Volume 1 of 1
Bid Documents

HVAC Improvements and Associated Roofing Repairs
Westside Classroom Building
Western Connecticut State University
Danbury, CT
Project No.: BI-RD-298

Prepared By:
Gale Consultants, Inc.
703 Hebron Avenue
Glastonbury, CT
06033

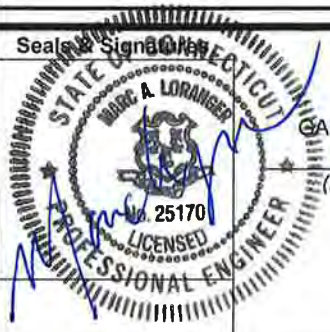
Melody A. Currey – Commissioner

State of Connecticut
Department of Administrative Services
Construction Services
Office of Legal Affairs, Policy, and Procurement
450 Columbus Boulevard, Suite 1302
Hartford, CT 06103

HVAC Improvements and Associated Roofing Repairs
Westside Classroom Building
Western Connecticut State University
Danbury, CT

Project No.: BI-RD-298

Prepared By:
Gale Consultants, Inc.
703 Hebron Avenue
Glastonbury, CT 06033

Seals & Signatures		Seals & Signatures	
	MARC A. LORANGER GALE CONSULTANTS, INC. Marc Loranger *(Print Consultant Name)*		ROB RICARD RZ DESIGN ASSOCIATES Rob Ricard *(Print Consultant Name)*
	(Print Consultant Name)		*(Print Consultant Name)*
	(Print Consultant Name)		*(Print Consultant Name)*
	(Print Consultant Name)		*(Print Consultant Name)*
	(Print Consultant Name)		*(Print Consultant Name)*

VOLUME 1 of 1

PROCUREMENT AND CONTRACTING REQUIREMENTS

Section No.	Title	Page Count	Not Used
00 01 01	**Project Title Page**	1	☐
00 01 07	**Seals Page**	1	☐
00 01 10	**Table of Contents**	5	☐
00 01 15	**List of Drawing Sheets**	1	☐
00 11 16	**Invitation to Bid**	-	☒
00 21 19	**Notice To Bidders**	-	☒
00 30 00	**Available Information**	-	☐
	00 31 19.26 - Hazardous Material Testing Report	52	☐
00 40 14	**Certificate (of Authority)** (submit with Bid Proposal)	-	☐
00 40 15	**DAS Pre-qualification Forms**	-	☒
00 41 00	**Bid Proposal Form**	-	☐
00 43 16	**Standard Bid Bond Form** (submit with Bid Proposal)	-	☐
00 45 14	**General Contractor Bidder's Qualification Statement** (submit with Bid Proposal)	-	☐
00 45 15	**Objective Criteria for Evaluating Qualifications of Bidders**	-	☐
00 45 17	**Named Subcontractor Bidder's Qualification Statement**	-	☒
00 52 03	**Contract**	-	☐
00 52 73	**Subcontract Agreement Form**	-	☒
00 62 16	**Certificate of Insurance**	-	☐
	00 62 16.1 -	-	☐
00 72 13	**General Conditions of the Contract for Construction – For Design-Bid-Build**	-	☐
	00 72 13.1 -	-	☐
00 73 27	**Set-Aside Contractor Schedule**	-	☒
00 73 38	**CHRO Contract Compliance Regulations**	-	☐
00 73 44	**Prevailing Wage Rates/Contractor's Wage Certification/Payroll Certification**	-	☐
00 73 63	**Security Requirements**	-	☐
00 92 10	**Additional Forms To be Submitted After Bond Commission Funding Approval**	-	☐
00 92 20	**Executive Orders**	-	☐
00 92 30	**Procedures Regarding Taxation for Nonresident General/Prime Contractor and Subcontractors**	-	☐

VOLUME 1 of 1
(continued)

DIVISION 01 GENERAL REQUIREMENTS

Section No.		Title	Page Count	Not Used
01 10 00	**SUMMARY**		**6**	☐
	01 11 00	**Summary of Work**	**1**	☐
	01 11 13	**Work Covered by Contract Documents**	**1**	☐
	01 12 16	**Work Sequence - Phase(s);**	**2**	☐
	01 12 19	**Contract Interface**	**3**	☐
	01 14 00	**Work Restrictions**	**4**	☐
	01 14 16	**Coordination with Occupants**	**5**	☐
	01 14 23	**Subcontractor Evaluations**	**6**	☐
01 20 00	**CONTRACT CONSIDERATIONS**		**13**	☐
	01 21 00	**Allowances**	**-**	☒
	01 22 00	**Unit Prices - General**	**1**	☐
	01 22 13	**Unit Price Schedules - Earth and Rock Excavation**	-	☒
	01 22 16	**Unit Price Schedule - Miscellaneous**	-	☒
	01 22 19	**Unit Price Schedule - Alterations**	**2**	☐
	01 23 00	**Supplemental Bids**	**2**	☐
	01 25 00	**Substitution Procedures**	**2**	☐
	01 26 00	**Contract Modification Procedures**	**6**	☐
	01 29 76	**Progress Payment Procedures**	**8**	☐
01 30 00	**ADMINISTRATIVE REQUIREMENTS**		**18**	☐
	01 31 13	**Project Coordination**	**1**	☐
	01 31 19	**Project Meetings**	**2**	☐
	01 32 16	**Construction Progress Schedules**	**3**	☐
	01 32 33	**Photographic Documentation**	**6**	☐
	01 33 00	**Submittal Procedures**	**6**	☐
	01 35 16	**Alteration Project Procedures**	**14**	☐
	01 35 19	**Confined Space Entry**	**17**	☐
	01 35 53	**Security Procedures**	**18**	☐
01 40 00	**QUALITY REQUIREMENTS**		**8**	☐
	01 42 16	**Definitions**	**1**	☐
	01 42 19	**Reference Standards**	**2**	☐
	01 45 00	**Quality Control**	**3**	☐
	01 45 23	**Testing For Indoor Air Quality, Baseline IAQ, & Materials**	**-**	☒

DIVISION 01 GENERAL REQUIREMENTS – TABLE OF CONTENTS (continued)

Section No.		Title	Page Count	Not Used
01 50 00	**TEMPORARY FACILITIES AND CONTROLS**		**14**	☐
	01 51 13	**Temporary Electricity and Lighting**	**1**	☐
	01 51 16	**Temporary Fire Protection**	**1**	☐
	01 51 23	**Temporary Heating, Cooling And Ventilating**	**2**	☐
	01 51 33	**Temporary Telecommunications**	**2**	☐
	01 51 36	**Temporary Water**	**2**	☐
	01 52 13	**Field Offices And Sheds**	**2**	☐
	01 52 19	**Temporary Sanitary Facilities**	**4**	☐
	01 54 00	**Construction Aids**	**5**	☐
	01 55 13	**Temporary Access Roads**	**5**	☐
	01 55 16	**Haul Routes**	**6**	☐
	01 56 00	**Temporary Barriers And Enclosures**	**6**	☐
	01 56 43	**Temporary Protection**	**6**	☐
	01 57 19	**Temporary Environmental Controls**	**7**	☐
	01 57 21	**Environmental Management**	**7**	☐
	01 57 23	**Temporary Storm Water Control**	**10**	☐
	01 57 30	**Indoor Environmental Control**	**10**	☐
	01 57 40	**Construction Indoor Air Quality Management Plan**	**12**	☐
	01 58 13	**Temporary Project Signage**	**14**	☐
01 60 00	**PRODUCT REQUIREMENTS**		**1**	☐
	01 60 00	**Product Requirements**	**1**	☐
01 70 00	**EXECUTION AND CLOSEOUT PROCEDURES**		**21**	☐
	01 71 23	**Field Engineering**	**1**	☐
	01 73 29	**Cutting and Patching**	**1**	☐
	01 74 13	**Progress Cleaning**	**2**	☐
	01 74 19	**Construction Waste Management & Disposal**	**3**	☐
	01 75 00	**Starting And Adjusting**	**7**	☐
	01 77 00	**Closeout Procedures**	**8**	☐
	01 78 23	**Operation And Maintenance Data**	**13**	☐
	01 78 30	**Warranties And Bonds**	**18**	☐
01 80 00	**PERFORMANCE REQUIREMENTS**		**-**	☒
	01 81 13	**Sustainable Design Requirements**	**-**	☐
01 90 00	**LIFE CYCLE ACTIVITIES**		**2**	☐
	01 91 00	**Commissioning**	**1**	☐

VOLUME 1 of 1
(continued)

TECHNICAL SPECIFICATION OUTLINES

DIVISION 02	EXISTING CONDITIONS	Not Used ☐
Section No.	**Title**	**Page Count**
02 82 13	ASBESTOS CONTAINING ROOFING (ACM) MATERIAL ABATEMENT	5

DIVISION 04	MASONRY	Not Used ☐
Section No.	**Title**	**Page Count**
04 01 20	MAINTENANCE OF UNIT MASONRY	14

DIVISION 05	METALS	Not Used ☐
Section No.	**Title**	**Page Count**
05 50 00	MISCELLANEOUS METALS	11

DIVISION 06	WOOD, PLASTICS AND COMPOSITES	Not Used ☐
Section No.	**Title**	**Page Count**
06 10 00	ROUGH CARPENTRY	6

DIVISION 07	THERMAL AND MOISTURE PROTECTION	Not Used ☐
Section No.	**Title**	**Page Count**
07 01 50	UPPER ROOF RESTORATION	10
07 22 00	ROOF AND DECK INSULATION	7
07 51 13	LOWER ROOF REPAIRS AND MAINTENANCE	13
07 60 00	FLASHING AND SHEET METAL	13

DIVISION 22	PLUMBING	Not Used ☐
Section No.	**Title**	**Page Count**
22 00 00	ROOF DRAINS	4

DIVISION 23	HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)	Not Used ☐
Section No.	**Title**	**Page Count**
23 05 00	HVAC GENERAL CONDITIONS	20
23 05 13	COMMON MOTOR REQUIREMENTS	9
23 05 16	EXPANSION FITTINGS AND LOOPS FOR PIPING	3
23 05 19	METERS AND GAGES FOR HVAC PIPING	4
23 05 23	GENERAL-DUTY VALVES FOR HVAC PIPING	7
23 05 33	HEAT TRACING FOR HVAC PIPING	6
23 05 48	VIBRATION CONTROLS FOR PIPING & EQUIPMENT	5
23 05 53	IDENTIFICATION FOR PIPING & EQUIPMENT	4
23 05 93	TESTING, ADJUSTING, & BALANCING FOR HVAC	11
23 07 13	DUCT INSULATION	4

23 07 19	**HVAC PIPING INSULATION**	**5**
23 09 23	**DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC**	**35**
23 21 13	**HYDRONIC PIPING**	**11**
23 21 14	**HYDRONIC SPECIALTIES**	**5**
23 21 23	**HYDRONIC PUMPS**	**4**
23 31 00	**HVAC DUCTS AND CASINGS**	**4**
23 33 00	**AIR DUCT ACCESSORIES**	**3**
23 64 16	**CENTRIFUGAL WATER CHILLERS**	**11**
23 65 13	**FORCED-DRAFT COOLING TOWERS**	**5**
23 73 13	**MODULAR CENTRAL-STATION AIR-HANDLING UNITS**	**12**

DIVISION 26	**ELECTRICAL**	**Not Used ☐**
Section No.	**Title**	**Page Count**
26 05 01	**MINOR ELECTRICAL DEMOLITION**	**2**
26 05 19	**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**	**7**
26 05 26	**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**	**4**
26 05 29	**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**	**4**
26 05 34	**CONDUIT**	**8**
26 05 37	**BOXES**	**5**
26 05 53	**IDENTIFICATION FOR ELECTRICAL SYSTEMS**	**6**
26 05 73	**POWER SYSTEM STUDIES**	**8**
26 27 17	**EQUIPMENT WIRING**	**2**
26 27 26	**WIRING DEVICES**	**5**
26 28 18	**ENCLOSED SWITCHES**	**5**

END OF TABLE OF CONTENTS

Section No.		Title
00 01 15	**Sheet No.**	**List of Drawing Sheets**
	C-1	Cover Sheet
	G001	Site Plan
	G002	Roof Cross Sections, Legends, and Notes
	A100	Overall Roof Area Plan
	A101	Upper Roof Area Plan
	A102	Lower Roof Area Plan
	A103	Lower Roof Area Plan
	A501	Details
	A502	Details
	A503	Details
	S101	Structural Plans and Notes
	M0	Mechanical General Notes, Symbols, Abbreviations
	MD1	Mechanical Demolition Roof Plan
	MD2	Mechanical Demolition Mechanical Rooms
	M1	Mechanical Roof Plan
	M2	Mechanical Equipment Rooms Plan
	M3	Mechanical Flow/Control Diagrams
	M4	Mechanical Details
	M5	Mechanical Equipment Schedules
	E0	Electrical Legends Abbreviations and Notes
	ED1	Electrical Demolition Roof Plan
	ED2	Electrical Demolition Equipment Rooms Plan
	E1	Electrical Roof Plan
	E2	Electrical Equipment Room Plans
	E3	Not Used

END OF SECTION

i:\976710\02 design\specs\000115_listofdrawingsheets.docx

LEAD TECH, INC.

ENVIRONMENTAL SERVICES

ASBESTOS • LEAD

RECEIVED
JUN 28 2000
Planning & Engineering
W.C.S.U.

December 17, 1999

State of Connecticut
Department of Public Health
Indoor Air Program
410 Capitol Avenue MS # 51 AIR
P.O. Box 340308
Hartford, CT. 06134-0308

Re: Asbestos flashing removal
Western Conn. State University
Westside Campus
Ancell Hall
Danbury, CT. 06896

TRANSMITTAL

Enclosed please find:

Asbestos Notification Form for work to be performed at the above referenced location.

Asbestos Notification Fee in the amount of $120.00 calculated as follows:

Base fee	$ 50.00
1 % of abatement cost of $ 7,000.00	70.00
TOTAL FEE	$ 120.00

Please call me with any questions.

LEAD TECH, INC.

Michael Sweeney
President

enclosures

129 COLONIAL ROAD PO BOX 1270 MANCHESTER CT 06045-1270

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH

STATE DPH ONLY
Postmark/Delivery Date: / /
Check #:
Amount: $
Record #:

ASBESTOS ABATEMENT NOTIFICATION FORM

This form is to be completed and filed with the Connecticut State Department of Health Services ten (10) days before the start of asbestos abatement (except for emergency notifications) as required by Section 19a-332a-3 of the Connecticut State Regulation concerning Standards for Asbestos Abatement. EPA may also require notice before the start of asbestos abatement as per Title 40, Code of Federal Regulations, Part 61.

MAIL TO:

Connecticut Department of Public Health
Division of Environmental Health
Indoor Air Program
410 Capitol Avenue - MS# 51AIR
P.O. Box 340308
Hartford, CT 06134-0308

(Fill In/Circle Each Item)

1. Type of Notification: Connecticut License Number: 000033

(A.) New C. Cancellation E. Emergency-Describe:

B. Blanket D. Revised-Items Revised:

2. Name of Abatement Contractor LEAD TECH, INC.

Address P.O. BOX 1270 149 COLONIAL ROAD

City MANCHESTER State CT Zip 06045

Phone (860) 646 6555 Contact Person MICHAEL SWEENEY

3. Facility Owner/Operator: WESTERN CONNECTICUT STATE UNIVERSITY

Address 181 WHITE STREET

City DANBURY State CT Zip 06810

Phone: (860) 483-0067 Contact Person: Eric Lessne

4. Facility Name WESTSIDE CAMPUS CLASSROOM (ANCELL HALL)

Address

City DANBURY State CT Zip 06896

5. Abatement Project Start Date 12/27/99 Completion Date 2/27/00

6. Total Abatement Cost $7000.00
(For Abatement Projects 160 Square Feet or Greater)

Phone: (860)509-7367 fax(860)509-7378
Telephone Device for the Deaf (860) 509-7191
410 Capitol Avenue - MS # 51-AIR
P.O. Box 340308 Hartford, CT 06134
An Equal Opportunity Employer

Revision Date 03/25/97

7. Use Of Facility:

A. School (K-12) B. Office C. Church/Synagogue
B. Public Building (E.) College H. Residential-Number Of Dwelling Units:_____
C. Manufacturing F. Commercial I. Other (Specify)_____

8. Building Data: Ft.² 98,681 Number Of Floors 5 Age 25 approx

9. Abatement Classification:

(A.) Renovation C. Ordered Demolition-Agency Issuing Order:_____
B. Demolition

10. Abatement Technique:

A. Full Containment With Negative Air
B. Alternative Work Practice (Pre-Approval Required)
(C.) Exterior Abatement

11. Abatement Method: (A.) Removal B. Encapsulation C. Enclosure

12. Type Of Decontamination System: A. Contiguous To Work Area (B.) Remote

13. Type And Amount Of Asbestos To Be Abated:

FRIABLE		NON-FRIABLE CATEGORY I	
A. Sprayed Or Troweled On	_____ Ft.²	I. Floor Covering/Tiles	_____ Ft.²
B. Boiler Insulation	_____ Ft.²	J. Roofing Material	30,000 Ft.²
C. Tank Insulation	_____ Ft.²	(Specify) Flashing	
D. Breeching Insulation	_____ Ft.²	K. Gaskets/Packings	_____ Ft.²
E. Duct Insulation	_____ Ft.²	NON-FRIABLE CATEGORY II	
F. Ceiling Tiles	_____ Ft.²	L. Transite Board	_____ Ft.²
G. Other	_____ Ft.²	M. Other	_____ Ft.²
(Specify)_____		(Specify)_____	

B. Pipe Insulation _____ Total Linear Feet

Pipe Diameter	Linear Feet	X	CF*	=	Ft.² of Pipe Insulation
_____ In.	_____ Ft.	X	_____	=	_____ Ft.²
_____ In.	_____ Ft.	X	_____	=	_____ Ft.²
_____ In.	_____ Ft.	X	_____	=	_____ Ft.²
_____ In.	_____ Ft.	X	_____	=	_____ Ft.²
_____ In.	_____ Ft.	X	_____	=	_____ Ft.²
					_____ Total Ft.² Of Pipe Insulation

* See Notification Conversion Table For Conversion Factor (CF)

14. Waste Disposal Site VALLEY LANDFILL

Address RD#2 P.O. Box 782A Pleasant Valley Road

City Irwin State PA Zip 15642

Owner/Operator Waste Management

15. Hauler/Waste Transporter Logano Trucking

Address Pickering Street

City Portland State CT Zip 06480

Revision Date 03/25/97

LEAD TECH INC,
P.O. BOX 1270
149 COLONIAL ROAD
MANCHESTER, CT 06045-1270

PEOPLE'S BANK
TRI-CITY PLAZA
VERNON, CT 06066
51-7218/2211

3046

**** ONE HUNDRED TWENTY AND 00/100 DOLLARS

TO THE ORDER OF

12/20/99 $120.00*****

Treasurer, State of Conn.

LEAD TECH, INC.
ENVIRONMENTAL SERVICES
ASBESTOS - LEAD
149 COLONIAL ROAD, P.O. BOX 1270, MANCHESTER, CT 06045-1270
TEL: (860) 646-6566 • FAX: (860) 646-8572

State of Connecticut
Department of Public Health
Indoor Air Program
410 Capitol Ave MS # 51 AIR
P.O. Box 340308
Hartford, CT 06134-0308

LEAD TECH, INC.

ENVIRONMENTAL SERVICES
ASBESTOS • LEAD

SUPERVISOR LOG

PROJECT: Bissell Hall

DATE: 1-5-2000

PROJECT LOCATION: Westside Campus Danbury, CT 06896

VISITORS:

	night before	8:00 AM	4:00 PM	job start	job end
temperature	34°	36°		26°	30°
weather	Rain	Clear		Clear	Clear

What P.O.s, shop dwgs, approvals, submittals, materials or equipment is needed in 2 wks?

