for which
it has no responsibility. The principal officer or officers of the PLA Committee will immediately instruct, order and use the best efforts of his office to cause the affiliated Union or Unions to cease any violations of this Article. The PLA Committee in its compliance with this obligation shall not liable for acts of its affiliates. The principal officer or officers of any involved affiliate will immediately instruct, order or use the best effort of his office to cause the employees the Union represents to cease any violations of this Article. A Union complying with this obligation shall not be liable for unauthorized acts of employees it represents. The failure of the Contractor to exercise its rights in any instance shall not be deemed a waiver of its rights in any other instance. During the term of this PLA, the Prime Contractor and its Subcontractors shall not engage in any lockout at the Project site of employees covered by this Agreement.

7.3 Upon notification of violations of this Article, the principal officer or officers of the local area Building and Construction Trades Council, and the Illinois AFL-CIO Statewide Project Labor Agreement Committee as appropriate, will immediately instruct, order and use their best efforts to cause the affiliated Union or Unions to cease any violations of this Article. A Trades Council and the Committee otherwise in compliance with the obligations under this paragraph shall not be liable for unauthorized acts of its affiliates.

7.4 In the event that activities in violation of this Article are not immediately halted through the efforts of the parties, any aggrieved party may invoke the special arbitration provisions set forth in paragraph 7.5 of this Article.

7.5 Upon written notice to the other involved parties by the most expeditious means available, any aggrieved party may institute the following special arbitration procedure when a breach of this Article is alleged:

(a) The party invoking this procedure shall notify the individual designated as the Permanent Arbitrator pursuant to paragraph 6.8 of the nature of the alleged violation; such notice shall be by the most expeditious means possible. The initiating party may also furnish such additional factual information as may be reasonably necessary for the Permanent Arbitrator to understand the relevant circumstances. Copies of any written materials provided to the arbitrator shall also be contemporaneously provided by the most expeditious means possible to the party alleged to be in violation and to all other involved parties.

(b) Upon receipt of said notice the Permanent Arbitrator shall set and hold a hearing within twenty-four (24) hours if it is contended the violation is ongoing, but not before twenty-four (24) hours after the written notice to all parties involved as required above.

(c) The Permanent Arbitrator shall notify the parties by facsimile or any other effective written means, of the place and time chosen by the Permanent Arbitrator for this hearing. Said hearing shall be completed in one session. A failure of any party or parties to attend said hearing shall not delay the hearing of evidence or issuance of an Award by the Permanent Arbitrator.

(d) The sole issue at the hearing shall be whether a violation of this Article has, in fact, occurred. An Award shall be issued in writing within three (3) hours after the close of the hearing, and may be issued without a written opinion. If any party desires a written opinion, one shall be issued within fifteen (15) days, but its issuance shall not delay compliance with, or enforcement of, the Award. The Permanent Arbitrator may order cessation of the violation of this Article, and such Award shall be served on all parties by hand or registered mail upon issuance.
(e) Such Award may be enforced by any court of competent jurisdiction upon the filing of the Award and such other relevant documents as may be required. Facsimile or other hardcopy written notice of the filing of such enforcement proceedings shall be given to the other relevant parties. In a proceeding to obtain a temporary order enforcing the Permanent Arbitrator's Award as issued under this Article, all parties waive the right to a hearing and agree that such proceedings may be ex parte. Such agreement does not waive any party's right to participate in a hearing for a final order of enforcement. The Court's order or orders enforcing the Permanent Arbitrator's Award shall be served on all parties by hand or by delivery to their last known address or by registered mail.

7.6 Individuals found to have violated the provisions of this Article are subject to immediate termination. In addition, CDB reserves the right to terminate this PLA as to any party found to have violated the provisions of this Article.

7.7 Any rights created by statute or law governing arbitration proceedings inconsistent with the above procedure or which interfere with compliance therewith are hereby waived by parties to whom they accrue.

7.8 The fees and expenses of the Permanent Arbitrator shall be borne by the party or parties found in violation, or in the event no violation is found, such fees and expenses shall be borne by the moving party.

ARTICLE VIII — TERMS OF AGREEMENT

8.1 If any Article or provision of this Agreement shall be declared invalid, inoperative or unenforceable by operation of law or by any of the above mentioned tribunals of competent jurisdiction, the remainder of this Agreement or the application of such Article or provision to persons or circumstances other than those as to which it has been held invalid, inoperative or unenforceable shall not be affected thereby.

8.2 This Agreement shall be in full force as of and from the date of the Authorization to Proceed until the Project contract is closed.

8.3 This PLA may not be changed or modified except by the subsequent written agreement of the parties. All parties represent that they have the full legal authority to enter into this PLA. This PLA may be executed by the parties in one or more counterparts.

8.4 Any liability arising out of this PLA shall be severable and not joint. CDB shall not be liable to any person or other party for any violation of this PLA by any other party, and no Contractor or Union shall be liable for any violation of this PLA by any other Contractor or Union.

8.5 The failure or refusal of a party to exercise its rights hereunder in one or more instances shall not be deemed a waiver of any such rights in respect of a separate instance of the same or similar nature.

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BIDDING & CONTRACT REQUIREMENTS
00 43 43 - Prevailing Wage Act

Execution Page

Illinois Capital Development Board

Jim Underwood, Executive Director

Illinois AFL-CIO Statewide Project Labor Agreement Committee, representing the Unions listed below:

List Unions:

Jim Allen
Bricklayers

Curtis Coke
United Association

Ed Christiansen, Elevator Constructors

Terry Fitzmaurice
Painters

Robert H. Hiltz
Teamstes

Terrence Healy
LUNA

David Board
Iron Workers

Patrick J. LaCasse
OPCMIA

Terry Ludden
Heat & Frost Insulators & Allied Workers

Richard Mathias
Roofers

Paul Noble
IDEW

Robert Paddock
IUOE

Gary Perino Jr., Carpenters

Brian Mulheran
Sheet Metal Workers

John Skernish
Boilermakers

*Only if Elevator Constructors union agreement language is attached to PLA

Project No. 805-030-020

12

2014

CDB-00 43 43  July 2014
CDB 805-030-020

00 43 43- 22

Correct Water Infiltration
Exhibit A - Contractor Letter of Assent

(Date)__________________________

To All Parties:

In accordance with the terms and conditions of the contract(s) for Construction Work on Project No. 805-030-020, this Letter of Assent hereby confirms that the undersigned Prime Contractor or Subcontractor agrees to be bound by the terms and conditions of the Project Labor Agreement established and entered into by the Illinois Capital Development Board in connection with said Project.

It is the understanding and intent of the undersigned party that this Project Labor Agreement shall pertain only to the identified Project. In the event it is necessary for the undersigned party to become signatory to a collective bargaining agreement to which it is not otherwise a party in order that it may lawfully make certain required contributions to applicable fringe benefit funds, the undersigned party hereby expressly conditions its acceptance of and limits its participation in such collective bargaining agreement to its work on the Project.

____________________________________
(Authorized Company Officer)

____________________________________
(Company)
BIDDING & CONTRACT REQUIREMENTS
00 43 43 - Prevailing Wage Act

END 00 43 43
DIVISION 1 - GENERAL REQUIREMENTS
01 11 00 – Project Summary

1. STANDARD DOCUMENTS FOR CONSTRUCTION: CDB’s 2009 edition of the Standard Documents for Construction (SDC) and the Supplement to Standard Documents for Construction (Section 01 11 01) shall apply to this project.

2. GENERAL PROJECT INFORMATION:

A. DESCRIPTION: Correct water infiltration in the Academic Building, including replacing approximately 97,000 square feet of roofing system, repairing approximately 14,000 square feet of roofing system, replacing monitor windows, removing/reinstalling and upgrading roof-mounted ventilating systems and associated ductwork/hydraulic and gas connections/electrical connections, tuckpointing and exterior envelope improvements. The following summaries of work are applicable at each roof area number (see drawing 1/G001 for roof area numbers):

Roof Area 1: Selectively remove sections of loose-laid, ballasted EPDM roof membrane 10'-0” from perimeter of roof and at each ventilator and replace with new loose-laid, ballasted EPDM membrane. Install new gutters and downspouts. Install new prefinished metal standing seam roof system and waterproofing membrane over existing insulated metal panel mansard roofs. Remove and replace ductwork at air handling units. Seal all penetrations through new standing seam roof system and existing metal panel mansard. Extend existing exhaust ducts through mansard and provide weatherproof louvers at new built-up knee wall.

Roof Area 2-4: Remove existing monitor window framing and glazing. Provide safety nets directly below monitor windows to prevent tools, construction materials and personnel from falling into occupied spaces. Install new prefinished, thermally improved aluminum framing with 1” thick insulated glass panels and 1” thick insulated blank-off panels. Install EPDM base flashing below new monitor windows. Remove and replace ductwork, flue vents, pipe vents and conduit penetrations at blank-off panels. Repair gypsum board and interior paint finishes affected by the removal of the existing monitor windows and frames and by the installation of the new monitor window framing. Provide waterproof cap on four air-handling units and perform remedial repair of one exhaust fan curb. Selectively remove existing EPDM roofing system and existing insulation down to steel deck and install new insulation and fully adhered EPDM membrane where indicated on the drawings.

Roof Areas 5-7: Remove existing fully adhered EPDM roof membrane and install new tapered polyisocyanurate insulation board, recover board and fully adhered TPO roof system (existing insulation and cover board to remain). Remove existing roof hatches and smoke vents and replace with new roof hatches and smoke vents. Install new roof drains at existing locations. Install one new roof drain and drain pipe at Roof Area 7 (connect new drain pipe to existing downspout located on West face of building, North of entry doors). Modify roof edges and rooftop equipment curbs to accommodate new insulation slope and thickness. Remove existing vertical standing seam metal roof/wall panels and install new vertical standing seam metal roof/wall panels as required to properly flash new TPO roofing systems.

Roof Areas 8, 9, 11-13: Remove existing fully adhered EPDM roof membrane and install new tapered polyisocyanurate insulation board, recover board and fully
adhered TPO roof system (existing insulation and cover board to remain). Remove existing roof hatches and replace with new roof hatches. Install new roof drains at existing locations. Provide new parapet walls to accommodate new insulation slope and thickness. Modify rooftop equipment curbs to accommodate new insulation slope and thickness. Install roof expansion joints and building expansion joints where indicated on the drawings. Install new exterior mounted painted steel access ladder from Roof Area 12 to Roof Area 16. See also scope of work at Roof Areas 14 and 15 as it relates to Roof Areas 8-13.

Roof Area 10 (over existing pool): Remove existing fully adhered EPDM roof membrane and existing insulation down to structural precast concrete deck. Install new fully adhered vapor barrier, new tapered polyisocyanurate insulation board, recover board and fully adhered TPO roof system. Install new roof drains at existing locations. Provide new parapet walls to accommodate new insulation slope and thickness. Modify rooftop equipment curbs to accommodate new insulation slope and thickness.

Roof Area 14: Remove existing rooftop equipment and salvage for reinstallation. Remove existing fully adhered EPDM roof membrane and insulation down to structural deck. At existing roof elevation, install new structural deck and supports at openings resulting from removal of existing equipment. Install new structural joists and roof deck to match elevation of Roof Area 8-10 deck. Install new rooftop equipment curbs, new tapered polyisocyanurate insulation and fully adhered TPO roofing system at new roof elevation. Reinstall existing rooftop equipment at new elevation (provide waterproof cap on both units) and reconnect to existing heating and ventilating system (extend ducts, vent pipes, electrical conduits, water and gas lines back to existing connection points). Install new roof drains at new roof elevation and connect to existing drain pipes with drain pipe extensions. Install new roof hatch, access ladder and lighting fixtures to serve new interstitial space. See also scope of work at Roof Areas 8-13 as it relates to Roof Areas 14.

Roof Area 15: Remove two existing rooftop air handling units and salvage for reinstallation. Remove and discard two rooftop air handling units. Remove existing fully adhered EPDM roof membrane and insulation down to structural deck. At existing roof elevation, install new structural deck and supports at openings resulting from removal of existing equipment. Install new structural joists and roof deck to match elevation of Roof Area 11-13 deck. Install new rooftop equipment curbs, new tapered polyisocyanurate insulation and fully adhered TPO roofing system at new roof elevation. Reinstall two existing rooftop equipment at new roof elevation (provide waterproof cap on both units) and reconnect to existing heating and ventilating system (extend ducts, vent pipes, electrical conduits, water and gas lines). Install two new air handling units and reconnect to existing heating and ventilating system (extend ducts, electrical conduits, water and gas lines back to existing connection points). Install new roof drains at new roof elevation and connect to existing drain pipes with drain pipe extensions. Install new roof hatch, access ladder and lighting fixtures to serve new interstitial space. See also scope of work at Roof Areas 8-13 as it relates to Roof Areas 15.

Roof Areas 16: Remove existing fully adhered EPDM roof membrane, existing insulation and existing cover board and install new tapered polyisocyanurate insulation board, recover board and fully adhered TPO roof system. Remove existing roof hatch. Install new roof drains at existing locations. Provide new parapet walls to accommodate new insulation slope and thickness. Modify rooftop equipment curbs to accommodate new insulation slope and thickness. Install new
knee walls at North and South sides to provide adequate flashing height and to accommodate building expansion/contraction. Scrape and paint CMU wall located on North side.

Roof areas 17-18: No work at shingle roofs with the following exceptions: 1) Selectively demolish shingle roofs at areas that interface with the installation of other roof areas noted above. Install new flashings and shingle roof system at interfacing locations and, 2) Remove existing roof saddles and install new roof saddles as indicated on the drawings. Remove existing vertical standing seam metal roof/wall panels and install new vertical standing seam metal roof/wall panels as required to properly flash new roofing saddles and systems.

Existing roof structures are sloped 1/8” per foot to roof drains. At all roof areas designated to receive new insulation, provide minimum finish roof slope of 1/4” per foot to drains.

B. EXISTING CONDITIONS: The Illinois Math and Science Academy (IMSA) operates 24 hours a day, 7 days a week and will be occupied during construction. The Work must be coordinated with IMSA’s operational schedules. Work shall be conducted so that all egress routes are maintained during construction. The Work shall be phased so that any Work that results in the creation of an opening in the building envelope, including but not limited to rooftop equipment removal and reinstallation and monitor window framing/glazing removal and reinstallation, shall be infilled, completed and finished on the same workday that the opening in the envelope is created. Work that will result in the loss of any heating, ventilating, plumbing or electrical system shall be completed and fully operational on the same day the system is affected unless otherwise approved in writing by IMSA. Work shall not commence without prior submission and written approval of a proposed Work plan and receipt of a written authorization to proceed from IMSA’s Facilities Planning & Development Department.

C. RELATED WORK
   1. WORK BY OTHERS: The following projects will be constructed concurrently with the Work of this Contract:
      a. CDB Project #805-030-018: Renovate A-Wing Laboratories
      b. CDB Project #805-030-019: Construct Innovation Center

      The work of all concurrent Contracts must be coordinated with the Work of this Contract.

   3. CONTRACT TIME: Refer to Articles 00 72 10 and 01 32 00 of the Standard Documents for Construction.

   SPECIAL NOTICE - DEADLINE FOR COMPLETION. Contractor shall commence work immediately upon receipt of the Authorization to Proceed and shall complete all work through Substantial Completion in accord with the contract no later than November 18, 2016. The contractor shall complete all work in accordance with the contract (Final Acceptance) within forty-one (41) consecutive calendar days from the date of Substantial Completion.
4. **CONTRACT(S).** Construct project under separate work contracts, under the terms of which CDB will assign the other contracts to the coordinating contractor, identified as the General contractor. Refer to Article 00 72 20 of the Standard Documents for Construction:

   1. General.
   2. Plumbing.
   3. Ventilation.
   4. Electrical.

5. **PRE-BID CONFERENCE.** The pre-bid meeting will be as indicated in 00 11 13. Bidders are strongly urged to attend this meeting. See SDC 00 21 10 and 00 25 00.

6. **CONSTRUCTION ADMINISTRATION FEE:** A construction administration fee (CAF) is applicable to each contract in accordance with Article 00 21 40 of the Standard Documents for Construction:

   Each trade will be assessed three percent (3%) of their awarded contract (base bid plus any awarded alternates). The assessed amount will be included in the Notice of Award Letter. Bidders shall include an allowance for the CAF assessment in their bid.

7. **BID SECURITY:** Bid security must be submitted with each bid equal to 10% of the base bid and must be in the form of a CDB bid bond, certified check, cashier’s check or bank draft. Refer to Article 00 43 13 of the Standard Documents for Construction.

8. **BUILDERS RISK INSURANCE, DESIGNATED PURCHASER.** Coordinating contractor shall purchase and maintain builder's risk insurance in accord with Article 00 73 19 of the Standard Documents for Construction.

9. **PROCUREMENT OF DOMESTIC PRODUCTS ACT.**
   
   A. The Procurement of Domestic Products Act, 30 ILCS 517/30, requires each purchasing agency making purchases of procured products to promote the purchase of and give preference to manufactured articles, materials, and supplies that have been manufactured in the United States.

   B. “Manufactured in the United States” means, in the case of assembled articles, materials, or supplies, that design, final assembly, processing, packaging, testing, or other process that adds value, quality, or reliability occurs in the United States.

   The promotion and preferences required are being applied to the project.

10. **LIQUIDATED DAMAGES:** Per Article 00 72 75 of the Standard Documents for Construction, liquidated damages in the amount of **$1,000.00** per working day per contract beyond the scheduled completion date may be assessed by CDB.

11. **PROJECT IDENTIFICATION SIGN:** The coordinating contractor shall provide and maintain the project identification sign in accordance with Article 01 58 00 of the Standard Documents for Construction.
12. **FIELD OFFICES:**

A. Coordinating contractor provide and maintain a field office in accordance with Article 01 52 00 of the Standard Documents for Construction.

B. See Related Requirements:
   1. Section 01 51 50 Use of Existing Facilities
   2. Section 01 51 00 Temporary Utilities

14. **VALUE MANAGEMENT.** The value management program is applicable to this project.
The Standard Documents for Construction and Standard Documents for Construction for Projects with a Construction Manager are hereby changed. The following articles replace those in the 2006 and 2009 editions. All other articles remain applicable.

00 21 50 WORK WITH OWN STAFF

.2 Subcontractors and Suppliers

C. Subcontract/Supplier Disclosure. The Contractor shall submit with his/her bid the names and CDB issued identification (ID) numbers (prequalification ID number or registration ID number), if known, of all first tier subcontractors and suppliers with a subcontract value greater than $50,000 to be utilized by the Contractor in the performance of this contract and any lower tier subcontractor/supplier with a subcontract value greater than $50,000 and where the subcontractor/supplier is either named in the specifications or is one over whom the Contractor retains the right to approve and/or make payments for work. The subcontract shall include reference for compliance with Illinois Procurement Code 30 ILCS 500/20-120. Financial and Conflict of Interest disclosures and standard certifications for each subcontractor over $50,000 must be submitted to CDB by the contractor within 20 days of the execution of a contract with CDB or 20 days of the execution of the subcontract, whichever is later. The Contractor shall promptly notify the State in writing of any additional or substitute subcontractors meeting the above criteria hired during the term of this contract (names, addresses, expected contract amount and CDB ID nos.). Upon request by the CPO, the Contractor shall provide CDB a copy of each subcontractor’s subcontract. No work can be performed by these subcontractors until the Certifications and Disclosures have been reviewed and approved by the State Purchasing Officer.

00 21 55 USE OF ILLINOIS LABOR

.1 30 ILCS 570 mandates that during a period of excessive unemployment at least 90% of the total labor hours on State construction projects must be performed by persons who have resided in Illinois for at least thirty (30) days and intend to become or remain Illinois residents. (30 ILCS 570/3). ‘A period of excessive unemployment’ means any month immediately following 2 consecutive calendar months during which the level of unemployment in the State of Illinois has exceeded 5% as measured by the United States Bureau of Labor Statistics in its monthly publication of employment and unemployment figures. (30 ILCS 570/1)

.2 Contractors are required to incorporate the above provisions into all subcontracts for subcontractors who will have workers at the project site.

.3 To verify that this requirement is being met, contractors must submit Certified Payroll forms for themselves and their subcontractors each month for the duration of the contract/subcontract.

A. The Certified Payroll form(s) must include the name and address of each worker on the project site during the time period covered by the form.
B. For subcontractors, the contractor will include the beginning and ending dates of the subcontract on the Certified Payroll form.
C. If Certified Payroll forms are not submitted timely, payment may be reduced or withheld until Certified Payroll submittals are brought up to date.
00 43 30 BUY ILLINOIS PROGRAM

.1 General. The Buy Illinois Program encourages contractors to incorporate products manufactured, fabricated or assembled in the State of Illinois. It is a voluntary program; there is no incentive provision affecting the award of the contract nor is there a required percent of the contract that must be Illinois products.

.2 Illinois products will be indicated in the project manual with (IL) preceding the item in the specification paragraph. Typically, only specifications that are prescriptive, those listing three or more manufacturers, will be in the program. Contractors should consider these products when procuring the materials and equipment for the project. If the contractor is aware of an Illinois product not listed, the contractor is encouraged to advise the A/E prior to bidding or offer a product substitution with the bid. CDB will verify that the product meets the definition of an Illinois product and add it to CDB’s Buy Illinois product directory.

.3 Contractors should provide the total value of Illinois products on the Contractor’s Schedule of Values (CSV) in the space provided. The individual items included in the total should be identified by putting “IL” in front of their descriptions on the CSV.

.4 Where material is specified by standards and codes and not by a list of acceptable manufacturers, contractors are still encouraged to purchase Illinois products. However, the contractor should not include these materials in the computation of the total dollars for Illinois products on the CSV.

00 43 39 MINORITY AND FEMALE AND VETERAN BUSINESS ENTERPRISE PARTICIPATION

.1 Certification. CDB will only accept Minority and Female and Veteran Business Enterprise (MBE/FBE/VBE) firms certified by the Illinois Department of Central Management Services (CMS) as a MBE or FBE or VBE. The MBE/FBE/VBE’s certification/registration with CMS shall be in good standing prior to the bid opening date.

.2 Designated Projects. CDB may designate projects with "MBE/FBE/VBE Participation Goals." See the bid form and Section 01 11 00 of the project manual for applicable goals for first and second tier (level) subcontractors and supplier MBE/FBE/VBE participation.

.3 Bid Form. Each bidder shall name, on the bid form provided, the minority and female and veteran owned businesses it intends to use to meet the specified goals. If the specified goals are not met, the bidder shall submit with its bid a request for change/waiver of MBE/FBE/VBE goals or, within 7 (seven) calendar days of the bid opening, submit documentation of its good faith efforts to achieve the goals.

.4 MBE/FBE/VBE Bidder. If the bidder is a minority or female or veteran owned business, indicate by stating “Bidder is an MBE/FBE/VBE firm” on the applicable page of the bid form. CDB encourages MBE/FBE/VBE prime bidders to use MBE/FBE/VBE subcontractors/suppliers.

.5 Joint Venture. If the bidder is a joint venture, the percentage of ownership held by the MBE/FBE/VBE joint venturer may be used to meet the MBE/FBE/VBE goal for the contract.

.6 Subcontracts. Subcontracting of work to a lower tier non-MBE/FBE/VBE firm which would reduce the proceeds received by the subcontracting MBE/FBE/VBE firm below the specified
goal is prohibited. CDB may, in such cases, reject the bid or terminate the contract. Refer to Paragraph 00 51 20.2.A.10).

.7 Request for Assistance. If the bidder needs assistance in locating subcontractors or suppliers to meet the goals, bidder shall contact CDB’s Fair Employment Practices Division prior to the submittal of the bid.

.8 Submittal of Good Faith Effort documentation or change waiver request. Include with the package:

A. All information indicating why the specified goal cannot be met.
B. A list of all MBE/FBE/VBE firms contacted and the dates they were contacted, including documentation from those firms.
C. Copies of all bid solicitation letters to MBE/FBE/VBE firms. Letters shall contain, as a minimum:
   1) Project Title and Location
   2) Classification of Work Items for Which Quotations are Requested
   3) Date, Time, and Place Quotations are Due
   4) Returnable Acknowledgment of the Solicitation
D. Evidence, such as a log, of telephone contact including time and date of call, telephone number, and name of the person called.
E. All other evidence of good faith efforts made by the bidder to secure eligible MBE/FBE/VBE firms to meet the specified goal. Evidence may include documentation that states the following:
   1) A reasonable number of MBE/FBE/VBE firms were contacted.
   2) The work selected by the bidder for allocation to MBE/FBE/VBE firms was selected in order to increase the likelihood of achieving the specified goal.
   3) The bidder negotiated, in good faith, with the potential MBE/FBE/VBE firms by not imposing any conditions which are not similarly imposed on all other subcontractors and suppliers, or by denying benefits ordinarily conferred on subcontractors or suppliers for the type of work for which bids were solicited.
   4) The services of the referral agencies were used by the bidder in efforts to achieve the specified goal.
   5) The bidder attended CDB pre-bid meeting for the project.
F. Other relevant information in support of the change/waiver request.

.9 Replacement of MBE/FBE/VBE Subcontractor or Supplier. If it can be demonstrated that the MBE/FBE/VBE subcontractor or supplier cannot perform the work, or if a MBE/FBE/VBE loses its CMS certification/registration after the bid opening, then the Contractor shall make a good faith effort to replace, in-kind, the MBE/FBE/VBE. The contractor shall identify the replacement MBE/FBE/VBE or provide evidence of good faith effort to find a replacement on the Contractor’s letterhead and submit with documented evidence of cause to CDB’s Office of Fair Employment Practice. CDB will review submittal and may, at its sole discretion, authorize the replacement or approve the good faith effort.

.10 Calculation of MBE/FBE/VBE Participation as a Material Supplier or Subcontractor
A. MBE/FBE/VBE as a material supplier: A 100 percent goal credit is allowed for the cost of materials or purchases from a MBE/FBE/VBE regular dealer.
B. MBE/FBE/VBE as a subcontractor: A 100 percent goal credit is allowed for the work of the subcontract performed by the MBE/FBE/VBE’s own forces (performing, managing
and supervising the work), including the cost of materials and supplies, excluding the purchase of materials and supplies or the lease of equipment by the MBE/FBE/VBE subcontractor from the prime Contractor or its affiliates. Work that a MBE/FBE/VBE subcontractor in turn subcontracts to a non-MBE/FBE/VBE does not count toward the MBE/FBE/VBE goal.

00 45 00 CERTIFICATIONS OF COMPLIANCE WITH APPLICABLE LAWS

14 Recertification. If the contract extends over multiple years, vendor (A/E or Contractor) and its subcontractors will sign and submit to CDB Contracts the required Compliance Form (available in the Reference Library on CDB’s website: www.illinois.gov/cdb) by April 1 of each subsequent year after the contract is signed. Failure to do so may result in voiding the contract by operation of law or rendering the contract voidable at the option of the State without additional compensation. Violations of certain provisions may also be deemed a civil or criminal offense.

00 51 20 ACCEPTANCE AND REJECTION OF BIDS

.1 CDB’s Rights. When, in its opinion, it is in the best interest of the state, CDB reserves the right to:

A. Accept any bid  
B. Reject any or all bids  
C. Waive technical deficiencies and irregularities  
D. Allow bidder to remedy technical deficiencies or irregularities within a stated time  
E. Rescind any notice of award if CDB determines the notice of award was issued in error  
F. Rescind any notice of award when it is in the best interest of the state  
G. Rebid any contract

.2 Bid Rejection.

A. Bids will be rejected for the following material deficiencies:

1) Failure to be prequalified with CDB no later than the close of business the day before the bid opening (Article 00 21 05) or being determined non-responsive after bid opening.

2) Submission of a bid late (Paragraph 00 51 10.1).

3) Failure to submit bid and/or bid modifications to appropriate bid opening office.

4) Submission of a bid in a manner that reveals the bid price prior to the bid opening (example: by fax). (Paragraph 00 42 10.4).

5) Use of a bid envelope, which is received by CDB unsealed, or marked in a manner that does not reasonably identify the project and/or contract for which it is intended (Paragraph 00 42 10.3).

6) Omission of a base bid price, alternate bid price or unit price (Paragraph 00 42 10.1).

7) Submission of a bid price that cannot be determined.

8) Deletion of original signatures to the extent that an intent to be bound by the bid is not apparent.

9) When CDB does not accept the unit price(s), when those prices are an integral part of the base bid, all bids for that contract will be rejected.
10) Failure to attend a mandatory pre-bid meeting.

11) Bids not in substantial conformance with the bidding documents and whose non-conformance is determined to be material and unresponsive.

12) Failure to submit a completed CDB form 00 41 05 (Minority/Female/Veteran Business Participation).

13) Failure to use good faith efforts to achieve minority/female/veteran business participation goals.

14) Failure to submit Bidder Disclosure(s) form and Certifications with bid, when the bidder is not registered with the Illinois Procurement Gateway (IPG).

15) Failure to be registered with the State Board of Elections, prior to bid opening date, when applicable.


B. The following technical deficiencies may be remedied by the bidder within seven calendar days. Failure to remedy the bid within seven calendar days shall result in rejection of the bid. These technical deficiencies are:

1) Failure to use a revised bid form when bid forms have been changed by addenda.

2) Failure to acknowledge an addendum, however adjustment of the bid amount will not be allowed.

3) Failure to provide USDOL Apprenticeship and Training Certification for bidder and all known subcontractors.

4) Failure to submit bidder’s Certificate of Registration in an approved apprenticeship and training program.

5) Failure to supply subcontractor and/or supplier names and Taxpayer Identification Numbers as required.

6) Submission of a bid bond not on CDB’s form (Paragraphs 00 43 13.1 and 00 43 13.2).

7) Submission of a bid security in a form other than a bid bond, certified check, cashier’s check or bank draft (Paragraph 00 43 13.1).

8) Omission of the signature of the officer of the surety or any other required signatures except the signature in Paragraph 00 51 20.2.A.8), submission of those signatures in pencil or submission of a non-original signature.

9) Replacement of a bid security from an unacceptable surety with one from a surety acceptable to CDB (Paragraph 00 43 13.4).

10) Failure to furnish and/or complete the DHR PC-2 form.

11) When applicable, failure to submit documentation of good faith efforts to meet MBE/FBE/VBE goals.
12) Failure to submit a signed affidavit stating that the bidder will maintain an Illinois office as the primary place of employment for persons employed in the construction authorized by the contract.

13) Failure to submit Certificate of Registration with State Board of Elections in accord with 30 ILCS 500/20-160.

C. CDB at its sole discretion and without conferring any rights on any bidder may waive bid technical deficiencies or irregularities that are not in conformance with the bidding documents but whose non-conformance is non-material or minor.

D. Submittal of conditions or qualifying statements contrary to CDB’s contract terms is not acceptable and, unless rescinded, the bid shall be rejected.

00 51 28 MBE/FBE/VBE BUSINESS CERTIFICATION, POST REQUIREMENTS

.1 Post-Award submittal. See Article 005140. The contract awardee shall submit CDB’s MBE/FBE/VBE Subcontractor Supplier Certification form, Document 00665 (available in the Reference Library on CDB’s website), for each of the MBE/FBE/VBE subcontractor(s) and/or supplier(s) being utilized to meet the designated participation goals as specified on the bid form and in Section 01 11 00 of the project manual. The form must be signed by the MBE/FBE/VBE subcontractor or supplier and shall be submitted to CDB’s FEP section.

Completion of the 00665 form is not required if the Contractor is an MBE or FBE or VBE firm. MBE/FBE/VBE prime contractors are encouraged to utilize MBE/FBE/VBE subcontractors/suppliers. If goals are split (separate MBE and FBE and VBE goals), then an MBE or FBE or VBE firm must supply 00665 forms for the subcontractor firm(s) utilized to meet the FBE or MBE or VBE goal, respectively.

.2 Listed Firms. The 00665 certification form shall be completed and submitted for each MBE/FBE/VBE firm listed on the bid form.

.3 Compliance. The MBE/FBE/VBE participation goal dollar value is based upon the total contract sum (including awarded alternates). The participation goal percentage amount(s) shall meet or exceed the goal(s) as specified on the bid form (and in Section 01 11 00 of the project manual), or in an approved change/waiver request (refer to Article 00 43 39 herein).

.4 Voluntary. Contractors are encouraged to utilize MBE/FBE/VBE subcontractors/suppliers for those projects that are not designated for MBE/FBE/VBE participation and complete the 00665 certification form for each MBE/FBE/VBE firm. MBE/FBE/VBE subcontractors/suppliers may be added at any time during the project.

.5 Subcontracts/Supplier agreements. Copies of subcontracts or supplier agreements (to correspond with each 00665 form) are required to be submitted within ten (10) days of the Notice of Award.

00 51 40 POST AWARD REQUIREMENTS

.1 Contractor’s Duty to Comply. The Contractor may not proceed with the work until the following post award requirements are met. These requirements are part of the contract and failure to comply with these requirements shall constitute a breach of the contract. CDB shall issue Authorization to Proceed upon successful completion of these post award requirements.
.2 **Submittals.** Within ten (10) calendar days from the date of the notice of award letter, the Contractor shall furnish, on CDB forms, the following:

A. Contract executed by the Contractor;
B. Performance Bond;
C. Labor and Material Payment Bond;
D. Certificates of Insurance;
E. Builder's Risk Insurance Policy (if applicable);
F. MBE/FBE/VBE Subcontractor Supplier Certifications, Form 00665 and MBE/FBE/VBE Subcontractor/Supplier agreements (if applicable);
G. Completed substance Abuse Prevention Certification form and Contractor’s substance abuse plan (if applicable),
H. DHR PC-2 accepted by FEP Technician; and
I. Project Labor Agreement signature sheets for the Contractor and known Subcontractors.

.3 **Cancellation of Award.** All post award requirements are mandatory. Noncompliance shall be cause for CDB to cancel the notice of award and make a claim against the bid security.

.4 **Post Award Extensions.** CDB may extend the time limitations for good cause. No extension shall operate as a waiver of post award requirements, nor shall it extend the contract completion date.

.5 **Delays.** Any delays to the commencement of the work due to the Contractor’s failure to meet the post award requirements shall be the responsibility of the Contractor and its surety. Contractor and its surety shall be responsible for the costs of any such delays.

00 73 17 **BONDS, GENERAL**

.4 Discretion to Adjust Criteria

5) Sureties that do not have an A.M. Best rating may apply for acceptance to provide bonds up to 50% of their statutory allowed limit or $500,000, whichever is less, if they meet the following criteria and obtain the Director’s approval based on the information requested below.