Any Subs behind schedule? Material deliveries behind schedule? Anticipate any problems?

WORK PERFORMED (Continue on reverse side as necessary)
Arrived on site at 7:00. Abate small lower section of upper roof after Commercial Crew cut. Sections were taken off with [illegible] cut and bagged. Bags were [illegible] [illegible] [illegible] lowered off roof. Bags were placed in [illegible] truck and brought [illegible]. Commercial will [illegible] again tomorrow [illegible] [illegible] Left site at 9:00

MATERIAL USED 2 Bags, 1 Roll Tape 1 Sign

MATERIAL RECEIVED

149 Colonial ROAD, P.O. BOX . . MANCHESTER, CT 06040-0310
TEL: (860) 646-6555 • FAX: (860) 646-8572

LEAD TECH, INC.

LOG IN/OUT

DATE 1-5-00 PROJECT [illegible] LOCATION W. C. [illegible] Ct.

Name	Cert.#	Affiliation	Purpose of Entry	Time In	Time Out
[illegible]	[illegible]	Lead Tech	[illegible]	7:00	8:00
[illegible]	[illegible]	Lead Tech	[illegible]	–	–

LEAD TECH, INC.

ENVIRONMENTAL SERVICES

ASBESTOS • LEAD

SUPERVISOR LOG

PROJECT: Arcell Hall

DATE: 1-2-08

PROJECT LOCATION: Western Con St Univ. outside Campus

VISITORS:

	night before	8:00 AM	4:00 PM	job start	job end
temperature	25°	29		27°	30
weather	Clear	clear		clear	Clear

What P.O.s, shop dwgs, approvals, submittals, materials or equipment is needed in 2 wks?

Any Subs behind schedule? Material deliveries behind schedule? Anticipate any problems?

WORK PERFORMED (Continue on reverse side as necessary)

Arrived on site at 7:00 set up signs, brought up equipment, waited for board to be cut. Started abatement at 7:30, worked pushing from west side of roof. Double bagged all flashing, loaded into truck. [illegible] no visual [illegible] flashing on upper [illegible]. Clean all debris and bagged it. Finished job & paper work at 10:00 am.

[illegible]

MATERIAL USED 2 [illegible] 20 BAGS

MATERIAL RECEIVED

149 Colonial ROAD, P.O. BOX , MANCHESTER, CT 06040-0310
TEL: (860) 646-6555 • FAX: (860) 646-8572

LEAD TECH, INC.

ENVIRONMENTAL SERVICES
ASBESTOS • LEAD

SUPERVISOR LOG

PROJECT: Arcell Hall

DATE: 01-07-00

PROJECT LOCATION: W'S Con. State Un.

VISITORS:

	night before	8:00 AM	4:00 PM	job start	job end
temperature	25°	34°		30°	34°
weather	pt cloudy	pt cloudy		pt cloudy	pt cloudy

What P.O.s, shop dwgs, approvals, submittals, materials or equipment is needed in 2 wks?

Any Subs behind schedule? Material deliveries behind schedule? Anticipate any problems?

WORK PERFORMED (Continue on reverse side as necessary)

arrival at 7:00 Put up signs spoke with Dan as to area & amount being pulled. Dan informed me very little would be done. Mostly finishing off the side that was ripped yesterday. Bagged asbestos flashing. Had Norm bring it down into my truck and left site at 9:30 after paper work was finished.

AMB

MATERIAL USED 6 bags. ½ roll 6 mil poly. 1 signs

MATERIAL RECEIVED

149 Colonial ROAD, P.O. BOX .. , MANCHESTER, CT 06040-0310
TEL: (860) 646-6555 • FAX: (860) 646-8572

LEAD TECH, INC.

ENVIRONMENTAL SERVICES
ASBESTOS • LEAD

SUPERVISOR LOG

PROJECT: WCSU

DATE: Feb 29, 02

PROJECT LOCATION: Angell Hall
181 White St
Danbury CT

VISITORS:

	night before	8:00 AM	4:00 PM	job start	job end
temperature	29°	32°		32°	37°
weather	clear	clear		clear	clear

What P.O.s, shop dwgs, approvals, submittals, materials or equipment is needed in 2 wks?

Any Subs behind schedule? Material deliveries behind schedule? Anticipate any problems?

WORK PERFORMED (Continue on reverse side as necessary)
1st Arrived on site, spoke with Dan from Commercial
Sent up bags & poly, pumps hose. Dan
decided to only do small portion. Commercial
used cutter, area was abated. Bags & flashing
was put in bags and commercial clean from
roof into truck. Manifest was made up
and paper work was finished. Left job
at 9:30

MATERIAL USED 12 bags, 1 suit, 1 sign, 1 Roll Tape
100 ft ribbon.

MATERIAL RECEIVED

149 Colonial Road BOX 8310, MANCHESTER, CT 06040-0310
TEL: (860) 646-6555 • FAX: (860) 646-8572

LEAD TECH, INC.

LOG IN/OUT

DATE Feb 29 00 PROJECT WCSC LOCATION Danbury

Name	Cert.#	Affiliation	Purpose of Entry	Time In	Time Out
Jannmarie Barros	[illegible]	LeadTech	removal of lock for Caulking [illegible]	7:00	9:15

LEAD TECH, INC.
160 Chapel Road
Manchester, CT 06040

PROJECT 'UCSC Ancell Hall DATE 2-29-00 TEMP. 37°
151 White Street Danbury

SAMPLE TYPE: (AREA) (PERSONAL) /PCM TEM CASSETTE SIZE: (25) 37

SAMPLE NUMBER	DATE	SAMPLE INFORMATION	TIME			PUMP FLOW RATE	ug/m³	FIBRES /CC	8 hr. TWA	Resp. Used	Resp. Req.
			START	STOP	TOTAL						
A229-1	2-29-00	Ancell Hall	7:00	9:00	120.	2.0	240.0		<LOD		
P229-2	2-29-00	042-44-4453 Jannmarie Buras	7:00	9:00	120.	2.0	240.0		<LOD		

WORK DESCRIPTION: removal of flashing containing asbestos.

CHAIN OF CUSTODY

Released Jannmarie Buras Date 02-29-00
Print
By [signature]
Signature
Received Carol Barcomb Date 03-06-00
Print
By Carol Barcomb
Signature

LABORATORY RECEIPT

Received ______ Date ______
Print
By ______
Signature
Book ______ Page ______
Analyst ______ Date ______
QC Approval ______

LTIform

LEAD TECH, INC.

ENVIRONMENTAL SERVICES
ASBESTOS • LEAD

SUPERVISOR LOG

PROJECT: WCSC

DATE: MARCH 1-00

PROJECT LOCATION:
Ancell Hall
181 White Street, Danbury

VISITORS:

	night before	8:00 AM	4:00 PM	job start	job end
temperature	34	34		36°	42°
weather	Clear	Clear		Clear	[illegible] sun

What P.O.s, shop dwgs, approvals, submittals, materials or equipment is needed in 2 wks?

Any Subs behind schedule? Material deliveries behind schedule? Anticipate any problems?

WORK PERFORMED (Continue on reverse side as necessary)

Arrived on site at 6:30 - put up signs, ribbon - had Jay & [illegible] brought up to roof. Set up one (1) [illegible] and one (1) personal decon. Commercial cut flashing. Then flashing was pulled off & placed on poly. When all flashing had been pulled and after cleaning, asbestos flashing was put in 6 mil [illegible] bags and moved off roof. I packed my truck. Finished up work including [illegible] test and left site at [illegible]

MATERIAL USED 24 bags, 1/2 roll 10x100 poly, 1 roll tape, 1 suit, 2 [illegible] 200ft [illegible]

MATERIAL RECEIVED

149 Colonial Road BOX 8310, MANCHESTER, CT 06040-0310
TEL: (860) 646-6555 • FAX: (860) 646-8572

LEAD TECH, INC.

LOG IN/OUT

DATE March 1-03 PROJECT WCSU-Ancell Hall LOCATION Danbury, Ct.

Name	Cert.#	Affiliation	Purpose of Entry	Time In	Time Out
[illegible] Burns	463-44-[illegible]	Lead Tech	Removal of flashing containing asbestos	7:00	10:00

LEAD TECH, INC.
160 Chapel Road
Manchester, CT 06040

PROJECT WCSC DATE 03-01-00 TEMP. 42°

SAMPLE TYPE: (AREA) PERSONAL /PCM TEM CASSETTE SIZE: (25) 37

SAMPLE NUMBER	DATE	SAMPLE INFORMATION	TIME			PUMP FLOW RATE	ug/m³	FIBRES /CC	8 hr. TWA	Resp. Used	Resp. Req.
			START	STOP	TOTAL						
A301-1	03-1-00	Ancell Hall	7:00	10:00	180	2.0	560.0		<LOD		
P301-2	03-1-00	Jannemarie Bucas	7:00	10:00	180	2.0	360.0		<LOD		

WORK DESCRIPTION: removal asbestos flashing

CHAIN OF CUSTODY

Released Jannemarie Bucas Date 3-01-00
Print
By [signature]
Signature
Received Carol Barcomb Date 03-06-00
Print
By Carol Barcomb
Signature

LABORATORY RECEIPT

Received ______ Date ______
Print
By ______
Signature
Book ______ Page ______
Analyst ______ Date ______
QC Approval ______

LTIform

commercial

LEAD TECH, INC.

ENVIRONMENTAL SERVICES
ASBESTOS • LEAD

SUPERVISOR LOG

PROJECT: WCSC   DATE: 03-02-10

PROJECT LOCATION: Ansell Hall Danbury Ct.   VISITORS:

	night before	8:00 AM	4:00 PM	job start	job end
temperature	52°	32°		32°	43°
weather	cloudy	sunny		sunny	sunny

What P.O.s, shop dwgs, approvals, submittals, materials or equipment is needed in 2 wks?

Any Subs behind schedule? Material deliveries behind schedule? Anticipate any problems?

WORK PERFORMED (Continue on reverse side as necessary)
arrived at 6:30 - spoke with Dan as to area being abated. Set up ribbon, signs and HEPA pump (commercial cat) I started at 7:00 am to abate area; All asbestos was put in waste bags & doubled. All bags were labeled for transportation. Bags were removed during site packing. Abatement ended at 10:00 am, finished paper work left site at 10:30 am.

MATERIAL USED 1 sign 200 ft ribbon 1 suit 20 bags 1 roll tape 1 can spray

MATERIAL RECEIVED

149 [illegible] ROAD, P.O. BOX , MANCHESTER, CT 06040-0310
TEL: (860) 646-6555 • FAX: (860) 646-8572

LEAD TECH, INC.

LOG IN/OUT

DATE 03-02-02 PROJECT WSCC LOCATION Danbury

Name	Cert.#	Affiliation	Purpose of Entry	Time In	Time Out
[illegible]	[illegible]	Lead Tech	Remove Flashing Containing Asbestos	7:00	10:00

LEAD TECH, INC.
160 Chapel Road
Manchester, CT 06040

PROJECT Jarvell Hall WCSC. DATE 03-02-00 TEMP. 59°

Danbury

SAMPLE TYPE: AREA PERSONAL /PCM TEM CASSETTE SIZE: 25 37

SAMPLE NUMBER	DATE	SAMPLE INFORMATION	TIME			PUMP FLOW RATE	ug/m'	FIBRES /CC	8 hr. TWA	Resp. Used	Resp. Req.
			START	STOP	TOTAL						
A320-1	3-2-00	MECH Hardhat	7:00	10:00	180	2.0	360.0		<LOD		
P320-2	3-2-00	082-49-7953 Jacqueline Burns	7:00	10:00	180	2.0	360.0		<LOD		

WORK DESCRIPTION: Removal of Flooring Containing Asbestos

CHAIN OF CUSTODY

Released Jacqueline Burns Date 03-2-00
Print
By Jacqueline Burns
Signature
Received Carl Barcomb Date 03-06-00
Print
By Carol Barcomb
Signature

LABORATORY RECEIPT

Received _____ Date _____
Print
By _____
Signature
Book _____ Page _____
Analyst _____ Date _____
QC Approval _____

LTIform

LEAD TECH, INC.

ENVIRONMENTAL SERVICES
ASBESTOS • LEAD

SUPERVISOR LOG

PROJECT: WCSC [illegible] DATE: MARCH 3 '05 [illegible]

PROJECT LOCATION: Danbury VISITORS:

	night before	8:00 AM	4:00 PM	job start	job end
temperature	32°	35°		33°	36°
weather	clear	Clear/windy		clear	windy & sunny

What P.O.s, shop dwgs, approvals, submittals, materials or equipment is needed in 2 wks?

Any Subs behind schedule? Material deliveries behind schedule? Anticipate any problems?

WORK PERFORMED (Continue on reverse side as necessary).
Crew started to get ready to cut at 1:00. [illegible] Ribbon was up and sign was posted. Abatement started at 1:[illegible] All asbestos was removed and bagged in 6 mil asbestos bags. Bags were [illegible] and taped for transportation. Abatement ended at [illegible]. [illegible] helped with removal of bags from roof. Bags were placed in truck and secured by [illegible]. [illegible] work was finished and I left site at [illegible] to get rid of waste.

MATERIAL USED 1 sign, 100 ft ribbon, 1 roll tape, 1 can of spray, 14 bags, 1 suit

MATERIAL RECEIVED

149 Colonial Road BOX 8310, MANCHESTER, CT 06040-0310
TEL: (860) 646-6555 • FAX: (860) 646-8572

LEAD TECH, INC.

LOG IN/OUT

DATE March 3, 2000 PROJECT W.C.S.C. LOCATION Danbury

Name	Cert.#	Affiliation	Purpose of Entry	Time In	Time Out
[illegible] Burns	[illegible]	Lead Tech	Removal of Masonry	7:00	9:45
			[illegible]	7:00	9:45

LEAD TECH, INC.
160 Chapel Road
Manchester, CT 06040

PROJECT Western Com. State College DATE 03 03 00 TEMP. 35

SAMPLE TYPE: (AREA) (PERSONAL) /PCM TEM CASSETTE SIZE: (25) 37

SAMPLE NUMBER	DATE	SAMPLE INFORMATION	TIME START	TIME STOP	TIME TOTAL	PUMP FLOW RATE	ug/m³	FIBRES /CC	8 hr. TWA	Resp. Used	Resp. Req.
A-1	3-03-00	Surface roof	7:00	8:45	16.5	2.0	3.5		<LOD		
P-2	3-03-00	092-44-1433 Jane Marie Burns	7:00	8:45	16.5	2.0	3.5		<LOD		

WORK DESCRIPTION: Removal of flashing containing Asbestos

CHAIN OF CUSTODY

Released Jane Marie Burns (Print) Date 03-3-00

By [signature] (Signature)

Received Carol Barcomb (Print) Date 03-06-00

By Carol Barcomb (Signature)

LABORATORY RECEIPT

Received Shawn Carson (Print) Date

By Shawn C. (Signature)

Book Page

Analyst Date

QC Approval

LTIform

LEAD TECH, INC.

ENVIRONMENTAL SERVICES

ASBESTOS • LEAD

SUPERVISOR LOG

PROJECT: Ancell Hall

DATE: 03-06-00

PROJECT LOCATION:

Danbury CT

VISITORS:

	night before	8:00 AM	4:00 PM	job start	job end
temperature	23°	29°		29°	37°
weather	Clear	Clear		Clear	clear pt. windy

What P.O.s, shop dwgs, approvals, submittals, materials or equipment is needed in 2 wks?

Any Subs behind schedule? Material deliveries behind schedule? Anticipate any problems?

WORK PERFORMED (Continue on reverse side as necessary)

Crew from Commercial started working [illegible] at 6:30 - 7:00 caution cut. Tape up ribbon and sign. Started on [illegible] area [illegible] at 8:00. Abatement finished by 9:00 AM. All bundles of asbestos had been placed on 6 mil poly then bagged in 6 mil bags then bagged again. Manifest was made up [illegible]. Work done and I left the site after loading bags into their truck. Bags were secured in [illegible]. Left for Manchester at 11:00 AM.

MATERIAL USED 1 roll tape, 1 can spray bag[illegible], 200 ft ribbon, [illegible] BAGS.

MATERIAL RECEIVED

149 Colonial Road BOX 8310, MANCHESTER, CT 06040-0310
TEL: (860) 646-6555 • FAX: (860) 646-8572

LEAD TECH, INC.

LOG IN/OUT

DATE 5-06-00 PROJECT Usel Hall-WSCC LOCATION Drawbridge Ct

Name	Cert.#	Affiliation	Purpose of Entry	Time In	Time Out
Tammie's Burns	052-4474	LEAD Tech	remove flashing	8:00	10:30
			containing asbestos		

LEAD TECH, INC.
160 Chapel Road
Manchester, CT 06040

PROJECT Ancell Hall - WSCC DATE 3-6-00 TEMP. 39°
Danbury, CT

SAMPLE TYPE: (AREA) (PERSONAL) /PCM TEM CASSETTE SIZE: (25) 37

SAMPLE NUMBER	DATE	SAMPLE INFORMATION	TIME START	TIME STOP	TIME TOTAL	PUMP FLOW RATE	ug/m³	FIBRES /cc	8 hr. TWA	Resp. Used	Resp. Req.
A306-1	3-06-00	Jeanmarie Burns	8:0	10:30	150	2.0	300.0		<LOD		
A306-2	↓	Library roof-complex	8.0	10:30	150	2.0	300.0		<LOD		

WORK DESCRIPTION: removal of asbestos roofing material

CHAIN OF CUSTODY

Released Jeanmarie Burns Date 3-06-00
Print
By [signature]
Signature
Received Carol Barcomb Date 3-14-00
Print
By Carol Barcomb
Signature

LABORATORY RECEIPT

Received ______ Date ______
Print
By ______
Signature
Book ______ Page ______
Analyst ______ Date ______
QC Approval ______

LTIform

LEAD TECH, INC.

ENVIRONMENTAL SERVICES
ASBESTOS • LEAD

SUPERVISOR LOG

PROJECT: WCSC
DATE: 3-9-00

PROJECT LOCATION: Danbury
VISITORS: Ed Hendrickson

	night before	8:00 AM	4:00 PM	job start	job end
temperature	45°	45°		46°	54°
weather	Cloudy	pt sunny		pt sunny	sunny

What P.O.s, shop dwgs, approvals, submittals, materials or equipment is needed in 2 wks?

Any Subs behind schedule? Material deliveries behind schedule? Anticipate any problems?

WORK PERFORMED (Continue on reverse side as necessary)
Arrived at site at 6:30. Crane was just setting up. Set up material [illegible] box on [illegible] area to be abated [illegible] at about 7:00 [illegible] then started. All asbestos was [illegible] [illegible] & gotten ready for transportation. Ed [illegible] [illegible] [illegible] because there were to many bags. All bags loaded into both trucks and left the site at 7:30

MATERIAL USED Bags - 1 Box, 2 Rolls Tape,

MATERIAL RECEIVED

149 Colonial Road BOX 8310, MANCHESTER, CT 06040-0310
TEL: (860) 646-6555 • FAX: (860) 646-8572

LEAD TECH, INC.