**Criteria**

1. The company must be an Illinois Domiciled company.
2. The company must be licensed to write surety in the State of Illinois.
3. The company has been writing contract surety in Illinois for a minimum of two years.
4. The company is currently and has been a member of the Surety and Fidelity Association of American (SFAA) for the two most recent years.
5. The company must have a Risk-Based Capital ration of 250% or greater.
6. The company must be able to demonstrate the underwriting expertise for contract surety.

01 29 73.1 **SCHEDULE OF VALUES**

F. Provide CDB prequalification/registration ID numbers on the CSV form for subcontractors/suppliers described in 00 21 50.2C.

G. Identify work performed by MBE/FBE/VBE subcontractors and suppliers on the CSV form.
H. Revise and resubmit CSV for approval if any substitution or replacement of subcontractors or suppliers occurs.

I. Revise and resubmit CSV for approval if any change in the contract amount of subcontractors or suppliers other than a change resulting from a change order occurs.

01 29 76    PROGRESS PAYMENT PROCEDURES

.5 Payments to Subcontractors and Suppliers.

D. Subcontractors (as described in 00 21 50.2C.) who have not obtained a CDB ID number and/or have not submitted the required Disclosures and Certifications may have their payment amounts withheld by CDB in addition to any other remedy provided by this contract or by law. No work can be performed by these subcontractors until the Certifications and Disclosure documents have been reviewed and approved by the State Purchasing Officer.
DIVISION 1 - GENERAL REQUIREMENTS
01 31 00 - Coordination

1.1 The basic requirements for coordination are specified in Article 01 31 00 of the
Standard Documents for Construction.

1.2 The coordinating contractor shall be responsible for general coordination of assigned
contractors work. Assigned contractors shall be responsible for the coordination of
work effort of their own forces.

1.3 At all equipment where electrical power is required, the electrical contractor shall
provide conduit and wire required from the power source to the input terminals of the
equipment. When specified, the electrical contractor shall provide the electrical
disconnect to the equipment.

1.4 At all equipment where control wiring is required to interconnect various items, such
wire and conduit shall be the responsibility of the contractor providing the equipment.

1.5 All wiring, including conduit, boxes & fittings, for control systems shall be the
responsibility of the contractor providing the system.

1.6 All wiring for low voltage data and communication systems shall be the
responsibility of the contractor providing the system.

1.7 All openings in floor, wall or ceiling shall be coordinated with the coordinating
contractor. All openings shall be appropriately sealed by General contractor to
maintain fire ratings.

1.8 Operation of equipment or systems shall be the responsibility of the installing
contractor until acceptance by CDB.

END 01 31 00
1. **GENERAL**

1.1 **REQUIREMENTS INCLUDE:**

   A. General Contractor lay out the work for all contractors.

1.2 **RELATED REQUIREMENTS**

   A. Specified Elsewhere:

      1. 01 11 00 - General Requirements.

1.3 **QUALITY ASSURANCE:**

   A. Qualifications of Surveyor:

      1. Five years of experience in layout of similar or more difficult complexity.
      2. Licensed by the State of Illinois.

1.4 **SUBMITTALS**

   A. Submit resume of surveyor for documentation purposes only.

   B. CDB or the A/E may at any time require written verification of grades, lines, and levels by a licensed surveyor as work progresses.

END 01 32 23.
DIVISION 1 - GENERAL REQUIREMENTS
01 33 23 - Shop Drawings, Product Data & Samples

1. GENERAL

1.1 REQUIREMENTS INCLUDE

A. Each Contractor make submittals to Architect/Engineer and Coordinating (General) Contractor. Architect/Engineer shall maintain a master list of submittals.

1.2 Coordinating Contractor:

A. Review Assigned Contractors' submittals within 5 business days.
   1. Verify field dimensions.
   2. Verify compliance with Contract requirements.

B. Certify review.

C. Transmit reviewed submittals to Architect/Engineer.

1.3 RELATED REQUIREMENTS

A. Specified elsewhere:
   1. 01 51 00 - Temporary Utilities.
   2. 01 73 29 - Cutting & Patching
   3. 01 74 13 - Construction Cleaning
   4. 01 74 23 - Final Cleaning.

1.1 DEFINITIONS

A. Shop drawings: Shop drawings are original drawings prepared by Contractor, subcontractor, sub-subcontractor, supplier or distributor, which illustrate some portion of the work, showing fabrication, layout, setting or erection details.
   1. Prepared by qualified detailer.
   2. Identify details by reference to sheet and detail numbers shown on contract drawings.
   3. Maximum sheet size: 36" x 48".
   4. Submit five (5) copies.

B. Shop drawings consisting of a reproduction of the Architect/Engineer’s Bid Documents will not be acceptable when submitted to represent the “Shop Drawings”.

C. Product data:
   1. Manufacturer's standard schematic drawings, edited to fit this project.
   2. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data.
a. Clearly mark each copy to identify pertinent materials, products or models.
b. Show dimensions and clearances.
c. Show wiring diagrams and controls.

D. Samples: Physical samples to illustrate materials, equipment or workmanship. Approved samples establish standards by which complete work is judged. Maintain at site as directed. Protect until no longer needed.

1. Office samples: Of sufficient size to clearly illustrate:
   a. Functional characteristics of product or material.
   b. Full range of color samples.
   c. After review, samples may be used on construction of project.

2. Field samples and mock-ups:
   a. Erect at project site at location approved by Architect/Engineer.
   b. Construct each sample or mock-up complete, including work of all crafts required in finished work.
   c. Remove as directed.

1.2 SCHEDULE SUBMITTAL

A. Submit schedule of all exhibits to Architect/Engineer within ten (10) business days after preconstruction meeting.

1. Prepare schedule in bar chart format. Include:
   a. Exhibit identification.
   b. Specification section and page number.
   c. Date of submittal to Architect/Engineer and General Contractor.
   d. Latest date for final approval.
   e. Fabrication time.
   f. Date of installation.

2. Architect/Engineer will review and comment on exhibit schedule and will advise the contractor as to which submittals require longer review durations.

Submit number of copies of shop drawings, product data and samples which contractor requires for distribution plus five (5) copies which will be retained by Architect/Engineer.

B. Accompany submittals with transmittal letter, in duplicate, containing:

1. Date.
2. Project title and number.
3. Contractor's name and address.
4. The number of shop drawings, product data and samples submitted.
5. Notification of deviations from Contract.
6. Other pertinent data.
C. Submittals shall include:

1. Date and revision dates.
2. Project title and number.
3. Names of:
   a. Architect/Engineer.
   b. Subcontractor.
   c. Sub-subcontractor.
   d. Supplier.
   e. Manufacturer.
   f. Separate detailer when pertinent.
4. Identification of product or material.
5. Relation to adjacent structure or material.
6. Field dimensions, clearly identified as such.
7. Specification section and page number.
8. Specified standards, such as ASTM number or ANSI.
9. A blank space, 5” x 5”, for Architect/Engineer's stamp.
10. Identification of previously approved deviation(s) from contract documents.
11. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of field measurements and compliance with Contract.
12. Space for Contractor's approval stamp.

1.3 RESUBMISSION REQUIREMENTS

A. Resubmit all shop drawings, product data, and samples as requested by the contractor and/or A/E.

1.4 RESPONSIBILITIES

A. Review shop drawings, product data and samples prior to submission to the next level of authority.

B. Verify:

1. Field dimensions.
2. Field construction criteria.
3. Catalog numbers and similar data.

C. Coordinate each submittal with requirements of:

1. The work.
2. The contract documents.
3. The work of other contractors.

D. Contractor's responsibility for errors, omissions or deviation from contract documents in submittals is not relieved by Architect/Engineer's review of submittals.

E. Prior to submission, notify Architect/Engineer and CDB in writing of all proposed deviations in submittals from contract requirements. Substitution of materials or equipment may only be approved by change order.
F. Do not begin any work which requires submittals without Architect/Engineer's approval.

G. After Architect/Engineer's review, make response required by A/E's stamp and distribute copies. Indicate by transmittal that copy of approved data has been delivered to installer.

H. When the other contracts are assigned to the Coordinating Contractor:

   1. Assigned contractors send their submittals to Coordinating Contractor.
   2. Coordinating Contractor reviews and initials assigned contractors' submittals for compliance with scope, coordination and integration with the work of all other contractors.
   3. Coordinating Contractor transmits his reviewed copies of assigned contractors' submittals to Architect/Engineer.
   4. Coordinating Contractor retains copy of submittals after review by Architect/Engineer and distributes copies to submitting contractor and to other contractors for coordination and integration.
   5. Coordinating Contractor: Enforce resubmission requirements.

1.5 ARCHITECT/ENGINEER'S DUTIES

A. Review submittals within 14 calendar days.

   1. Review for:

      a. Design concept of project.
      b. Compliance with contract documents.

   2. Review all requests for proposed deviations. Obtain CDB's concurrence and respond to Contractor's request.

   3. Affix stamp, date and initials or signature certifying to review of submittal, and with instructions for contractor response.

   4. Return submittals to sender for response or distribution.

B. Schedule 01 33 23:

   1. Provide a summary schedule of submittals in spec section order required of each contractor. Completely specify all submittals in each technical Project Manual section.

END 01 33 23
1. **GENERAL**

1.1 **REQUIREMENTS INCLUDE**

A. Each Contractor:

1. Coordinate work of employees and subcontractors.
2. Schedule elements of remodeling and renovation work to expedite completion.
3. Schedule noisy or hazardous work to avoid problems with Using Agency's operations.
4. In addition to demolition, cut, move or remove existing construction to provide access or to allow remodeling and new work to proceed. Include:
   a. Repair or remove hazardous or unsanitary conditions.
   b. Remove abandoned piping, conduit and wiring.
   c. Remove unsuitable or extraneous materials not marked for salvage, such as abandoned furnishings and equipment, and debris such as rotted wood, rusted metals and deteriorated concrete.
   d. Clean surfaces. Remove surface finishes to install new work and finishes.
5. Patch, repair and refinish existing items to remain, to the specified condition for each material, with a neat transition to adjacent new construction.
6. Note or record existing project conditions before beginning work to minimize later disputes.

1.2 **RELATED REQUIREMENTS**

A. Specified elsewhere:

1. 01 51 00 - Temporary Utilities.
2. 01 73 29 - Cutting & Patching
3. 01 74 13 - Construction Cleaning
4. 01 74 23 - Final Cleaning.

1.3 **SEQUENCE AND SCHEDULES**

A. Submit separate detailed subschedule for alterations work, coordinated with Construction Schedule. Show:

1. Each stage of work; occupancy dates of areas.
2. Date of Substantial Completion for each area of alteration work.
3. Crafts and subcontractors employed in each stage.
1.4 ALTERATIONS, CUTTING AND PROTECTION

A. Cut finish surfaces such as masonry, tile, plaster or metals, by methods to terminate surfaces in a straight line at a natural point of division.

B. Protect existing and new work from weather and temperature extremes.

1. Provide weather protection, waterproofing, heat and humidity control to prevent damage to remaining existing work and to new work.

C. Provide temporary enclosures to separate work areas from existing building and from areas occupied by Using Agency, and to provide weather protection.

2. PRODUCTS

2.1 SALVAGED MATERIALS

A. Salvage sufficient quantities of cut or removed materials to replace damaged work, when material is not readily obtainable on current market.

1. Use particular care in removal and salvage of:
   a. Air Handling Units.
   b. Rooftop Equipment.

2. Store salvaged items in a dry, secure place on site. Reinstall salvaged items on the same day they are removed.


4. Do not use salvaged or used material in new construction except with prior written authorization from Architect/Engineer.

2.2 MATERIALS FOR PATCHING, EXTENDING AND MATCHING

A. Ensure that work is complete:

1. Provide same materials or types of construction as that in existing structure, to patch, extend or match existing work.

3. EXECUTION

3.1 PERFORMANCE. Patch and extend existing work using skilled craftsmen capable of matching existing quality of workmanship. For patched or extended work, provide quality equal to that specified for new work.

3.2 ADJUSTMENTS

A. Where partitions are removed, patch floors, walls and ceilings with finish materials to match existing as closely as possible.

1. Where removal of partitions results in adjacent spaces becoming one, rework floors and ceilings to provide smooth planes without breaks, steps or bulkheads.
2. Where extreme change of plane of two inches or more occurs, request instructions from Architect/Engineer.

3.3 DAMAGED SURFACES

A. Patch and replace all portions of existing finished surfaces found to be damaged, lifted, discolored or showing other imperfections, with matching material.

   1. Provide adequate support prior to patching the finish.
   2. Refinish patched portions of painted or coated surfaces in a manner to produce uniform color and texture over entire surface.
   3. When existing surface cannot be matched, refinish entire surface to match nearest adjacent material finish.

3.4 TRANSITION FROM EXISTING TO NEW WORK

A. When new work abuts or finishes flush with existing work, make a smooth transition. Patched work shall match existing adjacent work in texture and appearance as closely as possible.

   1. When finished surfaces are cut in such a way that a smooth transition with new work is not possible, terminate existing surface in a neat manner along a straight line at a natural line of division, and provide trim appropriate to finished surface.

3.5 CLEANING

A. Perform construction cleaning as specified in 01 74 13.

   1. Clean User-occupied areas daily.
   2. Clean all spillage, overspray or heavy dust collections in User occupied areas immediately.

B. At completion of work of each craft, clean area and make surfaces ready for work of successive crafts.

C. At completion of alterations work in each area, provide final cleaning in accord with 01 74 23 and return space to a condition suitable for use of User.

END 01 35 16.
DIVISION 1 - GENERAL REQUIREMENTS
01 35 53 - Security

1. GENERAL

1.1 REQUIREMENTS INCLUDE General Contractor:

A. Comply with site security program specified in Article 01 35 53 of the Standard Documents for Construction.

B. Comply with the supplemental security program specified in this section specific to security protocol required by Illinois Math and Science Academy (IMSA).

1.1 PERSONNEL IDENTIFICATION:

A. Provide identification to each person authorized to enter project premises, showing:

1. Personal photograph.
2. Name of individual and assigned number.
3. Employer's name.
4. Maintain a current list of accredited persons; submit copy of list to CDB and IMSA, the Using Agency.
5. Require that identification be displayed by all persons entering, leaving or on premises.

B. Exclude improperly identified persons from site.

1.2 ENTRANCE CONTROL:

A. Provide control of all persons and vehicles entering and leaving project site.

1. Require display of proper identification by each person.
2. Allow no visitors except with issuance of temporary identification.
3. Maintain log of all visitors.

B. Using Agency will control deliveries and vehicles related to its own operations.

1.1 MISCELLANEOUS RESTRICTIONS:

A. Do not take photographs of any kind except with prior written authorization from CDB and ISMA.

END 01 35 53.
1. GENERAL

1.1 REQUIREMENTS INCLUDE

A. Each Contractor comply with all laws, rules and regulations governing the work.

1. When Contractor observes that contract documents are at variance with specified codes, notify Architect/Engineer in writing immediately. Architect/Engineer will process changes in accord with General Conditions.
2. When Contractor performs any work knowing or having reason to know that the work is contrary to such laws, rules and regulations and fails to so notify the Architect/Engineer, Contractor shall pay all costs arising therefrom. However, it will not be the Contractor's primary responsibility to make certain that the contract documents are in accord with such laws, rules and regulations.

1.2 DEFINITIONS & ABBREVIATIONS

A. Definitions:

1. Dates: Reference Codes, Regulations and Standards are the issue current at date of bidding documents unless otherwise specified.
2. Codes: Codes are rules, regulations or statutory requirements of government agencies.
3. Standards: Standards are requirements set by authorities, custom or general consent and established as accepted criteria.

B. Abbreviations: (*)

1. ADA Americans with Disabilities Act.
2. AGCI Associated General Contractors in Illinois.
6. AZO City of Aurora Zoning Ordinance.
7. CDB Capital Development Board.
9. FED Federal Agencies.
10. FM Factory Mutual Engineering Corp.
11. IBHE Illinois Board of Higher Education.
13. IDOL Illinois Department of Labor.
15. IEPA Illinois Environmental Protection Agency.
16. ISPE Illinois Society of Professional Engineers.
18. OSFM Office of State Fire Marshal.
19. SOS Secretary of State.
20. UL Underwriters Laboratories, Inc.

1.3 QUALITY ASSURANCE

A. Architect/Engineer has designed the project with full knowledge of code requirements and has copies of all specified codes available for Contractor's inspection.

B. Contractor:

1. Ensure that copies of specified codes and standards are readily available to Contractor's personnel. Copies are available at Contractor's expense from source or publisher.
2. Ensure that Contractor's personnel are familiar with workmanship and installation requirements of specified codes and standards.

1.4 REGULATORY REQUIREMENTS

A. Source and requirements: (*NOTE: Include only those appropriate to project. Include date of issuance for each item. Date should be most current at time of bid, unless local governing authority or Using Agency requires otherwise.)

1. CDB:
   a. Illinois Accessibility Code, April 1997

1. FED:
      a. ADA 1990

2. State of Illinois:
   a. Illinois Steel Products Procurement Act, as amended (30 ILCS 565/1 et seq.).
   b. Illinois Procurement Code, as amended (30 ILCS 500/1 et. seq.)

3. IDOL: Safety Glazing Materials Act, as amended, with interpretive statement (430 ILCS 60/1 et seq.).

4. IDPH:
   a. Illinois Asbestos Abatement Act (105 ILCS 105/1 et. seq.).
   c. Structural Pest Control Act and Code.

5. IDFPR: Illinois Roofing Industry Licensing Act, as amended (225 ILCS 335/1 et. seq.).
6. OSFM:

7. STANDARDS:
   a. ANSI No. C-2, National Electrical Safety Code,
   b. ASHRAE No. 62, Standard for Natural and Mechanical Ventilation (*Except IDMH and ISBE.).
   d. ASHRAE No. 15, Safety Code for Mechanical Refrigeration.

8. NFPA: National Fire Codes
   a. 70-2008, National Electrical Code
   b. 72-2008, National Fire Alarm Code

9. ADDITIONAL APPLICABLE CODES & ORDINANCES
   a. Refer to Drawing Sheet G001.

END 01 41 00.
1. GENERAL

1.1 REQUIREMENTS INCLUDE. Designated contractor provide and maintain specified temporary utilities during construction period.

A. General/Coordinating Contractor Provide:
   1. Utilities for CDB and/or A/E field offices, except those specifically identified as the responsibility of other Contractors.
   2. Temporary heat.
   3. Toilets.
   4. Telephone Service and Telephones.
   5. Payment of all utility, telephone, and fuel bills, except charges specifically identified as the responsibility of other Contractors.
   6. Temporary Ventilation.

B. Plumbing Contractor Provide:
   1. Temporary water service, including initial hookup or connection charges.
   2. Water for CDB/A/E office (trailer).

C. Electrical Contractor Provide:
   1. Temporary power, including service hookup and connection charges.
   2. Temporary lighting.
   3. Electrical power to CDB/A/E office (trailer).

D. Each Contractor:
   1. All utilities required in excess of those specified, or exceed capacity of existing or permanent system(s).
   2. Hoses and fittings from temporary standpipes or water service connection.
   3. Drinking water for own forces.
   4. All utilities to own field office.

1.2 RELATED REQUIREMENTS

A. Specified elsewhere:
   1. 01 11 00 - Project Summary.

B. Furnished by others:
   1. Using Agency will authorize use of existing facilities or services for temporary use.
      a. Electrical power service.
      b. Telephone for toll-free calls only. (Toll calls paid for by caller, credit card only.)
c. Water service.

2. Using Agency will pay all costs of consumables (except toll calls) used for construction purposes for utilities it furnishes.

3. Contractor requiring Using Agency furnished services will provide and pay for extension or modification of services to perform the work, and for restoration of services at completion of work.

1.3 DEFINITIONS

A. Temporary Heat: Provision, operation and maintenance of approved portable heating devices, including costs of fuel, from start of construction until the permanent enclosure has been certified by the A/E as substantially complete and the permanent heating system, including permanent metered fuel line (except electric) is, in the A/E’s and installing contractor’s opinion, sufficiently complete to allow safe operation, and CDB gives written authorization for its use.

B. Temporary Ventilation: Provision, operation and maintenance of approved portable fans, louvers, ductwork, dampers necessary from start of construction until the permanent enclosure has been certified as substantially complete, and the permanent ventilating system is in the A/E’s and installing contractor’s opinion, sufficiently complete to allow safe operation, and CDB gives written authorization for its use.

C. Temporary Enclosure: Sufficient enclosure of an area, structure or building to prevent entrance or infiltration of rainwater, wind or other natural elements, and which will prevent undue heat loss from within enclosed areas.

D. Permanent Enclosure: Stage of construction at which all moisture and weather protection elements of construction have been installed in accord with the contract for the building or part thereof. The A/E may certify in writing that the building or defined portion thereof is substantially permanently enclosed when walls, windows, and roof are complete and openings left for construction access are adequately closed with movable material having an “R” value equivalent to the finished opening.

1.4 DESCRIPTION OF TEMPORARY UTILITY SYSTEMS

A. Temporary Heating System:

1. Provide specified temporary heating in enclosed areas throughout construction period in order to:
   a. Facilitate progress of work by all contractors.
   b. Protect work and products against dampness and cold.
   c. Prevent moisture condensation on surfaces.
   d. Provide specified ambient temperatures for installation and curing of finish materials.

2. Heat field offices for CDB's representative and A/E.

3. Minimum heating temperatures:
a. Minimum temperatures shall be at least that specified in specific specification sections.
b. Unless otherwise specified, areas in temporary enclosures shall be maintained at temperatures of at least 45 degrees F (7.22 degrees C), 24 hours per day, seven days per week.
c. Unless otherwise specified, areas in permanent enclosures or during placement of interior finishes (woodwork, flooring, painting, drywall, etc) shall be maintained at temperatures of at least 65 degrees F (18.3 degrees C), 24 hours per day, seven days per week.

B. Temporary Ventilating System:

1. Provide specified temporary ventilation in enclosed areas throughout construction period to:

   a. Facilitate progress of work.
   b. Protect work and products against dampness and heat.
   c. Prevent moisture condensation on surfaces.
   d. Provide suitable ventilation for installation and curing of finish materials.
   e. Provide adequate ventilating to meet health regulations for safe working environment.
   f. Prevent hazardous accumulations of dusts, fumes, mists, vapors or gases in areas occupied during construction.

2. Duration of ventilating operations:

   a. At all times personnel occupy an area, when subject to hazardous accumulations of harmful elements.
   b. Continue operation of ventilating system after cessation of work to assure removal of harmful elements.

C. Temporary Electrical system:

1. Provide and maintain specified temporary primary electric power system throughout construction period.

   a. Provide main distribution panel, complete with meter:

      1.) Capacity of:

         a.) 120/208 volts, 200 amperes, 3-phase, 60 hertz.

      2.) Circuit protected feeders for:

         a.) Field office of CDB, Architect/Engineer.
         b.) Operation and testing of heating system (except electric heating).
         c.) Operation and testing of ventilation system (except electric chillers).
         d.) Pumping, dewatering.
         e.) Power centers.
f.) Temporary lighting.

3.) All other connections are to be made at secondary power centers.

2. Provide secondary power centers for miscellaneous hand tools and equipment used in construction work.
   a. Indoor:
      1.) Provide distribution box with grounded outlets.
      2.) Provide circuit protection for each circuit.
      3.) Provide ground-fault protection for each circuit.
   b. Outdoor:
      1.) Provide weatherproof distribution box with grounded outlets.
      2.) Provide circuit protection for each circuit.
      3.) Provide ground-fault protection for each circuit.
   c. Each contractor and each subcontractor using the power centers shall provide their own grounded, UL listed extension cords and other accessories from the power centers to the point of operation.

3. Contractors who require primary power, secondary power centers or service connections in excess of that specified may, at their option:
   a. Make arrangements with Electrical Contractor for excess service and pay all associated costs, including consumables, or
   b. Make arrangements with Power Company for separate service and pay all costs thereof, including consumables.

4. Power source:
   b. Prior to availability of utility company service, provide specified power by means of portable power plants.

D. Temporary Lighting:

1. Electrical Contractor provide temporary lighting for:
   a. Construction needs (minimum 5 footcandles).
   b. Safety lighting (minimum 5 footcandles).
   c. Security lighting (minimum 2 footcandles).
   d. Temporary lighting for Using Agency to match existing footcandle levels.

2. Security lighting: (*)
   a. Within the buildings, illuminate all stairways, corridors and entrances on a 24 hour per day basis.
   b. Outside the building(s) provide:
1.) An illuminated route from site entrance to project area for security guard or emergency access.
2.) Site lighting controlled by photoelectric cell.
3.) Illumination of all main electrical switching equipment, other equipment for which emergency access is specified.

3. Safety lighting:
   a. Provide 5 footcandles minimum over barriers and other obstacles which are not apparent as safety hazards.

4. Basic requirements, all lighting:
   a. Lamps:
      1.) Covered with safety guard or deeply recessed in reflector.
      2.) Not suspended by their electric cords unless cord and fixture designed for that purpose.

5. Contractors or subcontractors who require lighting in excess of that specified: Make arrangements with Electrical Contractor and pay all costs thereof.

E. Temporary Telephone service:
   1. Provide telephone service for construction needs throughout construction period.
      a. Minimum two (2) direct line instruments in General Contractor's field office.
   2. Other contractors and subcontractors may provide at their own expense separate additional telephone service that they may require.
   3. Telephone company: AT&T

F. Temporary Water service:
   1. Provide and maintain temporary water service throughout construction period.
      a. For construction purposes:
         1.) Provide service standpipe.
         2.) Provide a ¾- inch water service connection on each roof level.
         3.) Minimum discharge at water service connection not required for fire protection: 20 psi.
         4.) Provide backflow protection.
         5.) Each contractor and subcontractor shall provide their own water hoses from hose bibbs to point of his operations.
   2. For other purposes:
      a. Temporary fire protection.
      b. Cleaning.
c. Nonpotable water:

1.) Use only where permitted (fire protection, dust control).
2.) Identify outlets for nonpotable water with signs to indicate clearly that water is unsafe. Do not use for drinking, washing or cooking purposes.

3. Water Source:

a. Supplier: City of Aurora.

G. Temporary Toilets:

1. Plumbing Contractor provide temporary toilet facilities for use of all workmen and authorized parties throughout construction period.

2. Plumbing Contractor provide a minimum number of enclosed combination toilet and urinal units for construction personnel:

   a. One for every 20 employees, or fraction thereof.

3. Temporary toilets shall be an approved commercial, self-contained, chemical type with integral enclosure constructed on skids.

4. Units shall be properly vented, constructed as to prevent entrance of flies, and positioned as to provide screening from adjacent public areas.

5. Plumbing Contractor shall be responsible for keeping the facility supplied and maintained including cleaning and sanitizing daily and pumping at intervals not exceeding one week.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. Only on CDB's prior written authorization, obtain:

1. Permits and inspections required by City of Aurora.

1.6 USE OF PERMANENT SYSTEMS FOR CONSTRUCTION PURPOSES

A. Obtain CDB's prior written authorization for system to be used. Request for authorization shall indicate:

1. Reason for use.
2. Conditions of use.
3. Parts of system to be used.
4. Modifications necessary.
5. Isolation of elements not authorized for use.
6. Approval of installing contractor; (and equipment manufacturer where extended warranties are involved.)

B. Modifications necessary shall be at contractor's expense, since use of permanent systems is for contractor's benefit.
C. Upon completion of need to use permanent system, or when directed by A/E restore permanent system to specified condition prior to substantial completion.

1. Provide all new filters in heating and ventilating systems.
2. Replace all burned out or defective lamps.
3. Repair or restore all damaged parts or components.
4. Clean all ducts and coils.
5. Rebalance the heating/ventilating systems as required by A/E.

D. CDB's authorization for use of permanent systems will not relieve Contractors' responsibility for warranties in accordance with the General Conditions.

E. NOTE: The above does not prohibit installing contractor from normal test and check out of system.

1.7 USE OF USING AGENCY'S EXISTING SYSTEMS

A. Make written arrangements with Using Agency's representative.

B. General Contractor: modify, supplement and extend system to meet temporary utility requirements for project, subject to approval of Architect/Engineer and Using Agency.

C. Limitations:

1. Do not overload systems. When project requirements exceed system capacity, provide separate system to meet needs.
2. Prevent interference with Using Agency's normal use of system.

D. Maintain strict supervision of use of temporary facilities.

1. Enforce conformance with Using Agency's regulations.
2. Use only designated facilities, systems or portions thereof.

E. Upon completion of need to use existing systems, or when directed by Architect/Engineer, restore existing systems to specified permanent condition.

2. PRODUCTS

2.1 MATERIALS. May be new or used, but shall be adequate for purposes used, shall not create unsafe or unsanitary conditions, nor violate applicable codes.

3. EXECUTION

3.1 INSTALLATION

A. Heating and Ventilating: Locate units to meet project progress, and as approved by Architect/Engineer. Avoid interference with:

1. Work or traffic areas.
2. Materials handling or storage areas.
3. Stairwells, access ramps and ladders.
B. Electrical:
   1. Do not run branch circuits on floor or on ground.
   2. Verify proper operation of all safety devices.

C. Water service:
   1. Do not run piping on floor or on ground.
   2. Provide drip pan under each water service connection located within building.
   3. Provide insulation, or other means, to prevent pipes from freezing.
   4. When necessary to maintain pressure, provide temporary pumps, tanks and compressors.

D. Toilets:
   1. Service regularly.

3.2 REMOVAL
   A. Upon CDB's prior written authorization, completely remove temporary materials and equipment.
   B. Repair all damage caused by temporary utilities' installation. Restore to original conditions.

3.3 MAINTENANCE
   A. Maintenance of permanent system when used for construction purposes:
      1. Permanent systems shall be maintained by installing contractor so as to prevent any damage thereto.

END 01 51 00.
1. GENERAL

1.1 The project will be constructed at an occupied facility. These requirements supplement the Standard Documents for Construction and other sections of the Project Manual.

1.2 The Using Agency (IMSA) will occupy all area(s) for uninterrupted academic purposes (24 hours per day, 7 days per week).

1.3 REQUIREMENTS INCLUDE General Contractor provide:
   A. Scheduling
   B. Security and site regulations
   C. Entrances
   D. Construction aids
   E. Temporary enclosures and barriers
   F. Fences
   G. Temporary utilities
   H. Access roads & parking areas
   I. Traffic regulation
   J. Construction Cleaning
   K. Field Offices
   L. Storage
   M. Close-out

1.4 RELATED REQUIREMENTS
   A. Specified elsewhere:
      1. Section 01 35 16 – Remodeling Project Procedures
      2. Section 01 51 00 – Temporary Utilities
      3. Section 01 74 13 – Construction Cleaning
      4. Section 01 74 23 – Final Cleaning

2. EXECUTION

2.1 SCHEDULING
   A. Schedule the work to allow the User Agency to continue all academic programs. Submit separate detailed subschedule showing:
      1. Each stage of work; occupancy dates of areas.
      2. Date of Substantial Completion for each area of work.

   B. Schedule early completion of designated area(s) for Using Agency's usage prior to substantial completion of entire project: (*List areas designated, all mandatory dates.)
C. Schedule noisy or hazardous work to avoid problems with Using Agency's operations.

2.2 SECURITY AND SITE REGULATIONS

A. Confer with the Using Agency's representative and obtain full knowledge of all site rules and regulations affecting work.

B. Provide control of all persons and vehicles entering and leaving project site. Reasonable proof of identification and signature to the visitor's log shall be required of the visitors by the contractor's site superintendent.

C. Do not take photographs of any kind except with prior written authorization from CDB and Using Agency.

2.3 ENTRANCES

A. Primary facility access shall be from Buildings & Grounds / Maintenance Entrance.

2.4 CONSTRUCTION AIDS

Except as noted, General Contractor provide and maintain construction aids and equipment for common use and to facilitate execution of the work.

A. Do not use stairs in existing building.

B. Do not use elevators in existing building.

2.1 TEMPORARY ENCLOSURES AND BARRIERS

General Contractor:

A. Provide temporary enclosures to separate work areas from existing building and from areas occupied by Using Agency.

B. Provide and maintain suitable barriers to prevent unauthorized entry, and to protect the work.

2.2 TEMPORARY UTILITIES

A. Using Agency will authorize use of existing facilities or services:

1. Electrical power service.
2. Telephone for toll-free calls only. (Toll calls paid for by caller, credit card only.)
3. Water service.

B. Make written arrangements with Using Agency's representative.

C. Prevent interference with Using Agency's normal use of system.

D. Modify, supplement and extend systems to meet temporary utility requirements for project, subject to approval of Architect/Engineer and Using Agency. Modifications shall be at General Contractor's expense.
E. Using Agency will pay all costs of consumables (except toll calls) used for construction purposes for utilities it furnishes.

F. General Contractor requiring facilities or services beyond those available from the User shall provide and pay for extension or modification of services to perform the work, and for restoration of services at completion of work.

2.3 ACCESS ROADS & PARKING AREAS

A. Existing on-site streets and driveways may be used for construction traffic. Maintain existing condition.

B. Designated areas of existing parking facilities may be used for parking of construction personnel's private vehicles and of contractor's lightweight (not exceeding a B plate) vehicles.

C. Maintain roads, walks and parking areas in a sound, clean condition. Restore to original condition upon work completion prior to Final Acceptance.

D. Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, Using Agency's operations or construction operations.

2.4 TRAFFIC REGULATION General Contractor provide traffic control and directional signs, mounted on barricades or standard posts:

A. At each change of direction of a roadway and at parking areas.

2.5 CONSTRUCTION CLEANING

A. Coordinating/General Contractor provide cleaning and disposal of waste materials, debris and rubbish during construction.

B. Coordinating/General Contractor supervise and coordinate cleaning operations of all Assigned Contractors.

C. Clean User occupied areas daily.

2.6 FIELD OFFICES

A. Provide space for project meetings and furnishings, including Portable folding conference table and chairs for at least ten (10) persons.

2.7 STORAGE

A. Make arrangements with Using Agency's Representative for any on-site storage of materials and equipment to be installed in project. Protection and security for stored materials and equipment is solely contractor's responsibility.

2.8 CLOSEOUT

A. Upon completion of need to use existing user-provided facilities, or when directed by Architect/Engineer, restore each to original or specified condition.
B. At completion of work in each area, provide final cleaning and return space to a condition suitable for use of User.

END 01 51 50
1. GENERAL

1.1 Base Bid. Work Includes:

A. General Contractor must provide and maintain suitable barriers to prevent injury and damage to personnel or public entry, to prevent dust migration and to protect their work, existing utilities and facilities from construction operations.

B. General Contractor must remove barriers when no longer needed, at completion of the work or as directed.

1.2 RELATED REQUIREMENTS

A. Specified elsewhere:

1. Section 01 11 00 – Project Summary
2. Section 01 31 00 – Coordination
3. Section 01 51 50 – Use of Existing Facilities
4. Section 01 74 13 – Construction Cleaning
5. Section 01 74 23 – Final Cleaning

2. PRODUCTS

2.1 MATERIALS

A. Material may be new or used, but must be suitable for intended purpose. Comply with all code and regulatory requirements.

3. EXECUTION

3.1 INSTALLATION

A. Install barriers in a neat and uniform appearance, structurally adequate for purposes.

B. Maintain barriers during entire construction period.

C. Relocate barriers as required by construction progress.

3.2 REMOVAL

A. General Contractor must completely remove barriers when construction has progressed to the point they are no longer needed, and when removal has been approved by Architect/Engineer.
B. General Contractor must clean any repair damage caused by installation of barriers. Clean the area after completion of repair activities.

End 01 56 00
1. GENERAL

1.1 REQUIREMENTS INCLUDE

A. Base bid. General Contractor: Supervise and coordinate cleaning operations of all assigned Contractors.

1.2 RELATED REQUIREMENTS

A. Specified elsewhere:

1. 01 35 16 - Remodeling Project Procedures
2. 01 74 23 – Final Cleaning
3. Individual Specification Sections: specific cleaning for product or work.

2. PRODUCTS

2.1 MATERIALS

A. Use commercial grade cleaning products and equipment.

3. EXECUTION

3.1 CLEANING

A. Perform construction cleaning.

1. Clean User-occupied areas daily.
2. Clean all spillage, over-spray and heavy dust collections in User occupied areas immediately.

B. At completion of work of each trade, clean area and make surfaces ready for work of successive trades.

C. At completion of work in each area, provide final cleaning in accordance with Section 01 74 23 and return space to a condition suitable for use of User.

D. IMSA reserves the right to hire a professional cleaning company and back charge the General Contractor if cleaning is not adequate or acceptable as per the sole judgement of the Architect/Engineer.

END 01 74 13.
1. GENERAL

1.1 REQUIREMENTS INCLUDE

   A. Each Contractor: Provide final cleaning:

      1. At completion of work, or at such other times as directed by the Coordinating Contractor, remove all waste, debris, rubbish, tools, equipment, machinery and surplus materials. Clean all sight exposed surfaces; leave work clean and ready for occupancy.

   B. Coordinating Contractor:

      1. Supervise and coordinate the cleaning operations of all Assigned Contractors.
      2. At project completion, leave project clean, ready for occupancy.
         a. Cleaning to be performed by a professional cleaning company.

1.2 RELATED REQUIREMENTS

   A. Specified elsewhere:

      1. Section 01 74 13 – Construction Cleaning.

2. PRODUCTS – NOT USED

3. EXECUTION

3.1 FINAL CLEANING

   A. Coordinating Contractor employ experienced workmen or professional cleaners for final cleaning.

   B. Coordinating Contractor remove grease, dust, dirt, stains, labels, fingerprints, protection and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces so designated to specified finish.

      1. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces to ensure performance.

   C. Coordinating Contractor repair, patch and touch up marred surfaces to specified finish, to match adjacent surfaces.

   D. Coordinating Contractor soft broom clean all exposed concrete surfaces clean; other paved areas with soft or stiff broom as directed. Rake clean other surfaces on grounds.

   E. Coordinating Contractor sweep and mop clean all resilient and ceramic flooring.
F. Coordinating Contractor vacuum clean all carpet and shampoo if necessary.

G. Coordinating Contractor clean all furniture and furnishings affected by the Work, per the sole judgment of the Architect/Engineer.

H. Coordinating Contractor clean all walls, windows and doors affected by the Work, per the sole judgment of the Architect/Engineer.

I. Ventilation Contractor shall replace all air handling filters at all air handling units at least twice during construction, and shall replace all air handling filters at all air handling units after commissioning, testing and balancing efforts are completed.

J. Coordinating Contractor maintain finally cleaned areas until project, or designated portion thereof, is accepted by CDB.

END 01 74 23.
1. GENERAL

1.1 REQUIREMENTS INCLUDE

   A. Each Contractor provide three (3) sets of Operating and Maintenance Data
      (include CD Rom for ventilation systems) in accordance with Article 01 78 23

1.2 RELATED REQUIREMENTS

   A. Specified elsewhere:
      1. Section 01 33 23 - Shop Drawings, Product Data & Samples Schedule
      2. Section 01 78 36 – Extended Warranties & Bonds Schedule

2. REQUIRED SUBMITTALS

2.1 General Contractor

   A. Section 07 62 00 – Sheet Metal Flashing and Trim
      1. Manufacturer's instructions for maintenance, and service and care.

   B. Section 07 71 00 – Roof Specialties
      1. Manufacturer's instructions for maintenance, and service and care.

   C. Section 07 72 00 – Roof Accessories
      1. Manufacturer's instructions for maintenance, and service and care.

   D. Section 08 41 13 – Aluminum Storefronts
      1. Manufacturer's instructions for maintenance, and service and care.

2.2 Ventilation Contractor

   A. Section 23 41 00 – Particulate Air Filtration
      1. Manufacturer's instructions for maintenance, and service and care for each
         type of filter and rack.

   B. Section 23 74 33 – Dedicated Outdoor-Air Units
      1. Manufacturer's instructions for maintenance, and service and care of units.
2.3 Electrical Contractor

A. Section 26 27 26 – Wiring Devices

1. Manufacturer's instructions for maintenance, and service and care, to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

B. Section 26 28 16 – Enclosed Switches & Circuit Breakers

1. Manufacturer's instructions for maintenance, and service and care, for enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
2. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
3. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device.

C. Section 26 51 00 – Interior Lighting

1. Manufacturer's instructions for maintenance, and service and care for lighting equipment and fixtures to include in emergency, operation and maintenance manuals.

END 01 78 23.
1. GENERAL

1.1 REQUIREMENTS INCLUDE

A. Each Contractor shall warrant their work in accordance with the Standard Documents for Construction. In addition, the following extended Warranties and Bonds shall be provided as specified.

2. EXTENDED WARRANTIES AND BONDS

2.1 General Contractor

A. Section 07 13 26 – Self-Adhering Sheet Waterproofing
   1. Manufacturer: Five (5) years on material.

B. Section 07 31 05 – Fiberglass 3-Tab Shingles
   1. General Contractor: Two (2) years on materials and workmanship.
   2. Manufacturer: Thirty (30) years standard pro-rated on material.

C. Section 07 41 13 – Preformed Metal Roof Panels
   1. General Contractor: Two (2) years on materials and workmanship.
   2. Manufacturer: Twenty (20) years non pro-rated for weathertightness.
   3. Manufacturer: Twenty (20) years finish paint integrity and color retention.

D. Section 07 54 23 – TPO Membrane Roofing
   1. General Contractor: Two (2) years on materials and workmanship.
   2. Manufacturer: Twenty (20) years for weathertightness.

E. Section 07 62 00 – Sheet Metal Flashing and Trim
   1. Manufacturer: Twenty (20) years for finish.

F. Section 07 71 00 – Roof Specialties
   1. Manufacturer: Twenty (20) years for finish.

G. Section 07 71 29 – Manufactured Roof Expansion Joints
1. Manufacturer and General Contractor: Two (2) years on materials and workmanship.

2. Manufacturer: Twenty (20) years for finish.

H. Section 07 72 00 – Roof Accessories

1. Manufacturer: Twenty (20) years for finish.

I. Section 07 92 00 – Joint Sealants

1. General Contractor: Two (2) years on materials and workmanship.

2. Manufacturer: Five (5) years for performance and other specified requirements.

J. Section 08 41 13 – Aluminum Storefronts

1. Manufacturer: Two (2) years or manufacturer’s standard (whichever is longer) on materials and workmanship.

2. Manufacturer: Twenty (20) years or manufacturer’s standard (whichever is longer) for finish.

K. Section 08 80 00 – Glazing

1. Manufacturer: Ten (10) years or manufacturer’s standard (whichever is longer) on materials (coated glass).

2. Manufacturer: Ten (10) years or manufacturer’s standard (whichever is longer) on materials (insulating glass).

2.2 Ventilation Contractor

A. Section 23 74 33 – Dedicated Outdoor-Air Units

1. Manufacturer: Five (5) years on heat exchangers.

2.3 Electrical Contractor

A. Section 26 51 00 – Interior Lighting

1. Manufacturer: Five (5) years on ballasts.

2. Manufacturer: Two (2) years on T5 and T8 lamps.
DIVISION 1 - GENERAL REQUIREMENTS
01 78 39 - Project Record Documents

1. GENERAL

1.1 REQUIREMENTS INCLUDE

A. Each Contractor:

1. At project site, maintain one record copy of:
   a. Contract drawings, including separate volume(s) of details.
   c. Interpretations and supplemental instructions.
   d. Addenda.
   e. Reviewed, approved shop drawings and product data.
   f. Other modifications to contract.
   g. Field test records.
   h. All schedules.
   i. Correspondence file.

2. Store documents in temporary field office, apart from documents used for
   field construction.
5. Maintain documents in clean, dry, legible condition.
6. Do not use record documents for field construction purposes.
7. Make documents available at all times for inspection by Architect/Engineer
   and CDB.

1.2 RELATED REQUIREMENTS

A. Specified elsewhere:

   1. 01 33 23 - Shop Drawings, Product Data & Samples.
   2. 01 78 23 - Operating & Maintenance Data.
   3. 01 78 36 - Warranties & Bonds.

1.3 RECORDING

A. Label each document "PROJECT RECORD DOCUMENTS" in 2" high printed
   letters.

B. Keep record documents current.

C. Do not permanently conceal any work until specified information has been
   recorded.

D. Contract drawings: Legibly mark to record actual construction:

   1. Depths of various elements in relation to top of existing structural roof deck
      and other existing static elements.
   2. Horizontal and vertical location of utilities and appurtenances referenced to
      permanent surface improvements.
3. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
4. Field changes of dimension and detail.
5. Changes made by change order.
6. Details not on original contract drawings.

E. Specifications and addenda: Legibly mark up each section to record:
   1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
   2. Changes made by change order or field order.
   3. Other matters not originally specified.

F. Shop drawings: Maintain as record documents; legibly annotate drawings to record changes made after review.

G. A/E will periodically review documents to confirm they are up-to-date. Contractor payment may be withheld or reduced if record documents are not current.

1.4 SUBMITTAL

A. At completion of project, deliver record documents to A/E.

B. Accompany submittal with transmittal letter, in duplicate, containing:
   1. Date.
   2. Project title and number.
   3. Contractor's name and address.
   4. Title and number of each record document.
   5. Certification that each document submitted is complete and accurate.
   6. Signature of contractor, or his authorized representative.

END 01 78 39.
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid
   1. General Contractor
      a. This section includes the following:
         1) New roof level framing for Roof Areas 14 and 15, utilizing steel joists.
            a) K-series steel joists.
            b) KCS-type K-series steel joists.
            c) K-series steel joist substitutes.
            d) Joist accessories.

B. Related Requirements:
   1. Section 051200 "Structural Steel Framing" for field-welded shear connectors.

1.2 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:
   1. Include layout, designation, number, type, location, and spacing of joists.
   2. Include joining and anchorage details, bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
   3. Indicate locations and details of bearing plates to be embedded in other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer licensed in Illinois.

B. Welding certificates.

C. Manufacturer certificates.
D. Mill Certificates: For each type of bolt.

E. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications.

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications.

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

2. PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.

1. Use ASD; data are given at service-load level.

2. Design special joists to withstand design loads with live-load deflections no greater than the following:


B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than \[25\%\] of [50\% \[60\%\]] <Insert number> percent.

2.2 K-SERIES STEEL JOISTS


1. Joist Type: [K-series steel joists] and [KCS-type K-series steel joists].
B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Provide holes in chord members for connecting and securing other construction to joists.

D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

F. Do not camber joists.

G. Camber joists according to SJI's "Specifications."

H. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches

2.3 LONG-SPAN STEEL JOISTS

A. Provide holes in chord members for connecting and securing other construction to joists.

B. Camber long-span steel joists according to SJI's "Specifications."

C. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches

2.4 PRIMERS

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.5 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of [horizontal] [or] [diagonal] bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications. Furnish additional erection bridging if required for stability.
C. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated. Hot-dip zinc coat according to ASTM A 123/A 123M.

D. Steel bearing plates with integral anchorages are specified in Section 055000 "Metal Fabrications."

E. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated.

F. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
   1. Finish: [Plain, uncoated] [Hot-dip zinc coating, ASTM A 153/A 153M, Class C] [Mechanically deposited zinc coating, ASTM B 695, Class 50].

G. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

H. Welding Electrodes: Comply with AWS standards.


J. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.6 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories[to receive sprayed fire-resistive materials].

C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

D. Shop priming of joists and joist accessories is specified in [Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
3. EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications, joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

C. Field weld joists to supporting steel [bearing plates] [and] [framework]. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.


F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect [field welds] [and] [bolted connections] and to perform field tests and inspections and prepare test and inspection reports.
B. Visually inspect field welds according to AWS D1.1/D1.1M.
   1. In addition to visual inspection, test field welds according to AWS D1.1/D1.1M and the following procedures, as applicable:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709.

C. Visually inspect bolted connections.

D. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

E. Perform additional testing to determine compliance of corrected Work with specified requirements.

3.4 PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates and accessories.
   1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2, or power-tool cleaning according to SSPC-SP 3.
   2. Apply a compatible primer of same type as primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 21 00
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. General Contractor

   a. This section includes the following:

      1) Roof deck.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
2. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
4. Section 099123 "Interior Painting" for repair painting of primed deck and finish painting of deck.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.
D. Evaluation Reports: For steel deck.
E. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
   1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

2. PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
D. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
2.2  ROOF DECK  

A.  <Double click here to find, evaluate, and insert list of manufacturers and products.>

B.  Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1.  Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 (230) minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.

2.  Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230).

3.  Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

4.  Deck Profile: As indicated.

5.  Profile Depth: As indicated.

6.  Design Uncoated-Steel Thickness: As indicated.

7.  Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.


2.3  ACCESSORIES  

A.  General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B.  Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C.  Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D.  Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E.  Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile [indicated] [recommended by SDI Publication No. 31 for overhang and slab depth].

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, [0.0598 inch (1.52 mm)] [0.0747 inch (1.90 mm)] thick, with factory-punched hole of 3/8-inch minimum diameter.

J. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

K. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch-wide flanges and [level] [sloped] recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

L. Galvanizing Repair Paint: [ASTM A 780] [SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight].

M. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

3. EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.
D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
   1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
   2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches apart in the field of roof and 6 inches apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.
   3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches, and as follows:
   1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Lapped 2 inches minimum.
D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and [weld] [mechanically fasten] flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
3. Weld Spacing: Space and locate welds as indicated.
4. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch-long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

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

B. Field welds will be subject to inspection.

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

D. Remove and replace work that does not comply with specified requirements.

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

3.6 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
   1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
   2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00
DIVISION 5 – METALS
05 50 00 – Metal Fabrications

1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. General Contractor

a. This section includes the following:

1) Steel framing and supports for mechanical and electrical equipment.
2) Steel framing and supports for applications where framing and supports are not specified in other Sections.
3) Shelf angles.
4) Metal ladders.
5) Ladder safety cages.
6) Loose steel lintels.
7) Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

B. Related Requirements:

1. Section 052100 "Steel Joist Framing."

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.
B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Shelf angles.
4. Metal ladders.
5. Ladder safety cages.
6. Metal ships' ladders and pipe crossovers.

C. Samples for Verification: For each type and finish of extruded nosing and tread.

D. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by structural engineer licensed in the State of Illinois.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.
2. PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

E. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

F. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.


J. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.
4. Provide bronze fasteners for fastening bronze.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 1 (A1).

E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.


2.4 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
2. Unless otherwise indicated, provide 1/2-inch (12.7-mm) baseplates with four 5/8-inch (16-mm) anchor bolts and 1/4-inch (6.4-mm) top plates.

D. Galvanize miscellaneous framing and supports where indicated.

E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.
B. Galvanize shelf angles located in exterior walls.

C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

A. General:

1. Comply with ANSI A14.3.

B. Steel Ladders:

1. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
2. Siderails: Continuous, 1/2-by-2-1/2-inch (12.7-by-64-mm) steel flat bars, with eased edges.
3. Rungs: 1-inch- (25-mm-) diameter steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
6. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inch (12 mm) in least dimension.
7. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
8. Galvanize exterior ladders, including brackets.

2.9 LADDER SAFETY CAGES

A. General:

1. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless-steel fasteners.
2. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet (6 m) o.c. Provide secondary intermediate hoops spaced not more than 48 inches (1200 mm) o.c. between primary hoops.
3. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless-steel fasteners unless otherwise indicated.

B. Steel Ladder Safety Cages:

1. Primary Hoops: 1/4-by-4-inch (6.4-by-100-mm) flat bar hoops.
3. Vertical Bars: 3/16-by-1-1/2-inch (4.8-by-38-mm) flat bars secured to each hoop.
4. Galvanize and prime ladder safety cages, including brackets and fasteners.
2.10 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

2.11 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
   3. Other Items: SSPC-SP 3, "Power Tool Cleaning."
E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

3. EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. 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 surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

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 no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 50 00
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. General Contractor

   a. This section includes the following:

      1) Fire retardant-treated wood blocking, cants, and nailers.
      2) Fire retardant-treated wood furring and grounds.

1.2 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:

   2. NLGA: National Lumber Grades Authority.
   3. RIS: Redwood Inspection Service.
   5. WCLIB: West Coast Lumber Inspection Bureau.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

   1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
   3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Fire-retardant-treated wood.
2. Engineered wood products.
4. Expansion anchors.
5. Metal framing anchors.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

2. PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.
B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

C. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat all rough carpentry.

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
5. Furring.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, fire retardant-treated, or in area of high relative humidity, provide stainless steel fasteners complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

B. Nails, Brads, and Staples: ASTM F 1667.


D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.


2.5 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.

B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.

C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

3. EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC’s International Residential Code for One- and Two-Family Dwellings.

D. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD GROUND, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Fire retardant-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

D. Provide permanent grounds of dressed, fire retardant-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. General Contractor

   a. This section includes the following:

      1) Modified bituminous self-adhering sheet waterproofing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.

2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of air handling unit duct penetrations, exhaust duct penetrations and interface with existing steel ladders.

C. Samples: For each exposed product and for each color and texture specified, including the following products:

1. 8-by-8-inch (200-by-200-mm) square of waterproofing and flashing sheet.
1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
B. Field quality-control reports.
C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
   1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatment, corner treatment, and protection.
      a. Size: 100 sq. ft. (9.3 sq. m) in area.
      b. Description: At each type of mansard roof installation.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
   1. Do not apply waterproofing in snow, rain, fog, or mist.
B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.
2. PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain waterproofing materials from single source from single manufacturer.

2.2 MODIFIED BITUMINOUS SELF-ADHERING SHEET WATERPROOFING

A. Modified Bituminous Sheet: Minimum 60-mil (1.5-mm) nominal thickness, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated on one side to a 4-mil- (0.10-mm-) thick, polyethylene-film reinforcement, and with release liner on adhesive side.

1. Manufacturers:
   b. Soprema, Inc.
   c. W.R. Meadows, Inc.

2. Physical Properties:
   a. Tensile Strength, Membrane: 250 psi (1.7 MPa) minimum; ASTM D 412, Die C, modified.
   b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
   c. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D 1970.
   d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C 836.
   e. Puncture Resistance: 40 lbf (180 N) minimum; ASTM E 154.
   f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D 570.
   g. Water Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m) maximum; ASTM E 96/E 96M, Water Method.
   h. Hydrostatic-Head Resistance: 200 feet (60 m)] minimum; ASTM D 5385.


2.3 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.

E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.

F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick, predrilled at 9-inch (229-mm) centers.

3. EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.

1. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from metal mansard.

D. Remove fins, ridges, mortar, and other projections and fill holes and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch (1.6 mm).
F. Bridge and cover isolation joints, expansion joints and discontinuous deck-to-wall and
deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's
written instructions.

1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second
sheet strip to first and overlap to substrate.

G. Corners: Prepare, prime, and treat inside and outside corners according to
ASTM D 6135.

1. Install membrane strips centered over vertical inside corners. Install 3/4-inch (19-
mm) fillets of liquid membrane on horizontal inside corners.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations
through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

A. Install modified bituminous sheets according to waterproofing manufacturer's written
instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas
that will be covered by sheet waterproofing in same day. Reprime areas exposed for
more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align
sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps.
Overlap and seal seams, and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F (minus
4 and plus 5 deg C), install self-adhering, modified bituminous sheets produced
for low-temperature application. Do not use low-temperature sheets if ambient or
substrate temperature is higher than 60 deg F (16 deg C).

D. Two-Ply Application: Install sheets to form a membrane with lap widths not less than
50 percent of sheet widths, to provide a minimum of two thicknesses of sheet
membrane over areas to receive waterproofing.

E. Horizontal Application: Apply sheets from low to high points of decks to ensure that
laps shed water.

F. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks,
construction, and contraction joints.

G. Seal edges of sheet-waterproofing terminations with mastic.

H. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.
I. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.

3.4 PROTECTION, REPAIR, AND CLEANING

A. Do not permit foot on unprotected membrane.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 13 26
DIVISION 7 – THERMAL & MOISTURE PROTECTION
07 21 00 – Thermal Insulation

1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. General Contractor

   a. This section includes the following:

      1) Polysiocyanurate foam-plastic board.
      2) Glass-fiber blanket.

B. Related Requirements:

   1. Section 07 53 23 “EPDM Membrane Roofing" and Section 07 54 23 TPO Membrane Roofing for additional information regarding insulation specified as part of roofing construction.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.
2. PRODUCTS

2.1 POLYISOCYANURATE FOAM-PLASTIC BOARD

A. Polyisocyanurate Board, Glass-Fiber-Mat Faced: ASTM C 1289, glass-fiber-mat faced, Type II, Class 2.

1. Manufacturers:
   b. Dow Chemical Company (The).
   c. Firestone Building Products.
   d. Hunter Panels
   e. Johns-Mansville


2.2 GLASS-FIBER BLANKET

A. Glass-Fiber Blanket, Foil Faced: ASTM C 665, Type III (reflective faced), Class B (faced surface with a flame-propagation resistance of 0.12 W/sq. cm); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

1. Manufacturers:
   a. CertainTeed Corporation.
   b. Guardian Building Products.
   c. John Mansville, a Berkshire Hathaway company.

2.3 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

1. Manufacturers:
   a. AGM Industries, Inc.
   b. Gemco.
   d. Firestone Building Products.
   e. John Mansville, a Berkshire Hathaway company.

2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.

B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

1. Manufacturers:
   a. Gemco.
   c. John Mansville, a Berkshire Hathaway company.
   d. Firestone Building Products.

2. Angle: Formed from 0.030-inch- (0.762-mm-) thick, perforated, galvanized carbon-steel sheet with each leg 2 inches (50 mm) square.

3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.

C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.

1. Manufacturers:
   a. AGM Industries, Inc.
   b. Gemco.
   d. John Mansville, a Berkshire Hathaway company.
   e. Firestone Building Products.

2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
   a. Ceiling plenums.
   b. Attic spaces.

D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

1. Manufacturers:
   a. AGM Industries, Inc.
   b. Gemco.
   d. John Mansville, a Berkshire Hathaway company.
   e. Firestone Building Products.
2.4 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

3. EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Vapor Retarder-Faced Blankets: Tape joints and ruptures in vapor retarder facings, and seal each continuous area of insulation to ensure airtight installation.
   a. Exterior Walls: Set units with facing placed toward interior of construction unless noted otherwise.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Glass Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
   2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.4 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. General Contractor provide: Fiberglass Shingles and related roofing items as shown on the drawings and herein specified.
2. Remove existing construction:
   a. Shingles and felt.
   b. Vent pipe flashings.
   c. Step flashings.
   d. Drip edge and rake metal.
3. Install new:
   a. Fiberglass singles.
   b. Drip edge and rake metal.
   c. Step flashings.
   d. Vent pipe flashing.

1.2 RELATED WORK

A. Specified Elsewhere:

1. 06 10 00 – Rough Carpentry.
2. 07 54 23 – TPO Membrane Roofing
3. 07 62 00 – Sheet Metal Flashing & Trim.
4. 07 92 00 – Joint Sealants.

1.3 QUALIFICATIONS OF INSTALLERS

A. Employ only experienced workmen, skilled in the installation of the specified shingles.

1.4 REFERENCES

A. Cited Standards and specified manufacturer's catalogs, current at the date of bidding documents, are incorporated herein by reference and govern the work. If conflict is discovered between the Standards or catalogs and the projects specifications, request written clarification from the A/E. Do not proceed with the work until receiving such clarification.


D. Underwriters Laboratories, Inc. (UL).


F. Factory Mutual, Norwood, MA.

1.5 SUBMITTALS

A. Make all submittals in accord with the Standard Documents for Construction, Section 01 33 23.

   1. Product Data:
      a. Two (2) copies of the manufacturer's literature showing application instructions for the specified shingles.
      b. Two (2) copies of the manufacturer's standard warranty.

   2. Samples:
      a. Two (2) manufacturer's shingle swatches showing color, texture, and construction of the specified shingles.
      b. Two (2) representative samples of the sheet metal used with the roofing.
      c. Two (2) roofing nails, exact gauge and length to be used.
      d. Two (2) - 6" x 6" swatch of ice and water dam sheet to be used.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials requiring a fire and wind resistance classifications in unopened packages with the label attached.

B. Store all materials on clean, raised platforms, a minimum of 4 inches above the ground, and with weather protective covering when stored outdoors.

C. Remove damaged or defective materials from the job site.

1.7 JOB CONDITIONS

A. Existing Construction: Roof Areas 17 and 18 are to remain with the following exception: Remove and replace with new asphalt shingles areas of existing asphalt shingles that interface with other Work (at new and reconfigured parapet walls, at new and reconfigured flashings, at interface with new TPO Membrane roofing systems and at reconfigured roofing saddles). One existing asphalt shingle roof is present at Roof Areas 17 and 18, mechanically fastened directly through the existing insulation.
B. Environmental Requirements:
   1. Remove existing roofing in dry weather.
   2. Install new roofing in dry weather.

C. Protection:
   1. Avoid traffic on completed work.
   2. Restore to original condition, or replace with like materials, all work or materials
      damaged by the roofing operation.

1.8 WARRANTY
A. General Contractor's Warranty: Two (2) years on workmanship in accord with the
   Standard Document for Construction, Section 01 78 36.

B. Manufacturer's Warranty: Thirty (30) year standard prorated.

2. PRODUCTS

2.1 MATERIALS
A. Fiberglass shingles, 3-tab, self-sealing, metric or standard size, with a U.L. Class “A”
   and Wind Resistant label.
   1. Acceptable Manufacturers & Products:
      a. Atlas “GlassMaster"
      b. CertainTeed “XT30"
      c. GAF “Marquis Weathermax”
      d. IKO “Marathon Ultra AR”.

2. Drip Edge & Rake Edge Metal:
   a. 024 prefinished aluminum, minimum 3 inch deck flange, 1½ inch fascia,
      with a 3/8 inch drip at the lower edge. Maximum length: 12' Color to match
      existing adjacent drip edges and rake edges to remain.

3. Ice & Water Dam Sheet:
   a. Acceptable Manufacturers: Same as shingles.

4. Roofing Felt:
   a. 15# asphalt felt paper complying with ASTM D226, Type I, non-perforated.
5. Nails:
   a. Galvanized roofing nails, 11 gauge minimum, 3/8 inch diameter head, barbed or deformed shank, and a minimum length to provide total penetration through the deck.

6. Step Flashing:
   a. Nailable substrate: .024 prefinished aluminum, 8 inches by 7 inches overall, bent in the middle 90 degrees to form two 4 inch by 7 inch areas.

7. All Valleys:
   b. Shingles, Closed-Cut. Woven or laced valley not permitted.

8. Valley liner concealed cleats: Same as valley liner.
   a. Sealants: (*A/E specify.)

B. Other Materials:
   1. Asphalt Plastic Cement, ASTM D4586, Type II.
   2. Vent Pipe Flashing: EPDM rubber "boot" with integral aluminum deck flange.

3. EXECUTION

3.1 REMOVE EXISTING CONSTRUCTION
   A. Remove areas of existing asphalt shingles that interface with other Work (at new and reconfigured parapet walls, at new and reconfigured flashings, at interface with new TPO Membrane roofing systems and at reconfigured roofing saddles).

3.2 INSPECTION
   A. Inspect all surfaces to receive new shingles and accessory items, and report to the Architect/Engineer in writing, all conditions that could adversely effect their correct installation and longevity.
   B. Do not proceed with the work until all deficiencies have been corrected.

3.3 INSTALLATION
   A. Install drip edge under the ice and water dam at eaves.
B. Unroll the ice and water dam sheet, cut into two nearly equal length pieces. Remove approximately 3 feet of the release paper and align the edge with the lip of the drip edge, sticky side down. Continue to peel the release paper and adhere the membrane. Overlap vertical and horizontal joints at least 4 inches. Install ice & water dam sheet a minimum of 24" inside the building wall line.

1. Snap a LEVEL chalk line approximately 7 inches up from the drip edge to provide a straight line guide for the starter course when the eave is crooked.
2. Use manufacturer’s pre-made starter shingle or self-sealing shingles with the tabs cut off for starter strips. Do not invert the starters to avoid mis-positioning the asphalt sealant strip.
3. Install shingles with a 1/4" overhang at both the eaves and the rakes.
4. Start the first course with a full shingle placed over the starter strip at the far left for left rake start or far right rake. Align butts with starter course butts.
5. Start the second course by cutting 6 inches from the left end for left rake start or right end for right rake start, and installing the remaining portion at the far left side or far right side of the roof area.
6. Start the third and succeeding courses with shingles cut either 6 inches progressively narrower from the left or right side as appropriate. **STACK BONDING IS NOT PERMITTED.**
7. Use a minimum of 4 nails per shingle, placed 5/8 inch above the top of each cut-out, and 1 inch in from each side. Drive nails flush, but do not crush shingles. **STAPLES ARE NOT PERMITTED.**
8. (Secure shingle tabs adjacent to the valley with plastic cement only. Do not install nails less than 8 inches from the valley centerline. Use shingles with at least two tabs next to the valley. Metal valleys to have 6 inch maximum exposure at the eave.
9. Step flashing on nailable walls: Install 5-1/2" up-roof from the butt of the shingle, or as recommended on the package. Secure with one nail at the top of the roof portion.
10. Base flashing & Counter flashing on chimney or masonry walls: Install per SMACNA’s "Architectural Sheet Metal Manual, 5th edition, Figure 4-17, Page 4.34.

3.4 ADJUST AND CLEAN

A. Thoroughly inspect all completed work. Replace all shingles or other work that is damaged, and correct all other defects.

END OF SECTION 07 31 05
State of Illinois
CAPITAL DEVELOPMENT BOARD
WARRANTY INFORMATION

**Warranty No.:**

**Date of Warranty:** **Years:**

**End of Warranty:**

**Roofing System Manufacturer:**

**Address:**

**Total Warranty - Square Footage:**

**Type:** **Trade-name:**

**Lin. Ft. Flashing:**

**Insulation Type:**

**Roofing System Installed Cost $:**

**Each Building or Area:$**

**Roofing Contractor:**

**Address:**

**Phone:** **Fax:**

**NOTE:** Contractor: Complete ** information and submit this form with manufacturer’s warranty.

Project Name: IMSA – Correct Water Infiltration

Project Number: 805-030-020

CDB Project Manager: Mr. John Nalis

Using Agency: Illinois Board of Higher Education

Agent: Capital Development Board
3rd Floor, William G. Stratton Bldg.
401 S. Spring St., Springfield, IL 62706

Building Name: Illinois Math & Science Academy – Academic Building

CDB Bldg No.: CP078

Building Address: 1500 Sullivan Road, Aurora, IL 60506

Location of Area(s) Installed: Portions of Roof Areas 17 and 18 (as indicated on the drawings).
DIVISION 7 – THERMAL & MOISTURE PROTECTION
07 41 13 – Preformed Metal Roof Panels

1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. General Contractor provide preformed standing seam metal roofing and flashing systems as shown and specified.

   a. Remove existing construction:

      1) Metal roof panels
      2) Flashing
      3) Roof projection flashing
      4) Gravel stop
      5) Gutters and downspouts

   b. Install new:

      1) Self-adhering sheet waterproofing
      2) Prefabricated metal roof panel system
      3) Flashings and trim
      4) End closures
      5) Sealants
      6) Gutters and downspouts

1.2 RELATED WORK

A. Specified elsewhere

   1. 06 10 00 – Rough Carpentry.
   2. 07 13 26 – Self Adhering Sheet Waterproofing
   3. 07 53 23 - EPDM Membrane Roofing
   4. 07 54 23 - TPO Membrane Roofing
   5. 07 62 00 – Sheet Metal Flashing & Trim.
   6. 07 71 00 – Roof Specialties.
   7. 07 92 00 – Joint Sealants.

1.3 QUALITY ASSURANCE

A. Installing Contractor’s Qualifications:

   1. Shall be “Certified” or “Approved”, and trained by the roofing manufacturer. The job foreman shall also be trained by the manufacturer in the installation of the specified system. Show proof of training at the pre-construction meeting, or at least 2 weeks before commencement of roofing work.
a. Provide the A/E with a list of five project locations and contact persons that can be contacted prior to approval to do this work.
b. Take field measurements, where possible, prior to fabrication of components.
c. Use an adequate number of thoroughly trained and experienced workmen who are familiar with the specified requirements of this Section.

2. Manufacturer’s Qualifications:
   a. Maintains a “Certified” installer training program and a list of installing contractors.
   b. Has technically qualified personnel available to inspect the installation at a time when corrections can still be made if needed, and at completion.