LOG IN/OUT

DATE 3-9-00 PROJECT Western Connecticut College LOCATION Danbury

Name	Cert.#	Affiliation	Purpose of Entry	Time In	Time Out
[illegible] Burns	052-44-7452	Lead Tech	remove flashing containing Asbestos	7:00	

LEAD TECH, INC.
160 Chapel Road
Manchester, CT 06040

PROJECT: WCSC Danbury   DATE: 3.9.00   TEMP. 44°

SAMPLE TYPE: (AREA) (PERSONAL) /PCM TEM   CASSETTE SIZE: (25) 37

SAMPLE NUMBER	DATE	SAMPLE INFORMATION	TIME			PUMP FLOW RATE	ug/m³	FIBRES /CC	8 hr. TWA	Resp. Used	Resp. Req.
			START	STOP	TOTAL						
P309-[illegible]	3/9/00	082-44-7853 Janemarie Burns	7:00	1:30	390	2.0	780.0		Not Readable		
A3098-2	3/9/00	Step Roofs	7:00	1:30	390	2.0	780.0		.011		

RECEIVED
00 MAR 16 AM 10:02

WORK DESCRIPTION: remove Asbestos flashing

CHAIN OF CUSTODY

Released: Janemarie Burns (Print)   Date: 3-9-00
By: Janemarie Burns (Signature)
Received: Carol Barcomb (Print)   Date: 3-14-00
By: Carol Barcomb (Signature)

LABORATORY RECEIPT

Received ______ (Print)   Date ______
By ______ (Signature)
Book ______ Page ______
Analyst ______   Date ______
QC Approval ______

LTIform

LEAD TECH, INC.

ENVIRONMENTAL SERVICES

ASBESTOS • LEAD

SUPERVISOR LOG

PROJECT: WCSC

DATE: 3-10-00

PROJECT LOCATION: 181 Danbury, Ct.

VISITORS: Ed

	night before	8:00 AM	4:00 PM	job start	job end
temperature	43°				
weather	Clear	Partly Sunny		Partly Sunny	Partly Sunny

What P.O.s, shop dwgs, approvals, submittals, materials or equipment is needed in 2 wks?

Any Subs behind schedule? Material deliveries behind schedule? Anticipate any problems?

WORK PERFORMED (Continue on reverse side as necessary)
Arrived on site at 6:45 - Crew started ripping at 7:00. All asbestos flashing was pulled, doubled bagged and placed in my truck. Since a large amount was there Ed came down for a load. All bags were removed from site. At 12:30 Steve told Dan there was more to be removed, at which time they began to rip again so I put back up signs & ribbon. Asbestos was finished at 4:15 and all bags were removed/put together in boxes, total 82 bags. Ed returned for a second load.

MATERIAL USED 114 BAGS, 1 sign, 400 ft ribbon.

MATERIAL RECEIVED

149 Colonial Road BOX 8310, MANCHESTER, CT 06040-0310
TEL: (860) 646-6555 • FAX: (860) 646-8572

LEAD TECH, INC.

LOG IN/OUT

DATE 3-10-00 PROJECT Western Cooperative State College LOCATION Duxbury

Name	Cert.#	Affiliation	Purpose of Entry	Time In	Time Out
Jeremie Burns	082-[illegible]	Lead Tech	removal of asbestos flashing	7.00	11.30
"	"	"	"	12.00	4.00

LEAD TECH, INC.
160 Chapel Road
Manchester, CT 06040

PROJECT WCSC Danbury DATE 3-10-00 TEMP. 40°

SAMPLE TYPE: (AREA) (PERSONAL) /PCM TEM CASSETTE SIZE: (25) 37

SAMPLE NUMBER	DATE	SAMPLE INFORMATION	TIME			PUMP FLOW RATE	ug/m³	FIBRES /CC	8 hr. TWA	Resp. Used	Resp. Req.
			START	STOP	TOTAL						
A310-1	3-10-00	ES-3 level roof	7:00	4:00	540.0	2.0	1080.0		.008		00 MAR 15 WID: 02
P310-2	3-10-00	030-44-7923 Janemarie Bucos	7:00	4:00	540.0	2.0	1080.0		.005		

WORK DESCRIPTION: Remove flashing containing Asbestos.

CHAIN OF CUSTODY

Released Janemarie Bucos Date 3-10-00
Print

By Jane Marie Bucos
Signature

Received Carol Barcomb Date 3-14-00
Print

By Carol Barcomb
Signature

LABORATORY RECEIPT

Received ______ Date ______
Print

By ______
Signature

Book ______ Page ______

Analyst ______ Date ______

QC Approval ______

LTIform

LEAD TECH, INC.

ENVIRONMENTAL SERVICES
ASBESTOS • LEAD

SUPERVISOR LOG

PROJECT: WCSC-Ancell Hall

DATE: 3-20-00

PROJECT LOCATION: West Cor. State Un. 181 White St. Danbury

VISITORS:

	night before	8:00 AM	4:00 PM	job start	job end
temperature	29°	33°		30°	50°
weather	pt cloudy	pt cloudy		pt sunny	sunny

What P.O.s, shop dwgs, approvals, submittals, materials or equipment is needed in 2 wks?

Any Subs behind schedule? Material deliveries behind schedule? Anticipate any problems?

WORK PERFORMED (Continue on reverse side as necessary)
Arrived on site @ 6:30. Set up equipment in dock. Put up Signs Ribbon. Set pumps @ 6:45. Crew started ripping - when sections were lifted + started the abatement of flashing. 3 small roof areas where abate. All asbestos was put in doubled 6 mil bags were sacked and placed in box for clean up to take off dock. Truck was loaded up, load was secured and I left site @ 12:30.

MATERIAL USED 1 Unit, 1 Sign, 200 lbs, ribbon, 1 roll tape, 40 bags

MATERIAL RECEIVED

149 Colonial Road BOX 8310, MANCHESTER, CT 06040-0310
TEL: (860) 646-6555 • FAX: (860) 646-8572

LEAD TECH, INC.

LOG IN/OUT

DATE 3-20-00 PROJECT Axell Hall LOCATION DC SLC

Name	Cert.#	Affiliation	Purpose of Entry	Time In	Time Out
Jannarie Barros	082-147453	Lead Tech	remove tiles containing asbestos	6:30	12:00

LEAD TECH, INC.
160 Chapel Road
Manchester, CT 06040

PROJECT WCSU - Ancell Hall Danbury, Ct. DATE 3-20-00 TEMP. 38°

SAMPLE TYPE: (AREA) (PERSONAL) /PCM TEM CASSETTE SIZE: (25) 37

SAMPLE NUMBER	DATE	SAMPLE INFORMATION	TIME START	TIME STOP	TIME TOTAL	PUMP FLOW RATE	ug/m³	FIBRES /CC	8 hr. TWA	Resp. Used	Resp. Req.
P320-1	3-20-00	[illegible] 7553 [illegible]	6:30	12:00	390	2.0	[illegible]0.0		.003		
A320-2	3-20-00	West Side roof	6:30	12:00	390	2.0	[illegible]0.0		.007		

00 MAR 24 AM 11:40

WORK DESCRIPTION: remove asbestos flashing from roof.

CHAIN OF CUSTODY

Released [illegible] Date 3-20-00
Print
By [signature]
Signature
Received Carol Barcomb Date 3-22-00
Print
By [signature]
Signature

LABORATORY RECEIPT

Received ______ Date ______
Print
By ______
Signature
Book ______ Page ______
Analyst ______ Date ______
QC Approval ______

LTIform

LEAD TECH, INC.

ENVIRONMENTAL SERVICES

ASBESTOS • LEAD

SUPERVISOR LOG

PROJECT: WCSU

DATE: 3-2/.00

PROJECT LOCATION: Ancell Hall
181 White St.
Danbury, Ct. 06

VISITORS:

	night before	8:00 AM	4:00 PM	job start	job end
temperature	32°	38°		35°	40°
weather	cloudy	cloudy		cloudy	cloudy

What P.O.s, shop dwgs, approvals, submittals, materials or equipment is needed in 2 wks?

Any Subs behind schedule? Material deliveries behind schedule? Anticipate any problems?

WORK PERFORMED (Continue on reverse side as necessary)

6:30. Crew started removing stone & cutting sent up bags & pumps. Set up ribbon & put up sign. Doubled bagged all asbestos finishing up 6 mil asbestos bags. Small roof near office was abated on 1st floor. All bags were sent down in crane box & loaded into back of truck. Abatement was finished by 10:00 - loaded and left site at 10:30.

MATERIAL USED 10 BAGS - 1 Roll, Tape 1 Sign - 20 ft Ribbon

MATERIAL RECEIVED

149 Colonial Road BOX 8310, MANCHESTER, CT 06040-0310
TEL: (860) 646-6555 • FAX: (860) 646-8572

LEAD TECH, INC.

LOG IN/OUT

DATE 3-21-00 PROJECT Ancell Hall-WCSU LOCATION Danbury

Name	Cert.#	Affiliation	Purpose of Entry	Time In	Time Out
Janemarie Burns	182-44740	Lead Tech	ABATE flashing containing ASBESTOS	9:00	10:00

LEAD TECH, INC.
149 Colonial Road
Manchester, CT 06040

PROJECT WCSU - Ancell Hall DATE 3-21-00 TEMP. 40°
181 White St. Danbury CT

SAMPLE TYPE: (AREA) (PERSONAL) /PCM TEM CASSETTE SIZE: (25) 37

SAMPLE NUMBER	DATE	SAMPLE INFORMATION	TIME START	TIME STOP	TIME TOTAL	PUMP FLOW RATE	ug/m³	FIBRES /CC	8 hr. TWA	Resp. Used	Resp. Req.
A321-1	3-21-00	1st floor affected	7:00	10:00	180	2.0	360.0		<LOD		
P321-2	3-21-00	Jonnamarie Burns	7:00	10:00	180	2.0	360.0		<LOD		

WORK DESCRIPTION: Removal of flashing containing Asbestos.

CHAIN OF CUSTODY

Released Jonnamarie Burns Date 3-21-00
Print
By [signature]
Signature
Received Carol Barcomb Date 3-22-00
Print
By Carol Barcomb
Signature

LABORATORY RECEIPT

Received ______ Date ______
Print
By ______
Signature
Book ______ Page ______
Analyst ______ Date ______
QC Approval ______

LTIform

LEAD TECH, INC.

ENVIRONMENTAL SERVICES

ASBESTOS • LEAD

SUPERVISOR LOG

PROJECT: Ancell Hall

DATE: 3-27-00

PROJECT LOCATION: Western Conn. State Univ. Westside Campus Danbury CT

VISITORS:

	night before	8:00 AM	4:00 PM	job start	job end
temperature	39°	42°		40°	55°
weather	Clear	clear		clear	Sunny

What P.O.s, shop dwgs, approvals, submittals, materials or equipment is needed in 2 wks?

Any Subs behind schedule? Material deliveries behind schedule? Anticipate any problems?

WORK PERFORMED (Continue on reverse side as necessary)

Arrived at 6:30, set up signs, ribbon & wings. Crew started at 7:00 (cutting roof - Abatement started shortly after cut was made. All asbestos flashing was cleaned, bagged and lowered into pickup truck. Abatement ended at 10:00 am. Signs & ribbon was removed. Abate work completed and left site at 10:15 am.

MATERIAL USED 1 sign, 200 ft ribbon, 24 bags, 1 roll ribbon.

MATERIAL RECEIVED

149 COLONIAL ROAD, P.O. BOX 1270, MANCHESTER, CT 06045-1270
TEL: (860) 646-6555 • FAX: (860) 646-8572

LEAD TECH, INC.

LOG IN/OUT

DATE 3-27-00 PROJECT Burwell Hall LOCATION UNCSU - Dunbar

Name	Cert.#	Affiliation	Purpose of Entry	Time In	Time Out
Jannmarie Burns	052-44-7938	Lead Tech	removal of asbestos tiles	9:00	10:00

RECEIVED
EMSL
[illegible] NJ

00 APR -3 PM 12:13

LEAD TECH, INC.
149 Colonial Road
Manchester, CT 06040

PROJECT Ancell Hall 181 White St. Danbury Ct. DATE 3-27-00 TEMP. 50°

SAMPLE TYPE: AREA / PERSONAL /PCM TEM CASSETTE SIZE: 25 37

SAMPLE NUMBER	DATE	SAMPLE INFORMATION	TIME			PUMP FLOW RATE	ug/m³	FIBRES /CC	8 hr. TWA	Resp. Used	Resp. Req.
			START	STOP	TOTAL						
A 327-1	3-27-00	Ancell Hall	7:00	10:00	180	2.0	360.0		<LOD		
P327-2	3-27-00	082-99-7885 Jamemarie Burns	7:00	10:00	180	2.0	360.0		<LOD		

WORK DESCRIPTION: removal of asbestos flashing from roof.

CHAIN OF CUSTODY

Released Jamemarie Burns Print Date 3-27-00

By [signature] Signature

Received Carol Barcomb Print Date 3-29-00

By Carol Barcomb Signature

LABORATORY RECEIPT

Received Sharon Carson Print Date 4/3

By Sharon C[signature] Signature

Book ______ Page ______

Analyst ______ Date ______

QC Approval ______

LTIform

LEAD TECH, INC.

ENVIRONMENTAL SERVICES

ASBESTOS • LEAD

SUPERVISOR LOG

PROJECT: Ancell Hall

DATE: 3-30-00

PROJECT LOCATION: WCSC
181 White St.
Danbury, CT.

VISITORS:

	night before	8:00 AM	4:00 PM	job start	job end
temperature	39°	43°		41°	51°
weather	pt cloudy	pt sunny		pt sunny	pt sunny

What P.O.s, shop dwgs, approvals, submittals, materials or equipment is needed in 2 wks?

Any Subs behind schedule? Material deliveries behind schedule? Anticipate any problems?

WORK PERFORMED (Continue on reverse side as necessary)
Arrived on site at 6:30am. Put up signs & ribbon. Crew cut roof about 7:00am. Abatement started after that. All asbestos flashing was placed in doubled 6 mil asbestos bags. Clean up last of the asbestos at 11:07. Bags were then covered down into my truck for transporting. I clean up area and checked around then did paper work. Left site at 11:30.

MATERIAL USED 30 bags, 1 roll Tape, 1 sign, 1 suit

MATERIAL RECEIVED

149 COLONIAL ROAD, P.O. BOX 1270, MANCHESTER, CT 06045-1270
TEL: (860) 646-6555 • FAX: (860) 646-8572

LEAD TECH, INC.

LOG IN/OUT

DATE 3-30-00 PROJECT Ancell Hall - WCSC LOCATION Danbury

Name	Cert.#	Affiliation	Purpose of Entry	Time In	Time Out
Jennmarie Burns	[illegible]-7453	Lead Tech	Removal of flashing containing asbestos	7:00	11:00

LEAD TECH, INC.
149 Colonial Road
Manchester, CT 06040

PROJECT Ancell Hall WCSC DATE 3-30-00 TEMP. 430
181 White St, Danbury

SAMPLE TYPE: AREA PERSONAL /PCM TEM CASSETTE SIZE: 25 37

SAMPLE NUMBER	DATE	SAMPLE INFORMATION	TIME			PUMP FLOW RATE	ug/m³	FIBRES /CC	8 hr. TWA	Resp. Used	Resp. Req.
			START	STOP	TOTAL						
A330	3-30-00	Sarenalie Burns	7:00	11:00	240	2.0	480.0		<LOD		
A330	√	EAST Wing	7:00	11:00	240	2.0	480.0		<LOD		

WORK DESCRIPTION: Removed Asbestos flashing.

CHAIN OF CUSTODY

Released Sarenalie Burns (Print) Date 3-30-00
By Sarenalie Burns (Signature)
Received Carol Barcomb (Print) Date 3-31-00
By Carol Barcomb (Signature)

LABORATORY RECEIPT

Received Sharon Carson (Print) Date 4/3
By Sharon Carson (Signature)
Book _____ Page _____
Analyst _____ Date _____
QC Approval _____

LTIform

LEAD TECH, INC.

ENVIRONMENTAL SERVICES

ASBESTOS • LEAD

SUPERVISOR LOG

PROJECT: Ancell Hall **DATE:** 3-31-20

PROJECT LOCATION: WCSU
181 White St.
Danbury, Ct.

VISITORS:

	night before	8:00 AM	4:00 PM	job start	job end
temperature	33°	43°		39°	48°
weather	clear	Sunny		Sunny	Sunny

What P.O.s, shop dwgs, approvals, submittals, materials or equipment is needed in 2 wks?

Any Subs behind schedule? Material deliveries behind schedule? Anticipate any problems?

WORK PERFORMED (Continue on reverse side as necessary)

Arrived at 6:30 - set up sign. Set up ramps, waited for roof to be cut - began abatement at 7:00 am. All flashing was placed in double 6mil poly bags. All flashing was pulled from sides & then Burbing was cleaned of all loose pieces. Crane brought down the bags and they were loaded up into my truck. Abatement finished & truck loaded by 10:30. Checked lower roof for any fallen peices - finished the walk around and did my paper work - left site at 11:00 am.

MATERIAL USED 10 bags 1 sign 2 caution ribbon 1 roll tape.

MATERIAL RECEIVED

149 COLONIAL ROAD, P.O. BOX 1270, MANCHESTER, CT 06045-1270
TEL: (860) 646-6555 • FAX: (860) 646-8572

LEAD TECH, INC.

LOG IN/OUT

DATE 3-31-00 PROJECT Ancell Hall WCSU LOCATION Danbury

Name	Cert.#	Affiliation	Purpose of Entry	Time In	Time Out
Jomomarie Burns	02-241-7163	LEAD Tech	Removal of asbestos flooring	7:00	10:30

RECEIVED
WE[illegible]
00 APR -3 PM 12: 13

LEAD TECH, INC.
149 Colonial Road
Manchester, CT 06040

PROJECT Ancell Hall - ... - 181 White St Danbury Ct. DATE 3-31-00 TEMP. 48°

SAMPLE TYPE: AREA PERSONAL /PCM TEM CASSETTE SIZE: 25 37

SAMPLE NUMBER	DATE	SAMPLE INFORMATION	TIME START	TIME STOP	TIME TOTAL	PUMP FLOW RATE	ug/m³	FIBRES /CC	8 hr. TWA	Resp. Used	Resp. Req.
A331-1	3-31-00	West side upper roof	7:00	10:30	210	2.0	4/20.0		<LOD		
P331-2	3-31-00	032-44-[illegible] Jeannade Bucas	7:00	10:30	210	2.0	4/20.0		<LOD		

WORK DESCRIPTION: Removal of Asbestos flashing

CHAIN OF CUSTODY

Released Jeannade Bucas (Print) Date 3-31-00
By Jean Marie Bucas (signature)
Received Carol Barcomb (Print) Date 3-31-00
By Carol Barcomb (signature)

LABORATORY RECEIPT

Received Sharon Carson (Print) Date 4/3
By Sharon Car[illegible] (signature)
Book ____ Page ____
Analyst ____ Date ____
QC Approval ____

LTIform

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Attn: Carol Barcomb
Lead Tech, Inc. Environmental Services
149 Colonial Road
PO Box 1270
Manchester, CT 06045
Fax: 860-646-8572 Phone: 860-646-8555
Project: **WCSU-Ancell Hall Danbury, CT**

Customer ID: LEAD56
Customer PO:
Received: 03/09/00 11:21 AM

EMSL Order: 040003402
EMSL Project ID:

Phase Contrast Microscopy (PCM) Fiber Count by NIOSH 7400 Method, Revision 3, Issue 2, 8/15/94

Sample / Location	Sample Date	Volume	Fibers	Fields	LOD (f/cc)	Fibers/ mm²	Fibers/ cc	Notes
A3030-1 040003402-0001	3/3/00	350.00	<5.5	100	0.008	<7.0	<0.008	-
P3030-2 040003402-0002	3/3/00	350.00	<5.5	100	0.008	<7.0	<0.008	
A320-1 040003402-0003	3/3/00	280.00	<5.5	100	0.010	<7.0	<0.010	
P320-2 040003402-0004	3/3/00	280.00	5.5	100	0.010	7.01	0.010	
A301-1 040003402-0005	3/3/00	360.00	<5.5	100	0.007	<7.0	<0.007	
P301-2 040003402-0006	3/3/00	360.00	6.0	100	0.007	7.64	0.008	
A229-1 040003402-0007	3/3/00	240.00	<5.5	100	0.011	<7.0	<0.011	
P229-2 040003402-0008	3/3/00	240.00	<5.5	100	0.011	<7.0	<0.011	

Tom Beer
Analyst

Stephen Siegel, CIH
or other approved signatory

LOD = Limit of Detection. The method assumes the lowest detection concentration is 7 fibers/mm². The laboratory is not responsible for data reported a fibers/cc, which is dependent on volume collected by non-laboratory personnel. This report relates only to the samples reported above. This report may not be reproduced, except in full, without written approval by EMSL.
Analysis performed by EMSL Westmont (NY State ELAP #10872)

1 of 1

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Attn:	Carol Barcomb Lead Tech, Inc. Environmental Services 149 Colonial Road PO Box 1270 Manchester, CT 06045	Customer ID:	LEAD66
		Customer PO:	
		Received:	03/16/00 10:02 AM
Fax:	860-646-6572 Phone: 860-646-6555		
Project:	WCSC Danbury	EMSL Order:	040003887
		EMSL Project ID:	

Phase Contrast Microscopy (PCM) Fiber Count by NIOSH 7400 Method, Revision 3, Issue 2, 8/15/94

Sample	Location	Sample Date	Volume	Fibers	Fields	LOD (f/cc)	Fibers/ mm²	Fibers/ cc	Notes
P309-1		3/9/2000							Overloaded
040003887-0001									
A309-2		3/9/2000	780.00	21.5	100	0.003	27.39	0.014	
040003887-0002									
A310-1		3/10/2000	1080.00	16.5	100	0.002	21.02	0.007	
040003887-0003									
P310-2		3/10/2000	1080.00	11.0	100	0.002	14.01	0.005	
040003887-0004									
P305-1		3/5/2000	300.00	<5.5	100	0.009	<7.0	<0.009	
040003887-0005									
A305-2		3/5/2000	300.00	<5.5	100	0.009	<7.0	<0.009	
040003887-0006									

Tom Bear
Analyst

Stephen Siegel, CIH
or other approved signatory

LOD = Limit of Detection. This method assumes the lowest detectable concentration (LOD) is 5 fibers/mm². The laboratory is not responsible for data reported (f/cc/mm/cc), which is dependent on volume collected by non-laboratory personnel. This report relates only to the samples reported above. This report may not be reproduced, except in full, without written approval by EMSL.

Analysis performed by EMSL, Westmont (NY State ELAP # 3672)

1 of 1

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Attn:	Carol Barcomb Lead Tech, Inc. Environmental Services 149 Colonial Road PO Box 1270 Manchester, CT 06045	Customer ID:	LEAD56
		Customer PO:	
		Received:	03/24/00 11:40 AM
Fax:	860-646-8572 Phone: 860-646-6555		
Project:	WCSU/Ancell Hall	EMSL Order:	040004464
		EMSL Project ID:	

Phase Contrast Microscopy (PCM) Fiber Count by NIOSH 7400 Method, Revision 3, Issue 2, 8/15/94

Sample	Location	Sample Date	Volume	Fibers	Fields	LOD (f/cc)	Fibers/ mm²	Fibers/ cc	Note
P320-1 040004464-0001	JaneMarie Burns 662-44-7453	3/20/00	660.00	7.0	100	0.004	8.92	0.005	
A320-2 040004464-0002	Westside Roof	3/20/00	660.00	15.0	100	0.004	19.11	0.011	

Steve Siegel
Analyst

Stephen Siegel, CIH
or other approved signatory

LOD = Limit of Detection. The method assumes the lowest detection concentration is 7 fibers/mm². The laboratory is not responsible for data reported on basis(s), which is dependent on volume collected by non-laboratory personnel. This report relates only to the samples reported above. This report may not be reproduced, except in full, without written approval by EMSL.
Analysis performed by EMSL, Westmont (NY State ELAP #10872)

1 of 1

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Attn: Carol Barcomb
Lead Tech, Inc. Environmental Services
149 Colonial Road
PO Box 1270
Manchester, CT 06045
Fax: 860-646-8572 Phone: 860-646-6555
Project: **181 White St./WCSU**

Customer ID: LEAD56
Customer PO:
Received: 03/24/00 11:40 AM

EMSL Order: 040004465
EMSL Project ID:

Phase Contrast Microscopy (PCM) Fiber Count by NIOSH 7400 Method, Revision 3, Issue 2, 8/15/94

Sample	*Location*	*Sample Date*	*Volume*	*Fibers*	*Fields*	*LOD (fib/cc)*	*Fibers/ mm²*	*Fibers/ cc*	*Notes*
A321-1 040004465-0001	1st Fl Office	3/21/00	360.00	<5.5	100	0.007	<7.0	<0.007	
P321-2 040004465-0002	Jane Marie Burns 082-44-7450	3/21/00	360.00	<5.5	100	0.007	<7.0	<0.007	

Dave Stanhope
Analyst

Stephen Siegel, CIH
or other approved signatory

LOD = Limit of Detection. The method assumes the lowest detection concentration [illegible] fibers/mm². The laboratory is not responsible for data reported in fibers/cc, which is dependent on volume collected by non-laboratory personnel. This report relates only to the samples reported above. This report may not be reproduced, except in full, without written approval by EMSL.
Analysis performed by EMSL Westmont (NY State ELAP #[illegible])

EMSL Analytical, Inc.
197 Haddon Ave., Westmont, NJ 08108

Attn:	Carol Barcomb Lead Tech, Inc. Environmental Services 149 Colonial Road PO Box 1270 Manchester, CT 06045	Customer ID:	LEAD56
		Customer PO:	
		Received:	04/03/00 12:13 PM
Fax:	860-646-8572 Phone: 860-646-6555		
Project:	WCSU-Ancell Hall	EMSL Order:	040005016
		EMSL Project ID:	

Phase Contrast Microscopy (PCM) Fiber Count by NIOSH 7400 Method, Revision 3, Issue 2, 8/15/94

Sample	Location	Sample Date	Volume	Fibers	Fields	LOD (fibers)	Fibers/ mm²	Fibers/ cc	Notes
A331-1 040005016-0001	Westside Upper Roof	3/31/00	420.00	<5.5	100	0.006	<7.0	<0.006	
P331-2 040005016-0002	Janemarie Burns 082-44-7453	3/31/00	420.00	<5.5	100	0.006	<7.0	<0.006	
P330 040005016-0003	Janemarie Burns 082-44-7453	3/30/00	480.00	<5.5	100	0.006	<7.0	<0.006	
A330 040005016-0004	East Wing	3/30/00	480.00	<5.5	100	0.006	<7.0	<0.006	
A321-1 040005016-0005	Ancel Hall	3/31/00	360.00	<5.5	100	0.007	<7.0	<0.007	
P322-2 040005016-0006	Janemarie Burns 082-44-7453	3/31/00	360.00	<5.5	100	0.007	<7.0	<0.007	

Dave Stanhope
Analyst

Stephen Siegel, CIH
or other approved signatory

LOD = Limit of Detection. The method sensitivity (the lowest detectable concentration) is 7 fibers/mm². The laboratory is not responsible for data reported/interpretations which are dependent on volume collected by non-laboratory personnel. This report relates only to the samples reported above. This report may not be reproduced, except in full, without written approval by EMSL.
Analysis performed by EMSL Westmont (NY State ELAP #10872)

1 of 1

#99 03805

WASTE MANAGEMENT

LOGANO TRUCKING

P.O. Box 144
Portland, CT 06480
(860) 342-0667 • Fax: (860) 342-4866
Out of State 1-800-272-3867

FB#

ASBESTOS DISPOSAL & DOCUMENTATION FORM

Job Number _____ P.O. # _____
Contractor _____
Address _____
City _____ State _____ Zip _____
Telephone Number _____
Date Container Del. _____ Date of Pickup 3-1-00
Type of Container Open Top
Friable ☐ Non-Friable ☒
Bag ☑ Drum ☐ Wrapped ☑ Other ☐
Approximate Volume of Asbestos Removed
20 A.L.F.

I hereby certify that the above named material does not contain free liquid as defined by 40 CFR part 260.10 or any applicable state law, is not a hazardous waste as defined by 40 CFR part 261 or any applicable state law, has been properly described, classified and packaged, and is in proper condition for transportation according to applicable regulations.

Authorized Signature _____

GENERATOR/BUILDING OWNER

_____
Address _____
City _____ State _____ Zip _____
Phone Number _____

GENERATING LOCATION

_____
Address _____
City _____ State _____ Zip _____
Phone Number _____

E.P.A. AGENCY

CT, MA, RI, VT, NH, ME GENERATORS
U.S. EPA - Region I
Air Management - JFK Building
Boston, MA 02203
(617) 565-3865

NY GENERATORS
U.S. EPA - Region II
NESHAP, Asbestos Coordinator,
26 Federal Plaza
New York, New York 10007
(212) 264-6770

RQ, ASBESTOS, 9, NA2212, PG III

Transporter 1: _____

I hereby certify that the above named materials picked up at the generator site listed above, and, if applicable delivered to the temporary storage/transfer location or final landfill destination.

Driver: _____ Signature Registration #: _____ State / # Date: _____

Transporter 2: Waste Management, PO Box 144, Portland, CT 06480

I hereby certify that the above named material was delivered without incident to the temporary storage/transfer location or final landfill destination.

Driver: _____ Signature Registration #: _____ State / # Date: 3-1-00

TEMPORARY STORAGE / TRANSFER FACILITY: WASTE MANAGEMENT • 203 PICKERING STREET • PORTLAND, CT 06480
PHONE: (800) 272-3867 PERMIT # SW 1130223

Received By: _____ Date: _____

I hereby certify that the above named material has been accepted at the above named facility.

Transporter 3: _____

I hereby certify that the above named material was delivered without incident to the destination listed below.

Driver: _____ Signature Registration #: _____ State / # Date: _____

Landfill Name: _____ Phone No: _____

Location: _____ Permit #: _____

Approximate Volume of Asbestos Received: _____

Discrepancy If Any: _____

I hereby certify that the above named material has been accepted and to the best of my knowledge the information provided is true and accurate.

Received by: _____ Date: _____
CONTRACTOR

WM WASTE MANAGEMENT
LOGANO
P.O. Box 144 • Portland, CT 06480
(860) 342-0667 • Fax: (860) 342-4866
Out of State 1-800-272-3867

E.P.A. AGENCY

CT, MA, RI, VT, NH, ME GENERATORS
EPA New England
1 Congress Street
Boston, MA 02114-2023
(617) 918-1111

NY GENERATORS
EPA Region 2
290 Broadway, 26th Floor
New York, NY 10007-1866
(212) 264-6770

99 24931

EMERGENCY RESPONSE TELEPHONE
#1-800-272-3867

FB# 15581

ASBESTOS DISPOSAL & DOCUMENTATION FORM

Job Number ______ P.O. # ______
Contractor: LEAD TECH, INC.
Address: 149 COLONIAL RD
City: MANCHESTER State: CT Zip: 06045
Telephone Number: 860 429 8620
Date Container Del. ______ Date of Pickup ______
Type of Container: 30 CY LIVE PICKUP
VOLUME 6 (SIX) **CY** Friable ☐ Non-Friable ☒
Bag ☒ Drum ☐ Wrapped ☐ Other ☐
RQ, ASBESTOS, 9, NA2212, PG III

GENERATOR/BUILDING OWNER
WCSC
Address: 181 WHITE ST
City: DANBURY State: CT Zip: 06810
Phone Number: 860 483 0067

GENERATING LOCATION
WCSC
Address: ANCELL HALL
City ______ State ______ Zip ______
Phone Number ______

I certify the above named material does not contain free liquid as defined by 40 CFR part 260.10 or any applicable state law, is not a hazardous waste as defined by 40 CFR part 261 or any applicable state law, has been properly described, classified and packaged, and is in proper condition for transportation according to NESHAP standards for asbestos waste disposal found in 40 CFR part 61.150.

Shipper's Certification: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national government regulations.

AUTHORIZED SIGNATURE [signature], Pres.

Transporter 1: ______ Name ______ Address ______ Telephone # ______
Driver: N/A Signature ______ Registration #: N/A State / # ______ Date: ______
Acknowledgement of receipt of materials.

Transporter 2: Waste Management of CT Inc., PO Box 144, Portland, CT 06480 1-800-272-3867
Driver: [signature] Signature Registration #: 24074 A CT. State / # Date: 4/5/00
Acknowledgement of receipt of materials.

TEMPORARY STORAGE / TRANSFER FACILITY: **WASTE MANAGEMENT OF CT INC. • 203 PICKERING STREET • PORTLAND, CT 06480 PHONE: (800) 272-3867 PERMIT # SW 1130223**
Received By: [signature] Date: 4500
Certification of receipt of materials covered by this manifest.

Transporter 3: [illegible] Name Box 3326 Altoona, Pa Address 814-946-9344 Telephone #
Driver: [signature] Signature Registration #: XC 25454 PA State / # Date: 4-7-00
Acknowledgement of receipt of materials.

Landfill Name: VALLEY LANDFILL Phone No: 724-[illegible]
Location: [illegible] VALLEY ROAD [illegible], PA. [illegible] Permit #: 100280
Approximate Volume of Asbestos Received: [illegible]
Discrepancy If Any: ______
Received by: [signature] Date: 4-7-00
Certification of receipt of materials covered by this manifest.
COPY 2 - CONTRACTOR

END OF SECTION

CERTIFICATE (of Authority)

I _____ , _____
(Signer's Name)[1] *(Signer's Title)*

of _____ , an entity lawfully organized and existing under the laws
(Name of Entity)

of _____ , do hereby certify that the following is a true and correct
(Name of State or Commonwealth)

copy of a resolution adopted on the _____ day of _____ , 20 _____ by the governing body of
(Day)[2] *(Month)*[2] *(Year)*[2]

_____ , in accordance with all of its documents of governance and
(Name Of Entity)

management and the laws of _____ and further certify that such resolution has not
(Name of State or Commonwealth)

been modified, rescinded or revoked, and is at present in full force and effect.

RESOLVED: that _____ , _____
(Name and Title of Signer of Contract Documents)[3]

of _____ is empowered and authorized, on behalf of the entity,
(name of entity)

to execute and deliver contracts and amendments thereto, and all documents required by the Governor, the Connecticut Department of Administrative Services, the Connecticut State Properties Review Board and the Office of the Attorney General associated with such contracts and amendments.

IN WITNESS WHEREOF, the undersigned has executed this certificate this _____ day of _____ , 20 _____ .
(Day)[4] *(Month)*[4] *(Year)*[4]

_____
(Signature)

_____ _____
(Print Name) *(Title)*

1 – The signer of this certificate must be someone *other than* the signer of the contract documents *except for* a sole managing member of an LLC or the sole officer or sole principal of a corporation. *If* the signer is a sole managing member of an LLC, *then* along with this certificate the signer must provide a letter on company letterhead that indicates the signer is a sole member and managing member. If the signer is the sole officer or sole principal of a corporation, then the signer must provide with the certificate a letter on company letterhead setting forth this fact.
2 – This date must be on or before the **date of signing** of the contract document.
3 – This person shall sign the contract document and other required documents.
4 – This date must be on or after the **date of signing** of the contract documents.

FOR YOUR INFORMATION

Certificate (of Authority)

What the **Certificate** is saying is that the organization authorized the signatory to sign the pertinent **documents other than** the Certificate (of Authority) and that, as of the date of **execution** of the CERTIFICATE (i.e., the date set forth in the "In Witness Whereof" blanks) there has been no change in that authorization.

Instructions for completing the **Certificate** (of Authority)

The **Certificate (Authority)** to Accompany the **Bid Proposal Form:**

1. **1st Paragraph:**
   - **a.** First, enter the name and title of the individual signing the Certificate (of Authority).
   - **b.** Second, enter the legal name of the entity (exactly as it is shown on the Secretary of State registry).
   - **c.** Third, enter the name of the state or commonwealth the entity is registered in.
   - **d.** Fourth, enter the **date** the **resolution** was adopted by the governing body. This **date** is **on** or **before** the date the **Bid Proposal** is signed.
   - **e.** Fifth, enter the name of the state or commonwealth the entity is registered in.
2. **2nd Paragraph:**
   - **a.** First enter the name and title of the individual signing bid documents for the entity.
   - **b.** Second, enter the legal name of the entity (exactly as it is shown on the Secretary of State registry).
3. **Last Paragraph:**
   - **a.** Enter the **Witness date.** This date will likely be the date of execution of the **Bid Proposal form**. THE DATE SHOULD **NOT** BE BEFORE THE DATE OF **EXECUTION** OF THE **BID PROPOSAL**.

The **Certificate (Authority)** to Accompany the **Contract:**

1. **1st Paragraph:**
   - **a.** First, enter the name and title of the individual signing the Certificate (of Authority).
   - **b.** Second, enter the legal name the entity (exactly as it is shown on the Secretary of State registry).
   - **c.** Third, enter the name of the state or commonwealth the entity is registered in.
   - **d.** Fourth, enter the **date** the **resolution** was adopted by the governing body. This **date** is **on** or **before** the date the **Contract** is signed.
   - **e.** Fifth, enter the name of the state or commonwealth the entity is registered in.
2. **2nd Paragraph:**
   - **a.** First enter the name and title of the individual signing contract documents for the entity.
   - **b.** Second, enter the legal name of the entity (exactly as it is shown on the Secretary of State registry).
3. **Last Paragraph:**
   - **a.** Enter the **Witness date.** This date will likely be the date of execution of the **CONTRACT**. THE DATE SHOULD **NOT** BE BEFORE THE DATE OF **EXECUTION** OF THE **CONTRACT**.

END OF SECTION

i:\976710\02 design\specs\004014 certificateofauthority.docx

01 10 00 SUMMARY

A. **Summary:** Section 01 10 00 Summary contains the following Subsections:

01 11 00	**Summary of Work**	**Not Used** ☐
01 11 13	**Work Covered by Contract Documents**	**Not Used** ☐
01 12 16	**Work Sequence - Phase(s);**	**Not Used** ☐
01 12 19	**Contract Interface**	**Not Used** ☐
01 14 00	**Work Restrictions**	**Not Used** ☐
01 14 16	**Coordination with Occupants**	**Not Used** ☐
01 14 23	**Subcontractor Evaluations**	**Not Used** ☐

01 11 00 SUMMARY OF WORK

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Project Number:** ***BI-RD-298***.

C. **Project Title:** ***HVAC Improvements and Associated Roof Repairs***.

It is to be completed and ready for use by the Owner and Agency within the Contract Time specified in Division 00, Section 00 11 16 "Invitation to Bid".

D. **Project Location:** The ***Westside Classroom Building, at Western Connecticut State University***, located in ***Danbury***, Connecticut.

E. **The Project Description:**

1. Construction of an ***HVAC improvement and roofing repair project*** with approximately **10,000 SF** square feet of roof restoration.

2. The building is existing; however, work installed as part of this work shall be new unless designated as salvaged for reuse. Roof construction shall consist of ***roof repairs, a new restorative flood coat, and gravel at select (mostly upper) roof areas, as well as new access platforms, new base flashings at penetrations and perimeters, and new roof walkway pads. Various repairs elsewhere, typically at lower roofs (E through II) are Supplemental Bid No. 1.***

3. Mechanical upgrades shall include ***new cooling towers, new multi-zone unit, new chillers, new pumps, and updated controls. Replacement of roof piping and supports is Supplemental Bid No. 2.***

01 11 13 WORK COVERED BY CONTRACT DOCUMENTS

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. The Work includes but is not limited to the following:

1. ***Schedule; Construction phasing to be based on building MEP schedule with considerations for equipment lead times;***

2. ***Masonry; Removal and replacement of masonry and flashings at the base of the sloped skylight unit;***

3. ***Early submission package and equipment order for long-lead-time items;***

4. ***Roofing; isolated repairs to lower roof areas;***

5. ***Roofing; Restoration of upper roof areas including removal of existing gravel, repairs, flashing replacement, and installing of new flood coat and gravel;***

6. ***Roofing; Roof replacement below the cooling towers; and***

7. ***Mechanical; Removal and replacement of water chillers, air-handling units, cooling towers, water pumps, HVAC controls, and associated piping and equipment.***

C. The Contractor will include in his bid, all items required in order to carry out the intent of the work as described, shown, and implied in the Contract Documents.