3. Manufacturer’s Responsibility:
   a. The manufacturer has primary responsibility for the system, following the minimum specified requirements.
   b. The manufacturer shall sell products only to the “Certified” or “Approved” installing contractor for this project.

4. Performance Requirements:
   a. Air Infiltration: maximum air infiltration rate of 0.009 cfm/ft² at a pressure differential of 6.24 psf when tested in accord with ASTM E1680-95.
   b. Water Penetration: No uncontrollable water leakage at a pressure differential of 6.24 psf when tested in accord with ASTM E1646-95.
   d. Roofing system shall conform with UBC.

1.4 REFERENCES
   A. Cited standards and manufacturer’s catalogs, current at the date of bidding documents, unless otherwise specified, are incorporated herein by reference and govern the work. In conflict between these standards or catalogs and the project specifications, request written clarification from the A/E.

1.5 SUBMITTALS
   A. Submit to the A/E and the CDB project manager at the pre-construction meeting, or on new construction, at least two weeks prior to commencement of roofing work:
      1. The roofing contractor’s name, address and telephone number, and the name of the job foreman for this project.
2. The manufacturer’s written statement that the job foreman has been trained in the installation of the specified system, and the contractor is currently a “Certified” or “Approved” installer.

B. Shop Drawings:

1. Manufacturer is to supply shop drawings.
2. The manufacturer’s shop drawings shall be submitted to the Architect and the CDB Project Manager. A copy shall be used at the job site.
3. If the manufacturer has an agreement with the contractor allowing them to supply the shop drawings, the manufacturer shall review drawings and submit to the A/E and the CDB Project Manager.
4. Submit the following:
   a. Panel profile with concealed clip.
   b. Panel end laps.
   c. All flashing, closures and trim.
   d. Valleys and ridges.
   e. Curbs, ladders, ducts and other penetrations.
   f. Gutters and downspouts.
5. Samples:
   a. Sample of size and shape to show panel finish, seam, and concealed clip.
6. Product Data:
   a. Specifications for roof panels, attachment clips, and insulation.
   b. Installation instructions for all components.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with the manufacturer's instructions to prevent components from being damaged, deformed, or stained.

1.7 JOB CONDITIONS

A. Existing Construction

1. Existing roof construction to be covered is comprised of 1-1/2” (nominal) thick interlocking insulated metal panels, approximately 30” wide forming a mansard roof configuration with a slope of approximately 60 degrees. Major existing items penetrating the existing mansard the will penetrate the new preformed metal roof panels include air handling ducts, exhaust ducts, gas pipe supports and ladder supports.

1.8 WARRANTY

A. Requirements include:
1. All materials either furnished or approved by the roofing manufacturer.
2. The use of manufacturer supplied shop drawings during construction.
3. Two inspections by the manufacturer: 1) during construction, 2) prior to issuing their warranty.
4. Installation by manufacturer trained and approved contractor and job foreman.

B. General Contractor: Two years in accord with the Standard Documents for Construction.

C. Manufacturer: The following warranties shall be submitted to the CDB Project Manager before Final Completion, and become effective on the date the materials were shipped from the factory.

1. Provide a single source, total system, non pro-rated, 20 year, weather-tightness warranty for materials supplied or approved by the manufacturer, and for labor.

   a. The warranty shall cover leaks in roof panels, trim, flashings, and penetrations, resulting from workmanship, ordinary wear, and normal weather conditions.
   b. The warranty to be signed by the manufacturer and the Certified/Approved installing contractor, agreeing to repair/replace defective materials and workmanship during the warranty period.
   c. Liability shall be limited to the installed cost of the roofing system, as listed on the Contractor’s Schedule of Values (CDB form CSV).

2. The manufacturer shall provide a 20 year Finish Warranty on paint integrity and color retention. This includes: cracking, flaking, blistering, chalking in excess of number 8 rating of ASTM D659, or fade in excess of 5 units per ASTM D2244.

3. Alternative Dispute Resolution: Should the Owner (Using Agency) and the manufacturer fail to agree on a warranty claim, it shall be submitted for arbitration to a Registered Roof Consultant member of the Roof Consultants Institute, mutually selected by both parties, who shall act as an arbitrator in accord with Section 00 72 60 of the CDB “Standard Documents for Construction”, January 2006.

2. PRODUCTS

2.1 MATERIALS

A. ARCHITECTURAL standing seam metal roof panels having field crimped side joints, designed for concealed clip attachment over a solid deck.

2.2 MANUFACTURERS:

A. McElroy Metal Co.

B. Metal Sales, Rock Island, IL, Vertical Seam.
C. Petersen Aluminum Co, Elk Grove Village, IL., Integral Standing Seam.

D. FOR THE ENTIRE ROOFING SYSTEM, including sub-framing, clips, panels, fasteners, valley flashings, roof-to-wall flashings, eaves, rakes, ridges, curbs, skylights, and other components as specified, the contractor shall use materials either manufactured or approved by the roofing manufacturer.

2.3 ROOFING PANELS

A. Preformed roofing panels to have the configuration shown on the drawings. Fabricate from 24 ga. Kynar 500 prefinished aluminum.

B. Panel width to be from 12 inches to 24 inches.

C. Panel end laps (allowed only on lengths greater than 52’-0”) shall be a minimum 6 inch overlap, using the manufacturer’s required method and sealant.

D. Panels to be designed for attachment with concealed clip fasteners, spaced as required by the manufacturer to provide for both positive and negative design loads, while allowing for expansion and contraction of the entire roofing system resulting from variations in temperature. Exposed fasteners are permitted only to control expansion, and at panel end splices.

E. Factory installed sealant in panel side joints.

F. Exterior Finish: Kynar 500 containing 70% fluoropolymer or Hylar 5000 Polyvinylidene fluoride (PVFD).

G. Interior Finish: Manufacturer's corrosion resistant paint.

2.4 OTHER MATERIALS

A. Exposed threaded fasteners shall be #300 stainless steel, stainless steel capped, or zinc capped with neoprene washers. Series 400 or self-drilling stainless steel fasteners are not acceptable.

B. Eave Closures & Gable Trim: Shall be fabricated from the same material as the roof panels finished to match adjoining components. Panel end closures shall be weather-tight metal closures.

C. Provide other shapes, tape, fasteners, and flashing as required or recommended by the manufacturer to complete a weather-tight system.

D. Sealants: As required or recommended by the manufacturer. For general purpose sealants see Section 07 92 00.

E. Flexible EPDM Flashings and EPDM Pipe Flashings: As recommended by the roofing manufacturer. Use only high-temperature silicone flashings on hot pipes.

F. Touch-up Paint: Kynar 500 or Hylar 5000 to match panel and trim finish.
G. Waterproofing Membrane: Refer to Section 07 13 26, Self-Adhering Sheet Waterproofing, to be installed over the entire surface of the existing metal mansard.

2.5 EXTERIOR GUTTERS & DOWNSPOUTS :
   A. Metal and color shall be the same as the roofing material and as indicated on the drawings.
   B. Manufacturer to be the same as the roofing manufacturer.

2.6 SNOW GUARDS
   A. "Snow Dam" by ThyCurb, Addison, IL. 800/666-2872.
   B. "S-5" by Petersen Aluminum, 800/323-1960.
   C. “SnoBar”, 800/711-9724.
   E. “F-Rail, E-Rail or S-Rail” by Berger Building Products, Feasterville, PA 800/523-8852.
   F. “S-5 ColorGard”(color strips)and “S-5 SnoFence by LMCurbs, 800/284-1412.

3. EXECUTION

3.1 REMOVE EXISTING CONSTRUCTION
   A. Temporary Removals (surrounding construction):
      1. Roof Area 1 perimeter edge, including deteriorated blocking.
      2. Roof Area 16 EPDM roofing system, down to structural deck.
      3. Air Handling ducts penetrating existing mansard roof.

3.2 INSPECTION
   A. Verify the substrate or structural system is complete, at proper elevation, and otherwise ready for roofing installation.
   B. Verify the work of other contractors which penetrates the roof, or requires people and equipment to traverse the roof deck is complete.
   C. Notify the Architect in writing of unsatisfactory conditions that may adversely affect the performance or appearance of the roof. Do not proceed with installation until those conditions are corrected.
3.3 INSTALLATION

A. Install self-adhering sheet waterproofing where shown on the drawings and as indicated in Section 07 13 26, and in accord with the manufacturer’s recommendations.

B. String lines or other means shall be used to indicate the correct placement height of each panel support. The top surface of each panel support shall be bent to match the specified slope, as shown in the drawings.

C. Install roofing panels in accord with the manufacturer's instructions using concealed attachment clips.
   1. Secure panels to prevent movement only at the location determined by the manufacturer.
   2. Install panels properly aligned, constant slope, and within 1/4" in 20 feet.

D. Install all flashing, trim, gutters & downspouts per the roofing manufacturer's instructions.

E. Close field seams with the tools and seaming machine recommended by the manufacturer, operated in a manner to avoid damage to the panel finish.

F. Paint all field cut and other raw edges with Kynar 500 or Hylar 5000 to match panels and trim.

3.4 FIELD QUALITY CONTROL

A. The roofing manufacturer shall provide on-site observation and instruction soon after the start of installation, during installation as they deem necessary, and at completion.

B. The A/E will provide periodic observation during installation.

C. Accompany the manufacturer's technical representative during his completion inspection. Assist the inspector with equipment and workmen when necessary to provide access to the roof. Correct all items noted.

3.5 CLEAN AND ADJUST

A. Carefully inspect all completed work and correct all defects.

B. Prevent movement or storage of materials or equipment on the completed roof.

C. Remove from the job site and legally dispose of all debris and metal scraps. Remove all surplus materials, tools and equipment.

D. Sweep the roof daily to remove construction debris and power wash the entire roof at project close out.

END OF SECTION 07 41 13
State of Illinois  
CAPITAL DEVELOPMENT BOARD  
WARRANTY INFORMATION  

**Warranty No.:**  
**Date of Warranty:**  **Years:**  
**End of Warranty:**  

**Roofing System Manufacturer:**  
**Address:**  
**Total Warranty - Square Footage:**  
**Type:**  **Trade-name:**  
**Lin. Ft. Flashing:**  
**Insulation Type:**  
**Roofing System Installed Cost $$:**  
**Each Building or Area:$**  
**Roofing Contractor:**  
**Address:**  
**Phone:**  Fax:  

**NOTE: Contractor:** Complete ** information and submit this form with manufacturer’s warranty.

Project Name: IMSA – Correct Water Infiltration  
Project Number: 805-030-020  
CDB Project Manager: Mr. John Nalis  

Using Agency: Illinois Board of Higher Education  
Agent: Capital Development Board  
Address: 3rd Floor, William G. Stratton Bldg.  
401 S. Spring St., Springfield, IL 62706  
Building Name: Illinois Math & Science Academy – Academic Building  
CDB Bldg No.: CP078  
Building Address: 1500 Sullivan Road, Aurora,  
IL 60506  
Location of Area(s) Installed: Over existing metal mansard roof at Roof Area 1 (as indicated on the drawings).
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. General Contractor provide single-ply EPDM membrane roofing and flashing system (fully adhered at portions of Roof Areas 2-4, inclusive, and ballasted at portions of Roof Area 1) as indicated on the drawings and herein specified.

   a. Remove existing construction:

      1) Ballast (Roof Area 1).
      2) Roofing membranes.
      3) Counterflashings.
      4) Gravel stops.
      5) Base flashings.
      6) Damaged wood blocking.
      7) Roof projection flashings.

   b. Temporarily remove existing:

      1) Ventilators.
      2) Precast concrete walkway pavers.

   c. Install new:

      1) Roof membrane.
      2) Seam tape.
      3) Seam cover.
      4) Base flashing.
      5) Roof projection flashings.
      6) Ballast (Roof Area 1).
      7) Termination bar.
      8) Precast concrete walkway pavers (where existing pavers have deteriorated). Reinstall existing precast concrete pavers that are in satisfactory condition.
      9) Counterflashing.
     10) Gravel stops.
     11) Coping cap.
     12) Expansion joints.
     13) Pourable sealer pocket.
B. RELATED WORK

1. Specified elsewhere:
   a. 06 10 00 – Rough Carpentry.
   b. 07 62 00 – Sheet Metal Flashing & Trim.
   c. 07 71 00 – Roof Specialties.
   d. 07 92 00 – Joint Sealants.
   e. 22 14 26 – Facility Storm Drains.

1.2 DEFINITIONS

A. Roofing System Manufacturer: Any of the manufacturers whose systems are specified under "Acceptable Roofing System Manufacturers" in this section hereinafter called "manufacturer."

1.3 QUALITY ASSURANCE

A. Qualifications
   1. The installing contractor shall be approved or franchised by the roofing system manufacturer.
   2. The job foreman shall be trained by the manufacturer in the installation of the specified system.
   3. The installing contractor shall comply with the Illinois Roofing Industry Licensing Act.

1.4 REFERENCES

A. Cited Standards and specified manufacturers' catalogs, current at the date of bidding documents, unless otherwise specified, are incorporated herein by reference and govern the work. If conflict is discovered between referenced Standards or catalogs and the project specifications, request written clarification from the A/E. Do not proceed with the work until receiving clarification.

B. Standards:
   2. Factory Mutual Laboratories (FM).
   3. Underwriters Laboratories (UL)
   4. Sheet Metal and Air Conditioning Contractors National Assoc. (SMACNA)

1.5 SUBMITTALS

A. Make all submittals in accord with the Standard Documents for Construction, Section 01 33 23.

B. Endorsement of Roofing Firm: Contractor: Within 15 days of receiving the Notice of Award, submit the manufacturer's endorsement of the installing firm.
C. Shop Drawings:

1. Submit shop drawings to the manufacturer for review and comment.
2. Submit only manufacturer reviewed shop drawings to the A/E.
3. Minimum Scale for Overall Roof Plan: 1/16" = 1' 0".
4. Minimum Scale for Roof Plan Details: 1/8" = 1' 0".
5. Minimum Scale for Details: 1-1/2" = 1' 0".
6. Submit the following:
   a. Base flashings.
   b. Membrane terminations.
   c. Roof projection flashings.
   d. Sheet metal:
      1) Counterflushing.
      2) Gravel stop/fascia.
      3) Copings.
      4) Equipment curbs.
      5) Gutters and downspouts.

D. Samples:

1. EPDM membrane, 8" x 10", 3 pieces.
2. Ballast rock, 2 pounds.
3. Sheet Metal:
   a. Metal used with roofing, 4" x 4" of each type, 3 pieces.

E. Product Data:

1. Manufacturer's specifications for roofing system, 2 sets.
2. Roof insulation specifications, 2 sets.

1.6 DELIVERY, STORAGE AND HANDLING

A. Per roofing manufacturer's recommendations.

B. Deliver materials requiring fire resistant classifications packaged with labels intact and legible.

1.7 JOB CONDITIONS

A. Existing Construction:

1. Roof Area 1 consists of corrugated steel deck, two layers of 1.5” polyisocyanurate insulation and one loose laid 60 mil EPDM membrane with river rock ballast. Roof slope is 1/8” per 1’-0”. Membrane replacement is limited to a 10’-0” width at the entire perimeter and at each ventilator, including all flashings, copings and edge details and as indicated on the drawings.
2. Roof Areas 2 through 4, inclusive, consist of corrugated steel deck, one layer of 2” polyisocyanurate insulation, one layer of ½” wood fibreboard mechanically fastened and one fully adhered 60 mil EPDM membrane. Roof slope is 1/8” per 1’-0”. Membrane replacement is limited to areas indicated on the drawings. Installation of a new EPDM base flashing is required below and along the entire length of new monitor window installation locations. Other than the areas mentioned above and as indicated on the drawings, Roof Areas 2-4 are to remain and shall be protected from damage by Work activities.

3. Where indicated on the drawings, provide new fully adhered EPDM membrane over galvanized steel sheet metal cover caps on top of designated air handling units.

B. Protection:

1. Protect existing roof membrane to remain, building surfaces, paving, and landscaping from traffic and roofing equipment. Provide protective cover material to prevent damage to (and that will not in of itself cause damage to) the existing EPDM membrane.
2. Restore or replace all work or materials damaged by the roofing operation.
3. Remove protection materials upon completion of the work.

C. Sequencing, Scheduling Coordination: In accord with the Standard Documents for Construction, Section 01 31 00.

D. Comply with all regulations imposed by the using agency at the job site.

1.8 WARRANTY

A. General Contractor: Two years in accord with the Standard Documents for Construction, Section 01 78 36.

2. PRODUCTS

2.1 MATERIALS

A. For the entire roofing system provide adhesives, sealants, premolded and field fabricated flashings, fasteners, and other related components manufactured or recommended by the selected manufacturer.

2.2 ACCEPTABLE ROOFING SYSTEM MANUFACTURERS

<table>
<thead>
<tr>
<th>CODE</th>
<th>BRAND</th>
<th>MANUFACTURER</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>CAR</td>
<td>Sure-Seal</td>
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<tr>
<td></td>
<td></td>
<td>Carlisle SynTec Systems, Carlisle, PA.</td>
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<tr>
<td>2.</td>
<td>FIR</td>
<td>Rubbergard</td>
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<td></td>
<td></td>
<td>Firestone Building Products Co., Carmel, IN.</td>
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<tr>
<td>3.</td>
<td>MAN</td>
<td>SPM</td>
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<tr>
<td></td>
<td></td>
<td>Johns-Manville, Denver, CO.</td>
</tr>
</tbody>
</table>
2.3 ACCEPTABLE SYSTEMS

A. Fully Adhered .060 EPDM and Ballasted .060 EPDM.
   1. CAR Design “A” Design “B”
   2. FIR Rubbergard Rubbergard
   3. MAN SE6A SE6B

B. Manufacturer’s 6" wide, pressure-sensitive, self-adhering EPDM seam cover.

2.4 OTHER MATERIALS

A. Wood Nailers: Wood shall be No. 2 or better construction grade lumber.

B. Manufacturer's EPDM Flashing.

C. Termination Bar: Required by CDB on all wall terminations. Attach 6" o.c.
   1. 040" x 1" aluminum bar under counterflashing or other restricted spaces.
   2. 1/8" x 1-1/2" aluminum bar with 45° sealant pocket where space permits.

2.5 METAL FLASHINGS

A. 24ga aluminum, Kynar 500 prefinished.
   1. Counterflashing: Factory-made, 2-piece that can be removed and reused for repairs or next re-roof.
   2. Building Expansion Joint Cover: Refer to Section 07 71 29, “Manufactured Roof Expansion Joints”.
   3. Coping cap: Refer to Section 07 71 00, “Roof Specialties”.
   4. Gravel stop/fascia: Refer to Section 07 62 00, “Sheet Metal Flashing and Trim”.
   5. Drainage bar, pre-punched: 0.18" x 4" mill finish aluminum.

2.6 BALLAST

A. Rounded, water-worn, washed stone, 3/4" - 1½" nominal diameter, with the following gradations: 50% retained by a 3/4" screen, 95% retained by a ½" screen, and 98% retained by a ¼" screen, applied at the rate of 10 pounds per square foot.

B. Minimum 11 pound per square foot interlocking precast concrete roof pavers.

3. EXECUTION

3.1 ENVIRONMENTAL CONDITIONS

A. Remove existing roofing only in dry weather.

B. Install roofing only in dry weather.
C. Comply with manufacturer's climatic restrictions.

3.2 REMOVE EXISTING CONSTRUCTION

A. Temporary removals:
   1. Ventilators.
   2. Precast concrete roof pavers.

B. Permanent removals:
   1. Remove all existing roof membrane and related components on the areas indicated on the drawings.
   2. Remove existing insulation down to structural deck on the areas indicated on the drawings.

3.3 INSPECTION

A. Examine all surfaces for inadequate anchorage, foreign material, moisture, unevenness, or other conditions which could prevent the best quality and longevity of roofing, flashing, and accessory components. Notify the A/E of all deficiencies.

B. Do not proceed with the work until all deficiencies have been corrected to the satisfaction of the A/E and the roofing manufacturer.

3.4 PREPARATION

A. Ensure that all surfaces are clean and dry before starting and during performance of work.

B. Verify that all work of other contractors and subcontractors which penetrates the roof deck or requires men and equipment to traverse the roof deck has been completed.

3.5 INSTALLATION

A. Install the roofing and flashing system and all accessory items in accord with the manufacturer's printed instructions.

B. Install all field seams using the manufacturer's seam tape, primers, and cleaners, and in accord with the manufacturer's recommendations.

C. Centered over all field seams, apply a minimum 6" wide strip of pressure sensitive, self-adhering EPDM.

D. Install new precast concrete pavers at locations where existing concrete pavers have deteriorated.

E. Reinstall existing ventilators and existing precast concrete pavers.
3.6 FIELD QUALITY CONTROL

A. The A/E will provide onsite observation during installation.

B. The roofing manufacturer will provide onsite observation and instruction as they deem necessary.

3.7 ADJUST AND CLEAN

A. Carefully inspect all completed work and correct all defects.

B. Remove from the job site and legally dispose of all debris.

C. Remove all tools, equipment, and construction aids.

D. Prevent storage of materials and equipment on the completed roof.

E. Accompany the manufacturer's technical inspector and assist with equipment and workmen if necessary to provide access to the roof. Correct all defects noted during the inspection.

END OF SECTION 07 53 23
DIVISION 7 – THERMAL & MOISTURE PROTECTION
07 54 23 – TPO Membrane Roofing

1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. General Contractor provide single-ply TPO fully adhered membrane roofing and flashing system as shown and herein specified.

a. Remove existing construction:

   1) Roofing membranes.
   2) Counterflashings.
   3) Roof drain flashings.
   4) Base flashings.
   5) Cants.
   6) Insulation (Roof Areas 10, 14-16 and selected areas where indicated on the drawings).
   7) Roof projection flashings.
   8) Roof hatches.
   9) Smoke vents.
   10) HVAC equipment as designated on the drawings.
   11) Capped openings.

b. Temporarily remove existing:

   1) Air handling units.
   2) Condensing units.
   3) Exhaust fans.
   4) HVAC equipment as designated on the drawings.

c. Install new:

   1) Vapor retarder (Roof Area 10 only).
   2) Structural deck and structural framing at openings in metal decks created by the removal of existing capped openings and rooftop equipment not designated to be reinstalled.
   3) Insulation.
   4) Coverboard.
   5) TPO roof membrane.
   6) Base flashing.
   7) Roof projection flashings.
   8) Roof drain flashings.
   9) Termination bar.
10) Walkway pads.
11) Counterflashing.
12) Scuppers
13) Coping cap.
14) Equipment curbs.
15) Expansion joints.
16) Pourable sealer pocket.
17) Roof hatches.
18) Smoke vents.

B. RELATED WORK

1. Specified elsewhere:
   a. 06 10 00 – Rough Carpentry.
   b. 07 62 00 – Sheet Metal Flashing & Trim.
   c. 07 71 00 – Roof Specialties.
   d. 07 71 29 – Manufactured Roof Expansion Joints
   e. 07 72 00 – Roof Accessories
   f. 07 92 00 – Joint Sealants.
   g. 22 14 26 – Facility Storm Drains.

1.2 DEFINITIONS

A. Roofing System Manufacturer: Any of the manufacturers whose systems are specified under "Acceptable Roofing System Manufacturers" in this section hereinafter called "manufacturer."

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. The installing contractor shall be approved or franchised by the roofing system manufacturer.
   2. The job foreman shall be trained by the manufacturer in the installation of the specified system.
   3. The installing contractor shall comply with the Illinois Roofing Industry Licensing Act.

B. Manufacturer’s Qualifications:
   1. The A/E has certificates (CDB Form RSMC) on file from each of the specified manufacturers stating:
      a. They have examined project drawings, specifications and warranty requirements.
      b. Their specified products are acceptable for and compatible with the roofing and flashing system design.
c. They will issue the specified warranty if the roofing and flashing systems are installed in accord with their requirements.

1.4 REFERENCES

A. Cited Standards and specified manufacturers' catalogs, current at the date of bidding documents, unless otherwise specified, are incorporated herein by reference and govern the work. If conflict is discovered between referenced Standards or catalogs and the project specifications, request written clarification from the A/E. Do not proceed with the work until receiving clarification.

B. Standards:

2. Factory Mutual Laboratories (FM).
3. Underwriters Laboratories (UL).
4. Sheet Metal and Air Conditioning Contractors National Assoc. (SMACNA).
5. EPA – Energy Star Roof Products.

1.5 SUBMITTALS

A. Make all submittals in accord with the Standard Documents for Construction, Section 01 33 23.

B. Endorsement of Roofing Firm: Contractor: Within 15 days of receiving the Notice of Award, submit the manufacturer's endorsement of the installing firm.

C. Shop Drawings:

1. Submit shop drawings to the manufacturer for review and comment.
2. Submit only manufacturer reviewed shop drawings to the A/E.
3. Minimum Scale for Roof Plan: 1/8" = 1’ 0".
4. Minimum Scale for Details: 1-1/2" = 1’ 0”.
5. Submit the following:

   a. Tapered roof insulation plan.
   b. Insulation fastener pattern.
   c. Base flashings.
   d. Reglets.
   e. Membrane terminations.
   f. Roof projection flashings.
   g. Roof drains.
   h. Sheet metal:

      1) Counterflashing.
      2) Scupper.
      3) Copings.
4) Expansion joint cover.
5) Equipment curbs.
6) Gutters and downspouts.

D. Samples:
1. Roof insulation, 8” x 10, 2 pieces.
2. Insulation fastener and plate, 2 of each.
3. TPO membrane, 4” x 6”, 3 pieces.
4. Sheet Metal:
   a. Metal used with roofing, 4” x 4” of each type, 3 pieces.
   b. Expansion joint cover, 4” length, 2 pieces.

E. Product Data:
1. Manufacturer's specifications for roofing system, 2 sets.
2. Roof insulation specifications, 2 sets.

1.6 DELIVERY, STORAGE AND HANDLING
A. Per roofing manufacturer's recommendations.
B. Deliver materials requiring fire resistant classifications packaged with labels intact and legible.

1.7 JOB CONDITIONS
A. Existing Construction:
1. Roof Areas 5-9 and 11-16 consist of a corrugated steel deck, two layers of 1.5” polyisocyanurate insulation, one layer of ½” wood fiberboard mechanically fastened and one fully adhered 60 mil EPDM membrane. Existing roof structure slopes are 1/8” per foot. Various types of rooftop HVAC equipment are located over these roof areas and must be removed to allow for modification of the existing curbs or installation of new curbs and installation of the new fully adhered TPO roofing system (after which time the existing equipment must be reinstalled).
2. Roof Area 10 (over indoor pool) consists of a precast concrete structural deck with an approximately 2” thick lightweight concrete topping, two layers of fully adhered 1.5” polyisocyanurate insulation, one layer of fully adhered ½” wood fiberboard and one fully adhered 60 mil EPDM membrane. Existing roof structure slopes are 1/8” per foot. Various types of rooftop HVAC equipment are located over this roof area and must be removed to allow for modification of the existing curbs or installation of new curbs and installation of the new fully adhered TPO roofing system (after which time the existing equipment must be reinstalled).
B. Protection:

1. Protect roof membrane, building surfaces, paving, and landscaping from traffic and roofing equipment.
2. Restore or replace all work or materials damaged by the roofing operation.
3. Remove protection materials upon completion of the work.

C. Sequencing, Scheduling Coordination: In accord with the Standard Documents for Construction, Section 01 31 20.

D. Comply with all regulations imposed by the using agency at the job site.

1.8 WARRANTY

A. General Contractor: Two years in accord with the Standard Documents for Construction, Section 01 78 36.

B. Manufacturer: Execute CDB's Roofing System Manufacturer's Warranty - CDB Form RSMW. See the final pages of this section.

2. PRODUCTS

2.1 MATERIALS

A. For the entire roofing system provide adhesives, sealants, pre-molded and field fabricated flashings, fasteners, and other related components manufactured or recommended by the selected manufacturer.

2.2 ACCEPTABLE PVC ROOFING SYSTEM MANUFACTURERS

<table>
<thead>
<tr>
<th>CODE</th>
<th>BRAND</th>
<th>MANUFACTURER</th>
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<tbody>
<tr>
<td>CAR</td>
<td>Sure-Weld</td>
<td>Carlisle SynTec Systems, Carlisle, PA.</td>
</tr>
<tr>
<td>FIR</td>
<td>UltraPly</td>
<td>Firestone Building Products, Indianapolis, IN.</td>
</tr>
<tr>
<td>MAN</td>
<td>JM TPO</td>
<td>Johns-Manville, Denver, CO.</td>
</tr>
</tbody>
</table>

2.3 ACCEPTABLE SYSTEMS

A. Fully Adhered .060 TPO.

1. CAR Sure-Weld
2. FIR UltraPly
3. MAN JM TPO

2.4 ROOF INSULATION

A. The Contractor shall select a brand acceptable to the roofing manufacturer.
B. **INSULATION TYPE**

<table>
<thead>
<tr>
<th>ASTM</th>
<th>R/INCH</th>
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1. **Base Insulation**
   a. Polyisocyanurate C1289 5.70 (LTTR)

2. **Coverboard (1/4” minimum thickness)**
   a. Invinsa – Johns Manville
   b. Isogard HD – Firestone
   c. SecurShield HD – Carlisle

C. **Roof Insulation for Tapered Areas:**

1. Polyisocyanurate, Minimum Thickness: 1/2 inch. Slope: 1/8 in./ft. min., (Final roof slope to be 1/4 in./ft. minimum, refer to Section 07 54 23, H, 1 for existing structural slope information).
2. Crickets & Saddles: Polyisocyanurate, Slope: ¼ in./ft. minimum
3. ¼” minimum coverboard.
4. LTTR of finished roof system shall achieve a minimum insulating value of R-25.

D. **Roof Insulation for Non-Tapered Areas:**

1. First Layer: Polyisocyanurate, Minimum thickness: 1.5 inches
2. Second and Subsequent Layers: Polyisocyanurate, Minimum thickness: 1.5 inches (or thickness required to achieve a finish roof system with a LTTR value of R-25)
4. ¼” minimum coverboard.
5. LTTR of finished roof system shall achieve a minimum insulating value of R-25.

2.5 **INSULATION ATTACHMENT**

A. Fasteners manufactured or approved by the roofing system manufacturer, and that have Factory Mutual approval.

B. Adhesive manufactured or approved by the roofing system manufacturer, and that have Factory Mutual approval.

2.6 **OTHER MATERIALS**

A. Wood Nailers: Wood shall be No. 2 or better construction grade lumber.

B. Manufacturer's TPO Flashing.

C. Vapor Retarder: Self-adhered membrane over concrete deck at Roof Area 10 only.
D. Termination Bar: Required by CDB on all wall terminations. Attach 6" o.c.
   1. 040" x 1" aluminum bar under counterflashing or other restricted spaces.
   2. 1/8" x 1-1/2" aluminum bar with 45° sealant pocket where space permits.

E. TPO Walkway Pads: Furnished by the roofing manufacturer.


2.7 METAL FLASHINGS

A. Counterflashing: Refer to Section 07 62 00 “Sheet Metal Flashing and Trim”.

B. Expansion Joint Cover: Refer to Section 07 71 29 “Manufactured Roof Expansion Joints”.

C. Coping cap: Concealed cleat attachment on the outside, exposed fasteners with neoprene gaskets on the inside. Refer to Section 07 71 00 “Roof Specialties”.

3. EXECUTION

3.1 ENVIRONMENTAL CONDITIONS

A. Remove existing roofing only in dry weather.

B. Install roofing only in dry weather.

C. Comply with manufacturer's climatic restrictions.

3.2 REMOVE EXISTING CONSTRUCTION

A. Temporary removals:
   1. Temporarily remove items in a quantity and manner such that they can be completely reinstalled on the same workday that they are removed. Items include, but are not limited to:
      a. Air handling units.
      b. Condensing units.
      c. Exhaust fans.
      d. HVAC equipment.

B. Permanent removals:
   1. Remove all existing roof membrane, roof insulation, flashing, and related components down to the roof deck on the areas indicated on the drawings.
2. Remove all existing capped openings down to structural deck (where indicated on the drawings).
3. Remove all abandoned equipment and associated roof curbs down to structural deck (where indicated on the drawings).

3.3 INSPECTION

A. Examine all surfaces for inadequate anchorage, foreign material, moisture, unevenness, or other conditions which could prevent the best quality and longevity of roofing, flashing, and accessory components. Notify the A/E of all deficiencies.

B. Do not proceed with the work until all deficiencies have been corrected to the satisfaction of the A/E and the roofing manufacturer.

3.4 PREPARATION

A. Ensure that all surfaces are clean and dry before starting and during performance of work.

B. Verify that all work of other contractors and subcontractors which penetrates the roof deck or requires men and equipment to traverse the roof deck has been completed.

3.5 INSTALLATION

A. Install self-adhering vapor barrier membrane on top of existing concrete deck (at Roof Area 10 only).

1. Adhere per manufacturer’s recommendations.

B. Install the roof insulation with end joints staggered at mid-point in each layer. Offset all joints between layers a minimum of six inches.

1. Attach insulation per manufacturer's recommendations.

C. Install the roofing and flashing system and all accessory items in accord with the manufacturer's printed instructions.

D. Weld all field seams using the manufacturer's approved welding equipment and in accord with the manufacturer's recommendations.

E. Reinstall temporarily removed items noted in section 3, B, 1 on the same workday that they are removed.

3.6 FIELD QUALITY CONTROL

A. The A/E will provide onsite observation during installation.

B. The roofing manufacturer will provide onsite observation and instruction as they deem necessary, but not less than two (2) site visits each week during construction.
3.7 ADJUST AND CLEAN

A. Carefully inspect all completed work and correct all defects.

B. Remove from the job site and legally dispose of all debris.

C. Remove all tools, equipment, and construction aids.

D. Prevent storage of materials and equipment on the completed roof.

E. Accompany the manufacturer's technical inspector and assist with equipment and workmen if necessary to provide access to the roof. Correct all defects noted during the inspection.