D. It shall be the Contractor's responsibility upon discovery to immediately notify the Construction Administrator (CA), in writing, of errors, omissions, discrepancies, and instances of non-compliance with applicable codes and regulations within the documents, and of any work, which will not fit or properly function if installed as indicated on the Contract Documents. Any additional costs arising from the Contractor's failure to provide such notification shall be borne by the Contractor.

E. **The Work will be constructed under a single lump sum.**

F. **Examination of Site:**

1. It is not the intent of the Documents to show all existing conditions. All contractors are advised to visit and examine the site with the Construction Administrator prior to submitting bids.

2. Contractors should investigate and satisfy themselves as to the conditions affecting the work, including but not restricted to those bearing upon transportation, disposal, handling, and storage of materials, availability of labor, water, electric power, uncertainties of weather, roads, or similar physical conditions of the ground, the character of equipment, and facilities needed preliminary to and during the prosecution of the Work. The Contractor should further satisfy himself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, as well as from information presented by the Contract Documents. Any failure by the Contractor to acquaint himself with the available information shall not relieve him from the responsibility for estimating properly the difficulty and cost of successfully performing the Work.

3. **Pre-Bid Conference:**

3.1 A Pre-Bid Conference and tour of the site will be conducted as scheduled in Division 00 Section 00 11 16 “Invitation to Bid”. This scheduled conference is the only official opportunity for the bidders to tour the site with the Owner, Architect, Engineer, Construction Administrator, and Agency.

G. **Project Documents:**

1. The Specifications and Drawings are intended to describe and illustrate the materials and labor necessary for the work of this Project.

H. The Contractor shall receive ***one (1)*** set of AutoCAD compatible (latest version) Floor Plans on disks at no cost on or about the time of execution of the Contract from the Architect. Additional sets of AutoCAD compatible (latest version) Floor Plans on disks from the Architect at the cost of their reproduction, to the Contractor.

01 12 16 WORK SEQUENCE - PHASE(S)

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. The entire Project shall be constructed in ***Four (4)*** Phase(s). Work of these Phases shall be substantially complete, ready for occupancy within ***two hundred and ninety (290)*** Calendar Days of commencement of the Work (the **“Contract Time”**).

C. Note that repairs to the lower roof areas are excluded from the project phasing and can be completed at any time during the contract duration, weather permitting. Phasing is required to minimize the shut-down of the building’s air-conditioning systems. The following phasing is a suggested method of achieving this goal. Actual phasing remains the Contractor’s responsibility as part of means and methods.

1. Phase ***One (1)*** shall include the submittal of a ***Detailed Work Phasing Plan*** within two (2) weeks of Contract award. Phasing will include details of required shutdowns of the HVAC and electrical systems and estimated time that systems are shut down. The dates will be coordinated with and approved by the University.

2. Phase ***Two (2)*** shall include the following portions of work, including all labor and material, shown on the drawings, and/or as specified hereinafter. Work of this Phase shall be substantially complete prior to beginning the next phase. The intent of this Phase is to ***initiate the order of long-lead-time mechanical equipment*** and includes but is not limited to the following:

2.1 MEP Submittals for early release of cooling towers and air handlers;

2.2 Crane plan, rigging, and procedure plan for removal of existing rooftop equipment and placement of new equipment;

2.3 Remaining project submittals; and

2.4 Pre-equipment mechanical work that does not require shut-down.

3. Phase ***Three (3)*** shall include the following portions of work, including all labor and material, shown on the drawings and/or as specified hereinafter. Work of this Phase shall be substantially complete prior to beginning the next phase. The intent of this Phase is to ***initiate MEP shut-down, removals and installations, modifications to steel structure, and roofing repair and replacement work*** and includes but is not limited to the following:

3.1 In accordance with the approved phasing plan and coordinated with the equipment delivery dates, shut down the HVAC systems, including cooling towers, pumps, chillers, and air-handling units.

3.2 During shut-down, remove and replace cooling towers, condensing water pumps, chilled water pumps, rooftop multi-zone unit, and single-zone air-handling unit and related piping, ductwork, and controls. Coordinate and perform repair/modifications to steel dunnage, and roof replacement.

3.3 Once installation is complete, equipment start-up, testing and balancing, and commissioning shall be accomplished. Coordinate and perform roof repair and restoration work.

3.4 Building inspection to be completed and Certificate of Substantial Completion awarded.

3.5 Building to be ready for occupancy before Fall semester commences.

4. Phase ***Four (4)*** shall include the following portions of work, including all labor and material, shown on the drawings and/or as specified hereinafter. The intent of this Phase is to ***replace the existing chillers and*** includes but is not limited to the following:

4.1 During chiller shut-down season (estimated mid-November to late March) remove and replace chiller and related piping.

4.2 Start-up, testing and balancing, commissioning, and inspection to be completed before shutdown season ends for timely change over to chiller operating season.

01 12 19 CONTRACT INTERFACE

A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Owner: The Owner is the State of Connecticut, Department of Administrative Services.

1. The authorized representative for the Owner is ***Peter Visentin***, Director, Facilities Planning and Engineering. The Facilities Director is located at 001A White Hall, 181 White Street, Danbury, CT 06810. Phone: ***(203) 837-8680;*** Fax: ***(203) 837-8723***; E-mail: ***visentinp@wcsu.edu***.

2. The Facilities Director is the authorized representative for the Department of Administrative Services Commissioner to act in matters involving revoking, altering, enlarging, or relaxing any requirement of the contract documents.

C. Agency: The Agency is ***Western Connecticut State University***.

1. The Agency Representative is ***Peter Visentin***. The Agency Representative's title is ***Director, Facilities Planning and Engineering.*** The Agency Representative is located at ***181 White Street, Danbury***. Connecticut, ***06810***. Phone: ***203.837.8680***; Fax: ***203.837.8723***; E-mail: ***visentinp@wcsu.edu***.

2. The Agency Representative has the administrative authority for the facility and or site where the work is being performed but does not have the authority to change the Contract Documents or direct the Contractor.

D. Architect and Engineer: The Architectural Firm is ***Gale Consultants, Inc.***, and is located at ***703 Hebron Avenue***, ***Glastonbury***, ***CT***. The Engineer representing the firm for this project is ***Elliott T. Hambrook, P.E.***. Phone: ***860.430.5660***; Fax: ***860.430.9072***; E-mail: ***eth@gainc.com***.

1. The Architect and Engineer or their accredited representative is referred to in the Contract Documents as "Architect" or "Architects" or "Engineer" or "Engineers" or by pronouns which imply them. As information for the Contractor, the Architect's, or Engineer's status is defined as follows:

1.1 The Architect and Engineer will not make interpretations or decisions directly to the Contractor. All interpretations or decisions will be conveyed through the Construction Administrator.

1.2 As the authorized representative of the Department of Administrative Services Commissioner, the Architect and Engineer is responsible for review of shop drawings, materials, and equipment intended for the work, in accordance with the "General Conditions", and the "Supplementary Conditions".

1.3 Wherever the Architect or Engineer is mentioned in the documents in connection with an administrative function, it shall include the Construction Administrator in that function except for shop drawings.

E. **Construction Administrator:** The Construction Administrator is ***Eric Lessne***, and is located at ***Room 302, 61 Woodland Street, Hartford***, Connecticut, ***06105***. Phone: ***860.982.8364***; Fax: ***N/A***; E-mail: ***lessnee@ct.edu***.

1. The Construction Administrator is referred to in the Contract Documents as "Construction Administrator" or "Construction Manager" or by pronouns which imply it. All communications concerning the project will be directed through the Construction Administrator or a designated representative(s).

2. As information to the Contractor, the Construction Administrator's status is defined as follows:

2.1 The Construction Administrator is the Owner's Agent who will, among other things, monitor the General Contractor's performance, scheduling, and construction, process shop drawings, material, and equipment submittals, review and process periodic billings, review and recommend cost changes.

2.2 The Construction Administrator will process all requests for information, interpretations, and decisions regarding the meaning and intent of the Contract Documents, consulting with appropriate parties prior to rendering the interpretations or decisions to the Contractor. All such requests and replies shall be in writing.

F. **PMWeb Project Management:**

1. DCS is using PMWeb as the project management collaborative software tool for this project.

2. The General Contractor is required to utilize PMWeb for the duration of this project and shall provide all project information via this program management software. This includes, but is not limited to contracts, applications for payment, change orders, change order proposals, requests for information, etc.

3. The DCS Project Manager (or the Construction Administrator (CA) shall arrange for training. This training is for the General Contractor's Staff, the DCS Project Manager, the Construction Administrator**,** the A/E, and their representatives.

4. DCS will be establishing a project specific email "file" address for this project. The General Contractor shall send an electronic "file" copy of all project documents to this email address, to include but not limited to all project correspondence, project emails, forms, etc.

5. The General Contractor is required to scan all documents that contain wet (ink) signatures and send a copy of those documents electronically to the DCS Project Manager and the project specific email "file" address. The hard copy of the wet signature documents shall be transmitted as directed by the DCS Project Manager. This includes, but is not limited to all contracts, change orders, applications for payment, closeout documentation, etc.

01 14 00 WORK RESTRICTIONS

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. The Contractor shall confine his operations, including storage of apparatus, equipment, and materials to the contract limit lines as directed by the Construction Administrator.

C. The areas and/or spaces, including their access, shall be maintained free and clear throughout the contract term.

D. Parking for Contractor's employees will be limited to an area (or areas) designated by the Construction Administrator. The Contractor may be required to provide identification stickers for employees' cars.

E. Note that Graduation is tentatively scheduled for May 20, 2018 and the 2018/2019 school year is scheduled to begin around August 27, 2018. The Construction Administrator may introduce unique work restrictions around these dates.

01 14 16 COORDINATION WITH OCCUPANTS

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Full Agency Occupancy During Construction:** The Agency will occupy the site and existing building during the construction period. Personnel relocation is expected while the building's A/C system(s) are shut down. Cooperate with the Agency during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with the Agency's operations.

1. Provide adequate building and fire code egress from the buildings during the renovation process. The Contractor will be responsible to maintain and protect egress ways during the construction sequence per the design as supplied by the Architect. Contractor shall be responsible for preparing egress plans for Owner approval and for Office of State Building Official and Office of State Fire Marshal for approval if required.

C. **Partial Agency Occupancy:** The Agency reserves the right to occupy and to place and install equipment in completed areas of the building prior to Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. Should it become necessary or advisable, as the work nears final completion, for the Agency to occupy a portion of the building prior to final acceptance, the Contractor shall cooperate in completing such areas and making same accessible.

2. The Construction Administrator will determine whether such occupancy or use is possible and, if so, will make arrangements for holding a job inspection with the DCS Project Manager, Agency Representative, Architect, and General Contractor.

3. A comprehensive list of items to be completed or corrected as issued by the General Contractor, together with the status of completion and terms of occupancy, will be forwarded to the DCS Project Manager and the Architect by the Construction Administrator. A letter will be issued by the DCS Project Manager and Architect to Construction Administrator granting such occupancy and will state the terms and conditions of occupancy.

4. Prior to partial Agency occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Agency will operate and maintain mechanical and electrical systems serving occupied portions of the building.

5. The Architect will prepare a "Certificate of Substantial Completion" for each specific portion of the Work to be occupied prior to Agency occupancy. Use the "Certificate of Substantial Completion" form as required by the Owner.

6. The DCS Project Manager will request a signed "Certificate of Compliance" from the Architect and Contractor, and forward the Certificate to the Office of State Building Inspector for a Certificate of Occupancy and obtain the same after his review and approval.

7. A letter from the DCS Project Manager to the Agency Representative with copy to the General Contractor granting occupancy will state the terms and conditions of occupancy and that fire insurance coverage has been requested, the effective date of which will indicate to the Contractor that he may cancel fire insurance coverage for that portion of the project.

8. Upon occupancy, the Agency will assume responsibility for maintenance and custodial service for occupied portions of the building.

9. **Work after Partial Agency Occupancy:**

9.1 For all work to complete the area occupied, warranty work, the balancing and commissioning of systems, repair of latent defects and adjustments after

partial occupancy, the Contractor is responsible for all costs associated with working in occupied buildings.

D. Agency Occupancy:

1. The Construction Administrator will determine whether such occupancy is possible and, if so, will make arrangements for holding a job inspection with the DCS Project Manager, Agency Representative, Architect, and General Contractor.

2. A comprehensive list of items to be completed or corrected as issued by the General Contractor, together with the status of completion and terms of occupancy, will be forwarded to the DCS Project Manager and the Architect by the Construction Administrator. A letter will be issued by the DCS Project Manager and Architect to Construction Administrator granting such occupancy and will state the terms and conditions of occupancy.

3. Prior to Agency occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Agency will operate and maintain mechanical and electrical systems serving occupied portions of the building.

4. The Architect will prepare a **"**Certificate of Substantial Completion" for the Work to be occupied prior to Agency occupancy. Use the "Certificate of Substantial Completion" form as required by the Owner.

5. The DCS Project Manager will request a signed "Certificate of Compliance" from the Architect and Contractor, and forward the Certificate to the State Building Inspector for a Certificate of Occupancy and obtain the same after his review and approval.

5. A letter from the DCS Project Manager to the Agency Representative with copy to the General Contractor granting occupancy will state the terms and conditions of occupancy and that fire insurance coverage has been requested, the effective date of which will indicate to the Contractor that he may cancel fire insurance coverage for the project.

6. Upon occupancy, the Agency will assume responsibility for maintenance and custodial service for occupied portions of the building.

7. Work after Agency Occupancy:

7.1 For all work to complete the occupied building, warranty work, the balancing and commissioning of systems, repair of latent defects and adjustments after occupancy, the Contractor is responsible for all costs associated with working in occupied buildings.

01 14 23 SUBCONTRACTOR EVALUATIONS:

A. Pursuant to C.G.S. Sec. 4a-101, the General Contractor shall compile evaluation information during the performance of the contract on each of its subcontractors who are performing work with a value in excess of five hundred thousand dollars ($500,000.00). The General Contractor shall complete and submit to the DCS evaluations of each such subcontractor upon fifty percent (50%) completion of the project and upon Substantial Completion of the project. The General Contractor acknowledges that its failure to complete and submit these evaluations in a timely manner may, by statute, result in a delay in project funding and, consequently, payment to the General Contractor. The General Contractor agrees to indemnify and hold the State harmless from any loss, damage, or expense that results from or is caused by the General Contractor's failure to complete and submit the evaluations to DCS in accordance with this provision.

END OF SECTION

i:\976710\02 design\specs\011000_summary_dbb_minor_capital.docx

01 20 00 CONTRACT CONSIDERATIONS

A. **Summary:** Section 01 20 00 Contract Considerations contains the following subsections:

01 21 00	**Allowances**	**Not Used** ☒
01 22 00	**Unit Prices - General**	**Not Used** ☐
01 22 13	**Unit Price Schedules - Earth And Rock Excavation**	**Not Used** ☒
01 22 16	**Unit Price Schedule - Miscellaneous**	**Not Used** ☒
01 22 19	**Unit Price Schedule – Alterations**	**Not Used** ☐
01 23 00	**Supplemental Bids**	**Not Used** ☐
01 25 00	**Substitution Procedures**	**Not Used** ☐
01 26 00	**Contract Modification Procedures**	**Not Used** ☐
01 29 76	**Progress Payment Procedures**	**Not Used** ☐

01 21 00 ALLOWANCES NOT USED

01 22 00 UNIT PRICES - GENERAL

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Definition - Unit Price:** Amount the General Contractor acknowledges in the Bid Proposal Form as a price per unit of measurement for materials or services as described in the Bidding Documents or in the Contract Documents.

C. **Procedures:**

1. Unit Prices included in the Contract Documents are to be used for determining compensation to the Contractor or Owner for changes to the scope of the work indicated in the Contract Documents, and included in the Lump Sum Contract Price. Special Unit Prices are for items complete, in place, and shall be inclusive of furnishing and installing of all material, labor, trucking, overhead, profit, equipment, hoisting, engineering, scaffolding, power hookups, protection, shop drawings, taxes, permits, appliances, delivery, insurance, supervision, cost of bond, etc. and shall remain in effect until completion of the Contract.

2. **Unit Price:** Is identified by the Owner as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if the estimated quantities of Work required by the Contract Documents are increased or decreased.

3. **Increases or Decreases:** Should the amount of the Work required be increased or decreased because of changes in the work ordered in writing by the DCS Project Manager, the Undersigned agrees that the following supplemental UNIT PRICES will be decreased 10% for a reduction of work. Each Unit Price shall include all equipment, tools, labor, permits, fees, etc., incidental to the completion of the work involved. All items marked with an asterisk (*****) in the unit price schedules shall include the completion of the excavation, formation and compaction of sub-grade and the disposal of surplus or unsuitable materials in accordance with the Plans and Specifications or as directed by the Construction Administrator.

D. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and to have this work measured, at the Owner's expense, by an independent surveyor acceptable to the Contractor.

E. **Defect Assessment:** Replace the Work, or portions of the Work, not conforming to the specified requirements. If, in the opinion of the Architect/Engineer it is not practical to remove and replace the work the Architect/Engineer will direct an appropriate remedy or adjust the payment.

F. **Unit Price Schedule:** A "Unit Price Schedule" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials described under each unit price.

01 22 13 UNIT PRICE SCHEDULES - EARTH AND ROCK EXCAVATION NOT USED

01 22 16 UNIT PRICE SCHEDULE - MISCELLANEOUS NOT USED

01 22 19 UNIT PRICE SCHEDULE - ALTERATIONS

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Unit Price Schedule – Alterations:**

1.	Alteration Items		Unit	$ Add	$ Deduct
	1.1.1	***BUR Replacement Repair***	SF	4.50	4.05
	1.1.2	***BUR Strip Flashing***	LF	11.00	9.90
	1.1.3	***BUR Surface Repair***	SF	12.00	10.80
	1.1.4	***BUR Build-up Repair***	SF	4.00	3.60

2. Unit prices shall be negotiated if there is a change in scope of work.

01 23 00 SUPPLEMENTAL BIDS

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Definition:** A Supplemental Bid is an amount proposed by bidders and stated on the Bid Proposal Form for certain work defined in the Bidding Documents that may be added to the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

The cost for each supplemental bid is the net addition to the Contract Sum to incorporate the Supplemental Bid into the Work. Supplemental Bids are only accepted in the numerical order that they are listed on the Bid Proposal Form and never accepted out of numerical sequence. No other adjustments are made to the Contract Sum.

C. **Procedures:**

1. **Coordination:** Modify or adjust affected adjacent Work as necessary to completely and fully integrate that Work into the Project.

1.1 Include as part of each Supplemental Bid, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the Supplemental Bid.

1.2 Execute accepted Supplemental Bids under the same conditions as other Work of this Contract.

1.3 Schedule: A "Schedule of Supplemental Bids" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials necessary to achieve the Work described under each Supplemental Bid.

D. **Schedule of Supplemental Bids:**

1. ***Supplemental Bid No. 1: ADD – Perform roof repairs at Areas E through II.***

2. ***Supplemental Bid No. 2: ADD – Remove and replace existing condensing water supply and return piping from point of exit at penthouse to point(s) of connection to new cooling towers. Include new pipe supports and saddles.***

01 25 00 SUBSTITUTION PROCEDURES

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Summary**

1. This Section includes administrative and procedural requirements for handling requests for equals and substitutions made after award of the Contract.