END OF SECTION 07 54 23
State of Illinois
CAPITAL DEVELOPMENT BOARD

025-0398

RSMW

Roofing System Manufacturer’s Warranty

Manufacturer’s Warranty Number(s):

Effective Date: Ending Date: Metal Finish Warranty Length: 20 years

Manufacturer Name: ___________________________________________________________________

Manufacturer Name: ___________________________________________________________________

Telephone #: Fax #: ______________________________________________________________________

CDB Project No.: 805-030-020

E-Mail: _______________________________________________________________________________

CDB Project Manager: Mr. John Nalis

Address: _____________________________________________________________________________

Agent: Capital Development Board, 3rd Floor, Stratton Building, Springfield, IL 62706

Total Warranty - Square Footage: _____________________________________________________________________________

Using Agency: Illinois Board of Higher Education

Roof Specification-System Name: _____________________________________________________________________________

Site Address: 1500 Sullivan Road, Aurora, IL 60506

Lin. Ft. Flashing: ______________________________________________________________________________

Building Name: Illinois Math & Science Academy – Academic Building

Lin. Ft. Expansion Joint Covers: ___________________________________________________________________________

CDB Building No.: CP078

Insulation Type(s): ______________________________________________________________________________

Identify Area of Work: Roof Area 5-16, inclusive and portions of Roof Area 18 (saddles) as indicated on the Drawings.

Roofing Contractor: ______________________________________________________________________________

Other Information: ________________________________________________________________________________

Note: Contractor to complete information above and Section II dollar amount, below.

WARRANTY

FOR CDB USE ONLY

P. M. Name __________________________ Project No: __________________________
Contract __________________________ C.F. Locale: __________________________

Contractor #7
I. THE ROOFING SYSTEM MANUFACTURER hereinafter called "Manufacturer" acknowledges that it has previously reviewed the drawings and specifications for the roofing system and certified that the design is acceptable for this Warranty. The Manufacturer warrants to the Building Owner named above, that, subject to the provisions of this document, the Manufacturer will, at its own expense, make or cause to be made all repairs necessary to maintain the roofing system in a watertight condition during the warranty period stated above which commences on the date of accepted Substantial Completion of the roofing system. System includes:

A. Membrane(s).
B. Flashings (except metal or components not furnished by the Manufacturer as part of its advertised system).
C. Insulation.
D. Fasteners and adhesives.

II. LIMITATIONS. The Manufacturer's liability under this Warranty is limited to (50,000) which is the Owner's original installed cost of the roofing system per CDB Contractor Schedule of Values (CSV).

III. OWNER'S RESPONSIBILITY. The Owner will notify the Manufacturer if repairs covered by the Warranty are required. The notice will be by, Telephone, Fax, E-mail, or Mail, to the Manufacturer's office specified in the Manufacturer's Maintenance Manual within 30 days of discovery of leaks or other defects in the roofing system. The Owner will provide the Manufacturer free access to the building during regular business hours over the life of the Warranty. The Owner acknowledges that the Manufacturer has provided its Roofing Maintenance Manual, including instructions necessary for the Owner to inspect and maintain the roofing system during the warranty period.

IV. EXCLUSIONS. The following are excluded from this Warranty:

A. Roof maintenance for corrections of conditions other than leaks.
B. Damage to any part of the building (other than the roofing system) or to its contents.
C. Damage resulting from repairs made to the roofing system without the Manufacturer's prior authorization.
D. Damage resulting from any one of the following:
   1. Settlement, expansion, contraction, cracking, warping, deflection or movement of roof deck, walls, coping structural members or building foundation.
   2. Natural disasters (i.e., windstorm, hail, flood, hurricane, cyclone, lighting, tornado or earthquake).
   3. Changes in building usage; new installations on, through or adjacent to the roofing system made after the effective date of this Warranty, unless the Manufacturer has given prior written approval of such changes in building usage or new installations.
   4. Accidents, vandalism or other uncontrollable events.
   5. Lack of positive drainage (standing water) for asphalt built-up systems.
   6. Chemical attacks on the membrane from sources unknown or not present at time of roofing system.
   7. Falling objects, misuse or abuse of the roofing system, traffic, recreational activities or storage of material on the roofing system.
   8. Infiltration or condensation of moisture in, through or around walls, copings, building structure or underlying or surrounding areas.
   9. Movement or deterioration of metal components adjacent to the roof (except where such components are a part of the Manufacturer's advertised roofing system).
   10. Failure of materials supplied by others (except where such materials are a part of the specified roofing system certified by the Manufacturer prior to bidding the roofing work).
   11. Tests of test cuts not authorized by the Manufacturer.
   12. Failure of the Owner to provide maintenance in accord with the Roofing Maintenance Manual.
   13. Failure of the Owner to notify the Manufacturer of leaks or other defects within 30 days of discovery.

A. The implied warranties of merchantability and fitness for a particular purpose are excluded.

In Witness Whereof: Manufacturer and Owner have caused this Warranty to be duly executed on the dates below.
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. General Contractor

   a. This section includes the following:

   1) Manufactured through-wall flashing with snaplock receiver.
   2) Manufactured reglets with counterflashings.
   3) Formed roof-drainage sheet metal fabrications.
   4) Formed low-slope roof sheet metal fabrications.
   5) Formed equipment support flashing.

B. Related Requirements:

   1. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking.
   2. Section 07 72 00 "Roof Accessories" for rooftop equipment curbs, roof hatches and smoke vents.

1.2 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

   1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
   3. Review requirements for insurance and certificates if applicable.
   4. Review sheet metal flashing observation and repair procedures after flashing installation.
1.4 ACTION SUBMITTALs

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.
   1. Include plans, elevations, sections, and attachment details.
   2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
   3. Include identification of material, thickness, weight, and finish for each item and location in Project.
   4. Include details for forming, including profiles, shapes, seams, and dimensions.
   5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
   6. Include details of termination points and assemblies.
   7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
   8. Include details of roof-penetration flashing.
   9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
   10. Include details of special conditions.
   11. Include details of connections to adjoining work.
   12. Detail formed flashing and trim at scale of not less than 3 inches per 12 inches.

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish.
   1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
   2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
   3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

1.5 INFORMATIONAL SUBMITTALs

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of coping and roof edge flashing that is FM Approvals approved.
1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1. For copings and roof edge flashings that are FM Approvals approved, shop shall be listed as able to fabricate required details as tested and approved.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup of typical roof edge, including built-in gutter, apron flashing approximately 10 feet long, including supporting construction cleats, seams, attachments, underlayment, and accessories.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.9 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

2. PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA’s "The NRCA Roofing Manual" and SMACNA’s "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. FM Approvals Listing: Manufacture and install copings, roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with name of fabricator and design approved by FM Approvals.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
1. Exposed Coil-Coated Finish:
   a. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As selected by Architect from manufacturer's full range.
3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; with smooth, flat surface.
   1. Finish: 4 (polished directional satin).

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
   1. Manufacturers:
      a. Carlisle Coatings and Waterproofing, Inc.
      b. Grace Construction Products; W.R. Grace & Company
      c. Protecto Wrap Company

2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. ((0.16 kg/sq. m))minimum.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item] unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
   a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
   b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

C. Solder:
   1. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.


2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junction and with interlocking counterflashing on exterior face, of same metal as reglet.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Cheney Flashing Company.
b. Fry Reglet Corporation.
c. Heckmann Building Products, Inc.
d. Hickman, W. P. Company.
e. Hohmann & Barnard, Inc.

2. Material: Stainless steel, 0.019 inch (0.48 mm) thick, Aluminum, 0.024 inch (0.61 mm) thick.
3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
5. Accessories:
   a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
   b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.


2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
D. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
   2. Use lapped expansion joints only where indicated on Drawings.

E. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

G. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

H. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

I. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

J. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

K. Do not use graphite pencils to mark metal surfaces.

2.7 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.

   1. Gutter Profile: as indicated on the drawings.
   2. Expansion Joints: Lap type.
   3. Accessories: Continuous, removable leaf screen with sheet metal frame and hardware cloth screen.
   4. Gutters with Girth 16 to 20 Inches (410 to 510 mm): Fabricate from the following materials:

      a. Aluminum: 0.040 inch thick.
5. Gutters with Girth 21 to 25 Inches (530 to 640 mm): Fabricate from the following materials:
   a. Aluminum: 0.050 inch (1.27 mm) thick.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.
   2. Fabricate from the following materials:
      a. Aluminum: 0.024 inch (0.61 mm) thick.

2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop and Fascia Cap): Fabricate in minimum 96-inch-(2400-mm-) long, but not exceeding 12-foot-(3.6-m-) long sections. Furnish with 6-inch-(150-mm-) wide, joint cover plates. Shop fabricate interior and exterior corners.
   1. Joint Style: Butted with expansion space and 6-inch-(150-mm-) wide, concealed backup plate.
   2. Fabricate from the Following Materials:
      a. Aluminum: 0.050 inch (1.27 mm) thick.

B. Copings: Fabricate in minimum 96-inch-(2400-mm-) long, but not exceeding 12-foot-(3.6-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, solder or weld watertight. Shop fabricate interior and exterior corners.
   2. Joint Style: Butted with expansion space and 6-inch-(150-mm-) wide, concealed backup plate.
   3. Fabricate from the Following Materials:
      a. Aluminum: 0.050 inch (1.27 mm) thick.

C. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
   1. Stainless Steel: 0.019 inch (0.48 mm) thick.
D. Counterflash: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Stainless Steel: 0.019 inch (0.48 mm) thick.

E. Flashing Receivers: Fabricate from the following materials:

1. Stainless Steel: 0.016 inch (0.40 mm) thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch thick.

3. EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.
6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel and aluminum sheet.
2. Do not use torches for soldering.
3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
5. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.
6. Copper-Clad Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for copper-clad stainless steel.

H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 ROOF-DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter spacers to front and back of gutter.
2. Anchor and loosely lock back edge of gutter to continuous cleat.
3. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
4. Anchor gutter with gutter brackets spaced not more than 24 inches apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.
5. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.
6. Install continuous gutter screens on gutters with noncorrosive fasteners, hinged to swing open for cleaning gutters.

C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints.

1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c.
2. Provide elbows at base of downspout to direct water away from building.
3. Connect downspouts to underground drainage system.

D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in asphalt roofing cement compatible with the substrate.

3.5 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

C. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

D. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.

   1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
   2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

E. Copings: Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.

F. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.

G. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints minimum of 4 inches (100 mm). Secure in waterproof manner by means of snap-in installation and sealant unless otherwise indicated.

H. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.
3.6 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.7 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.8 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.9 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. General Contractor

   a. This section includes the following:

      1) Copings.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 41 13 "Preformed Metal Roof Panels" for roof-edge drainage-system components provided by metal-roof-panel manufacturer.
3. Section 07 62 00 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
4. Section 07 71 29 "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint cover assemblies.
5. Section 07 72 00 "Roof Accessories" for set-on-type equipment curbs, roof hatches and smoke vents.
6. Section 07 92 00 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

C. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing installer, roofing-system manufacturer's representative, installer, structural-support installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
B. Shop Drawings: For roof specialties.
   1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
   2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
   3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
   4. Detail termination points and assemblies, including fixed points.
   5. Include details of special conditions.

C. Samples: For each type of roof specialty and for each color and texture specified.

D. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

E. Samples for Verification:
   1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
   2. Include copings made from 12-inch (300-mm) lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of roof specialty.

C. Product Test Reports: For copings, for tests performed by a qualified testing agency.

D. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.
1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

A. Roofing-System Warranty: Roof specialties are included in warranty provisions in each Roofing System Specification Section.

B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

2. PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
B. FM Approvals' Listing: Manufacture and install copings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C).

2.2 COPINGS

A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet (3.6 m), concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.

1. Manufacturers:
   a. Hickman Company, W.P.
   b. Metal-Era, Inc.
   c. Petersen Aluminum Corporation

2. Extruded-Aluminum Coping Caps: Extruded aluminum, 0.125 inch (3.18 mm) thick.
   a. Finish: Three-coat fluoropolymer.
   b. Color: As selected by Architect from manufacturer's full range.

4. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.
   a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches (300 mm) wide, with integral cleats.
   b. Face-Leg Cleats: Concealed, continuous stainless steel.

2.3 MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
C. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

D. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.4 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

3. Manufacturers:
   a. Carlisle Coatings & Waterproofing, Inc.
   b. Grace Construction Products; W.R. Grace & Co.
   c. Owens Corning

B. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
3. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
5. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

B. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

C. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.
D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.


2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Coil-Coated Aluminum Sheet Finishes:

   1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

      a. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

E. Aluminum Extrusion Finishes:

   1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

      a. Three-Coat Fluoropolymer: AAMA 2604. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

1. Apply continuously under copings.
2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

B. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

C. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

3.3 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Coat concealed side of uncoated aluminum and stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.


   1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.
   2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

3.4 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

   1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 71 00
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. General Contractor

   a. This section includes the following:

      1) Bellows-Type roof expansion joints.
      2) Aluminum roof expansion joints.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wooden curbs or cants for mounting roof expansion joints.
2. Section 07 31 05 “Fiberglas 3Tab Shingles” for fiberglass shingle roofing system.
3. Section 07 41 13 “Preformed Metal Roof Panels” for preformed metal roof panel roofing system.
4. Section 07 54 23 “TPO Membrane Roofing” for TPO membrane roofing system.
5. Section 07 62 00 "Sheet Metal Flashing and Trim" for shop- and field-fabricated sheet metal expansion-joint systems, flashing, and other sheet metal items.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roof expansion joints.

1. Include plans, elevations, sections, and attachment details.
2. Include details of splices, intersections, transitions, fittings, method of field assembly, and location and size of each field splice.
3. Provide isometric drawings of intersections, terminations, and changes in joint direction or planes, depicting how components interconnect with each other and adjacent construction to allow movement and achieve waterproof continuity.

C. Samples: For each exposed product and for each color specified, 6 inches (150 mm) in size.
1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each fire-barrier provided as part of a roof-expansion-joint assembly, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer of roofing membrane.

1.6 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace roof expansion joints and components that leak, deteriorate beyond normal weathering, or otherwise fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof expansion joints that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than five Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

2. PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Roof expansion joints shall withstand exposure to weather, remain watertight, and resist the movements indicated without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint seals, failure of connections, and other detrimental effects.
1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

C. Fire-Test-Response Characteristics: Provide fire-barrier assemblies with fire-test-response characteristics as determined by testing identical products, per test method indicated, by UL or another testing agency acceptable to authorities having jurisdiction. Assemblies shall be capable of anticipated movement while maintaining fire rating. Fire-barrier products shall bear classification marking of qualified testing agency.

2.2 BELLOWS-TYPE ROOF EXPANSION JOINTS

A. Source Limitations: Obtain bellows-type roof expansion joints approved by roofing manufacturer and that are part of roofing membrane warranty.

B. Flanged Bellows Roof Expansion Joint: Manufactured, continuous, waterproof, joint-cover assembly, consisting of exposed membrane bellows, laminated to flexible, closed-cell support foam, and secured along each edge to a 3- to 4-inch- (76- to 100-mm-) wide metal flange for nailing to substrate. Provide each size and type indicated, factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints, splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation. Fabricate each assembly specifically for installation configuration indicated on Drawings.

1. Manufacturers:
   a. Architectural Art Manufacturing, Inc., a division of Pittcon Architectural Metals, LLC.
   b. Balco, Inc.
   c. C/S Group

2. Joint Movement Capability: Plus and minus 1”.
3. Bellows: EPDM flexible membrane, nominal 60 mils (1.5 mm) thick.

4. Flanges: Stainless steel, 0.019 inch (0.48 mm) thick.
   a. Form: as indicated on Drawings.

5. Cover Membrane: EPDM flexible membrane, factory laminated to bellows and covering entire joint assembly and curbs.

6. Secondary Seal: Continuous, waterproof PVC membrane within joint and attached to substrate on sides of joint below the primary bellows assembly.
a. Drain-Tube Assemblies: Equip secondary seal with drain tubes and seals to direct collected moisture to drain.
b. Thermal Insulation: Fill space above secondary seal with manufacturer's standard, factory-installed glass-fiber insulation; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84.

2.3 ALUMINUM ROOF EXPANSION JOINTS

A. Aluminum Roof Expansion Joint: Manufactured, continuous, waterproof, joint-cover assembly; consisting of a formed or extruded metal cover secured to extruded aluminum frames, with water-resistant gasketing between cover and frames, and with provision for securing assembly to substrate and sealing assembly to roofing membrane or flashing. Provide each size and type indicated, factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints, splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation. Fabricate each assembly specifically for installation configuration indicated on Drawings.

1. Manufacturers:
   a. Architectural Art Manufacturing, Inc., a division of Pittcon Architectural Metals, LLC.
   b. Balco, Inc.
   c. C/S Group

2. Joint Movement Capability: Plus and minus 1”.
3. Frame Members: Extruded aluminum configured for curbs as indicated; with exposed finish as selected by Architect from manufacturer's full range.
4. Cover: Extruded aluminum; thickness as recommended by manufacturer.
   a. Aluminum Finish Color: As selected by Architect from manufacturer's full range.

5. Centering Devices: Centering bars.
6. Secondary Seal: Continuous, waterproof PVC membrane within joint and attached to substrate on sides of joint below the cover.
   a. Drain-Tube Assemblies: Equip secondary seal with drain tubes and seals to direct collected moisture to drain.
   b. Thermal Insulation: Fill space above secondary seal with mineral fiber blanket insulation; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84.

2.4 MATERIALS

B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

C. Aluminum: ASTM B 209 (ASTM B 209M) for sheet and plate, ASTM B 221 (ASTM B 221M) for extrusions; alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
   1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious or preservative-treated wood materials.
   3. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      a. Three-Coat Fluoropolymer: System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent PVDF resin by weight.

D. EPDM Membrane: ASTM D 4637, Type standard with manufacturer for application.

E. PVC Membrane: ASTM D 4434, Type standard with manufacturer for application.

F. Silicone Extrusions: ASTM D 2000, UV stabilized, and that does not propagate flame.

G. Adhesives: As recommended by roof-expansion-joint manufacturer and that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

H. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
   1. Exposed Fasteners: Gasketed. Use screws with hex washer heads matching color of material being fastened.


J. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

3. EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine roof-joint openings, inside surfaces of parapets, and expansion-control joint systems that interface with roof expansion joints, for suitable conditions where roof expansion joints will be installed.
C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for handling and installing roof expansion joints.

1. Anchor roof expansion joints securely in place, with provisions for required movement. Use fasteners, protective coatings, sealants, and miscellaneous items as required to complete roof expansion joints.

2. Install roof expansion joints true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.

3. Provide for linear thermal expansion of roof expansion joint materials.

4. Provide uniform profile of roof expansion joint throughout its length; do not stretch or squeeze membranes.

5. Provide uniform, neat seams.

6. Install roof expansion joints to fit substrates and to result in watertight performance.

7. Torch cutting of roof expansion joints is not permitted.

8. Do not use graphite pencils to mark aluminum surfaces.

B. Directional Changes and Other Expansion-Control Joint Systems: Coordinate installation of roof expansion joints with other expansion-control joint systems to result in watertight performance. Install factory-fabricated units at directional changes and at transitions between roof expansion joints to provide continuous, uninterrupted, and watertight joints.

C. Splices: Splice roof expansion joints with materials provided by roof-expansion-joint manufacturer for this purpose, to provide continuous, uninterrupted, and waterproof joints.

1. Install waterproof splices and prefabricated end dams to prevent leakage of secondary-seal membrane.

D. Fire Barrier: Install fire barrier where indicated to provide continuous, uninterrupted fire resistance throughout length of roof expansion joint, including transitions and end joints.

E. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
3.3 PROTECTION

A. Protect roof expansion joints from foot traffic, displacement, or other damage.

B. Remove and replace roof expansion joints and components that become damaged by moisture or otherwise.

END OF SECTION 07 71 29
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. General Contractor

   a. This section includes the following:

      1) Roof Curbs.
      2) Roof hatches.
      3) Hatch-type heat and smoke vents.

B. Related Sections:

   1. Section 05 50 00 "Metal Fabrications" for metal ladders.
   2. Section 07 62 00 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
   3. Section 07 710 0 "Roof Specialties" for manufactured copings.
   4. Section 07 71 29 "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint covers.

1.2 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

   1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

B. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.6 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

2. PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
2.2 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers:
   a. AES Industries, Inc.
   b. Curbs Plus, Inc.
   c. Thybar Corporation.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported. To match size of existing curbs to be replaced.

C. Supported Load Capacity: Match capacity of existing curb to be replaced.

D. Material: Aluminum sheet, 0.125 inch thick.

   1. Finish: Mill.
   2. Color: As indicated by manufacturer's designations.

E. Construction:

   1. Curb Profile: Manufacturer's standard, compatible with roofing system.
   2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
   3. Fabricate curbs to minimum height of 12 inches above completed roofing surface unless otherwise indicated.
   4. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange.
   5. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
   7. Liner: Same material as curb, of manufacturer's standard thickness and finish.
   9. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to meet wind uplift requirements.
10. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch (19-mm) thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
11. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.
2.3 **ROOF HATCH**

A. **Roof Hatches:** Metal roof-hatch units with lids and insulated single walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.

1. **Manufacturers:**
   a. Acudor Products, Inc.
   b. AES Industries, Inc.
   c. Bilco Company (The)
   d. Nystrom, Inc.

B. **Type and Size:** To match size of existing hatches to be replaced.

C. **Loads:** Minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 20-lbf/sq. ft. (0.95-kPa) internal uplift load.

D. **Hatch Material:** Aluminum-zinc alloy-coated steel sheet.

   1. **Thickness:** Manufacturer's standard thickness for hatch size indicated.
   2. **Finish:** Two-coat fluoropolymer.
   3. **Color:** As selected by Architect from manufacturer's full range.

E. **Construction:**

   1. **Insulation:** Polyisocyanurate board.
      a. **R-Value:** 12.0 according to ASTM C 1363.
   2. **Nailer:** Factory-installed wood nailer continuous around hatch perimeter.
   3. **Hatch Lid:** Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
   4. **Curb Liner:** Manufacturer's standard, of same material and finish as metal curb.
   5. **On ribbed or fluted metal roofs,** form flange at perimeter bottom to conform to roof profile.
   6. **Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.**
   7. **Sloping Roofs:** Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is constant. Equip hatch with water diverter or cricket on side that obstructs water flow.

F. **Hardware:** Spring operators, hold-open arm, stainless-steel spring latch with turn handles, stainless-steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

   1. **Provide two-point latch on lids larger than 84 inches (2130 mm).**
2. Provide remote-control operation.

G. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 42 inches (1060 mm) above finished roof deck.
5. Finish: Manufacturer's standard baked enamel or powder coat.
   a. Color: As selected by Architect from manufacturer's full range.

2.4 HEAT AND SMOKE VENTS

A. Hatch-Type Heat and Smoke Vents: Manufacturer's standard, with single-walled insulated curbs, welded or mechanically fastened and sealed corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double-walled lid and continuous weathertight perimeter lid gaskets, and equip with automatic self-lifting mechanisms and UL-listed fusible links rated at 165 deg F.

1. Manufacturers:
   a. Acudor Products, Inc.
   b. Bilco Company (The)
   c. Nystrom, Inc.

2. Type and Size: Double-leaf lid, match size of existing vents to be replaced.
3. Loads: Minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 30-lbf/sq. ft. (1.4-kPa) internal uplift load.
   a. When release is actuated, lid shall open against 10-lbf/sq. ft. (0.5-kPa) snow or wind load and lock in position.

4. Heat and Smoke Vent Standard: Provide units that have been tested and listed to comply with UL 793 and are FM Approved.

   a. Thickness: Manufacturer's standard thickness for hatch size indicated.
   b. Finish: Two-coat fluoropolymer.
   c. Color: As selected by Architect from manufacturer's full range.
6. Construction:
   a. Insulation: Polyisocyanurate board.
      1) R-Value: 12.0 according to ASTM C 1363.
   c. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
   d. Hatch Lid: Glazed, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
   e. Exterior Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
   f. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.
   g. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is constant. Equip hatch with water diverter or cricket on side that obstructs water flow.
   h. Security Grille: Provide for all units.


2.5 METAL MATERIALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
   1. Mill Finish: As manufactured.
   2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
   3. Exposed Coil-Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      a. Two-Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
   4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).

B. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.
C. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.

D. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

E. Steel Tube: ASTM A 500/A 500M, round tube.

F. Galvanized-Steel Tube: ASTM A 500/A 500M, round tube, hot-dip galvanized according to ASTM A 123/A 123M.


2.6 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisoxyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.

D. Security Grilles: 3/4-inch (19-mm) diameter, ASTM A 1011/A 1011M steel bars spaced 6 inches (150 mm) o.c. in one direction and 12 inches (300 mm) o.c. in the other; factory finished as follows:

   1. Surface Preparation: Remove mill scale and rust, if any, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."

   2. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.

   3. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer; selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats under prolonged exposure.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

F. Underlayment:

   1. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

   2. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.
3. **Slip Sheet**: Building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum, rosin sized.

4. **Self-Adhering, High-Temperature Sheet**: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

5. **Fasteners**: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

6. **Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel**: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

7. **Fasteners for Aluminum Sheet**: Aluminum or Series 300 stainless steel.

8. **Fasteners for Stainless-Steel Sheet**: Series 300 stainless steel.

9. **Gaskets**: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

10. **Elastomeric Sealant**: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

11. **Butyl Sealant**: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.


**2.7 GENERAL FINISH REQUIREMENTS**

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

**3. EXECUTION**

**3.1 EXAMINATION**

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum and stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.

C. Roof-Hatch Installation:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach safety railing system to roof-hatch curb.
3. Attach ladder-assist post according to manufacturer's written instructions.

D. Heat and Smoke Vent Installation:

1. Install heat and smoke vent so top perimeter surfaces are level.
2. Install and test heat and smoke vents and their components for proper operation according to NFPA 204.

E. Security Grilles: Weld bar intersections and, using tamper-resistant bolts, attach the ends of bars to structural frame or primary curb walls.

F. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.
3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 00
DIVISION 7 THERMAL & MOISTURE PROTECTION
07 92 00 – Joint Sealants

1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

   1. General Contractor

      a. This section includes the following:

         1) Silicone joint sealants.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured
   sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide
   Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-
   inch- (150-mm-) long strips of material matching the appearance of exposed surfaces
   adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified
   testing agency.

C. Preconstruction Laboratory Test Schedule: Include the following information for each
   joint sealant and substrate material to be tested:
1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
5. Number of samples required.

D. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

E. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

F. Field-Adhesion-Test Reports: For each sealant application tested.

G. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
6. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
      1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
4. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.7 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
1.8 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

2. PRODUCTS

2.1 JOINT SEALANTS, GENERAL

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

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers:
   a. GE Construction Sealants; Momentive Performance Materials, Inc.
   b. Pecora Corporation
   c. Sika Corporation
2.3 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Manufacturers:
   a. BASF Corporation – Construction Systems
   b. Construction Foam Products; a division of Nomaco, Inc.
   c. W.R. Meadows, Inc.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C closed-cell material with a surface skin, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

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

2.4 MISCELLANEOUS MATERIALS

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

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

3. EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
   a. Concrete.
   b. Masonry.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
   a. Metal.
   b. Glass.
   c. Porcelain enamel.
   d. Glazed surfaces of ceramic tile.

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

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

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C 1193.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:
   a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
   b. Perform one test for each 1000 feet (300 m) of joint length thereafter or one test per each floor per elevation.

3. Inspect tested joints and report on the following:
   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.
   c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.

5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

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

3.6 PROTECTION

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

3.7 JOINT-SEALANT SCHEDULE

1. Joint Locations:
   b. Joints between plant-precast architectural concrete units.
   c. Control and expansion joints in unit masonry.
   d. Joints in dimension stone cladding.
   e. Joints in glass unit masonry assemblies.
   f. Joints in exterior insulation and finish systems.
   g. Joints between metal panels.
   h. Joints between different materials listed above.
   i. Perimeter joints between materials listed above and frames of doors, windows and louvers.
   j. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. General Contractor

a. This section includes the following:

1) Exterior storefront framing.

B. Related requirements:

1. Section 05 50 00, “Metal Fabrications”.
2. Section 06 10 00, “Rough Carpentry”.
3. Section 07 53 23, “EPDM Membrane Roofing”.
4. Section 07 62 00, “Sheet Metal Flashing and Trim”.
5. Section 07 92 00, “Joint Sealants”.
6. Section 08 80 00, “Glazing”.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Prior to removal of existing monitor framing and glazing, General Contractor shall provide protective barrier at interior side of monitor windows that will prevent the infiltration of construction dust and prevent tools, construction materials, personnel and other items from falling into occupied spaces below. General Contractor shall submit proposed protective methods and plans to Architect/Engineer and CDB/IMSA for review a minimum of two (2) months in advance of the installation of their proposed protective barrier.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
   a. Joinery, including concealed welds.
   b. Anchorage.
   c. Expansion provisions.
   d. Glazing.
   e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Initial Selection: For units with factory-applied color finishes.
   1. Per 2.10 ALUMINUM FINISHES.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   5. Flashing and drainage.

1.4 INFORMATIONAL SUBMITTALS

A. Preconstruction Laboratory Mockup Testing Submittals:
   1. Testing Program: Developed specifically for Project.
   2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
   3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.

B. Qualification Data: For Installer, laboratory mockup testing agency and field testing agency.

C. Energy Performance Certificates: For aluminum-framed storefronts, accessories, and components, from manufacturer.
   1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
a. Structural: ASTM E 330 at 50 percent of positive test load.
b. Air Infiltration: ASTM E 283.
c. Water Penetration under Static Pressure: ASTM E 331.
e. Structural: ASTM E 330 at 100 percent of positive and negative test loads. Repeat the following:
   1) Air Infiltration: ASTM E 283.
   2) Water Penetration under Static Pressure: ASTM E 331.

f. Thermal Cycling: According to AAMA 501.5. Repeat the following:
   1) Air Infiltration: ASTM E 283.
   2) Water Penetration under Static Pressure: ASTM E 331.

g. Structural: ASTM E 330 at 100 and 150 percent of positive and negative test loads. Repeat the following:
   1) Air Infiltration: ASTM E 283.
   2) Water Penetration under Static Pressure: ASTM E 331.

D. Product Test Reports: For aluminum-framed storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.

F. Source quality-control reports.

G. Field quality-control reports.

H. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed storefronts to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Laboratory Mockup Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.
C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect’s approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 MOCKUPS

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical storefront area as shown on Drawings.
2. Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION LABORATORY MOCKUPS

A. Preconstruction Testing Service: General Contractor engage a qualified testing agency to perform testing on preconstruction laboratory mockups.

B. Build preconstruction laboratory mockups at testing agency facility; use personnel, products, and methods of construction that will be used at Project site.

1. Size and Configuration: As indicated on Drawings.
2. Notify Architect seven days in advance of the dates and times when preconstruction laboratory mockups will be constructed and tested.

C. Preconstruction Laboratory Mockup Testing Program: Test preconstruction laboratory mockups according to requirements in "Performance Requirements" Article. Perform the following tests in the following order:

1. Structural: ASTM E 330 at 50 percent of positive test load.
3. Water Penetration under Static Pressure: ASTM E 331.
5. Structural: ASTM E 330 at 100 percent of positive and negative test loads. Repeat the following:
   b. Water Penetration under Static Pressure: ASTM E 331.

6. Thermal Cycling: According to AAMA 501.5. Repeat the following:
   b. Water Penetration under Static Pressure: ASTM E 331.

7. Structural: ASTM E 330 at 100 and 150 percent of positive and negative test loads. Repeat the following:
   b. Water Penetration under Static Pressure: ASTM E 331.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed storefronts that do not comply with requirements or that fail in materials or workmanship within warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection.
   b. Noise or vibration created by wind and thermal and structural movements.
   c. Deterioration of metals and other materials beyond normal weathering.
   d. Water penetration through fixed glazing and framing areas.

2. Warranty Period: 2 years from date of Substantial Completion, or manufacturers standard whichever is longer.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion, or manufacturers standard whichever is longer.
2. PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

2. Failure also includes the following:
   a. Thermal stresses transferring to building structure.
   b. Glass breakage.
   c. Noise or vibration created by wind and thermal and structural movements.
   d. Loosening or weakening of fasteners, attachments, and other components.

B. Structural Loads:

1. Wind Loads: Corner: 30 lbs/sq. ft.; Other than corner: 25 lbs/sq. ft.

C. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.

2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

D. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.

2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.

3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:
   a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).
F. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
   1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft. (720 Pa).

G. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:
   1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft. (720 Pa).
   2. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

H. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.

I. Energy Performance: Certify and label energy performance according to NFRC as follows:
   1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K) as determined according to NFRC 100.
   2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC 200.
   3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 45 as determined according to NFRC 500.

J. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows.
   1. Outdoor-Indoor Transmission Class: Minimum 34.

K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
   1. Temperature Change: 140 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
   2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
b. Low Exterior Ambient-Air Temperature: -20 deg F.
c. Interior Ambient-Air Temperature: 75 deg F (24 deg C).

2.2 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Kawneer
2. Pittco Architectural Metals, Inc.
3. Tubelite, Inc.

B. Source Limitations: Obtain all components of aluminum-framed storefront system, including framing and accessories, from single manufacturer.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

2. Frame size: 2” wide x 4-1/2” deep.
6. Fabrication Method: Field-fabricated stick system.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
   d. Structural Profiles: ASTM B 308/B 308M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods
according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

2.5 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

2.6 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using head-and-sill-receptor system with shear blocks at intermediate horizontal members.

F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 ALUMINUM FINISHES

A. High-Performance Organic Finish: Four-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers’ written instructions.

1. Color and Gloss: From manufacturer’s full range.

3. EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure non-movement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.
B. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
   2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 088000 "Glazing."

F. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
   1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
   2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
   3. Alignment:
      a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
      b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
      c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
   4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

END OF SECTION 08 41 13
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. General Contractor

a. This section includes the following:

1) Glass for storefront framing.
2) Glazing sealants and accessories.

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of the following products; 12 inches (300 mm) square.

1. Acid-etched glass.
2. Insulating glass.
3. Any combination of the products noted above.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturers of insulating-glass units with sputter-coated, low-E coatings and glass testing agency.

B. Product Certificates: For glass.

C. Product Test Reports: For acid-etched glass, coated glass and insulating glass for tests performed by a qualified testing agency.

D. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Storefronts" to match glazing systems required for Project, including glazing methods.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.

3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.

4. Schedule enough time for testing and analyzing results to prevent delaying the Work.

5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).

1.11 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion, or manufacturer’s standard, whichever is longer.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to
manufacturer's written instructions. Evidence of failure is the obstruction of vision by
dust, moisture, or film on interior surfaces of glass.

1. **Warranty Period**: 10 years from date of Substantial Completion, or
manufacturer’s standard, whichever is longer.

### 2. PRODUCTS

#### 2.1 MANUFACTURERS

A. Subject to compliance with the requirements, provide products by one of the following
manufacturers:

1. Cardinal IG
2. Guardian Industries Corp.
3. PPG
4. Viracon, Inc
5. Walker Textures

B. Source Limitations for Glass: Obtain from single source from single manufacturer for
each glass type.

1. Obtain reflective-coated glass from single source from single manufacturer.
2. Obtain acid-etched glass from single source from single manufacturer.

C. Source Limitations for Glazing Accessories: Obtain from single source from single
manufacturer for each product and installation method.

#### 2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind
and impact loads (where applicable) without failure, including loss or glass breakage
attributable to the following: defective manufacture, fabrication, or installation; failure
of sealants or gaskets to remain watertight and airtight; deterioration of glazing
materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within
limits and under conditions indicated determined according to ASTM E 1300.

1. **Design Wind Pressures**: As indicated previously indicated herein.
2. **Design Wind Pressures**: Determine design wind pressures applicable to Project
according to ASCE/SEI 7, based on 50 foot height above grade.
3. **Maximum Lateral Deflection**: For glass supported on all four edges, limit center-
of-glass deflection at design wind pressure to not more than 1/50 times the short-
side length or 1 inch (25 mm), whichever is less.
4. **Differential Shading**: Design glass to resist thermal stresses induced by
differential shading within individual glass lites.
C. Safety Glazing: Safety glazing is typical. Provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick or of thickness indicated.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL’s WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.


B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where fully tempered float glass is typical, provide fully tempered float glass.
2.4 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary sealants.
2. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

B. Insulating-Glass Types:

1. Glass Type 1 (Typical):
   a. Overall Unit Thickness: 1 inch (25mm)
   b. Thickness of Each Glass Lite: ¼” (6mm)
   c. Outdoor Lite: Clear tempered float glass with Low-E sputter coat on surface 2.
   d. Interspace Content: Air.
   e. Indoor Lite: Clear tempered float glass with acid-etched finish on surface 3.
   f. Visible Light Transmittance: 70 percent maximum.
   g. Winter Nighttime U-Factor: 0.29 maximum.
   h. Summer Daytime U-Factor: 0.27 maximum.
   i. Solar Heat Gain Coefficient: 0.38 maximum.
   j. Provide safety glazing labeling.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Field-applied sealants shall have a VOC content of not more than 250 g/L.
4. Sealants shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

5. Colors of Exposed Glazing Sealants: As selected by Commissioner from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturer: Subject to compliance with requirements, provide product from one of the following manufacturers:
   a. Tremco
   b. GE
   c. Sonneborn

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 INSULATED PANELS

A. For 1” ± 1/32” thick insulating panels set into storefront frames:

1. Design and Construction
   a. Interior surface to be made of a one-piece flush porcelain enamel finished sheet, with the same specification as #3 below, Exterior surface.
   b. Core: inner layer 5/8” fire rated drywall. Middle layer of 6 mm thick rigid corrugated plastic. Outer layer of 3.1 mm thick Mineral Fiber Cement board stabilizer sheet.
   c. Exterior surface to be made of a one-piece flush porcelain enamel finished sheet. The ceramic coating shall be Type A, acid resistant continuously coil coated and fused at 1500 deg F fused to the 28 gauge, minimum thickness, enameling grade steel. The vitreous enamel shall be produced in accordance to the Porcelain Enamel Institute’s “PEI-S100 (65) – Specification for Porcelain Enamel on Steel for Exterior Use”. The porcelain enamel sheet shall be covered with a protective plastic film covering to be removed at the installation site immediately upon erection.
   d. Laminating Adhesives for the panels to be epoxy; urethane cross-linked structural adhesives or Neoprene that are permanently elastic, thermosetting adhesives, with bond strength equal to or higher than core stabilizer material, showing no creep at temperatures up to 200 deg F. The adhesive will be 100% applied to surfaces to be laminated via roll coating process.
   e. Edge Configuration: Sealed.
   f. Composite Panel to have a minimum “R” value of 4.4.
   g. Color: Finish color of interior and exterior surfaces of panels shall be selected by the Architect to contrast or match the color of the storefront frame. The color selection of the steel faced insulated panels shall be selected from the manufacturer’s full range of standard colors. The finish on exposed faces is to be a porcelain enamel color finish consisting of a specially formulated glass base substance applied by machine onto enameling grade steel and fixed by a firing process. A cover coat of porcelain enamel is then to be fused to the panel in a firing operation used
exclusively for color coat operation. Firing temperature to be plus or minus 1500 deg F.
h. Install panels into storefront frame. Place on setting blocks.
i. Frames must have weep holes to allow water drainage from underneath the insulating panels. Seal with glazing tape all around the perimeter and caulk.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

   a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

3. EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.
3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.
3.4 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.5 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 80 00
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid

   1. General Contractor

      a. This section includes the following:

         1) Surface preparation and the application of paint systems on the following exterior substrates:

            a) Concrete Masonry Unit (CMU) Walls.

B. Related Requirements:

   1. Section 05 50 00 "Metal Fabrications" for shop priming of metal substrates with primers specified in this Section.
   2. Section 09 91 23 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.2 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product.
C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches (200 mm) square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
   3. VOC content.

1.4 DELIVERY, STORAGE, AND HANDLING
   A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
      1. Maintain containers in clean condition, free of foreign materials and residue.
      2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS
   A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
   B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

2. PRODUCTS

2.1 MANUFACTURERS
   A. Subject to compliance with the requirements, provide products by one of the following manufacturers:
      1. Benjamin Moore & Co.
      2. Pratt & Lambert
      3. Sherwin-Williams Company (The)

2.2 PAINT, GENERAL
   A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
B. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

D. Colors: As selected by Architect from manufacturer's full range.

2.3 BLOCK FILLERS
   A. Block Filler, Latex, Interior/Exterior: MPI #4.
      1. <Insert, in separate subparagraphs, manufacturer's name; product name or designation>.

2.4 PRIMERS/SEALERS
   A. Primer, Alkali Resistant, Water Based: MPI #3.
      1. <Insert, in separate subparagraphs, manufacturer's name; product name or designation>.

2.5 WATER-BASED PAINTS
   A. Latex, Exterior Semi-Gloss (Gloss Level 5): MPI #11.
      1. <Insert, in separate subparagraphs, manufacturer's name; product name or designation>.

2.6 SOURCE QUALITY CONTROL
   A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
      1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
      2. Testing agency will perform tests for compliance with product requirements.
      3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove
rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3. EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Masonry (CMU): 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
   
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
3.6 EXTERIOR PAINTING SCHEDULE

A. CMU Substrates:

1. Latex System:
   c. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.

END OF SECTION 09 91 13
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:
   1. Plumbing Contractor:
      a. This section includes the following:
         1) Sleeves
         2) Sleeve-seal systems
         3) Sleeve-seal fittings
         4) Grout

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

2. PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 SLEEVE-SEAL SYSTEMS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   
   1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: Carbon steel.
   3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT


B. Characteristics: Nonshrink; recommended for interior and exterior applications

C. Design Mix: 5000-psi, 28-day compressive strength

D. Packaging: Premixed and factory packaged

3. EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
   
   1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   
   1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants".

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping".

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Exterior Concrete Walls above Grade:
   a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves
   b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves

2. Concrete Slabs above Grade:
   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves
   b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves

3. Interior Partitions:
   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves
   b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves

END OF SECTION 22 05 17
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:

1. Plumbing Contractor:

   a. This section includes the following:

      1) Metal pipe hangers and supports
      2) Fastener systems
      3) Pipe positioning systems

1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

   1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel".

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
2. PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components
   2. Galvanized Metallic Coatings: Pregalvanized or hot dipped
   3. Nonmetallic Coatings: Plastic coating, jacket or liner
   4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel

2.2 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.3 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.4 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

   1. Properties: Nonstaining, noncorrosive and nongaseous
   2. Design Mix: 5000-psi, 28-day compressive strength

3. EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
B. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

C. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

E. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

F. Install lateral bracing with pipe hangers and supports to prevent swaying.

G. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

H. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

3.2 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.3 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting."

C. Galvanized Surfaces: clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.4 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use padded hangers for piping that is subject to scratching.

G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
3. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
4. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
5. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
6. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
7. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
9. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
10. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
11. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
12. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
13. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

I. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 lb.
   b. Medium (MSS Type 32): 1500 lb.
   c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

K. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

L. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
   2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
   3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
   4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
   5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
   6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
   7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

   a. Horizontal (MSS Type 54): Mounted horizontally
   b. Vertical (MSS Type 55): Mounted vertically
   c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member

M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

N. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:

   1. Plumbing Contractor:
      a. This section includes the following:
         1) Pipe, tube and fittings
         2) Specialty pipe fittings

1.2 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

   1. Storm Drainage Piping: 10-foot head of water

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For controlled-flow roof drainage system. Include calculations, plans and details.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.


1.5 PROJECT CONDITIONS

A. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

   1. Notify Owner no fewer than two (2) days in advance of proposed interruption of storm-drainage service.
2. Do not proceed with interruption of storm-drainage service without Owner's written permission.

2. PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy classes
B. Gaskets: ASTM C 564, rubber
C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber

2.3 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste and vent
B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40
C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste and vent patterns and to fit Schedule 40 pipe.
D. Adhesive Primer: ASTM F 656
   1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers".
E. Solvent Cement: ASTM D 2564
   1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers".
2.4 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections same size as and compatible with pipes to be joined.

2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.

3. Unshielded, Nonpressure Transition Couplings:
   a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   b. Standard: ASTM C 1173
   c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
   d. Sleeve Materials:
      1) For Cast-Iron Soil Pipes: ASTM C 564, rubber
      2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC
      3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:
   a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   b. Standard: ASTM C 1460
   c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

2. Dielectric Unions:
   a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   b. Description:
      1) Standard: ASSE 1079
      2) Pressure Rating: 150 psig at 180 deg F
      3) End Connections: Solder-joint copper alloy and threaded ferrous
3. **Dielectric Flanges:**
   a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   b. Description:
      1) Standard: ASSE 1079
      2) Factory-fabricated, bolted, companion-flange assembly
      3) Pressure Rating: 150 psig
      4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

3. **EXECUTION**

3.1 **PIPING INSTALLATION**

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Install storm drainage piping at the following minimum slopes unless otherwise indicated:
1. Building Storm Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings".

L. Install aboveground PVC piping according to ASTM D 2665.

M. Install engineered controlled-flow drain specialties and storm drainage piping in locations indicated.

N. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook".
   1. Install encasement on piping according to ASTM A 674 or AWWA C105.

O. Plumbing Specialties:
   1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties".
   2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties".
   3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties".

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping".

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping".

S. Install escutcheons for piping penetrations of walls, ceilings and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping".
3.2 JOINT CONSTRUCTION


C. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

D. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:
   1. Install transition couplings at joints of piping with small differences in ODs.

B. Dielectric Fittings:
   1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
   2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
   3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
   4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 VALVE INSTALLATION

A. General valve installation requirements are specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping".

B. Backwater Valves: Install backwater valves in piping subject to backflow.
   1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
   2. Install backwater valves in accessible locations.
   3. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties".
3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment".

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Vertical Piping: MSS Type 8 or Type 42, clamps
4. Individual, Straight, Horizontal Piping Runs:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers
   c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls
5. Base of Vertical Piping: MSS Type 52, spring hangers

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

   1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod
   2. NPS 3: 60 inches with 1/2-inch rod
   3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod
   4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod
   5. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

   1. NPS 1-1/4: 84 inches with 3/8-inch rod
   2. NPS 1-1/2: 108 inches with 3/8-inch rod
   3. NPS 2: 10 feet with 3/8-inch rod
   4. NPS 2-1/2: 11 feet with 1/2-inch rod
   5. NPS 3: 12 feet with 1/2-inch rod
   6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod
7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod

H. Install supports for vertical steel piping every 15 feet.

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4: 72 inches with 3/8-inch rod
   2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod
   3. NPS 2-1/2: 108 inches with 1/2-inch rod
   4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod
   5. NPS 6: 10 feet with 5/8-inch rod

J. Install supports for vertical copper tubing every 10 feet.

K. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod
   2. NPS 3: 48 inches with 1/2-inch rod
   3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod
   4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod

L. Install supports for vertical PVC piping every 48 inches.

M. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.
   1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
   2. Install horizontal backwater valves with cleanout cover flush with floor.
   3. Comply with requirements for backwater valves, cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties".

D. Connect force-main piping to the following:
   1. Storm Sewer: To exterior force main.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment".

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.
3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground storm drainage piping NPS 6 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 22 14 13
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:

1. Plumbing Contractor:

   a. This section includes the following:

      1) Roof drains
      2) Miscellaneous storm drainage piping specialties
      3) Cleanouts
      4) Backwater valves
      5) Through-penetration firestop assemblies
      6) Flashing materials

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

2. PRODUCTS

2.1 METAL ROOF DRAINS

A. Cast-Iron, Large-Sump, General-Purpose Roof Drains:

   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   2. Standard: ASME A112.6.4, for general-purpose roof drains
   3. Body Material: Cast iron
   4. Dimension of Body: Nominal 14-inch diameter
   5. Combination Flashing Ring and Gravel Stop: Required
   6. Flow-Control Weirs: Not required
   7. Outlet: Bottom
   8. Extension Collars: Where required
   9. Underdeck Clamp: Where required
   10. Expansion Joint: Not required
   11. Sump Receiver Plate: Required
12. Dome Material: Cast iron
13. Perforated Gravel Guard: Not required
14. Vandal-Proof Dome: Not required
15. Water Dam: Not required

B. Cast-Iron, Medium-Sump, General-Purpose Roof Drains:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Standard: ASME A112.6.4, for general-purpose roof drains
3. Body Material: Cast iron
4. Dimension of Body: 8- to 12-inch diameter
5. Combination Flashing Ring and Gravel Stop: Required
6. Flow-Control Weirs: Not required
7. Outlet: Bottom
8. Extension Collars: Where required
9. Underdeck Clamp: Where required
10. Expansion Joint: Not required
11. Sump Receiver Plate: Required
12. Dome Material: Cast iron
13. Wire Mesh: Not required
14. Perforated Gravel Guard: Not required
15. Vandal-Proof Dome: Not required
16. Water Dam: Not required

2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Downspout Adaptors:

1. Description: Manufactured, gray-iron casting, for attaching to horizontal-outlet, parapet roof drain and to exterior, sheet metal downspout.
2. Size: Inlet size to match parapet drain outlet.

B. Downspout Boots:

1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
2. Size: Inlet size to match downspout and NPS 4 outlet.

2.3 CLEANOUTS

A. Test Tees:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
3. Size: Same as connected drainage piping.
4. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or hubless, cast-iron soil-pipe test tee as required to match connected piping.
5. Closure Plug: Countersunk or raised head, brass.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Wall Cleanouts:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
3. Size: Same as connected drainage piping.
5. Closure: Countersunk or raised-head, drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

2.4 BACKWATER VALVES

A. Cast-Iron, Horizontal Backwater Valves:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Standard: ASME A112.14.1, for backwater valves
3. Size: Same as connected piping.
4. Body Material: Cast iron
5. Cover: Cast iron with bolted or threaded access check valve
6. End Connections: Hub and spigot
7. Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
8. Extension: ASTM A 74, Service class; full-size, cast-iron soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Cast-Iron, Drain-Outlet Backwater Valves:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Size: Same as floor drain outlet.
3. Body Material: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
4. Check Valve: Removable ball float.
5. Inlet: Threaded
6. Outlet: Threaded or spigot
2.5 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Standard: ASTM E 814, for through-penetration firestop assemblies
4. Size: Same as connected pipe.
5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
7. Special Coating: Corrosion resistant on interior of fittings.

2.6 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft.
B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
D. Fasteners: Metal compatible with material and substrate being fastened.
E. Metal Accessories: Sheet metal strips, clamps, anchoring devices and similar accessory units required for installation; matching or compatible with material being installed.
F. Solder: ASTM B 32, lead-free alloy

3. EXECUTION

3.1 INSTALLATION

A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Install expansion joints, if indicated, in roof drain outlets.
3. Position roof drains for easy access and maintenance.
B. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.

C. Install downspout boots at grade with top 6 inches above grade. Secure to building wall.

D. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.

E. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
   1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
   3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
   4. Locate cleanouts at base of each vertical soil and waste stack.

F. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

G. Install horizontal backwater valves in floor with cover flush with floor.

H. Install drain-outlet backwater valves in outlet of drains.

I. Install test tees in vertical conductors and near floor.

J. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

K. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.

L. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping". Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
   1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 14 23
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:

1. Mechanical Contractor:

   a. This section includes the following:

      1) General requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units and accessory devices to be compatible with the following:

   1. Motor controllers
   2. Torque, speed and horsepower requirements of the load
   3. Ratings and characteristics of supply circuit and required control sequence
   4. Ambient and environmental conditions of installation location

2. PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3,300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor

B. Efficiency: Energy efficient, as defined in NEMA MG 1

C. Service Factor: 1.15

D. Multispeed Motors: Variable torque
   1. For motors with 2:1 speed ratio, consequent pole, single winding.
   2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed

F. Rotor: Random-wound, squirrel cage

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating

I. Insulation: Class F

J. Code Letter Designation:
   1. Motors 15 HP and Larger: NEMA starting Code F or Code G
   2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics and features coordinated with and approved by controller manufacturer:
   1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
   2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
   3. Inverter-Duty Motors: Class F temperature rise; Class H insulation
   4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor
2. Split phase
3. Capacitor start, inductor run
4. Capacitor start, capacitor run

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

3. EXECUTION (Not Applicable)

END OF SECTION 23 05 13
DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING
23 05 17 – Sleeves and Sleeve Seals for HVAC Piping

1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:
   1. Mechanical Contractor:
      a. This section includes the following:
         1) Sleeves
         2) Sleeve-seal systems
         3) Sleeve-seal fittings
         4) Grout

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

2. PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 SLEEVE-SEAL SYSTEMS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout

B. Characteristics: Nonshrink; recommended for interior and exterior applications

C. Design Mix: 5000-psi, 28-day compressive strength

D. Packaging: Premixed and factory packaged

3. EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants".

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping".

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.
   1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim".
   3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
   4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping".

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
B. Select type, size and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:
   a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves
   b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves

2. Concrete Slabs above Grade:
   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves
   b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves

3. Interior Partitions:
   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves
   b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves

END OF SECTION 23 05 17
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:

1. Mechanical Contractor:

   a. This section includes the following:

      1) Metal pipe hangers and supports
      2) Thermal-hanger shield inserts
      3) Fastener systems
      4) Pipe stands
      5) Equipment supports

1.2 ABBREVIATIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

   1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
   2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

   1. Pipe stands
   2. Equipment supports
C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

D. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel".

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

2. PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped
3. Nonmetallic Coatings: Plastic coating, jacket or liner
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts and washer made of carbon steel

2.2 THERMAL-HANGER SHIELD INSERTS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade I polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade I polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
2.3 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.4 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic
3. Vertical Members: Two or more protective-coated-steel channels
4. Horizontal Member: Protective-coated-steel channel
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.
2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

   1. Properties: Nonstaining, noncorrosive, and nongaseous
   2. Design Mix: 5000-psi, 28-day compressive strength

3. EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

C. Fastener System Installation:

   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

D. Pipe Stand Installation:

   1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
   2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.


G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick
   b. NPS 4: 12 inches long and 0.06 inch thick
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
3.2 EQUIPMENT SUPPORTS
   A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
   B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
   C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS
   A. Cut, drill and fit miscellaneous metal fabrications for equipment supports.
   B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
   C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
      1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
      2. Obtain fusion without undercut or overlap.
      3. Remove welding flux immediately.
      4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING
   A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
   B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING
   A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
      1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
   B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting".
   C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.
3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
   2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
   2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
   3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
   4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. **Steel Weldless Eye Nuts (MSS Type 17):** For 120 to 450 deg F piping installations.

L. **Building Attachments:** Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. **Steel or Malleable Concrete Inserts (MSS Type 18):** For upper attachment to suspend pipe hangers from concrete ceiling.
2. **Top-Beam C-Clamps (MSS Type 19):** For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
3. **Side-Beam or Channel Clamps (MSS Type 20):** For attaching to bottom flange of beams, channels, or angles.
4. **Center-Beam Clamps (MSS Type 21):** For attaching to center of bottom flange of beams.
5. **Welded Beam Attachments (MSS Type 22):** For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. **C-Clamps (MSS Type 23):** For structural shapes.
7. **Top-Beam Clamps (MSS Type 25):** For top of beams if hanger rod is required tangent to flange edge.
8. **Side-Beam Clamps (MSS Type 27):** For bottom of steel I-beams.
9. **Steel-Beam Clamps with Eye Nuts (MSS Type 28):** For attaching to bottom of steel I-beams for heavy loads.
10. **Linked-Steel Clamps with Eye Nuts (MSS Type 29):** For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. **Malleable-Beam Clamps with Extension Pieces (MSS Type 30):** For attaching to structural steel.
12. **Welded-Steel Brackets:** For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. **Light (MSS Type 31):** 750 lb.
   b. **Medium (MSS Type 32):** 1,500 lb.
   c. **Heavy (MSS Type 33):** 3,000 lb.
13. **Side-Beam Brackets (MSS Type 34):** For sides of steel or wooden beams.
14. **Plate Lugs (MSS Type 57):** For attaching to steel beams if flexibility at beam is required.
15. **Horizontal Travelers (MSS Type 58):** For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. **Saddles and Shields:** Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. **Steel-Pipe-Covering Protection Saddles (MSS Type 39):** To fill interior voids with insulation that matches adjoining insulation.
2. **Protection Shields (MSS Type 40):** Of length recommended in writing by manufacturer to prevent crushing insulation.
3. **Thermal-Hanger Shield Inserts:** For supporting insulated pipe.
N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
   a. Horizontal (MSS Type 54): Mounted horizontally
   b. Vertical (MSS Type 55): Mounted vertically
   c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member

O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 05 29
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:

1. Mechanical Contractor:
   a. This section includes the following:
      1) Elastomeric isolation pads
      2) Restrained elastomeric isolation mounts
      3) Housed-spring isolators
      4) Housed-restrained-spring isolators
      5) Spring hangers
      6) Restrained isolation roof-curb rails

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For each vibration isolation device.

1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
B. Qualification Data: For testing agency.

C. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel".

2. PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
   3. Size: Factory or field cut to match requirements of supported equipment.
   4. Pad Material: Oil and water resistant with elastomeric properties.
   5. Surface Pattern: Waffle pattern
   6. Infused nonwoven cotton or synthetic fibers.
   7. Load-bearing metal plates adhered to pads.
   8. Sandwich-Core Material: Resilient and elastomeric
      a. Surface Pattern: Waffle pattern
      b. Infused nonwoven cotton or synthetic fibers.

2.2 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   2. Description: All-directional isolator with restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
      a. Housing: Cast-ductile iron or welded steel.
      b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.3 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
   a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
   b. Top housing with threaded mounting holes and internal leveling device.

2.4 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.
   a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
   b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.5 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.6 RESTRAINED ISOLATION ROOF-CURB RAILS
A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
B. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment.
C. Upper Frame: Upper frame shall provide continuous and captive support for equipment.
D. Lower Support Assembly: The lower support assembly shall be formed sheet metal section containing adjustable and removable steel springs that support upper frame. The lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials and shall be insulated with a minimum of 2 inches of rigid glass-fiber insulation on inside of assembly. Adjustable, restrained-spring isolators shall be mounted on elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.
E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.
F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

3. EXECUTION
3.1 EXAMINATION
A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 VIBRATION CONTROL DEVICE INSTALLATION

A. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

END OF SECTION 23 05 48.13
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:
   1. Mechanical Contractor:
      a. This section includes the following:
         1) Equipment labels

1.2 SUBMITTALS

A. Product Data: For each type of product.
B. Samples: For color, letter style and graphic representation required for each identification material and device.
C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

2. PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
   3. Letter Color: Black
   4. Background Color: White
   5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
   6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
   8. Fasteners: Stainless-steel rivets or self-tapping screws
   9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

3. EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

END OF SECTION 23 05 53
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:

   1. Mechanical Contractor:

      a. This section includes the following:

         1) Balancing Air Systems:

            a. Constant-volume air systems
            b. Variable-air-volume systems

         2) Balancing Hydronic Piping Systems:

            a. Constant-flow hydronic systems
            b. Variable-flow hydronic systems
            c. Primary-secondary hydronic systems

1.2 ABBREVIATIONS

A. AABC: Associated Air Balance Council
B. BAS: Building Automation Systems
C. NEBB: National Environmental Balancing Bureau
D. TAB: Testing, Adjusting and Balancing
E. TABB: Testing, Adjusting and Balancing Bureau
F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
G. TDH: Total Dynamic Head

1.3 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the Owner, conduct a TAB conference at project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of fourteen (14) days' advance notice of scheduled meeting time and location.
1. Minimum Agenda Items:
   b. The TAB plan.
   c. Needs for coordination and cooperation of trades and subcontractors.
   d. Proposed procedures for documentation and communication flow.

1.4 SUBMITTALS

A. Qualification Data: Within thirty (30) days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.


D. System Readiness Checklists: Within sixty (60) days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Instrument calibration reports, to include the following:
   1. Instrument type and make
   2. Serial number
   3. Application
   4. Dates of use
   5. Dates of calibration

1.5 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC.

   1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC, NEBB or TABB.
   2. TAB Technician: Employee of the TAB specialist and certified by AABC, NEBB or TABB as a TAB technician.
B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation".

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing".

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing".

1.6 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

2. PRODUCTS (Not Applicable)

3. EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
F. Examine equipment performance data including fan and pump curves.
   1. Relate performance data to Project conditions and requirements, including system
effects that can create undesired or unpredicted conditions that cause reduced
capacities in all or part of a system.
   2. Calculate system-effect factors to reduce performance ratings of HVAC
equipment when installed under conditions different from the conditions used to
rate equipment performance. To calculate system effects for air systems, use
tables and charts found in AMCA 201, "Fans and Systems" or in SMACNA's
"HVAC Systems - Duct Design". Compare results with the design data and
installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing,
cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and
tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are
accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens have been replaced by permanent screens
with indicated perforations.

L. Examine control valves for proper installation for their intended function of throttling,
diverting, or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight
fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures.
Observe and record system reactions to changes in conditions. Record default set points
if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:
   1. Equipment and systems to be tested.
   3. Instrumentation to be used.
   4. Sample forms with specific identification for all equipment.
B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:
   a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
   b. Duct systems are complete with terminals installed.
   c. Volume, smoke, and fire dampers are open and functional.
   d. Clean filters are installed.
   e. Fans are operating, free of vibration, and rotating in correct direction.
   f. Variable-frequency controllers' startup is complete and safeties are verified.
   g. Automatic temperature-control systems are operational.
   h. Ceilings are installed.
   i. Windows and doors are installed.
   j. Suitable access to balancing devices and equipment is provided.

2. Hydronics:
   a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
   b. Piping is complete with terminals installed.
   c. Water treatment is complete.
   d. Systems are flushed, filled, and air purged.
   e. Strainers are pulled and cleaned.
   f. Control valves are functioning per the sequence of operation.
   g. Shutoff and balance valves have been verified to be 100 percent open.
   h. Pumps are started and proper rotation is verified.
   i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
   j. Variable-frequency controllers' startup is complete and safeties are verified.
   k. Suitable access to balancing devices and equipment is provided.

END OF SECTION 23 05 93
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:
   1. Mechanical Contractor:
      a. This section includes the following:
         1) Outdoor, concealed supply and return
         2) Outdoor, exposed supply and return

B. Related Sections:
   1. Section 230716 "HVAC Equipment Insulation"
   2. Section 230719 "HVAC Piping Insulation"

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
   1. Detail application of protective shields, saddles and inserts at hangers for each type of insulation and hanger.
   2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
   3. Detail application of field-applied jackets.
   4. Detail application at linkages of control devices.

B. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
   1. Sheet Form Insulation Materials: 12 inches square
   2. Sheet Jacket Materials: 12 inches square
   3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.3 SUBMITTALS

A. Qualification Data: For qualified Installer.
B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Ductwork Mockups:
   a. One 10-foot section each of rectangular and round straight duct.
   b. One each of a 90-degree mitered round and rectangular elbow, and one each of a 90-degree radius round and rectangular elbow.
   c. One rectangular branch takeoff and one round branch takeoff from a rectangular duct. One round tee fitting.
   d. One rectangular and round transition fitting.
   e. Four support hangers for round and rectangular ductwork.
   f. Each type of damper and specialty.

2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments and jackets.
3. Notify Architect seven (7) days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment".

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

2. PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General", "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."


1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight
5. Color: White

2.4 SEALANTS

A. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Materials shall be compatible with insulation materials, jackets and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F
5. Color: White
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers".

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.6 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering ducts.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2.7 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.

B. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   2. Width: 3 inches
   3. Thickness: 11.5 mils
   4. Adhesion: 90 ounces force/inch in width
   5. Elongation: 2 percent
   6. Tensile Strength: 40 lbf/inch in width
   7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   2. Width: 2 inches
   3. Thickness: 6 mils
   4. Adhesion: 64 ounces force/inch in width
   5. Elongation: 500 percent
   6. Tensile Strength: 18 lbf/inch in width
2.10 SECUREMENTS

A. Bands:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated.
   a. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
   a. <Double click here to find, evaluate, and insert list of manufacturers and products.>

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. **Self-Sticking-Base Insulation Hangers**: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
d. Adhesive-backed base with a peel-off protective cover.

6. **Insulation-Retaining Washers**: Self-locking washers formed from 0.016-inch thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. **Nonmetal Insulation-Retaining Washers**: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. <Double click here to find, evaluate, and insert list of manufacturers and products.>

**C. Staples**: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

**D. Wire**: 0.062-inch soft-annealed, galvanized steel

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2.11 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

3. EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

   b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

   d. Do not overcompress insulation during installation.

   e. Impale insulation over pins and attach speed washers.

   f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch
outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and
end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:
   1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:
   1. Outdoor, concealed supply and return
   2. Outdoor, exposed supply and return

B. Items Not Insulated:
   1. Fibrous-glass ducts
   2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1
   3. Factory-insulated flexible ducts
   4. Factory-insulated plenums and casings
   5. Flexible connectors
   6. Vibration-control devices
   7. Factory-insulated access panels and doors
3.10 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:
   1. Mineral-Fiber Blanket: 2 inches and 1.5-lb/cu. ft. nominal density

C. Concealed, round and flat-oval, return-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches and 1.5-lb/cu. ft. nominal density

D. Concealed, round and flat-oval, outdoor-air duct insulation shall be one of the following:
   1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density

E. Concealed, rectangular, supply-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches and 1.5-lb/cu. ft. nominal density

F. Concealed, rectangular, return-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches and 1.5-lb/cu. ft. nominal density

G. Concealed, supply-air plenum insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches and 1.5-lb/cu. ft. nominal density

H. Concealed, return-air plenum insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches and 1.5-lb/cu. ft. nominal density

I. Exposed, round and flat-oval, supply-air duct insulation shall be the following:
   1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density

J. Exposed, round and flat-oval, return-air duct insulation shall be the following:
   1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density

K. Exposed, rectangular, supply-air duct insulation shall be the following:
   1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density

L. Exposed, rectangular, return-air duct insulation shall be the following:
   1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density
M. Exposed, supply-air plenum insulation shall be the following:
   1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density

N. Exposed, return-air plenum insulation shall be one of the following:
   1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density

3.11 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:
   1. Aluminum, Smooth: 0.020 inch thick

D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
   1. Aluminum, Smooth: 0.020 inch thick

E. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
   1. Aluminum, smooth with 1-1/4-Inch-deep corrugations

END OF SECTION 23 07 13
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:
   1. Mechanical Contractor:
      a. This section includes the following:
         1) Chilled-water and brine piping, outdoors
         2) Heating hot-water piping, outdoors

B. Related Sections:
   1. Section 230713 "Duct Insulation"

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.
   1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2
   2. Sheet Form Insulation Materials: 12 inches square
   3. Jacket Materials for Pipe: 12 inches long by NPS 2
   4. Sheet Jacket Materials: 12 inches square
   5. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

C. Qualification Data: For qualified Installer.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

E. Field quality-control reports.
1.3 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Piping Mockups:
   a. One 10-foot section of NPS 2 straight pipe.
   b. One each of a 90-degree threaded, welded, and flanged elbow.
   c. One each of a threaded, welded, and flanged tee fitting.
   d. One NPS 2 or smaller valve, and one NPS 2-1/2 or larger valve.
   e. Four support hangers including hanger shield and insert.
   f. One threaded strainer and one flanged strainer with removable portion of insulation.
   g. One threaded reducer and one welded reducer.
   h. One pressure temperature tap.
   i. One mechanical coupling.

2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.
1.4 DELIVERY, STORAGE AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment".

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

2. PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General", "Indoor Piping Insulation Schedule", "Outdoor, Aboveground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

F. Mineral-Fiber, Preformed Pipe Insulation:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory-applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.2 INSULATING CEMENTS


1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>


1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Adhesive and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness
3. Service Temperature Range: Minus 20 to plus 180 deg F
4. Solids Content: 60 percent by volume and 66 percent by weight
5. Color: White

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. <Double click here to find, evaluate, and insert list of manufacturers and products.>
3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
4. Service Temperature Range: 0 to plus 180 deg F
5. Color: White

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.8 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Width: 3 inches
3. Thickness: 11.5 mils
4. Adhesion: 90 ounces force/inch in width
5. Elongation: 2 percent
6. Tensile Strength: 40 lbf/inch in width
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Width: 3 inches
3. Thickness: 6.5 mils
4. Adhesion: 90 ounces force/inch in width
5. Elongation: 2 percent
6. Tensile Strength: 40 lbf/inch in width
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape
2.11 SECUREMENTS

A. Bands:
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

3. EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
   1. Verify that systems to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
   1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
   2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
   a. For below-ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices
2. Testing agency labels and stamps
3. Nameplates and data plates
4. Manholes
5. Handholes
6. Cleanouts

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily
removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.
B. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FINISHES

A. Pipe Insulation with ASJ, Glass-Cloth or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting".
   1. Flat Acrylic Finish: Two (2) finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:
   1. Inspect pipe, fittings, strainers and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces
2. Underground piping
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Chilled Water and Brine:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 3 inches thick

B. Heating-Hot-Water Supply and Return, 200 Deg F and Below:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick

3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. Aluminum, Smooth: 0.020 inch thick

D. Piping, Exposed:

1. Aluminum, Smooth: 0.020 inch thick

END OF SECTION 23 07 19
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:
   1. Mechanical Contractor:
      a. This section includes the following:
         1) Distribution systems, including air distribution (heating and cooling) systems.