2. Related Sections: The following Sections contain requirements that relate to this Section:

2.1 Division 01 Section 01 33 00 "Submittal Procedures" specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.

2.2 Division 01 Section 01 42 19 "Reference Standards" specifies the applicability of industry standards to products specified.

2.3 Division 01 Section 01 60 00 "Product Requirements" specifies requirements governing the Contractor's selection of products and product options.

C. Definitions

1. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.

2. **Equals or Substitutions General:** Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract.

D. Submittals

1. **Equals and Substitution Request Submittals:** The Owner will consider requests for equals or substitutions if made prior to the Receipt of the Competitive Bid. The information on all materials shall be consistent with the information herein. After the contract award, substitutions will be considered for materials or systems specified that are no longer available. It will not be considered if the product was not purchased in a reasonable time after award. The Contractor shall submit all equal and substitutions requests on the ***"Equal or Substitute Product Request"*** Form, an example is shown at the end of this Section and the Form is available from the Construction Representative (CA). See Article 15 in the General Conditions for further refinement and information.

1.1 The Contractor is required to prepare and submit three (3) copies of the required data for the first manufacturer listed or procedure listed in the specifications section with reference to all of the following areas: the substance and function considering quality, workmanship, economy of operation, durability and suitability for purposes intended including the size, rating and cost. All submissions must include all the required data for the first listed manufacturer or procedure as specified, as well as the required data for the proposed Equal or Substitution. This will enable the Owner and Architect to determine that the proposed Equal or Substitution is or is not substantially equal to the first listed manufacturer or procedure.

2. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.

3. Provide complete documentation showing compliance with the requirements for equals or substitutions, and the following information, as appropriate:

3.1 Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate contractors that will be necessary to accommodate the proposed Equal or Substitution.

3.2 A detailed comparison chart of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.

3.3 Product Data, including Shop Drawings and descriptions of products and fabrication and installation procedures.

3.4 Samples, where applicable or requested.

3.5 A statement indicating the effect on the Contractor's Construction Schedule compared to the schedule without approval of the Equal or Substitution. Indicate the effect on overall Contract Time.

3.6 Cost information, broken down, including a proposal of the net change, if any in the Contract Sum.

3.7 The Contractor's certification that the proposed Equal or Substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.

3.8 The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the Equal or Substitution to perform adequately.

4. **Architect's Action:** If necessary, the Architect will request additional information or documentation for evaluation within **seven (7)** Calendar Days of receipt of the original request for equal or substitution request. The Architect will notify the Construction

Administrator who will notify the Owner of recommended acceptance or rejection of the proposed equal or substitution, within **fourteen (14)** Calendar Days of receipt of the request, or **seven (7)** Calendar Days of receipt of additional information or documentation, whichever is later. The Construction Administrator will give final acceptance or rejection by the Owner not less than **seven (7)** Calendar Days after notification.

4.1 Any request deemed an "Equal" and accepted by the Construction Administrator, Architect, Owner, and Agency will result in written notification to the Contractor and will not be in the form of a change order for an "Equal".

4.2 Any request deemed a "Substitution" and rejected or approved by Construction Administrator, Architect, and Owner may result in written notification to the Contractor and may be in the form of a Change Order if the "Substitution" is approved.

E. Equal or Substitutions

1. Conditions: The Architect will consider the Contractor's request for Equal or Substitution of a product or method of construction when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests to the Construction Administrator without action except to record noncompliance with these requirements.

1.1 The proposed request does not require extensive revisions to the Contract Documents.

1.2 The proposed request is in accordance with the general intent of the Contract Documents.

1.3 The proposed request is timely, fully documented, and/or properly submitted.

1.4 The proposed request can be provided within the Contract Time. However, the Architect will not consider the proposed request if it is a result of the Contractor’s failure to pursue the Work promptly or coordinate activities properly.

1.5 The proposed request will offer the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. However, if the proposed request requires the Owner to incur additional responsibilities, including but not limited to, additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or similar considerations, then the Owner will have just cause to reject the request for Equal or Substitution.

1.6 The proposed request can receive the necessary approvals, in a timely manner, required by governing authorities having jurisdiction.

1.7 The proposed request can be provided in a manner that is compatible with the Work as certified by the Contractor.

1.8 The proposed request can be coordinated with the Work as certified by the Contractor.

1.9 The proposed request can uphold the warranties required by the Contract Documents as certified by the Contractor.

2. The Contractor's submission and the Architect's review of Submittals, including but not limited to, Samples, Manufacturer’s Data, Shop Drawings, or other such items, which are not clearly identified as a request for an Equal or Substitution, will not be considered or accepted as a valid request for an Equal or Substitution, nor does it constitute an approval.

3. Equal or Substitution Produce Request Form (Example)**:**

Connecticut DAS
Division Of Construction Services

7001
Equal or Substitute Product Request

Page 1 of 1

Request Phase Pre-Bid ☐ Post Bid ☐ *(See Article 15 Materials; Standards, General Conditions)*

(If Pre-bid only) Current Bid Due Date: _____ **Request No.:** _____ **Dated:** _____

To: **State of Connecticut**
Department of Administrative Services
Division of Construction Services

DCS Project No.: _____
Project Name / Location:

References: Specification(s): Section(s): _____ Paragraph(s): _____
Drawing(s): Drawing(s) No(s): _____ Detail(s) No(s): _____

Contractually Specified Product: _____
Contractor Proposed Product: _____

Proposed Product is : Equal ☐ Substitute: ☐ Model No.: _____

*See attached data for **both** specified and proposed products as required by Article 15 General Conditions.*

Data attached: Drawings: ☐ Product Data: ☐ Reports: ☐ Samples: ☐
Tests: ☐ Other: _____

Reason(s) for not providing the Specified Product:

Similar Installation:
Project: Architect:
Address: Owner:
Date Installed:

Will proposed substitution impact other parts of the Work? No ☐ Yes ☐ *If yes attach explanation.*
Will proposed substitution increase Contract Time? No ☐ Yes ☐ *by number of Days* _____

Actual Dollar Savings to the State of Connecticut if substitution is accepted: $ _____

The Undersigned Certifies that the proposed Request for an Equal or Substitute Product conforms to all of the requirements of Division 01 General Requirements, Section 01 25 00 Substitution Procedures.

Request Submitted By General Contractor / CMR: _____
(Firm's Typed Name)

By: _____ _____ _____ _____
(Typed Name) *(Title)* *(Signature)* *(Date)*

CONTRACTOR / CMR Send copies to DCS PM: ☐ CA: ☐

Consultant's Review – This Substitution Request is: Request Received on (Date): _____

☐ **Approved:** *(Submittals in accordance with Div. 01 General Requirements, Section 01 33 00 Submittal Procedures.)*
☐ **Approved as Noted:** *(Submittals in accordance with Div. 01 General Requirements, Section 01 33 00 Submittal Procedures.)*
☐ **Rejected:** **Use Specified Materials.**
☐ **Rejected:** **Request Not Received Within Specified Time Period - Use Specified Materials.**

Reviewed Issued By: _____ _____ _____
(Typed Name) *(Signature)* *(Date)*

CONSULTANT Send copies to: DCS PM: ☐ CA: ☐ Chief Architect ☐ Chief Engineer ☐

If Approved: As noted by Consultant,
DCS Chief Architect: _____ _____
(Signature) *(Date)*

Copies: Project File Red R2

CT DAS – 7001 (Rev: 06.25.15) **7000 – Construction Phase Forms**

01 26 00 CONTRACT MODIFICATION PROCEDURES

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Summary**

1. This Section specifies administrative and procedural requirements for handling and processing contract modifications.

C. **Related Sections:** The following Sections contain requirements that relate to this Section:

1. Division 01 Section 01 25 00 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after award of the Contract.

2. Division 01 Section 01 29 76 "Progress Payment Procedures" for administrative procedures governing Applications for Payment.

3. Division 01 Section 01 32 16 "Construction Progress Schedules" for requirements for construction scheduling and reporting progress of work.

4. Division 01 Section 01 33 00 "Submittal Procedures" for requirements for submittal of the Construction Progress Schedule.

5. Division 00 General Requirements “Article 13” “Change Orders”.

D. **Requests for Information**

1. In the event that the Contractor or subcontractor, at any tier, determines that some portion of the drawings, specifications, or other contract documents requires clarification or interpretation by the Architect, the Contractor shall submit a "Request for Information" in writing to the Architect via the Construction Administrator. "Requests for Information" may only be submitted by the Contractor and shall only be submitted on the "Request for Information" forms as required by the Owner.

1.1 In the "Request for Information", the Contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed from the Architect.

1.2 In the "Request for Information", the Contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.

1.3 The Owner acknowledges that this is a complex project. Based upon the owner’s past experience with projects of similar complexity, the Owner anticipates that there will probably be some "Requests for Information" on this project.

1.4 The Architect will review all "Requests for Information" to determine whether they are valid "Requests for Information". If it is determined that the document is not a valid "Request for Information", it will be returned to the Contractor, unreviewed as to content, for resubmittal on the proper form and in the proper manner.

1.5 A "Requests for Information Response" shall be issued within seven (7) Calendar Days of receipt of the request from the Contractor unless the Owner determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the Owner, the Owner will, within seven (7) Calendar Days of receipt of the request, notify the Contractor of the anticipated response time. If the Contractor submits a "Request for Information" on an activity with seven (7) Calendar Days or less of float on the current project schedule, the Contractor shall not be entitled to any time extension due to the time it takes the Architect to respond to the request provided that the Architect responds within the seven (7) Calendar Days set forth above.

1.6 A "Request for Information Response" from Architect will not change any requirement of the Contract Documents. In the event the Contractor believes that the "Request for Information Response" will cause a change to the requirements of the Contract Documents, the Contractor shall within seven (7) Calendar Days give written notice to the Construction Administrator stating that the Contractor believes the "Request for Information Response" will result in a "Change Order" and the Contractor intends to submit a "Change Order Proposal" request. Failure to give such written notice seven (7) Calendar

Days shall waive the Contractor's right to seek additional time or cost under the requirement these Requirements.

E. Minor Changes in The Work

1. The Architect, through the Construction Administrator, will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or Contract Time, on the "Supplemental Instructions" form as required by the Owner.

F. Proposal Request

1. **Architect/Owner-Initiated Requests for Proposals:** The Architect or Owner will issue a detailed description of proposed changes in the Work via the Construction Administrator that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications. Such requests shall be on a "Proposal Request" form as required by the Owner.

1.1 "Proposal Request" is issued for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.

1.1.1 Within **fourteen (14)** Calendar Days of receipt of a "Proposal Request", submit a "Change Order Proposal" with the required information necessary to execute the change to the Construction Administrator for the Architect's/Owner's review.

1.1.2 Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

1.1.3 Indicate applicable delivery charges, equipment rental, and amounts of trade discounts.

1.1.4 Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.

1.1.5 The Agency is tax exempt. All Contractor and Subcontractor services provided under your Contract with the State of Connecticut may not be exempt from taxes. The Department of Revenue Services can guide you as to which services are exempt and which are not. Please contact the State of Connecticut, Department of Revenue Services at 1-800-382-9463 or 860-541-3280.

1.1.6 Dollar values shown on the Schedule of Values shall not be the governing (or deciding) final amounts for change orders involving either additional charges or deletions.

G. Change Order Proposal:

1. When either a "Request for Information" from the Contractor or a "Proposal Request" from the Architect or Owner results in conditions that may require modifications to the Contract, the Contractor may propose changes by submitting a request for a "Change Order Proposal" to the Architect via the Construction Administrator on forms as required by the Owner. These forms shall also include "Change Order Proposal Worksheets" as required by the Owner.

1.1 Include statements outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.

1.2 Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities as directed by Article 13 of the General Conditions of the Contract for Construction.

1.3 Indicate applicable delivery charges, equipment rental, and amounts of trade discounts.

1.4 Comply with requirements in Division 01 Section 01 25 00 "Substitution Procedures" if the proposed change requires an equal or substitution of one product or system for a product or system specified.

1.5 The State of Connecticut construction contract has the following tax exemptions:

1.5.1 Purchasing of materials which will be physically incorporated and become a permanent part of the project.

1.5.2 Tools, supplies and equipment used in fulfilling the construction contract are not exempt.

1.5.3 Services that are resold by the contractor are exempt, i.e. if a General Contractor hires a plumber, carpenter or electrician, a resale certificate may be issued to the subcontractor because these services are considered to be integral and inseparable component parts of the building contract.

2. "Change Order Request" Forms: Use "Change Order Proposal" and "Change Order Proposal Worksheets" forms as required by Owner.

3. A "Change Order Proposal" cannot be submitted without either prior submission of a "Request for Information" from the Contractor or as a response to a "Proposal Request" submitted by the Architect or Owner.

4. Any "Change Order Request" submitted without a prior submittal of a "Request for Information" or as a response to a "Proposal Request" will be immediately rejected and returned to the Contractor.

H. Construction Change Directive:

1. "Construction Change Directive": When the Owner and the Contractor disagree on the terms of a "Change Order Proposal" resulting from either a "Request for Information" or "Proposal Request", then the Architect through the Construction Administrator may issue a "Construction Change Directive" on a "Construction Change Directive" form as authorized by the Owner. The "Construction Change Directive" instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a "Change Order".

1.1 The "Construction Change Directive" contains a complete description of the change in the Work. It also designates the method to be followed to determine change in the Contract Sum or Contract Time.

1.2 Contractor must proceed with the Work once a "Construction Change Directive" is issued.

1.3 The change in the Contract Sum and Contract Time resulting from the issuance of a "Construction Change Directive" will be based on "Time & Material" or "Unit Prices".

1.4 Issuance of "Construction Change Directive" does not guarantee payment for the Work described in the "Construction Change Directive".

2. Documentation: The Contractor shall maintain detailed records on a time and material basis of work required by the "Construction Change Directive".

2.1 After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

2.2 The final value shall be negotiated based on the supporting data to determine the value of the work.

3. Change Order Procedures:

3.1 Upon the Owner's approval of a Contractor's "Change Order Proposal", the Construction Administrator will issue a "Change Order" for signatures of the Architect, Owner and the Contractor on a "Change Order" form as required by the Owner.

01 29 76 PROGRESS PAYMENT PROCEDURES

A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Summary:

1. This Section specifies procedures for preparation and submittal of the Contractor's Applications for Payment.

2. **Related Sections:** The following Sections contain requirements that relate to this Section.

2.1 **Division 00 Notice to Bidders:** Article 10.

2.2 **General Conditions:** Articles: 27 "Schedule of Values, Application for Payment"; 28 "Partial Payments"; 31 "Final Payment"; and 32 "Owner's Right to Withhold Payments".

2.3 Division 01 Section 01 32 16 "Construction Progress Schedules" for requirements for construction scheduling and reporting progress of work.

2.4 Division 01 Section 01 33 00 "Submittal Procedures".

2.5 Division 01 Section 01 77 00 "Closeout Procedures" for requirements for Final Payment.

C. **Schedule of Values:**

1. **Coordination:** Coordinate preparation of the "Schedule of Values" with preparation of the Construction Schedule. Use "Schedule of Values" form as required by the Owner.

1.1 Submit the "Schedule of Values" to the Construction Administrator at the earliest possible date but no later than **twenty-one (21)** Calendar Days after Contract Start Date.

1.2 **Sub-schedules:** Where Work is separated into phases requiring separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

2. **Format and Content:** Use the Project Manual Table of Contents as a guide to establish the format for the "Schedule of Values". Provide at least one line item for each Specification Section on electronic media printout.

2.1 Identification: Project identification on the Schedule of Values shall include, but not be limited to, the following:

2.1.1 Owner;

2.1.2 Project Number;

2.1.3 Project Name;

2.1.4 Project Location;

2.1.5. Contractor's name and address.

2.2 Arrange the "Schedule of Values" in tabular format as required by the Owner, containing separate columns including, but not limited to, the following Items:

2.2.1 Item Number;

2.2.2. Description of Work with Related Specification Section or Division Number;

2.2.3. Scheduled Values broken down by description number, type material, units of each material.

.1 Include break down of General Condition requirements, i.e. bonds, insurance premiums, taxes, job mobilization, temporary facilities, field supervision and layout, operation and maintenance manuals, punch list activities, project record documents, demonstration and training, overhead, and profit as separate line items.

2.2.4. Name of subcontractor;

2.2.5 Name of manufacturer or fabricator;

2.2.6 Name of supplier;

2.2.7 Retainage;

2.2.8 Contract sum in sufficient detail.

3. Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

4. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the

Project Manual Table of Contents. Break principal subcontract amounts down into several line items. In addition, the following items listed below must be included.

4.1 Project Coordination (01 31 13): a lump sum of this cost for payment at the submittal of this product a minimum cost of 1/10th of one percent of the base bid total project cost or $5,000 whichever is greater.

4.2 Photographic Documentation (01 32 33): a monthly cost of $1,000 per month to be paid each month upon receipt of the photographs or forfeit of that month's payment.

4.3 Submittal Procedures (01 33 00): a lump sum payment calculated at 1/20th of 1% of the base bid total project cost upon receipt of the schedule.

4.4 As-Built Updates (01 31 00) a monthly cost, a minimum payment of $1,000 with forfeit of that monthly payment if not done.

4.5 Progress Cleaning (01 74 13): a monthly cost. A minimum payment of $1,000 to $3,000 (based on size & complexity of the project) with forfeit of that monthly payment if not done.

4.6 Starting and Adjusting (01 75 00): a lump sum cost upon completion. (to be determined by DCS Project Manager with Architect/Engineer & Construction Administrator advice).

4.7 Construction Progress Schedules (01 32 16): For the Base Schedule a lump sum payment or 40% of the total schedule budget, with the remainder paid on an even payment over the duration of the project.

5. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.

6. **Unit-Cost Allowances:** Show the line-item value of unit-cost allowances, as a product of the unit cost, multiplied by the measured quantity. Estimate quantities from the best indication in the Contract Documents.

7. **General Conditions:** Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.

7.1 Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at the Contractor's option.

D. Applications for Payment:

1. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and Construction Administrator and paid for by the Owner.

1.1 The initial "Application for Payment", the "Application for Payment" at time of "Substantial Completion", and the final "Application for Payment", involve additional requirements.

2. **Payment-Application Terms:** The Owner will process monthly progress payments. The Contractor may submit applications for payment on a monthly basis.

3. **Payment-Application Forms:** Use the "Application for Payment" form as required by the Owner. Present the required information on electronic media printout or Owner approved form; multiple pages should be used if required.

3.1 For each item, provide a column including but not limited to the following items:

3.2 Item Number.

3.3 Description of Work and Related Specification Section or Division.

3.4 Scheduled Value, break down by units of material and units of labor.

3.5 Work Completed from previous application.

3.6 Work Completed this period.

3.6.1 Materials presently stored.

3.6.2 Total Completed and stored to date of application.

3.6.3 Percentage of Completion.

3.6.4 Balance to Finish.

3.6.5 Retainage.

E. **Application Preparation:** Complete every entry on the Application form. At the time of Final Payment only, include an executed Application form by a person authorized to sign legal documents on behalf of the Contractor. The Construction Administrator will return incomplete Applications without action.

1. Entries shall match data on the "Schedule of Values".

2. Include amounts of Change Orders issued prior to the last day of the construction period covered by the application.

F. Transmittal: Except for final payment, submit to the Construction Administrator by a method ensuring receipt within ***forty-eight (48)*** hours. ***One (1)*** complete, signed and notarized original of each Application for Payment, including lien waivers and similar attachments when required, along with ***six (6)*** copies. For Final Payment, ***nine (9)*** complete, signed and notarized copies shall be submitted.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect.

G. **Applications for Payment:** Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment and all subsequent Application for Payments including, but not limited to, the following items:

1. **Subcontractor Evaluations:**

Pursuant to C.G.S. Sec. 4a-101, the General Contractor shall compile evaluation information during the performance of the contract on each of its subcontractors who are performing work with a value in excess of five hundred thousand dollars ($500,000.00). The General Contractor shall complete and submit to the DCS evaluations of each such subcontractor **upon fifty percent (50%) completion of the project and upon Substantial Completion of the project**. The General Contractor acknowledges that its failure to complete and submit these evaluations in a timely manner may, by statute; result in a delay in project funding and, consequently, payment to the General Contractor. The General Contractor agrees to indemnify and hold the State harmless from any loss, damage, or expense that results from or is caused by the General Contractor's failure to complete and submit the evaluations to DCS in accordance with this provision.

2. List of subcontractors and suppliers' name, FEIN/Social Security numbers, and Connecticut Tax Registration Numbers;

3. List of principal suppliers and fabricators;

4. Schedule of Values;

5. Contractor's Construction Schedule (preliminary if not final);

6. Schedule of principal products;

7. Submittal Schedule (preliminary if not final);

8. List of Contractor's staff assignments;

9. List of Contractor's principal consultants;

10. Copies of all applicable permits;

11. Copies of authorizations and licenses from governing authorities for performance of the Work;

12. Proof that subcontractors have been paid amounts included on the Contractor's Application for Payment within thirty (30) days after the Owner has paid the Contractor for the particular Application for Payment in accordance with Connecticut General Statute § 49-41a (a)(1).

13. Releases of Lien from subcontractors with amounts included on the Contractor's Application for Payment when Contractor has been paid by the Owner for the particular Application for Payment but the subcontractors have not been paid.

14. Proof that as-built documents are updated as required by Section 01 77 00 "Closeout Procedures."

15. Initial as-built survey and damage report, if required.

16. Update the "Contractor's Master Subcontract Agreement List" and submit copies all recently executed Subcontract Agreements in accordance with CGS § 4b-96.

16.1 The "Contractor's Master Subcontract Agreement List" shall list all Subcontract Agreements in order of Contract Sum magnitude (from high to low) in the following format:

Contractor's Master Subcontract Agreement List				
Subcontractor Name	**Minority Or Small Business Designation**	**Trade**	**Address**	**Contract Sum**

17. In accordance with 42-158j (b):
Each payment requisition submitted shall include a statement showing the status of all pending construction change orders, other pending change directives and approved changes to the original contract or subcontract. Such statement shall identify the pending construction change orders and other pending change directives, and shall include the date such change orders and directives were initiated, the costs associated with their performance and a description of any work completed. As used in this section, "pending construction change order" or "other pending change directive" **means an authorized directive for extra work that has been issued to a contractor or a subcontractor and identified by an official Change Order Number or Construction Change Directive Number assigned by the State of Connecticut**.

H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion submit an Application for Payment form; use the form as required by the Owner. Present the required information on electronic media printout as applicable that include, but are not limited, to the following:

1. Subcontractor Evaluations:

Pursuant to C.G.S. Sec. 4a-101, the General Contractor shall compile evaluation information during the performance of the contract on each of its subcontractors who are performing work with a value in excess of five hundred thousand dollars ($500,000.00). **The General Contractor shall complete and submit to the DCS evaluations of each such subcontractor upon fifty percent (50%) completion of the project and upon Substantial Completion of the project.** The General Contractor acknowledges that its failure to complete and submit these evaluations in a timely manner may, by statute; result in a delay in project funding and, consequently, payment to the General Contractor. The General Contractor agrees to indemnify and hold the State harmless from any loss, damage, or expense that results from or is caused by the General Contractor's failure to complete and submit the evaluations to DCS in accordance with this provision.

2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

3. Administrative actions and submittals that shall precede or coincide with this application include, but are not limited to, the following:

3.1 Occupancy permits and similar approvals;

3.2 Warranties (guarantees) and maintenance agreements;

3.3 Test/adjust/balance records;

3.4 Maintenance instructions;

3.5 Meter readings;

3.6 Startup performance reports;

3.7 Changeover information related to Owner's occupancy, use, operation, and maintenance;

3.8 Final cleaning;

3.9 Application for reduction of retainage and consent of surety;

3.10 Advice on shifting insurance coverage;

3.11 Final progress photographs;

3.12 List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.

I. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include, but are not limited, to the following:

1. Completion of Project Closeout requirements.

2. Completion of list of items remaining to be completed as indicated on the attachment to the Certificate of Substantial Completion.

3. Ensure that unsettled claims will be settled.

4. Ensure that incomplete Work is not accepted and will be completed in accordance with a schedule prepared by the Contractor which is acceptable to the Owner.

5. Transmittal of required Project construction records to the Owner (including as-built documents specified in Section 01 77 00 "Closeout Procedures").

6. Certified property survey.

7. Proof that taxes, fees, and similar obligations were paid.

8. Removal of temporary facilities and services.

9. Removal of surplus materials, rubbish, and similar elements (Reference Section 01 74 19 "Construction Waste Management & Disposal").

10. Change of door locks to Owner's access.

11. The requirements of the General Conditions and Supplementary Conditions for Final Acceptance, Final Completion, Final Inspection, and Final Payment.

12. Asbestos, lead or other hazardous material manifests.

13. Completion of "Contractor Reporting Form" as supplied by DCS, for all Contractors, Subcontractors, Vendors, Suppliers, etc. who work on the Contract. The form includes the following information:

13.1 Contractor/Subcontractor name.

13.2 FEIN/Social Security Numbers

13.3 Connecticut Tax Registration Numbers

13.4 Type of work

13.5 Name of business and address

13.6 Remittance address.

END OF SECTION

i:\976710\02 design\specs\012000_contractconsiderations_dbb_minor_capital.docx

01 30 00 ADMINISTRATIVE REQUIREMENTS

A. **Summary:** Section 01 30 00 Administrative Requirements contains the following Subsections:

01 31 13	**Project Coordination**	**Not Used** ☐
01 31 19	**Project Meetings**	**Not Used** ☐
01 32 16	**Construction Progress Schedules**	**Not Used** ☐
01 32 33	**Photographic Documentation**	**Not Used** ☐
01 33 00	**Submittal Procedures**	**Not Used** ☐
01 35 16	**Alteration Project Procedures**	**Not Used** ☐
01 35 19	**Confined Space Entry**	**Not Used** ☐
01 35 53	**Security Procedures**	**Not Used** ☐

01 31 13 PROJECT COORDINATION

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Related Sections:** The following Sections contain requirements that relate to this section.

1. **Section 01 29 76 "Progress Payment Procedures"** submission of Schedule of Values and Applications for payment.

C. **Construction Administrator:**

1. The Construction Administrator is identified in Division 01 **Section 01 12 19 "Contract Interface".**

2. **Construction Mobilization:**

2.1 Cooperate with the Construction Administrator in the allocation of mobilization areas of the site, for field offices and sheds, for agency facility access, traffic, and parking facilities.

2.2 During Construction, coordinate use of site and facilities through the Construction Administrator.

2.3 Comply with Construction Administrators procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

2.4 Comply with instructions of the Construction Administrator for use of temporary utilities and construction facilities.

2.5 Coordinate field engineering layout as specified in Division 01 **Section 01 71 23 "Field Engineering"** for work under the instructions of the Construction Administrator.

D. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.

3. Make provisions to accommodate items scheduled for later installation.

E. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Construction Administrator, Owner and separate contractors where coordination of their work is required.

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

1. Preparation of schedules.

2. Installation and removal of temporary facilities.

3. Delivery and processing of submittals.

4. Progress meetings.

5. Project closeout activities.

G. General Coordination Provisions:

1. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed and coordinate such inspections with the Construction Administrator and authorities having jurisdictions. If unsatisfactory conditions exist notify the Construction Administrator immediately. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

2. The Contractor shall coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

2.1 Coordination Drawings:

2.1.1 The HVAC Subcontractor will initiate Mylar at 1/4" scale drawings done on AutoCAD showing ducts and piping in plan and section. Sheet metal shop drawings must be approved prior to starting coordination drawings.

2.1.2 The Sprinkler Subcontractor will then superimpose his piping layout on the tracing.

2.1.3 The Electrical subcontractor will superimpose all the electrical information on the tracing. Said information to include but not necessary limited to cable trays, equipment, lighting, conduits, bus duct, etc.

2.1.4 The sprinkler subcontractor will complete the coordination drawing by drawing his piping (include pitch) on the tracing.

2.1.5 The Construction Administrator will review the completed coordination drawing for general compliance and then submit it to the Architect for his review. All subcontractors shall rework the Mylar drawings until all systems are properly coordinated.

3. The Construction Administrator will meet with the Contractor on all major items of coordination.

4. See also **Division 00 General Conditions, Article 7 "Cooperation of Trades".**

01 31 19 PROJECT MEETINGS

A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Pre-construction Conference:

1. The Contractor will attend a Pre-construction Conference before starting construction, as scheduled by the Construction Administrator convenient to the Owner, the Construction Administrator, Architect, and Contractor. This meeting will take place within **fourteen (14)** Calendar Days after the written Notice to Proceed and before the Contract Start Date. Hold the conference at the Project Site or another convenient location as directed by the Construction Administrator. The Construction Administrator shall conduct the Pre-construction Conference to review the Contractor and Subcontractor responsibilities and personnel assignments.

2. Attendees: Authorized representatives of the Construction Administrator, Owner, Architect, and their consultants; the Contractor and its superintendent; major subcontractors; agency; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect progress, including the following:

3.1 Tentative construction schedule;

3.2 Critical work sequencing;

3.3 Progress meeting schedule;

3.4 Designation of responsible personnel;

3.5 Procedures for processing field decisions and Change Orders;

3.6 Procedures for processing Applications for Payment;

3.7 Distribution of Contract Documents;

3.8 Submittal of Shop Drawings, Product Data, and Samples;

3.9 Preparation of record documents;

3.10 Use of the premises;

3.11 Parking availability;

3.12 Office, work, and storage areas;

3.13 Equipment deliveries and priorities;

3.14 Safety procedures;

3.15 First aid;

3.16 Security;

3.17 Housekeeping;

3.18 Working hours;

3.19 Coordination with Audio-Visual and Telecommunications.

C. Progress Meetings:

1. The Construction Administrator will conduct progress meetings, bi-weekly, at the Project Site or at regular intervals as agreed upon at the Pre-construction Conference. The Construction Administrator will notify the Owner, the Architect, and the Contractor of the scheduled Progress Meeting dates. Coordinate dates of Progress Meetings with preparation of Application for Payment requests.

2. **Attendees:** In addition to representatives of the Contractor, Construction Administrator, Owner and the Architect, subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities may be requested to attend these meetings on an as needed basis. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work. The Contractor shall include the site superintendent as a minimum.

3. **Agenda:** Progress Meetings shall review and correct or approve minutes of the previous Progress Meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.

3.1 **Construction Schedule:** Review progress since the last Progress Meeting. Determine where each activity is in relation to the required Contractor's "Construction Schedule" and whether each activity is on time or ahead or behind Schedule. Determine how Work that is behind Schedule will be expedited; secure commitments from parties involved to do so. Discuss whether Schedule revisions are required to insure that current and subsequent activities will be completed within the Contract Time.

3.2 Review the present and future needs of each entity present

4. **Reporting:** The Construction Administrator will distribute minutes of the meeting to each party present, promptly and before the next scheduled meeting, and to parties who should have been present.

5. A schedule of regular Project Meetings will be established at the Pre-construction Conference.

01 32 16 CONSTRUCTION PROGRESS SCHEDULES

A. Related Documents

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Summary

1. This Section includes administrative and procedural requirements for the preparation, submittal, and updating of the Contractor's construction schedules and reporting progress of the Work.

1.1. Refer to the General Conditions and the Agreement for definitions and specific dates of Contract Time.

2. This Section includes the following:

2.1. Format.

2.2. Content.

2.3. Revisions to schedules.

2.4. Submittals.

2.5. Distribution.

3. **Related Sections**: The following Sections contain requirements that relate to this Section:

3.1 Division 01 Section 01 29 76 "Progress Payment Procedures" specifies requirements for submitting Schedule of Values and Application for Payments.

3.2 Division 01 Section 01 31 19 "Project Meetings" specifies requirements for submitting and distributing meeting and conference minutes.

3.3 Division 01 Section 01 33 00 "Submittal Procedures" specifies requirements for submitting the Submittal Schedule.

3.4 Division 01 Section 01 45 00 "Quality Control" specifies requirements for submitting inspection and test reports.

3.5 Division 01 Section 01 60 00 "Product Requirements" specifies requirements for submitting the list of products.

C. Definitions

1. **Construction Schedule:** A method of planning and scheduling a construction project utilizing a horizontal bar chart with a separate bar for each major portion of the Work or operation to make the schedule an effective tool for planning and monitoring the progress of the work.

D. Quality Assurance

1. **The Contractor's Consultant:** Retain a consultant to provide planning, evaluating, and reporting by CPM scheduling.

1.1. **In-House Option:** The Owner may waive the requirement to retain a consultant if the Contractor can demonstrate that:

1.1.1. The Contractor has the computer equipment required to produce construction schedules.

1.1.2. The Contractor employs skilled personnel with experience in construction scheduling and reporting techniques.

1.2. **Program:** Use **Microsoft Project** latest version.

1.3. **Standards:** Comply with procedures contained in AGC's "Construction Planning & Scheduling."

E. Preliminary Schedule

1. Preliminary Gantt schedule is to be prepared by the General Contractor and submitted to the Construction Administrator within **seven (7)** days of award of contract. This schedule is to cover all items of Work from the start of the project up to the completion of the project. This schedule must be revised when the actual schedule of significant items varies more than one week from the proposed schedule.

F. Construction Schedule Format

1. **Format:** Utilize a horizontal bar chart (Gantt) with a separate bar for each major portion of the Work or operation, identifying first work day of each week.

2. **Program:** Use **Microsoft Project**, latest version.

3. **Sequence of Listings:** Utilize the Table of Contents of this Project Manual and the chronological order **of the start of each item of work.**

4. **Scale and Spacing:** Provide space for notations and revisions.

5. **Sheet Size:** To be coordinated with Construction Administrator.

6. **Weather Days Allowance:** The Contractor shall include as a separate identifiable activity on the Critical Path of the Construction Schedule, and activity labeled "Weather Days Allowance." Insert this activity immediately prior to the substantial completion milestone.

6.1 The Contractor shall be fully responsible for determining the number of weather delay days to be included in the Construction Schedule. This determination shall be based on the normal anticipated weather for the project location and the nature of the project work. The Construction Schedule shall be based on the contractor's determined weather delay allowance., The weather delay activity shall be included in the construction schedule immediately prior to the Substantial Completion milestone.

6.2 The minimal allowed duration of the Weather Days Allowance shall be calculated as follows (decimals rounded to nearest whole number):

$$\frac{\text{Contract Time}}{365} \text{ multiplied by } 7 \text{ equals } \text{Weather Days Allowance}$$

290 multiplied by 7 equals *6*

6.3 The Contractor shall insert an activity in the Critical Path of the Construction Schedule to reflect weather day occurrences when weather days are experienced and accepted by the Owner. Identify this activity as a weather delay.

6.4 The Contractor shall reduce duration of Weather Days Allowance activity as weather delays are experienced and inserted into the schedule. Remaining weather days in Weather Day Allowance at completion of project is considered float. Weather delay, when justified, are considered allowable, non-compensable.

G. Content

1. Show complete sequence of construction by activity, with dates beginning and completion of each element of construction.

2. Identify each item by specification section numbers.

3. Identify work of separate phases and other logically grouped activities.

4. Show accumulated percentages of completion of each item, and total percentage of Work completed, as of the **first** day of each month.

5. Provide separate schedule of submittal dates for shop drawings, product data, and samples, Owner/Agency furnished products and any products identified as under Allowances, and dates reviewed submittals will be required from Architect/Engineer. Indicate decision dates for selection of finishes.

6. Indicate delivery dates for Owner/Agency furnished products and any products identified as under Allowances.

7. Indicate critical path with original baseline indicated.

8. Coordinate content with Schedule of Values specified in Section 01 29 76 "Progress Payment Procedures."

H. Submittals and Revisions to Schedules

1. An initial bar graph schedule is to be prepared by the General Contractor and submitted to the Construction Administrator. Refer to Article 1.5.

2. Indicate progress of each activity to date of submittal, and projected completion date of each activity.

3. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.

4. Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect.

5. Schedules must be revised monthly and when the actual schedule of significant items varies more than **seven (7) days** from the proposed schedule.

6. Submit revised Construction Schedules for each Application for Payment.

7. Submit **four (4)** copies of the Construction Schedule to the Construction Administrator.

I. Distribution

1. Distribute copies of the Construction Schedules to Construction Administrator, Architect, Owner, Subcontractors, suppliers, and other concerned parties.

2. Instruct recipients to promptly report, in writing, problem anticipated by projections indicated in schedules.

01 32 33 PHOTOGRAPHIC DOCUMENTATION

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Related Sections:** The following Sections contain requirements that relate to this section

1. **Section 01 29 76 "Progress Payment Procedures"** submission of Schedule of Values and Applications for payment.

C. On the date the work is begun and every **thirty (30)** days thereafter (typically at the end of the month- until the work is at least 95 percent complete), the Contractor shall have photographs of the construction taken by a professional photographer or an individual approved by the Owner.

D. Photographs: Provide a digital camera to take ***twenty-four (24)*** or more photos each time. Deliver 1 sets of photo files on CD-ROM and one set of prints to the Construction Administrator for DCS. Label each CD-ROM with project name and the date the photographs were taken. With each submittal provide an index sheet of digital photos and where the photos were taken.

E. As photographs are a record of the work progress, they shall be taken each month, whether or not they show work done during the preceding month. Deliver digital photos to the Construction Administrator within ***ten (10)*** Calendar Days of their taking.

01 33 00 SUBMITTAL PROCEDURES

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Summary**

1. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including but not limited to the following:

1.1 Submittal schedule.

1.2 Shop Drawings.

1.3 Product Data.

1.4 Samples.

1.5 Quality assurance submittals.

1.6 Proposed "Substitutions/Equals".

1.7 Warrantee samples.

1.8 Coordination Drawings.

1.9 O & M Manuals

C. **Administrative Submittals:** Refer to other Division 01 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Permits.

2. Applications for Payment.

3. Performance and payment bonds.

4. Contractor's construction schedule.

5. Daily construction reports.

6. Construction Photographs.

7. Insurance certificates.

8. List of subcontractors.

9. Subcontractors/Suppliers FEIN #'s and Connecticut tax registration #.

D. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 01 Section 01 25 00 "Substitution Procedures" specifies requirements for submittal of requests for equals and substitutions.

2. Division 01 Section 01 29 76 "Progress Payment Procedures" specifies requirements for submittal of the Schedule of Values.

3. Division 01 Section "Project Coordination" 01 31 13 for Project Coordination documents.

4. Division 01 Section 01 31 19 "Project Meetings" specifies requirements for submittal and distribution of meeting and conference minutes.

5. Division 01 Section 01 32 16 "Construction Progress Schedules" for requirements for construction scheduling and reporting progress of work.

6. Division 01 Section 01 32 33 "Photographic Documentation" specifies requirements for submittal of periodic construction photographs.

7. Division 01 Section 01 45 00 "Quality Control" specifies requirements for submittal of inspection and test reports and mockups.

8. Division 01 Section 01 77 00 "Closeout Procedures" specifies requirements for submittal of Project Record Documents and warranties at project closeout.

9. Division 01 Section 01 78 30 "Warranties and Bonds".

E. Definitions

1. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended and as identified in the Specification Divisions 02 through 49.

1.1 Preparation of Coordination Drawings is specified in Division 01 Section 01 31 13 "Project Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.

2. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

3. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

F. Submittal Procedures

1. **Coordination:** Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1.1 Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

1.2 Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

1.2.1 The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

1.2.2 The Architect reserves the right to reject incomplete submitted packages.

1.3 **Processing:** To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for re-submittals.