B. Related Requirements:
   1. Section 019113 "General Commissioning Requirements" for general commissioning process requirements and Commissioning Coordinator responsibilities.

1.2 ABBREVIATIONS

A. BAS: Building Automation System
B. DDC: Direct Digital Controls
C. HVAC&R: Heating, Ventilating, Air Conditioning and Refrigeration
D. "Systems", "Subsystems", "Equipment" and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.
E. TAB: Testing, Adjusting and Balancing

1.3 SUBMITTALS

A. Qualification Data: For HVAC&R Testing Technician.
B. Construction Checklists: See related Sections for technical requirements for the following construction checklists:
   1. Air handling units
1.4 QUALITY ASSURANCE

A. HVAC&R Testing Technician Qualifications: Technicians to perform HVAC&R construction checklist verification tests, construction checklist verification test demonstrations, commissioning tests, and commissioning test demonstrations shall have the following minimum qualifications:

1. Journey-level or equivalent skill level. Vocational School four-year program graduate or an Associate’s degree in mechanical systems, air conditioning, or similar field. Degree may be offset by three years' experience in servicing mechanical systems in the HVAC industry. Generally, required knowledge includes HVAC&R systems, electrical concepts, building operations, and application and use of tools and instrumentation to measure performance of HVAC&R equipment, assemblies, and systems.
2. Minimum three years’ experience installing, servicing, and operating systems manufactured by approved manufacturer.
3. One of the following:
   b. Associated Air Balance Council (AABC) Certified Test and Balance Technician.
   c. Owner retains the right to waive NEBB or AABC Certification.

B. Testing Equipment and Instrumentation Quality and Calibration: For test equipment and instrumentation required to perform HVAC&R commissioning work, perform the following:

1. Submit test equipment and instrumentation list. For each equipment or instrument, identify the following:
   a. Equipment/instrument identification number
   b. Planned commissioning application or use
   c. Manufacturer, make, model and serial number
   d. Calibration history, including certificates from agencies that calibrate the equipment and instrumentation.
2. Test equipment and instrumentation shall meet the following criteria:
   a. Capable of testing and measuring performance within the specified acceptance criteria.
   b. Be calibrated at the manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
   c. Be maintained in good repair and operating condition throughout the duration of use on this Project.
   d. Be recalibrated/reppaired if dropped or damaged in any way since last calibrated.
C. Proprietary Test Instrumentation and Tools:

1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the commissioning process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, perform the following:

   a. Submit proprietary instrumentation and tools list. For each instrument or tool, identify the following:

      1) Instrument or tool identification number.
      2) Equipment schedule designation of equipment for which the instrument or tool is required.
      3) Manufacturer, make, model, and serial number.
      4) Calibration history, including certificates from agencies that calibrate the instrument or tool, where appropriate.

   b. Include a separate list of proprietary test instrumentation and tools in the operation and maintenance manuals.

   c. HVAC&R proprietary test instrumentation and tools become the property of Owner at the time of Substantial Completion.

2. PRODUCTS (Not Used)

3. EXECUTION

3.1 GENERAL TESTING REQUIREMENTS

   A. Certify that HVAC&R systems, subsystems and equipment have been installed, calibrated, and started and are operating according to the Contract Documents and approved Shop Drawings and submittals.

   B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved Shop Drawings and submittals, and that pretest set points have been recorded.

   C. Certify that TAB procedures have been completed and that TAB reports have been submitted, discrepancies corrected, and corrective work approved.

   D. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
E. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment and components, including operational and control functions to verify compliance with acceptance criteria.

F. Test systems, assemblies, subsystems, equipment and components operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and response according to acceptance criteria.

G. Construction Checklists: Prepare and submit detailed construction checklists for HVAC&R systems, subsystems, equipment, and components.

1. Contributors to the development of construction checklists shall include, but are not limited to, the following:
   a. HVAC&R systems and equipment installers
   b. TAB technicians
   c. HVAC&R instrumentation and controls installers

H. Perform tests using design conditions, whenever possible.

1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by Commissioning Coordinator and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.

2. Commissioning test procedures may direct that set points be altered when simulating conditions is impractical.

3. Commissioning test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to Owner. After deficiencies are resolved, reschedule tests.

J. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.

K. Coordinate schedule with, and perform the following activities at the direction of, Commissioning Coordinator.

L. Comply with construction checklist requirements, including material verification, installation checks, start-up, and performance tests requirements specified in Sections specifying HVAC systems and equipment.

M. Provide technicians, instrumentation, tools and equipment to complete and document the following:
1. Performance tests
2. Demonstration of a sample of performance tests
3. Commissioning tests
4. Commissioning test demonstrations

3.2 TAB COMMISSIONING TESTS

A. TAB Verification:

1. Prerequisites: Completion of "Examination" Article requirements and correction of deficiencies, as specified in Section 230593 "Testing, Adjusting and Balancing for HVAC".
2. Completion of "Preparation" Article requirements for preparation of a TAB plan that includes strategies and step-by-step procedures, and system-readiness checks and reports, as specified in Section 230593 "Testing, Adjusting and Balancing for HVAC".
3. Scope: HVAC&R air systems and hydronic piping systems.
4. Purpose: Differential flow relationships intended to maintain air pressurization differentials between the various areas of Project.
5. Conditions of the Test:
   a. Commissioning Test Demonstration Sampling Rate: As specified in "Inspections" Article in Section 230593 "Testing, Adjusting and Balancing for HVAC".
   b. Systems operating in full heating mode with minimum outside-air volume.
   c. Systems operating in full cooling mode with minimum outside-air volume.
   d. For measurements at air-handling units with economizer controls; systems operating in economizer mode with 100 percent outside air.
6. Acceptance Criteria:
   a. Under all conditions, rechecked measurements comply with "Inspections" Article in Section 230593 "Testing, Adjusting and Balancing for HVAC".
   b. Additionally, no rechecked measurement shall differ from measurements documented in the final report by more than two times the tolerances allowed.
   c. Under all conditions, where the Contract Documents indicate a differential in airflow between supply and exhaust and/or return in a space, the differential relationship shall be maintained.

3.3 AIR-HANDLING SYSTEM COMMISSIONING TESTS

A. Supply Fans Variable-Volume Control:

1. Prerequisites: Installation verification of the following:
a. Volume Control Input Device: [Static-pressure transmitter]
[ Differential-pressure switch] sensing supply-duct static pressure referenced to conditioned-space static pressure.
b. Volume Control Output Device: [Receiver controller] [DDC system analog output] [DDC system analog output to digital-to-pneumatic transducer] to modulating damper actuator. Set inlet guide vanes to [minimum] [closed] position when fan is stopped.
c. Volume Control Input Device: [Static-pressure transmitter]
[ Differential-pressure switch] sensing supply-duct static pressure referenced to conditioned-space static pressure.
d. Volume Control Output Device: [Receiver controller] [DDC system analog output] to motor speed controller. Set variable-speed drive to minimum speed when fan is stopped.
e. High-Pressure Input Device: Static-pressure transmitter sensing supply-duct static pressure referenced to static pressure outside the duct.
f. High-Pressure Output Device: [Receiver controller] [DDC system binary output] to [alarm panel] [motor starter].
g. Display the following at the operator's workstation:
   1) Supply-fan-discharge static-pressure indication
   2) Supply-fan-discharge static-pressure set point
   3) Supply-fan airflow rate
   4) Supply-fan [inlet vane position] [speed]

2. Scope: Variable-air-volume supply fan units and associated controls.
3. Purpose:
   a. Supply-air discharge static pressure control
   b. Response to excess supply-air discharge static pressure condition

4. Conditions of the Test:
   a. Minimum supply-air flow
   b. Midrange Supply-Air Flow: 50 to 60 percent of maximum
   c. Maximum supply-air flow
   d. Excess supply-air discharge static pressure

5. Acceptance Criteria:
   a. At all supply-air flow rates, and during changes in supply-air flow, discharge air static pressure is at set point plus or minus 2 percent.
   b. Fan stops and an alarm is initiated at the operator's workstation when supply-air discharge static pressure is at the excess static pressure plus or minus 2 percent.
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:
   1. Mechanical Contractor:
      a. This section includes the following:
         1) Hot-water heating piping
         2) Chilled-water piping
         3) Condensate-drain piping

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following:
   1. Plastic pipe and fittings with solvent cement
   2. Pressure-seal fittings
   3. Chemical treatment

B. Delegated-Design Submittal:
   1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
   2. Locations of pipe anchors and alignment guides and expansion joints and loops.
   3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
   4. Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Suspended ceiling components
   2. Other building services
   3. Structural members

B. Qualification Data: For Installer.
C. Welding certificates.

D. Field quality-control reports.

E. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel".

C. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with ASME B31.9, "Building Services Piping" for materials, products, and installation.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

2. PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Hot-Water Heating Piping: 150 psig at 200 deg F
2. Chilled-Water Piping: 150 psig at 200 deg F
3. Condensate-Drain Piping: 150 deg F

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L

B. Grooved, Mechanical-Joint, Wrought-Copper Fittings: ASME B16.22

1.  
2. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
3. Grooved-End-Tube Couplings: Rigid pattern unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, prelubricated EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.

C. Copper or Bronze Pressure-Seal Fittings:
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   2. Housing: Copper
   3. O-Rings and Pipe Stops: EPDM
   4. Tools: Manufacturer's special tools
   5. Minimum 200-psig working-pressure rating at 250 deg F.

D. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube.
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

E. Wrought-Copper Unions: ASME B16.22

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.


D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125 and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts and gaskets of the following material group, end connections, and facings:
   1. Material Group: 1.1
   2. End Connections: Butt welding
   3. Facings: Raised face
H. Grooved Mechanical-Joint Fittings and Couplings:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E or S, Grade B fabricated steel; or ASTM A 106/A 106M, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle or lugs to secure grooved pipe and fittings.
3. Couplings: Ductile- or malleable-iron housing and EPDM or nitrile gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle or lugs to secure grooved pipe and fittings.

I. Steel Pressure-Seal Fittings:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Housing: Steel
3. O-Rings and Pipe Stop: EPDM
4. Tools: Manufacturer's special tool
5. Minimum 300-psig working-pressure rating at 230 deg F (110 deg C)

J. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.4 PLASTIC PIPE AND FITTINGS

A. CPVC Plastic Pipe: ASTM F 441/F 441M, with wall thickness as indicated in "Piping Applications" Article.


B. PVC Plastic Pipe: ASTM D 1785, with wall thickness as indicated in "Piping Applications" Article.


2.5 FIBERGLASS PIPE AND FITTINGS

A. RTRP: ASTM D 2996, filament-wound pipe with tapered bell and spigot ends for adhesive joints.

2.6 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.
   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

F. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Piping:
   1. CPVC Piping: ASTM F 493
      a. CPVC solvent cement shall have a VOC content of 490 g/L or less.
      b. Adhesive primer shall have a VOC content of 550 g/L or less.
      c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
   2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
      a. PVC solvent cement shall have a VOC content of 510 g/L or less.
      b. Adhesive primer shall have a VOC content of 550 g/L or less.
      c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

H. Gasket Material: Thickness, material and type suitable for fluid to be handled and working temperatures and pressures.
2.7 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   2. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.

B. Plastic-to-Metal Transition Unions:
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   2. Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

2.8 DIELECTRIC FITTINGS

A. General Requirements:
   Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   2. Description:
      a. Standard: ASSE 1079
      b. Pressure Rating: 125 psig minimum at 180 deg F
      c. End Connections: Solder-joint copper alloy and threaded ferrous

C. Dielectric Flanges:
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
   2. Description:
      a. Standard: ASSE 1079
      b. Factory-fabricated, bolted, companion-flange assembly
      c. Pressure Rating: 125 psig minimum at 180 deg F
      d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. **Description:**
   a. Nonconducting materials for field assembly of companion flanges
   b. Pressure Rating: 150 psig
   c. Gasket: Neoprene or phenolic
   d. Bolt Sleeves: Phenolic or polyethylene
   e. Washers: Phenolic with steel backing washers

3. **EXECUTION**

3.1 **PIPING APPLICATIONS**

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:
   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
   2. Schedule 40, Grade B, Type 96 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
   2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

C. Chilled-water piping, aboveground, NPS 2 and smaller, shall be any of the following:
   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
   2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

D. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
   2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

E. Condensate-Drain Piping: Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.
F. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

G. Air-Vent Piping:
   1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
   2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

H. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Section 230523.11 "Globe Valves for HVAC Piping", Section 230523.12 "Ball Valves for HVAC Piping", Section 230523.13 "Butterfly Valves for HVAC Piping", Section 230523.14 "Check Valves for HVAC Piping", and Section 230523.15 "Gate Valves for HVAC Piping".

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Install shutoff valve immediately upstream of each dielectric fitting.

T. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

U. Install sleeves for piping penetrations of walls, ceilings and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping".

V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping".

W. Install escutcheons for piping penetrations of walls, ceilings and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping".

3.3 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.4 HANGERS AND SUPPORTS

A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support and anchor devices. Comply with the following requirements for maximum spacing of supports.
B. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.

C. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
   2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
   3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
   4. Spring hangers to support vertical runs.
   5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
   6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
   1. NPS 3/4: Maximum span, 7 feet
   2. NPS 1: Maximum span, 7 feet
   3. NPS 1-1/2: Maximum span, 9 feet
   4. NPS 2: Maximum span, 10 feet
   5. NPS 2-1/2: Maximum span, 11 feet
   6. NPS 3 and Larger: Maximum span, 12 feet

E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
   1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch
   2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch
   3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch
   4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch
   5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch
   6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch
   7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch

F. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

G. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
B. Remove scale, slag, dirt and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook" using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook", "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
   3. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
   4. PVC Nonpressure Piping: Join according to ASTM D 2855.

I. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

J. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

K. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.
3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section 230519 "Meters and Gages for HVAC Piping".

3.7 CHEMICAL TREATMENT

A. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

B. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

C. Fill systems that have antifreeze or glycol solutions with the following concentrations:

   1. Hot-Water Heating Piping: Minimum of 20 percent propylene glycol
   2. Chilled-Water Piping: Minimum of 20 percent propylene glycol

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

   1. Leave joints, including welds, uninsulated and exposed for examination during test.
   2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
   3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
   4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
   5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping".
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 23 21 13
1. **GENERAL**

1.1 **WORK INCLUDES**

A. Base Bid:

1. Mechanical Contractor:

   a. This section includes the following:

      1) Single-wall rectangular ducts and fittings
      2) Single-wall round and flat-oval ducts and fittings
      3) Sheet metal materials
      4) Sealants and gaskets
      5) Hangers and supports

B. Related Sections:

1. Section 230593 "Testing, Adjusting and Balancing for HVAC" for testing, adjusting and balancing requirements for metal ducts.
2. Section 233119 "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
3. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 **PERFORMANCE REQUIREMENTS**

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 **SUBMITTALS**

A. Product Data: For each type of the following products:

   1. Liners and adhesives
   2. Sealants and gaskets
B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts
5. Dimensions of main duct runs from building grid lines
6. Fittings
7. Reinforcement and spacing
8. Seam and joint construction
9. Penetrations through fire-rated and other partitions
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses
2. Joint and seam construction and sealing
3. Reinforcement details and spacing
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
   a. Lighting fixtures
   b. Air outlets and inlets
   c. Speakers
   d. Sprinklers
e. Access panels  
f. Perimeter moldings

B. Welding certificates.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel" for hangers and supports.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel" for hangers and supports.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up".

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation".

2. PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Figure 2-1, "Rectangular Duct/Transverse Joints" for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

D. Elbows, Transitions, Offsets, Branch Connections and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards -
Metal and Flexible", Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

2.2 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Chapter 3, "Round, Oval and Flexible Duct" based on indicated static-pressure class unless otherwise indicated.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals" and Figure 3-6, "Conical Tees" for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G60
   2. Finishes for Surfaces Exposed to View: Mill phosphatized

C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G60
   2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick on sheet metal surface of ducts and fittings exposed to corrosive conditions, and minimum 1 mil thick on opposite surface.
   3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.

D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

E. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

F. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

G. Factory- or Shop-Applied Antimicrobial Coating:
   1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
   2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
   3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
   4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
   5. Shop-Applied Coating Color: Black
   6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

H. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes and bars; black and galvanized.
   1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
I. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches
3. Sealant: Modified styrene acrylic
4. Water resistant
5. Mold and mildew resistant
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative
7. Service: Indoor and outdoor
8. Service Temperature: Minus 40 to plus 200 deg F
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on
2. Solids Content: Minimum 65 percent
3. Shore A Hardness: Minimum 20
4. Water resistant
5. Mold and mildew resistant
6. VOC: Maximum 75 g/L (less water)
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative
8. Service: Indoor or outdoor
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on
2. Base: Synthetic rubber resin
3. Solvent: Toluene and heptane
4. Solids Content: Minimum 60 percent
5. Shore A Hardness: Minimum 60
6. Water resistant
7. Mold and mildew resistant
8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers".
11. Maximum Static-Pressure Class: 10-inch wg, positive or negative
12. Service: Indoor or outdoor.
13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric
2. Type: S
3. Grade: NS
4. Class: 25
5. Use: O
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Flange Gaskets: Butyl rubber, neoprene or EPDM polymer with polyisobutylene plasticizer.

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Table 5-1, "Rectangular Duct Hangers Minimum Size" and Table 5-2, "Minimum Hanger Sizes for Round Duct".

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:
   1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates
   2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates
   3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate

3. EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round and flat-oval ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction". Appendix G, "Duct Cleanliness for New Construction Guidelines".

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
2. Outdoor, Supply-Air Ducts: Seal Class A
3. Outdoor, Exhaust Ducts: Seal Class C
4. Outdoor, Return-Air Ducts: Seal Class C
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A
7. Unconditioned Space, Exhaust Ducts: Seal Class C
8. Unconditioned Space, Return-Air Ducts: Seal Class B
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B
11. Conditioned Space, Exhaust Ducts: Seal Class B
12. Conditioned Space, Return-Air Ducts: Seal Class C

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Table 5-1, "Rectangular Duct Hangers Minimum Size" and Table 5-2, "Minimum Hanger Sizes for Round Duct" for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories".

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting".

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:


2. Test the following systems:

   a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.

   b. Supply Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.

   c. Return Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.

   d. Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.

   e. Outdoor Air Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

4. Test for leaks before applying external insulation.

5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems".
   a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports. Retain this article for applications where construction dust and debris in duct system must be removed before air-system operation, or if applying for LEED certification.

3.8 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting and Balancing for HVAC".

3.9 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Supply Ducts:

1. Ducts Connected to Constant-Volume Air-Handling Units:
   a. Pressure Class: Positive 2-inch wg
   b. Minimum SMACNA Seal Class: B
   c. SMACNA Leakage Class for Rectangular: 12
   d. SMACNA Leakage Class for Round and Flat Oval: 6

2. Ducts Connected to Variable-Air-Volume Air-Handling Units:
   a. Pressure Class: Positive 3-inch wg
   b. Minimum SMACNA Seal Class: B
   c. SMACNA Leakage Class for Rectangular: 6
   d. SMACNA Leakage Class for Round and Flat Oval: 6

3. Ducts Connected to Equipment Not Listed Above:
   a. Pressure Class: Positive 2-inch wg
   b. Minimum SMACNA Seal Class: B
   c. SMACNA Leakage Class for Rectangular: 12
   d. SMACNA Leakage Class for Round and Flat Oval: 6
C. Return Ducts:

1. Ducts Connected to Air-Handling Units:
   a. Pressure Class: Positive or negative 2-inch wg
   b. Minimum SMACNA Seal Class: B
   c. SMACNA Leakage Class for Rectangular: 12
   d. SMACNA Leakage Class for Round and Flat Oval: 6

2. Ducts Connected to Equipment Not Listed Above:
   a. Pressure Class: Positive or negative 2-inch wg
   b. Minimum SMACNA Seal Class: B
   c. SMACNA Leakage Class for Rectangular: 12
   d. SMACNA Leakage Class for Round and Flat Oval: 6

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
   a. Pressure Class: Negative 2-inch wg
   b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
   c. SMACNA Leakage Class for Rectangular: 12
   d. SMACNA Leakage Class for Round and Flat Oval: 6

2. Ducts Connected to Air-Handling Units:
   a. Pressure Class: Positive or negative 3-inch wg
   b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
   c. SMACNA Leakage Class for Rectangular: 12
   d. SMACNA Leakage Class for Round and Flat Oval: 6

   a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
   b. Concealed: Type 304, stainless-steel sheet, No. 2D finish.
   c. Welded seams and joints.
   d. Pressure Class: Positive or negative 2-inch wg
   e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
   f. SMACNA Leakage Class: 3

4. Ducts Connected to Dishwasher Hoods:
   a. Type 304, stainless-steel sheet
   b. Exposed to View: No. 4 finish
   c. Concealed: No. 2D finish
d. Welded seams and flanged joints with watertight EPDM gaskets

e. Pressure Class: Positive or negative 2-inch wg

f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations

g. SMACNA Leakage Class: 3

5. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:

a. Type 316, stainless-steel sheet.

   1) Exposed to View: No. 4 finish
   2) Concealed: No. 2B finish

b. PVC-coated, galvanized sheet steel with thicker coating on duct interior.

c. Pressure Class: Positive or negative 3-inch wg

d. Minimum SMACNA Seal Class: A

e. SMACNA Leakage Class: 3

6. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg

b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.

c. SMACNA Leakage Class for Rectangular: 12

d. SMACNA Leakage Class for Round and Flat Oval: 6

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg

b. Minimum SMACNA Seal Class: B

c. SMACNA Leakage Class for Rectangular: 12

d. SMACNA Leakage Class for Round and Flat Oval: 6

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg

b. Minimum SMACNA Seal Class: B

c. SMACNA Leakage Class for Rectangular: 12

d. SMACNA Leakage Class for Round and Flat Oval: 6

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.
2. PVC-Coated Ducts:
   a. Exposed to Airstream: Match duct material
   b. Not Exposed to Airstream: Match duct material

3. Stainless-Steel Ducts:
   a. Exposed to Airstream: Match duct material
   b. Not Exposed to Airstream: Match duct material

4. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Figure 4-2, "Rectangular Elbows".
   a. Velocity 1000 fpm or Lower:
      1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      2) Mitered Type RE 4 without vanes.
   b. Velocity 1000 to 1500 fpm:
      1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners" and Figure 4-4, "Vane Support in Elbows".
   c. Velocity 1500 fpm or Higher:
      1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Figure 4-3, "Vanes and Vane Runners" and Figure 4-4, "Vane Support in Elbows".

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Figure 4-2, "Rectangular Elbows".
   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanels and Vane Runners" and Figure 4-4, "Vane Support in Elbows".

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Figure 3-4, "Round Duct Elbows".

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Table 3-1, "Mitered Elbows". Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated

c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Figure 4-6, "Branch Connection".

a. Rectangular Main to Rectangular Branch: 45-degree entry
b. Rectangular Main to Round Branch: Spin in

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", Figure 3-5, "90 Degree Tees and Laterals" and Figure 3-6, "Conical Tees". Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap
b. Velocity 1000 to 1500 fpm: Conical tap
c. Velocity 1500 fpm or Higher: 45-degree lateral

END OF SECTION 23 31 13
GENERAL

1.1 WORK INCLUDES

A. Base Bid:
   1. Mechanical Contractor:
      a. This section includes the following:
         1) Pleated panel filters
         2) Supported bag filters
         3) V-bank cell filters
         4) Front- and rear-access filter frames

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.

B. Shop Drawings: For air filters. Include plans, elevations, sections, details, and attachments to other work.
   1. Show filter rack assembly, dimensions, materials and methods of assembly of components.
   2. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.

C. Field quality-control reports.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation and maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Provide one (1) complete set of filters for each filter bank. If system includes prefilters, provide only prefilters.
2. PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance:
   1. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup".
   2. Comply with ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.

B. Comply with NFPA 90A and NFPA 90B.

C. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 METAL PANEL FILTERS

A. Description: Factory-fabricated, self-supported, cleanable, all-metal, impingement-type, panel-type, permanent air filters with holding frames.
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Media: Four alternate layers of stainless-steel flat and herringbone-crimp screen.
   1. Nonoiled for grease removal application.
   2. Adhesive coating.
      a. Adhesive: As recommended by air-filter manufacturer and with a VOC content of 80 g/L or less.
      b. Adhesive: As recommended by air-filter manufacturer and that complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers".

C. Filter-Media Frame: Hot-dip galvanized steel, hinged, and with pull and retaining handles fastened to the media.
   1. Drain holes

D. Capacities and Characteristics: Shall match existing.
2.3 FLAT PANEL FILTERS

A. Description: Factory-fabricated, self-supported, flat, nonpleated, panel-type, disposable air filters with holding frames.
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Filter Unit Class: UL 900, Class 2

C. Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.
   1. Adhesive: As recommended by air-filter manufacturer and with a VOC content of 80 g/L or less.
   2. Adhesive: As recommended by air-filter manufacturer and that complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
   3. Media shall be coated with an antimicrobial agent.

D. Filter-Media Frame: Cardboard with perforated metal retainer sealed or bonded to the media.

E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

F. Capacities and Characteristics: Shall match existing.

2.4 PLEATED PANEL FILTERS

A. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Filter Unit Class: UL 900, Class 2

C. Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.
   1. Adhesive: As recommended by air-filter manufacturer and with a VOC content of 80 g/L or less.
   2. Adhesive: As recommended by air-filter manufacturer and that complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
   3. Media shall be coated with an antimicrobial agent.
4. Separators shall be bonded to the media to maintain pleat configuration.
5. Welded-wire grid shall be on downstream side to maintain pleat.
6. Media shall be bonded to frame to prevent air bypass.
7. Support members on upstream and downstream sides to maintain pleat spacing.

D. Filter-Media Frame: Cardboard frame with perforated metal retainer sealed or bonded to the media.

E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

F. Capacities and Characteristics: Shall match existing.

2.5 NONSUPPORTED BAG FILTERS

A. Description: Factory-fabricated, dry, extended-surface, nonsupported filters with header frames.
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Filter Unit Class: UL 900, Class 2

C. Media: Glass-fiber or Synthetic material constructed so individual pockets are maintained in tapered form under rated-airflow conditions by flexible internal supports.
   1. Media shall be coated with an antimicrobial agent.

D. Filter-Media Frame: Galvanized steel

E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

F. Capacities and Characteristics: Shall match existing.

2.6 SUPPORTED BAG FILTERS

A. Description: Factory-fabricated, dry, extended-surface, self-supported filters with holding frames in steel, basket-type retainers.
   1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Filter Unit Class: UL 900, Class 2

C. Media: Fibrous material constructed so individual pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports.
   1. Media shall be coated with an antimicrobial agent.
D. Filter-Media Frame: Galvanized steel

E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

F. Capacities and Characteristics: Shall match existing.

2.7 RIGID CELL BOX FILTERS

A. Description: Factory-fabricated, adhesive-coated, disposable, packaged air filters with media perpendicular to airflow, and with holding frames.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Filter Unit Class: UL 900, Class 2

C. Media: Fibrous material constructed so individual pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports.

1. Adhesive: As recommended by air-filter manufacturer and with a VOC content of 80 g/L or less.

2. Adhesive: As recommended by air-filter manufacturer and that complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers".

3. Media shall be coated with an antimicrobial agent.

D. Filter-Media Frames: Galvanized steel

E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

F. Capacities and Characteristics: Shall match existing.

2.8 V-BANK CELL FILTERS

A. Description: Factory-fabricated, adhesive-coated, disposable, packaged air filters with media angled to airflow, and with holding frames.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Filter Unit Class: UL 900, Class 2

C. Media: Fibrous material constructed so individual pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports.
1. Adhesive: As recommended by air-filter manufacturer and with a VOC content of 80 g/L or less.
2. Adhesive: As recommended by air-filter manufacturer and that complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers".
3. Media shall be coated with an antimicrobial agent.

D. Filter-Media Frames: Galvanized steel

E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

F. Capacities and Characteristics: Shall match existing.

2.9 SELF-SUPPORTED POCKET FILTERS

A. Description: Factory-fabricated, panel-type, disposable air filters with contoured media for extended surface.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Filter Unit Class: UL 900, Class 2

C. Media: Fibrous material constructed so individual pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports.

1. Media shall be coated with an antimicrobial agent.

D. Configuration: Single-pocket cube

E. Filter-Media Frame: Galvanized steel

F. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

G. Capacities and Characteristics: Shall match existing.

3. EXECUTION

3.1 INSTALLATION

A. Equipment Mounting:

1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC".
B. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.

C. Install filters in position to prevent passage of unfiltered air.

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.

E. Coordinate filter installations with duct and air-handling-unit installations.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies and equipment installations, including connections.

C. Perform the following tests and inspections:
   1. Test for leakage of unfiltered air while system is operating.

D. Air filter will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.3 CLEANING

A. After completing system installation and testing, adjusting and balancing of air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION 23 41 00
DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING
23 74 33 – Dedicated Outdoor-Air Units

1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:
   1. Mechanical Contractor:
      a. This section includes the following:
         1) Factory-packaged units capable of supplying up to 100 percent outdoor air and providing cooling and heating.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings:
   1. Include plans, elevations, sections and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Prepare the following by or under the supervision of a qualified professional engineer:
      a. Mounting Details: For securing and flashing roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
      b. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For design of vibration isolation and wind restraints, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Unit fabrication and assembly details.
   2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
   3. Design Calculations:
      a. Calculate requirements for selecting vibration isolators and wind restraints and for designing vibration isolation bases.
      b. Indicate compliance with "Performance Requirements" article.
1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof-curb mounting details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Size and location of unit-mounted rails and anchor points and methods for anchoring units to roof curb.
2. Required roof penetrations for ducts, pipes, and electrical raceways, including size and location of each penetration.

B. Startup service reports.

C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For units to include in emergency, operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One (1) set for each belt-driven fan.
2. Filters: One (1) set for each unit.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to replace components of units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Heat Exchangers: Five (5) years from date of Substantial Completion.

2. PRODUCTS

2.1 MANUFACTURERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.2 PERFORMANCE REQUIREMENTS

A. General Fabrication Requirements: Comply with requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up".
B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design vibration isolation and wind restraints.

C. Wind-Restraint Performance:
   1. Basic Wind Speed: $<$Insert value$>$
   2. Building Classification Category: [I] [II] [III] [IV]
   3. Minimum 10 lb/sq. ft. multiplied by the maximum area of unit projected on a vertical plane that is normal to the wind direction and 45 degrees either side of normal.

D. Cabinet Thermal Performance:
   1. Maximum Overall U-Value: Comply with requirements in ASHRAE/IESNA 90.1.
   2. Include effects of metal-to-metal contact and thermal bridges in the calculations.

E. Cabinet Surface Condensation:
   1. Cabinet shall have additional insulation and vapor seals if required to prevent condensation on the interior and exterior of the cabinet.
   2. Portions of cabinet located downstream from the cooling coil shall have a thermal break at each thermal bridge between the exterior and interior casing to prevent condensation from occurring on the interior and exterior surfaces. The thermal break shall not compromise the structural integrity of the cabinet.

F. Maximum Cabinet Leakage: 1 percent of the total supply-air flow at a pressure rating equal to the fan shut-off pressure.

G. Cabinet Deflection Performance:
   1. Walls and roof deflection shall be within 1/240 of the span at the design working pressure equal to the fan shut-off pressure. Deflection limits shall be measured at any point on the surface.
   2. Floor deflections shall be within 1/240 of the span considering the worst-case condition caused by the following:
      a. Service personnel
      b. Internal components
      c. Design working pressure defined for the walls and roof.

H. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
I. Capacities and Characteristics:

2.3 CABINET

A. Construction: Double wall

B. Exterior Casing Material: Galvanized steel with paint finish

C. Interior Casing Material: Galvanized steel

D. Lifting and Handling Provisions: Factory-installed shipping skids and lifting lugs

E. Base Rails: Galvanized-steel rails for mounting on roof curb or pad as indicated.

F. Access for Inspection, Cleaning and Maintenance: Comply with requirements in ASHRAE 62.1.
   
   1. Service Doors: Hinged access doors with gaskets. Material and construction of doors shall match material and construction of cabinet in which doors are installed.

G. Roof: Standing seam or membrane; sloped to drain water.

H. Floor: Reinforced, metal surface; reinforced to limit deflection when walked on by service personnel. Insulation shall be below metal walking surface.

I. Cabinet Insulation:

   1. Type: Fibrous-glass duct lining complying with ASTM C 1071, Type II or flexible elastomeric insulation complying with ASTM C 534, Type II, sheet materials.
   
   2. Thickness: 2 inches

   3. Insulation Adhesive: Comply with ASTM C 916, Type I.

   4. Mechanical Fasteners: Suitable for adhesive, mechanical, or welding attachment to casing without damaging liner and without causing air leakage when applied as recommended by manufacturer.

J. Condensate Drain Pans:

   1. Shape: Rectangular, with 1 percent slope in at least two planes to direct water toward drain connection.

   2. Size: Large enough to collect condensate from cooling coils including coil piping connections, coil headers, and return bends.

      a. Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.

      b. Depth: Minimum of 2 inches deep
3. Configuration: Single wall
4. Configuration: Double wall, with space between walls filled with foam insulation and moisture-tight seal.
6. Material: Stainless-steel sheet
7. Drain Connection:
   a. Located on one end of pan, at lowest point of pan.
   b. Terminated with threaded nipple.
   c. Minimum Connection Size: NPS 1
8. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

K. Surfaces in Contact with Airstream: Comply with requirements in ASHRAE 62.1 for resistance to mold and erosion.

L. Roof Curb: Full-perimeter curb of sheet metal, minimum 12 inches high, with wood nailer, neoprene sealing strip, and welded Z-bar flashing.
   1. Comply with requirements in "The NRCA Roofing Manual".

2.4 SUPPLY FAN

A. Forward-Curved Fan Type: Centrifugal; statically and dynamically balanced.
   1. Fan Wheel Material: Galvanized steel, mounted on solid-steel shaft
   2. Bearings: Self-aligning, permanently lubricated ball bearings

B. Service Factor for Belt Drive Applications: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly with minimum 1.5 service factor.

C. Motors:
   1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment".
   2. Enclosure: [Open drip proof] [Totally enclosed]
   3. Enclosure Materials: [Cast iron] [Cast aluminum] [Rolled steel]
   4. Motor Bearings: <Insert>
   5. Efficiency: Premium efficient
   6. NEMA Design: <Insert designation>
   7. Service Factor: [1.0] [1.15]

D. Mounting: Fan wheel, motor, and drives shall be mounted to fan casing with spring isolators.
2.5 COOLING COILS
   A. Capacity Ratings: Comply with ASHRAE 33 and ARI 410.
   B. Coil Casing Material: Galvanized steel
   C. Tube Material: Copper
   D. Tube Header Material: Copper
   E. Fin Material: Aluminum
   F. Fin and Tube Joints: Mechanical bond
   G. Leak Test: Coils shall be leak tested with air underwater.
   H. Coating: Phenolic epoxy corrosion-protection coating after assembly.

2.6 HOT-WATER HEATING COIL
   A. Capacity Ratings: Comply with ASHRAE 33 and ARI 410.
   B. Coil Casing Material: Galvanized steel
   C. Tube Material: Copper
   D. Tube Header Material: Copper
   E. Fin Material: Aluminum
   F. Fin and Tube Joints: Mechanical bond
   G. Leak Test: Coils shall be leak tested with air underwater.
   H. Coating: Phenolic epoxy corrosion-protection coating after assembly.

2.7 OUTDOOR-AIR INTAKE HOOD
   A. Type: Manufacturer's standard hood or louver
   B. Materials: Match cabinet
   C. Bird Screen: Comply with requirements in ASHRAE 62.1.
   D. Configuration: Designed to inhibit wind-driven rain and snow from entering unit.

2.8 FILTERS
   A. Disposable Panel Filters:
1. Comply with NFPA 90A.
2. Factory-fabricated, viscous-coated, flat-panel type
3. Thickness: 2 inches
4. Initial Resistance: 0.1 inches wg
5. Recommended Final Resistance: 0.3 inches wg
6. Minimum Arrestance: 80, according to ASHRAE 52.1
7. Minimum Merv: 8, according to ASHRAE 52.2

B. Extended-Surface, Nonsupported-Media Filters:
   1. Comply with NFPA 90A.
   2. Factory-fabricated, dry, extended-surface, self-supporting type.
   3. Initial Resistance: 0.1 inches wg
   4. Recommended Final Resistance: 0.5 inches wg
   5. Minimum Arrestance: 95, according to ASHRAE 52.1
   6. Minimum Merv: 13, according to ASHRAE 52.2
   7. Media: Fibrous material constructed so individual pleats are maintained in tapered form by flexible internal supports under rated-airflow conditions.

C. Mounting Frames:
   1. Panel filters arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or from access plenum.
   2. Extended surface filters arranged for flat orientation, removable from access plenum.
   3. Galvanized or stainless steel with gaskets and fasteners, suitable for bolting together into built-up filter banks with space for prefILTER.

2.9 ELECTRICAL POWER CONNECTIONS

A. General Electrical Power Connection Requirements: Factory-installed and -wired switches, motor controllers, transformers, and other necessary electrical devices shall provide a single-point field power connection to unit.

B. Enclosure: NEMA 250, Type 4X, mounted in unit with hinged access door in unit cabinet having a lock and key or padlock and key,

C. Wiring: Numbered and color-coded to match wiring diagram.

D. Wiring Location: Install factory wiring outside an enclosure in a raceway.

E. Power Interface: Field power interface shall be to NEMA KS 1, heavy-duty, nonfused disconnect switch.

F. Factory Wiring: Branch power circuit to each motor and to controls with one of the following disconnecting means:
1. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
2. NEMA KS 1, heavy-duty, nonfusible switch
3. UL 489, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

G. Factory-Mounted, Overcurrent-Protection Service: For each motor.

H. Transformer: Factory-mounted with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.

I. Controls: Factory wire unit-mounted controls where indicated

J. Lights: Factory wire unit-mounted lights

K. Receptacle: Factory wire unit-mounted, ground fault interrupt (GFI) duplex receptacle

L. Control Relays: Auxiliary and adjustable time-delay relays

2.10 CONTROLS

A. Control equipment and sequence of operation are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC".

B. Control Valves: Comply with requirements in Section 230923.11 "Control Valves".

C. Control Wiring: Factory wire connection for controls' power supply

D. Control Devices: Sensors, transmitters, relays, switches, detectors, operators, actuators, and valves shall be manufacturer's standard items to accomplish indicated control functions.

E. Unit-Mounted Status Panel:

1. Cooling/Off/Heating Controls: Control operational mode.
2. Damper Position: Indicate position of outdoor-air dampers in terms of percentage of outdoor air.
3. Status Lights:
   a. Filter dirty
   b. Fan operating
   c. Cooling operating
   d. Heating operating
   e. Smoke alarm
   f. General alarm
4. Digital Numeric Display:
   a. Outdoor airflow
   b. Supply airflow
   c. Outdoor dry-bulb temperature
   d. Outdoor dew point temperature
   e. Space temperature
   f. Supply temperature
   g. Space relative humidity

F. Control Dampers:

1. Damper Location: Factory-installed inside unit for ease of blade axle and bushing service. Arrange dampers located in a mixing box to achieve convergent airflow to minimize stratification.
2. Damper Leakage: Comply with requirements in AMCA 500-D. Leakage shall not exceed 6.5 cfm per sq. ft. at a static-pressure differential of 4.0 inches water column when a torque of 5 inch pounds per sq. ft. is applied to the damper jackshaft.
3. Damper Rating: Rated for close-off pressure equal to the fan shutoff pressure.
4. Damper Label: Bear the AMCA seal for both air leakage and performance.
5. Blade Configuration: Unless otherwise indicated, use parallel blade configuration for two-position control and equipment isolation service and use modulating control when mixing two airstreams. For other applications, use an opposed-blade configuration.
6. Damper Frame Material: Galvanized steel
7. Blade Type: Single-thickness metal reinforced with multiple V-grooves or hollow-shaped airfoil.
8. Blade Material: Galvanized steel
9. Maximum Blade Width: 6 inches
10. Maximum Blade Length: 48 inches
13. Airflow Measurement:
   a. Monitoring System: Complete and functioning system of airflow monitoring as an integral part of the damper assembly where indicated.
   b. Remote Monitoring Signal: 0-10 volt or 4-20 mA scaled signal.
   c. Accuracy of flow measurement: Within 5 percent of the actual flow rate between the range of the scheduled minimum and maximum airflow. For units with a large range between minimum and maximum airflow, configure the damper sections and flow measurement assembly as necessary to comply with accuracy.
   d. Straightening Device: Integral to the flow measurement assembly if required to achieve the specified accuracy as installed.
e. Flow Measuring Device: Suitable for operation in untreated and unfiltered outdoor air. If necessary, include temperature and altitude compensation and correction to maintain the accuracy.

G. Damper Operators:

1. Factory-installed electric operator for each damper assembly with one operator for each damper assembly mounted to the damper frame.
2. Operator capable of shutoff against fan pressure and able to operate the damper with sufficient reserve power to achieve smooth modulating action and proper speed of response at the velocity and pressure conditions to which the damper is subjected.
3. Maximum Operating Time: Open or close damper 90 degrees in [60] [90] seconds.
4. Adjustable Stops: For both maximum and minimum positions.
5. Position Indicator and Graduated Scale: Factory installed on each actuator with words "OPEN" and "CLOSED" or similar identification, at travel limits.
6. Spring-return operator to fail-safe; either closed or open as required by application.
7. Operator Type: Direct coupled, designed for minimum 60,000 full-stroke cycles at rated torque.
9. Coupling: V-bolt and V-shaped, toothed cradle

H. Chilled-Water Coil Controls:

1. [Factory-mounted sensor in unit discharge] [Remote-sensor for field installation in supply-air duct] with sensor adjustment located in control panel to modulate factory-[mounted] [furnished] coil control valve to maintain temperature.
2. Space-temperature sensor with [temperature adjustment] [unit-mounted temperature adjustment] [adjustment on remote-control panel] to modulate factory-[mounted] [furnished] coil control valve to maintain temperature.

I. Hot-Water Coil Controls: [Factory-mounted sensor in unit discharge] [Remote sensor for field installation in supply-air duct] with sensor adjustment located in control panel to modulate factory-[mounted] [furnished] coil control valve to maintain temperature.

J. Hot-Water Coil Controls: Space-temperature sensor with [temperature adjustment] [unit-mounted temperature adjustment] [adjustment on remote-control panel] to modulate factory-[mounted] [furnished] coil control valve to maintain temperature.

K. Damper Controls: Space pressure sensor modulates outdoor- and return-air dampers to maintain a positive pressure in space at a minimum of 0.05 inch wg with respect to outdoor reference.
L. Integral Smoke Alarm: Smoke detector installed in [supply] [and] [return] air.

M. DDC Temperature Control: Standalone control module for link between unit controls and DDC temperature-control system. Control module shall be compatible with control system specified in Section 230923 "Direct Digital Control (DDC) System for HVAC". Links shall include the following:

1. Start/stop interface relay and relay to notify DDC temperature-control system alarm condition.
2. Hardware interface or additional sensors for the following:
   a. Room temperature
   b. Discharge-air temperature
   c. Constant and variable motor loads
   d. Variable-frequency-controller operation
   e. Cooling load
   f. Economizer cycles
   g. Air-distribution static pressure and ventilation-air volumes

N. Interface with DDC System for HVAC: Factory-installed hardware and software to enable the DDC system for HVAC to monitor, control, and display unit status and alarms.

1. Hardwired Points:
   b. Control: On-off operation, [space temperature set-point adjustment] [supply temperature set-point adjustment] [space humidity set-point adjustment] [space pressure set-point adjustment].

2. [ASHRAE 135 (BACnet)] [LonTalk] [Modbus] [Industry-accepted, open-protocol] <Insert type of interface> communication interface with the DDC system for HVAC shall enable the DDC system for HVAC operator to remotely control and monitor the unit from an operator workstation. Control features and monitoring points displayed locally at unit control panel shall be available through the DDC system for HVAC.

2.11 ACCESSORIES

A. Service Lights and Switch: Factory-installed in fan and coil sections with weatherproof cover. Factory wire lights to a single-point field connection.

B. Duplex Receptacle: Factory-mounted in unit supply-fan section, with 20 amp 120 V GFI duplex receptacle and weatherproof cover.
3. EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping, ducts and electrical systems to verify actual locations of connections before equipment installation.

C. Examine roof curbs and equipment supports for suitable conditions where units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's rigging and installation instructions for unloading units and moving to final locations.

B. Curb Support: Install roof curb on roof structure according to "The NRCA Roofing Manual".
   1. Install and secure units on curbs and coordinate roof penetrations and flashing with roof construction.
   2. Coordinate size, installation, and structural capacity of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories".
   3. Coordinate size, location and installation of unit manufacturer's roof curbs and equipment supports with roof Installer.

C. Restrained Curb Support: Install restrained vibration isolation roof-curb rails on roof structure according to "The NRCA Roofing Manual".

D. Equipment Mounting:

   1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC".

E. Install wall- and duct-mounted sensors furnished by manufacturer for field installation. Install control wiring and make final connections to control devices and unit control panel.

F. Comply with requirements for gas-fired furnace installation in NFPA 54, "National Fuel Gas Code".

G. Install separate devices furnished by manufacturer and not factory installed.
H. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

I. Install drain pipes from unit drain pans to sanitary drain.
   1. Drain Piping: Drawn-temper copper water tubing complying with ASTM B 88, Type L, with soldered joints.
   2. Drain Piping: Schedule 40 PVC pipe complying with ASTM D 1785, with solvent-welded fittings.
      a. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      b. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers".
   3. Pipe Size: Same size as condensate drain pan connection.

3.3 CONNECTIONS

A. Where installing piping adjacent to units, allow space for service and maintenance.

B. Hydronic Piping Connections:
   1. Comply with requirements in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties".
   2. Install shutoff valve and union or flange on each supply connection and install balancing valve and union or flange on each return connection.

C. Duct Connections:
   1. Comply with requirements in Section 233113 "Metal Ducts".
   2. Drawings indicate the general arrangement of ducts.
   3. Connect ducts to units with flexible duct connectors. Comply with requirements for flexible duct connectors in Section 233300 "Air Duct Accessories".

D. Electrical Connections: Comply with requirements for power wiring, switches and motor controls in electrical Sections.
   1. Install electrical devices furnished by unit manufacturer, but not factory mounted.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
1. Complete installation and startup checks according to manufacturer's written instructions.

2. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
   a. High-limit heat exchanger
   b. Alarms

3. Inspect units for visible damage to refrigerant compressor, condenser and evaporator coils, and fans.

4. Start refrigeration system when outdoor-air temperature is within normal operating limits and measure and record the following:
   a. Cooling coil leaving-air, dry- and wet-bulb temperatures
   b. Cooling coil entering-air, dry- and wet-bulb temperatures
   c. Condenser coil entering-air dry-bulb temperature
   d. Condenser coil leaving-air dry-bulb temperature

5. Simulate maximum cooling demand and inspect the following:
   a. Short-circuiting of air through outside coil or from outside coil to outdoor-air intake.

6. Inspect casing insulation for integrity, moisture content and adhesion.

7. Verify that clearances have been provided for servicing.

8. Verify that controls are connected and operable.

9. Verify that filters are installed.

10. Clean coils and inspect for construction debris.

11. Inspect and adjust vibration isolators and seismic restraints.

12. Verify bearing lubrication.

13. Clean fans and inspect fan-wheel rotation for movement in correct direction without vibration and binding.

14. Adjust fan belts to proper alignment and tension.

15. Start unit.

16. Inspect and record performance of interlocks and protective devices including response to smoke detectors by fan controls and fire alarm.

17. Operate unit for run-in period.

18. Calibrate controls.

19. Adjust and inspect high-temperature limits.

20. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.

21. Verify operational sequence of controls.

22. Measure and record the following airflows. Plot fan volumes on fan curve.
   a. Supply-air volume
   b. Return-air flow
   c. Outdoor-air flow
B. After startup, change filters, verify bearing lubrication, and adjust belt tension.

C. Remove and replace components that do not properly operate and repeat startup procedures as specified above.

D. Prepare written report of the results of start-up services.

3.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within twelve (12) months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two (2) visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain units.

END OF SECTION 23 74 33
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:

1. Electrical Contractor:

   a. This section includes the following:

      1) Building wires and cables rated 600 V and less
      2) Connectors, splices and terminations rated 600 V and less
      3) Sleeves and sleeve seals for cables

1.2 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

   1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.3 REGULATORY REQUIREMENTS

A. National Electric Code 2008

1.4 ABBREVIATIONS

A. EPDM: Ethylene-Propylene-Diene Terpolymer Rubber

B. NBR: Acrylonitrile-Butadiene Rubber
1.5 SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Qualification Data: For testing agency.
   C. Field quality-control test reports.

1.6 COORDINATION
   A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

2. PRODUCTS

2.1 CONDUCTORS AND CABLES
   A. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:
      1. General Cable Corporation
      2. Southwire Company
   B. Copper Conductors: Comply with NEMA WC 70.
   C. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN, XHHW, UF, USE and SO.
   D. Multi-Conductor Cable: Comply with NEMA WC 70 for Type NM, Type SO and Type USE with ground wire.

2.2 CONNECTORS AND SPLICES
   A. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:
      1. AFC Cable Systems, Inc.
      3. O-Z/Gedney; EGS Electrical Group LLC
      4. 3M; Electrical Products Division
      5. Tyco Electronics Corp.
   B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping".

2.4 SLEEVE SEALS

A. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:

   1. Advance Products & Systems, Inc.
   2. Calpico, Inc.
   3. Metraflex Co.
   4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

   1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   2. Pressure Plates: Stainless steel. Include two for each sealing element.
   3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

3. EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway, Type XHHW, single conductors in raceway or Type SE or USE multi-conductor cable.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions and Crawlspace: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, Below Slabs-on-Grade and Underground: Type THHN-THWN, single conductors in raceway and Underground feeder cable, Type UF.

E. Branch Circuits Concealed in Ceilings, Walls and Partitions: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Concrete, Below Slabs-on-Grade and Underground: Type THHN-THWN, single conductors in raceway and underground branch-circuit cable, Type UF.

G. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

H. Class 1 Control Circuits: Type THHN-THWN, in raceway.

I. Class 2 Control Circuits: Type THHN-THWN, in raceway and power-limited cable, concealed in building finishes.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems".

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems".

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping".

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Extend sleeves installed in floors 2 inches above finished floor level.
H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth and location of joint according to Division 07 Section "Joint Sealants".

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping".

L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping".

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.
C. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.
   a. Emergency Service
   b. Fire Alarm System


3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
   a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
   b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19
1. GENERAL

1.1 WORK INCLUDES
   A. Base Bid:
      1. Electrical Contractor:
         a. This section includes the following:
            1) Hangers and supports for electrical equipment and systems

1.2 REGULATORY REQUIREMENTS
   A. National Electric Code 2008

1.3 ABBREVIATIONS
   A. RMC: Rigid Metal Conduit
   B. EMT: Electrical Metal Tubing

1.4 SUBMITTALS
   A. Product Data: Steel slotted support systems

2. PRODUCTS

2.1 SUPPORT, ANCHORAGE AND ATTACHMENT COMPONENTS
   A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

      1. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:
         a. Cooper B-Line, Inc.; a division of Cooper Industries
         b. ERICO International Corporation
         c. Unistrut; Tyco International, Ltd.

      2. Painted Coatings: Manufacturer's standard painted coating.
      3. Channel Dimensions: Selected for applicable load criteria.
B. Conduit and Cable Support Devices: Steel hangers, clamps and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Mounting, Anchoring and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   a. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:

      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) MKT Fastening, LLC

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

   a. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:

      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) MKT Fastening, LLC

3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

5. Toggle Bolts: All-steel springhead type

6. Hanger Rods: Threaded steel

3. EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems.

END OF SECTION 26 05 29
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:
   1. Electrical Contractor:
      a. This section includes the following:
         1) Metal conduits and fittings
         2) Boxes and enclosures

1.2 REGULATORY REQUIREMENTS

A. National Electric Code 2008

1.3 ABBREVIATIONS

A. GRC: Galvanized Rigid Steel Conduit

B. EMT: Electrical Metallic Tubing

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, boxes, hinged-cover enclosures and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections and attachment details.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
   1. Structural members in paths of conduit groups with common supports.
   2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

2. PRODUCTS

2.1 METAL CONDUITS, TUBING AND FITTINGS

A. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:
1. Allied Tube & Conduit; a Tyco International Ltd. Co.
2. O-Z/Gedney; a brand of EGS Electrical Group
3. Wheatland Tube Company; a division of John Maneely Company
4. Approved equal

B. Listing and Labeling: Metal conduits, tubing and fittings shall be listed and labeled as defined in NFPA 70 by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Expansion Fittings: Steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

F. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 BOXES AND ENCLOSURES

A. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Technologies Company; Cooper Crouse-Hinds
2. Hoffman; a Pentair company
3. O-Z/Gedney; a brand of EGS Electrical Group
4. Approved equal

B. General Requirements for Boxes and Enclosures: Boxes and enclosures installed in wet locations shall be listed for use in wet locations.

C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1

D. Cast-Metal Access, Pull and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

E. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 12 with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

3. EXECUTION

3.1 RACEWAY APPLICATION

A. Indoors: Apply raceway products as specified below unless otherwise indicated:
   1. Exposed and Subject to Severe Physical Damage: GRC; raceway locations include all basement areas.
   2. Exposed Above Drop Ceilings and Stairwells: EMT
   3. Exposed in Hallways and Finished Areas: Wiremold

B. Minimum Raceway Size: 3/4-inch trade size

C. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Where conduit bushings are installed, use grounding type.
   2. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
   3. Use watertight hubs to connect GRC to threadless openings in all enclosures. Use grounding type.
   4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

D. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Division 26 Section "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Support conduit within 12 inches of enclosures to which attached.

H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

J. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

K. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

L. Do not rely on locknuts to penetrate non-conductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

M. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb. tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

O. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.

P. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
3.3 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.4 PROTECTION

A. Protect coatings, finishes and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:

1. Electrical Contractor:

   a. This section includes the following:

      1) Identification for raceways
      2) Identification of power and control cables
      3) Identification for conductors
      4) Warning labels and signs
      5) Instruction signs
      6) Equipment identification labels
      7) Miscellaneous identification products

1.2 QUALITY ASSURANCE


B. Comply with NFPA 70.


D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives and inks used by label printers, shall comply with UL 969.

1.3 REGULATORY REQUIREMENTS

A. National Electric Code 2008

1.4 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

2. PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:
   1. Black letters on an orange field
   2. Legend: Indicate voltage and system or service type

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
G. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

D. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

E. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
2.4 WARNING LABELS AND SIGNS


B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:
   1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
   2. 1/4-inch grommets in corners for mounting.
   3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:
   1. Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend and size required for application.
   2. 1/4-inch grommets in corners for mounting.
   3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:
   1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES"
   2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES"

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
   1. Engraved legend with black letters on white face.
   2. Punched or drilled for mechanical fasteners.
   3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.


2.7 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch
2. Tensile Strength at 73 deg F According to ASTM D 638: 12,000 psi
3. Temperature Range: Minus 40 to plus 185 deg F

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi
3. Temperature Range: Minus 40 to plus 185 deg F
4. Color: Black

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi
3. UL 94 Flame Rating: 94V-0
4. Temperature Range: Minus 50 to plus 284 deg F
5. Color: Black

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

3. EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways, 600 V or Less, for Service, Feeder and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label or self-adhesive vinyl tape applied in bands. Install labels at 10-foot or 30-foot maximum intervals.

B. Accessible Raceways and Cables Within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power
2. Power
3. UPS

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

   a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.

   b. Colors for 208/120-V Circuits:
      1) Phase A: Black
      2) Phase B: Red
      3) Phase C: Blue
      4) Neutral: White

   c. Colors for 480/277-V Circuits:
      1) Phase A: Brown
      2) Phase B: Orange
      3) Phase C: Yellow
      4) Neutral: Gray

   d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal
points and in boxes where splices or taps are made. Apply last two
turns of tape with no tension to prevent possible unwinding.Locate bands to avoid obscuring factory cable markings.

D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Conductors to Be Extended in the Future: Attach write-on tags or marker tape to conductors and list source.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

G. Warning Labels for Indoor Cabinets, Boxes and Enclosures for Power and Lighting: Self-adhesive warning labels or metal-backed, butyrate warning signs.

2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
   a. Power transfer switches
   b. Controls with external control power connections

H. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

I. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch high letters for emergency instructions at equipment used for power transfer and load shedding.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control
stations, terminal cabinets and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
   
a. Indoor Equipment: Engraved, laminated acrylic. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label; where two lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Engraved, laminated acrylic, stenciled legend 4 inches high.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment To Be Labeled:
   
a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets
   c. Emergency system boxes and enclosures
   d. Enclosed switches
   e. Enclosed circuit breakers
   f. Enclosed controllers
   g. Variable-speed controllers
   h. Push-button stations
   i. Contactors
   j. Remote-controlled switches, dimmer modules and control devices
   k. Battery-inverter units
   l. Monitoring and control equipment

END OF SECTION 26 05 53
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:

1. Electrical Contractor:
   a. This section includes the following:
      1) Receptacles, receptacles with integral GFCI, and associated device plates
      2) Wall-box motion sensors
      3) Wall switch

1.2 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.3 REGULATORY REQUIREMENTS

A. National Electric Code 2008

1.4 ABBREVIATIONS

A. EMI: Electromagnetic Interference
B. GFCI: Ground-Fault Circuit Interrupter
C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
D. RFI: Radio-Frequency Interference
E. TVSS: Transient Voltage Surge Suppressor
F. UTP: Unshielded Twisted Pair
1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

2. PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper)
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell)
3. Leviton Mfg. Company Inc. (Leviton)
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour)

2.2 GFCI RECEPTACLES

A. General Description: Straight blade, feed through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:

   a. Cooper; VGF20
   b. Hubbell; GFR5352L
c. Pass & Seymour; 2095
d. Leviton; 7590

2.3 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:

   a. Cooper; AH1221 (single pole), AH1222 (two pole), AH1223 (three way), AH1224 (four way)
   b. Hubbell; HBL1221 (single pole), HBL1222 (two pole), HBL1223 (three way), HBL1224 (four way)
   c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way)
   d. Pass & Seymour; CSB20AC1 (single pole), CSB20AC2 (two pole), CSB20AC3 (three way), CSB20AC4 (four way)

2.4 OCCUPANCY SENSORS

A. Wall-Switch Sensors:

1. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:

   a. Cooper; 6111 for 120 V, 6117 for 277 V
   b. Hubbell; WS1277
   c. Leviton; ODS 10-ID
   d. Pass & Seymour; WS3000
   e. Watt Stopper (The); WS-200

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.

B. Wall-Switch Sensors:

1. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:

   a. Hubbell; AT120 for 120 V, AT277 for 277 V
   b. Leviton; ODS 15-ID
2. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.

C. Long-Range Wall-Switch Sensors:

1. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:
   a. Hubbell; ATP1600WRP
   b. Leviton; ODWWV-IRW
   c. Pass & Seymour; PL-12
   d. Watt Stopper (The); CX-100

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1,200 sq. ft.

D. Long-Range Wall-Switch Sensors:

1. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:
   a. Hubbell; ATD1600WRP
   b. Leviton; ODW12-MRW
   c. Watt Stopper (The); DT-200

2. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1,200 sq. ft.

E. Wide-Range Wall-Switch Sensors:

1. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:
   a. Hubbell; ATP120HBRP
   b. Leviton; ODWHB-IRW
   c. Pass & Seymour; HS1001
   d. Watt Stopper (The); CX-100-3

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1,200 sq. ft.
F. Exterior Occupancy Sensors:

1. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:
   a. Leviton; PS200-10
   b. Watt Stopper (The); EW-100-120

2. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

2.5 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish
   2. Material for Finished Spaces: 0.035-inch thick, satin-finished stainless steel or as selected by the Architect
   3. Material for Unfinished Spaces: Galvanized steel
   4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations".

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.6 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.
   1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.

3. EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
   a. Cut back and pigtail or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtailed that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by
   the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A
   circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers
   used to hold device mounting screws in yokes, allowing metal-to-metal
   contact.

E. Receptacle Orientation: Install ground pin of vertically mounted receptacles
   down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall
   finishes and remount outlet boxes when standard device plates do not fit
   flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long
   dimension vertical and with grounding terminal of receptacles on top. Group
   adjacent switches under single, multi-gang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement
   of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems".
   1. Receptacles: Identify panelboard and circuit number from which served.
      Use hot, stamped or engraved machine printing with black-filled
      lettering on face of plate, and durable wire markers or tags inside outlet
      boxes.

3.3 FIELD QUALITY CONTROL

A. Perform Tests and Inspections and Prepare Test Reports:
   1. In healthcare facilities, prepare reports that comply with
      recommendations in NFPA 99.
   2. Test Instruments: Use instruments that comply with UL 1436.
   3. Test Instrument for Convenience Receptacles: Digital wiring analyzer
      with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher
      is not acceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight blade hospital-grade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.

END OF SECTION 26 27 26
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:

1. Electrical Contractor:
   a. This section includes the following:
      1) Control circuits
      2) Enclosed controllers
      3) Enclosed switches

1.2 REGULATORY REQUIREMENTS

A. National Electric Code 2008

1.3 SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
   a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
   b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.


4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit in PDF format.

5. Coordination charts and tables and related data.
2. PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Type RK-5: 600-V, zero- to 600-A rating, 200 kAIC, time delay
2. Type CC: 600-V, zero- to 30-A rating, 200 kAIC, time delay
3. Type CD: 600-V, 31- to 60-A rating, 200 kAIC, time delay
4. Type J: 600-V, zero- to 600-A rating, 200 kAIC, time delay
5. Type L: 600-V, 601- to 6000-A rating, 200 kAIC, time delay
6. Type T: 600-V, zero- to 800-A rating, 200 kAIC, time delay

B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

2.3 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel
3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.
3. EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Motor Branch Circuits: Class RK5, time delay
2. Large Motor Branch (601-4000 A): Class L, time delay

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinets in location shown on the Drawings or as indicated in the field by the Owner.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket and holder.

3.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation and maintenance manuals. In addition to items specified in Section 017700 "Closeout Procedures" and Section 017823 "Operation and Maintenance Data", include the following:
1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. Submit in PDF format.
4. Coordination charts and tables and related data.

END OF SECTION 26 28 13
1. GENERAL

1.1 WORK INCLUDES
A. Base Bid:
   1. Electrical Contractor:
      a. This section includes the following:
         1) Fusible switches
         2) Non-fusible switches
         3) Enclosures

1.2 QUALITY ASSURANCE
A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
D. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
E. Comply with NFPA 70.

1.3 REGULATORY REQUIREMENTS
A. National Electric Code 2008

1.4 ABBREVIATIONS
A. NC: Normally Closed
B. NO: Normally Open
1.5 **SUBMITTALS**

A. **Product Data:** For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.

B. **Shop Drawings:** For enclosed switches and circuit breakers. Include plans, elevations, sections, details and attachments to other work.

1. Wiring Diagrams: For power, signal and control wiring.

C. **Qualification Data:** For qualified testing agency.

D. **Field quality-control reports.**

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. **Manufacturer's field service report.**

F. **Operation and Maintenance Data:** For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data", include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.
1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6,600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect, Construction Manager and Owner no fewer than seven (7) days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Architect's, Construction Manager's and Owner's written permission.
4. Comply with NFPA 70E.

2. PRODUCTS

2.1 FUSIBLE SWITCHES

A. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution
4. Square D; a brand of Schneider Electric

B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: Two (2) NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.
9. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac

2.2 NON-FUSIBLE SWITCHES

A. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution
4. Square D; a brand of Schneider Electric

B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: Two (2) NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size and conductor material.
7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac
2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1
2. Outdoor Locations: NEMA 250, Type 3R
3. Kitchen or Wash-Down Areas: NEMA 250, Type 4X, stainless steel
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4
5. Indoor Locations Subject to Dust, Falling Dirt and Dripping Noncorrosive Liquids: NEMA 250, Type 12
6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7 or Type 9

3. EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems".

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems".
1. Identify field-installed conductors, interconnecting wiring and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
   c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
4. Test and adjust controls, remote monitoring and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study".

3.6 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

END OF SECTION 26 28 16
1. GENERAL

1.1 WORK INCLUDES

A. Base Bid:

1. Electrical Contractor:
   a. This section includes the following:
      1) Interior lighting fixtures, lamps and ballasts
      2) Exit signs
      3) Lighting fixture supports

1.2 REGULATORY REQUIREMENTS

A. National Electric Code 2008

1.3 ABBREVIATIONS

A. BF: Ballast Factor
B. CRI: Color-Rendering Index
C. CU: Coefficient of Utilization
D. HID: High-Intensity Discharge
E. LER: Luminaire Efficacy Rating
F. Luminaire: Complete lighting fixture, including ballast housing if provided

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes and the following:
   1. Physical description of lighting fixture including dimensions
   2. Ballast
   3. Energy-efficiency data
   4. Life, output, and energy-efficiency data for lamps
   5. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts and accessories identical to those indicated for the lighting fixture as applied in this Project.
B. Shop Drawings: Show details of non-standard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features and accessories.

1. Wiring Diagrams: Power and control wiring

C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Lighting fixtures
2. Suspended ceiling components
3. Structural members to which suspension systems for lighting fixtures will be attached.
4. Other items in finished ceiling including the following:
   a. Air outlets and inlets
   b. Speakers
   c. Smoke and fire detectors
   d. Occupancy sensors
   e. Access panels
5. Perimeter moldings.

D. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.

E. Qualification Data: For agencies providing photometric data for lighting fixtures.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation and maintenance manuals.

H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

C. Comply with NFPA 70.
1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system and partition assemblies.

1.7 WARRANTY

A. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Electronic Ballasts: Five (5) years from date of Substantial Completion.

B. Special Warranty for T5 and T8 Fluorescent Lamps: Manufacturer's standard form, made out to A/E and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Two (2) years from date of Substantial Completion.

2. PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Products: Subject to compliance with requirements, provide products by one of the following:

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Doors, Frames and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
F. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent
2. Specular Surfaces: 83 percent
3. Diffusing Specular Surfaces: 75 percent
4. Laminated Silver Metallized Film: 90 percent

G. Plastic Diffusers, Covers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
   b. UV stabilized
2. Glass: Annealed crystal glass, unless otherwise indicated

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. Electronic Ballasts: Comply with ANSI C82.11; instant or programmed-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

2. Total Harmonic Distortion Rating: Less than 10 percent
3. Transient Voltage Protection: IEEE C62.41, Category A or better
4. Operating Frequency: 42 kHz or higher
5. Lamp Current Crest Factor: 1.7 or less
6. BF: 0.85 or higher
7. Power Factor: 0.95 or higher
8. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Single Ballasts for Multiple Lighting Fixtures: Factory-wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

2.4 FLUORESCENT LAMPS

A. Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.
2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and non-metallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.6 REQUIREMENTS FOR INDIVIDUAL LIGHTING FIXTURES

A. Fixture Type: Refer to Lighting Fixture Schedules.

3. EXECUTION

3.1 INSTALLATION

A. Lighting Fixtures: Set level, plumb and square with ceilings and walls. Install lamps in each fixture.

B. Temporary Lighting: If it is necessary, and approved by A/E, to use permanent luminaries for temporary lighting, install and energize the minimum number of luminaries necessary. When construction is sufficiently complete, remove the temporary luminaries, disassemble, clean thoroughly, install new lamps and reinstall.

C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

D. Suspended Lighting Fixture Support:
   1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging
   3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables".

3.2 FIELD QUALITY CONTROL

A. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 26 51 00