1.3.1 Allow **fourteen (14)** calendar days for initial review. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals.

1.3.2 If an intermediate submittal is necessary, process the same as the initial submittal.

1.4 Allow **fourteen (14)** calendar days for reprocessing each submittal.

1.5 No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

2. **Submittal Preparation:** Place a permanent label, title block or ***8-1/2" x 11"*** cover page approved by the Architect, on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

2.1 The minimum number of copies required for each submittal shall be ***seven (7)*** or as determined otherwise at the pre-construction conference or by the Construction Administrator.

2.2 Provide a space approximately ***4" x 5"*** on the label, beside the title block or on the cover page on Shop Drawings to record the Contractor's review and approval markings and the action taken.

2.3 Include the following information on the label for processing and recording action taken.

2.3.1 ***Project Name and State of Connecticut Project Number.***

2.3.2 ***Date.***

2.3.3 ***Name and address of the Architect, Construction Administrator, and Owner Representative.***

2.3.4 ***Name and address of the Contractor.***

2.3.5 ***Name and address of the subcontractor.***

2.3.6 ***Name and address of the supplier.***

2.3.7 ***Name of the manufacturer.***

2.3.8 ***Number and title of appropriate Specification Section.***

2.3.9 ***Drawing number and detail references, as appropriate.***

2.3.10 ***Indicate either initial or resubmittal.***

2.3.11 ***Indicate deviations from Contract Documents.***

2.3.12 ***Indicate if "equal" or "substitution".***

3. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect using a transmittal form. Copy the Construction Administrator on the transmittal. The Architect will return all submittals to the Contractor after action is taken with a complete copy of the submittal package and one complete copy of the submittal package. The Architect will not accept submittals received from sources other than the Contractor.

3.1 On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

G. **Submittal Schedule:**

1. After development and review by the Owner and Architect acceptance of the Contractor's Construction or CPM schedule prepare a complete schedule of submittals. Submit the schedule to the Construction Administrator within **thirty (30)** Calendar Days of Contract Award.

1.1 Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction or CPM Schedule.

1.2 Prepare the schedule in chronological order. Provide the following information:

1.2.1 Schedule date for the initial submittal.

1.2.2 Related section number.

1.2.3 Submittal category (Shop Drawings, Product Data, or Samples).

1.2.4 Name of Subcontractor.

1.2.5 Description of the part of Work covered.

1.2.6 Scheduled date for resubmittal.

1.2.7 Scheduled date for the Architect's final release of approval.

2. **Submittal Schedule:** Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.

2.1 Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

2.2 Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

2.3 Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

2.3.1 Submit revised submittal schedule to reflect changes in current status and timing for submittals.

3. **Coordination:** Coordinate preparation and processing of submittals with performance of construction activities.

3.1 Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

3.2 Submit all submittal items required for each specification section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.

3.3 Submit action submittals and informational submittals required by the same specification section as separate packages under separate transmittals.

3.4 Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

3.4.1 ***Architect reserves*** the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

3.5 **Processing Time:** Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on ***Architect's*** receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

3.5.1 **Initial Review:** Allow **fourteen (14)** Calendar Cays for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. **Architect** will advise Contractor when a submittal being processed must be delayed for coordination with related submittals not yet received. Additional time will be required if processing must be delayed to permit review of related subsequent submittals.

3.5.2 **Intermediate Review:** If intermediate submittal is necessary, process it in same manner as initial submittal.

3.5.3 **Resubmittal Review:** Allow **fourteen (14)** Calendar Days for review of each resubmittal.

3.5.4 **Mass Submittals:** ***Six (6)*** or more submittals in ***one (1)*** Calendar Day or ***twenty (20)*** or more submittals in ***seven (7)*** Calendar Days. If "Mass Submittals" are received, Architect's review time stated above may be extended as necessary to perform proper review. Architect will review "Mass Submittals based upon priority determined by Architect after consultation with Owner and Contractor.

3.6 **Distribution:** Following response to the initial submittal, print and distribute copies to the Construction Administrator, Architect, Owner, subcontractors,

and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

3.6.1 When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

3.7 **Schedule Updating:** Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

H. Daily Construction Reports

1. Prepare a daily construction report recording the following information concerning events at the site, and submit duplicate copies to the Construction Administrator at weekly intervals:

1.1 List of subcontractors at the site.

1.2 Approximate count of personnel at the site.

1.3 High and low temperatures, general weather conditions.

1.4 Accidents and unusual events.

1.5 Meetings and significant decisions.

1.6 Stoppages, delays, shortages, and losses.

1.7 Meter readings and similar recordings.

1.8 List of equipment on site and identify if idle or in use.

1.9 Orders and requests of governing authorities.

1.10 Change Orders received, start and end dates.

1.11 Services connected, disconnected.

1.12 Equipment or system tests and startups.

1.13 Partial Completion's, occupancies.

1.14 Substantial Completion's authorized.

1.15 Equals or Substitutions approved or rejected.

I. Shop Drawings

1. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

2. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:

2.1 Dimensions.

2.2 Identification of products and materials included by sheet and detail number.

2.3 Compliance with specified standards.

2.4 Notation of coordination requirements.

2.5 Notation of dimensions established by field measurement.

2.6 Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least ***8-1/2" x 11"*** but no larger than ***36" x 48"***.

2.6.1 Submit ***one (1)*** reproducible media and ***seven (7)*** prints as directed by the Construction Administrator. The Contractor's submittal shall identify the specification section and/or drawing number applicable to the submittal.

2.6.2 Details shall be large scale and/or full size.

3. The Contractor shall review the Shop Drawings, stamp with this approval, and submit them with reasonable promptness and in orderly sequence so as to cause no delay in his Work or in the Work of any subcontractor. Shop Drawings shall be properly identified as specified for item, material, workmanship, and project number. At the

submission, the Contractor shall inform the Architect, in writing of any deviation in the shop drawings from the requirements of the Contract Documents.

4. The Architect will review and comment on shop drawings with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the project and with the information given in the Contract Documents. Refer to Article 5 of the General Conditions. Shop Drawings received by the Architect that indicate insufficient study of drawings and specifications, illegible portions or gross errors, will be rejected outright. Such rejections shall not constitute an acceptable reason for granting the Contractor additional time to perform the work.

5. The Contractor shall make any corrections required by the Architect and shall resubmit the required number of corrected copies of Shop Drawings until fully reviewed.

6. Upon final review submit ***four (4)*** additional prints, same as submitted, for use by the Construction Administrator.

7. The Architect's review and comments on Shop Drawings shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents.

8. Only final reviewed Shop Drawings are to be used on the Project site.

9. The Work installed shall be reviewed in accordance with the Shop Drawings and the drawings and specifications. Final Review of the Shop Drawings by the Architect shall constitute acceptance by the State and the Architect of a variation or departure that is **clearly identified**. If the contractor believes notations made by the Architect/Engineer increases the value or scope of the CD's, the contractor must provide written notice to the Construction Administrator within seven (7) days of this issue. Final reviewed Shop Drawings shall not replace or be used as a vehicle to issue or incorporate change orders or substitutions. Substitutions shall be submitted in accordance with Division 01 Section 01 25 00 "Substitution Procedures".

J. Shop Drawing For Fire Protection Systems

1. Shop drawings for fire protection systems shall comply with all of the requirements in the section above "Shop Drawings" In addition Sprinkler system shop drawings and hydraulic calculations must be stamped by a professional engineer licensed in the State of Connecticut and must include the DCS project number. **Two (2)** sets of information [as noted in this Section 01 33 00 "Submittal Procedures"] shall be submitted to the State's Insurance Carrier (SIC), and **one (1)** set shall be submitted to the Office of State Fire Marshal (OSFM):

1.1 Office of State Fire Marshal:
CT Department of Administrative Services
Division of Construction Services
Office of State Fire Marshal
165 Capitol Ave, Room 258
Hartford, CT 06106
Phone: (860) 713-5750

1.2 State Insurance Carrier (SIC):
FM Global Factory Mutual Insurance Company
P.O. Box 9102
500 River Ridge Drive
Norwood, MA 02062
Tel: (781) 440-8000 or FAX (781) 440-8742
Contact: Costa Terzides (781) 440-8204 or Jeannette Dantona (781) 440-8245

2. Before the shop drawings are submitted to SIC or OSFM, the Architect/Engineer's fire protection consultant must review the sprinkler design for compliance with the code, OSFM, and FM Global requirements.

2.1 The State Insurance Carrier (SIC) requires **two (2)** weeks prior notice of a sprinkler system acceptance test.

K. Product Data

1. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, schedules, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

1.1 Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:

1.1.1 Manufacturer's printed recommendations.

1.1.2 Compliance with trade association standards.

1.1.3 Compliance with recognized testing agency standards.

1.1.4 Application of testing agency labels and seals.

1.1.5 Notation of dimensions verified by field measurement.

1.1.6 Notation of coordination requirements.

1.2 Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

1.3 **Preliminary Submittal:** Submit a preliminary single copy of Product Data where selection of options is required.

1.4 **Submittals:** Submit ***seven (7)*** copies of each required submittal; submit ***five (5)*** copies where required for maintenance manuals. The Architect will retain ***one (1)*** and will return the other marked with action taken and corrections or modifications required.

1.4.1 Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

1.5 **Distribution:** Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.

1.5.1 Do not proceed with installation until a copy of Product Data is in the Installer's possession.

1.5.2 Do not permit use of unmarked copies of Product Data in connection with construction.

L. Samples

1. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.

1.1 Store, mount or display Samples on site in the manner to facilitate review of qualities indicated. Prepare Samples to match the Architect's sample. Include the following:

1.1.1 Specification Section number and reference.

1.1.2 Generic description of the Sample.

1.1.3 Sample source.

1.1.4 Product name or name of the manufacturer.

1.1.5 Compliance with recognized standards.

1.1.6 Availability and delivery time.

1.2 Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

1.2.1 Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least ***three (3)*** multiple units that show approximate limits of the variations.

1.2.2 Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

1.2.3 Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at

time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.

1.2.4 Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.

1.3 **Preliminary Submittals**: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices, unless otherwise noted in specification section.

1.3.1 The Architect will review and return preliminary submittals with the Architects notation, indicating selection and other action.

1.4 **Submittals:** Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit ***three (3)*** sets. The Architect will return ***one (1)*** set marked with the action taken.

1.5 Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.

1.5.1 Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

1.5.2 Sample sets may be used to obtain final acceptance of the construction associated with each set.

2. **Distribution of Samples:** Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

2.1 Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.

2.1.1 Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

M. **Quality Assurance Submittals**

1. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

2. **Certifications:** Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

2.1 Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

3. **Inspection and Test Reports:** Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 01 Section 01 45 00 "Quality Control."

N. **Architect's Action:**

1. Except for submittals for the record or information, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return promptly.

1.1 Compliance with specified characteristics is the Contractor's responsibility.

2. **Action Stamp:** The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:

2.1 **Final Unrestricted Release:** When the Architect marks a submittal "Approved for fabrication," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.

2.2 **Final-But-Restricted Release:** When the Architect marks a submittal "Incorporate Notations," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Submit corrected copies for record. Final payment depends on that compliance.

2.3 **Returned for Resubmittal:** When the Architect marks a submittal "Rejected, or Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

2.3.1 Do not use, or allow others to use, submittals marked "Rejected, or Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.

2.4 **Other Action:** Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal marked "Action Not Required."

3. **Unsolicited Submittals:** The Architect will discard unsolicited submittals without action.

01 35 16 ALTERATION PROJECT PROCEDURES

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Summary**

1. This Section includes administrative and procedural requirements for performing alteration and renovation Work.

2. **Related Sections:** The following Sections contain requirements that relate to this Section:

2.1 Division 01 Section 01 31 13 "Project Coordination" for procedures for coordinating cutting and patching with other construction activities.

2.2 Division 01 Section 01 73 29 "Cutting and Patching" for procedures for cutting and patching.

2.3 Division 02 Section 02 41 19 "Selective Structure Demolition" for demolition of selected portions of the building for alterations.

2.4 Refer to other Sections for specific requirements and limitations applicable to performing alteration Work with individual parts of the Work.

2.5 Requirements of this Section apply to mechanical and electrical installations. Refer to Division 21, 22, 23 and 26 Sections for other requirements and limitations applicable to renovation Work by mechanical and electrical installations.

C. **Products For Patching And Extending Work:**

1. **New Materials:** As specified in product sections; match existing Products and Work for patching and extending Work.

2. **Type and Quality of Existing Products:** Determine by inspecting and testing Products where necessary, referring to existing Work as a standard.

D. **Inspection**

1. **General:**

1.1 Verify that demolition is complete and areas are ready for installation of new Work.

1.2 Beginning of restoration Work means acceptance of existing conditions.

2. **Project Procedures for Work Involving <u>Lead Containing Material (LBP)</u>:**

2.1 Exposure levels for lead in the construction industry are regulated by 29 CFR 1926.62. Construction activities disturbing surfaces containing lead-based paint (LBP) which are likely to be employed, such as sanding, grinding, welding, cutting, and burning, have been known to expose workers to levels of lead in excess of the Permissible Exposure Limit (PEL). Conduct demolition and removal Work specified in the technical sections of this specification in conformance with these regulations. In addition, construction debris/waste may be classified as hazardous waste. Disposal of hazardous waste material shall be in accordance with 40 CFR Parts 260 through 271 and Connecticut Hazardous Waste Management Regulations Section 22a-209-1; 22a-209-8(c); 22a-449(c)-11; and 22a-449(c)-100 through 110.

2.2 The Contractor's Work shall be based on a child under the age of six (6) in residence; the Work shall also be in accordance with Connecticut Regulations Section 19a-111-1 through 11.

2.3 This facility was constructed prior to 1978 and is likely to have painted surfaces containing lead-based paint.

2.4 In accordance with the United States Environmental Protection Agency's (EPA) Lead-Based Paint Renovation, Repair, and Painting Program (RRP) issued by the EPA on April 22, 2008 and regulated by 40 CFR 745, contractors performing renovation, repair and painting projects that disturb lead-based paint in homes, child care facilities, and schools built before 1978 must be certified and must follow specific work practices to prevent lead contamination. EPA requires that firms performing renovation, repair, and painting projects that disturb lead-based paint in pre-1978 homes, child care facilities and schools be certified by EPA and that they use certified renovators who are trained by EPA-approved training providers to follow lead-safe work practices. The Contractor must be a Renovation Firm that has completed an EPA Lead-Safe Certification Program and be certified to conduct lead-based paint activities and renovations under the RRP rule. The Contractor shall have at least one "Certified Renovator" assigned to jobs where LBP is disturbed.

2.5 Testing for lead-based paint has been conducted at the facility scheduled for renovation, demolition, reconstruction, alteration, remodeling, or repair. Results of the LBP testing are for information purposes only. The results are in **Section 00 30 00 Available Information**. Under no circumstance shall this information be the sole means used by the Contractor for determining the extent of LBP. The Contractor shall be responsible for verification of all field conditions affecting performance of the Work.

3. Project Procedures for Work Involving <u>Asbestos Containing Material (ACM):</u>

3.1 The Owner is responsible for abating all ACM that is visible and accessible. This is to be accomplished through a separate project prior to the start of the renovation project. In demolition projects, every attempt should by the owner to remove all ACM.

3.2 If the Contractor should encounter any material suspect or known to contain ACM, he should immediately notify the Construction Administrator of same. It is the State's responsibility to have the material tested and abated (if necessary). The Owner will respond within ***twenty-four (24*)** hours after receiving the Contractor's written request to the Construction Administrator for testing the suspect material. The Owner will abate ACM (if necessary) within a reasonable time period, i.e. within **seven (7)** Calendar Days.

3.3 Testing for asbestos has been conducted at the facility scheduled for renovation, demolition, reconstruction, alteration, remodeling, or repair. Results of the asbestos testing are for information purposes only. The results are in **Section 00 30 00 Available Information**. Under no circumstance shall this information be the sole means used by the Contractor for determining the extent of asbestos. The Contractor shall be responsible for verification of all field conditions affecting performance of the Work.

3.4 See also Division 00 General Conditions, Article 23 "Cutting, Fitting, Patching, and Digging".

4. Project Procedures for Work Involving Products Containing Persistent Bioaccumulative Toxic Chemicals" (PBT's) such as Polychlorinated Biphenols (PCB's), Di-2-ethylhexyl Phthalate (DEHP), and Mercury:

4.1 The Contractor is responsible for abating all PCB's, DEHP, and mercury prior to the start any work involving construction, renovation or demolition (if necessary).

4.2 Exposure Levels for Products Containing Persistent Bioaccumulative Toxic Chemicals (PBT's) such as PCB's. DEHP, and mercury in the construction industry is regulated by 29CFR1910.1200 and 29CFR1926.28 et. al. Construction, renovation or demolition activities disturbing Products Containing Persistent Bioaccumulative Toxic Chemicals" (PBT's) such as PCB's and DEHP which are likely to be employed. These materials include but are not limited to fluorescent light fixture & exit sign, ballast's, high density discharge (HID) lamps, and certain types of construction products containing

vinyl, and mercury containing electrical switches and thermostats. These activities may expose workers in excess of the respective Permissible Exposure Limit (PEL). Conduct demolition and removal Work specified in the technical sections of these specifications in conformance with these regulations. In addition, construction debris/waste may be classified as hazardous waste. Disposal of all hazardous materials shall be in accordance with but not limited to 40CRF Parts 761 Subpart K, 761, and 761.65 and the Connecticut General Hazardous Waste Statute Sec. 22a-454.

4.3 A Survey for Products Containing Persistent Bioaccumulative Toxic Chemicals (PBT's) such as PCB's, DEHP and Mercury has **NOT** been conducted at the facility. Examples include but are not limited to fluorescent light fixture & exit sign, ballast's, high density discharge(HID) lamps, and certain types of construction products containing vinyl, and mercury containing electrical switches and thermostats. It is the Contractors responsibility for verification of all material and field conditions prior to construction, renovation, and demolition that may affect the performance of their Work.

E. Preparation:

1. Cut, move, or remove items as are necessary for access to alterations and renovation Work. Replace and restore at completion.

2. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

3. Remove debris and abandoned items from area and from concealed spaces.

4. Prepare surface and remove surface finishes to provide for proper installation of new Work and finishes.

5. Close openings in exterior surfaces to protect existing Work and salvage items from weather and extremes of temperature and humidity. Insulate ductwork and piping to prevent condensation in exposed areas.

F. Installation:

1. Coordinate Work of alterations and renovations to expedite completion and if required sequence Work to accommodate Owner occupancy.

2. Remove, cut and patch Work in a manner to minimize damage and to provide restoring Products and finishes to original and or specified condition in accordance with **Section 01 73 29 "Cutting and Patching".**

3. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with neat transition to adjacent finishes in accordance with **Section 01 73 29 "Cutting and Patching".**

4. In addition to specified replacement of ***equipment*** and ***fixtures***, restore existing ***plumbing***, ***heating***, ***ventilation***, ***air conditioning***, ***electrical***, systems to full operational condition.

5. Recover and refinish Work that exposes mechanical and electrical Work exposed accidentally during the Work.

6. Install Products as specified in individual sections.

G. Transitions:

1. Where new Work abuts or aligns with existing, perform a smooth and even transition. Patch work to match existing adjacent Work in texture and appearance.

2. When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect/Engineer.

H. Adjustments:

1. Where removal of partitions or walls result in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.

2. Where a change of plane of ***1/4"*** in ***12"*** or more occurs, request recommendation from Architect/Engineer for providing a smooth transition.

3. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.

4. Fit Work at penetrations of surfaces as specified in Section 01045 “Cutting and Patching”.

I. Repair of Damaged Surfaces:

1. Patch or replace portions of existing surfaces that are damaged, lifted, discolored, or showing imperfections.

2. Repair substrate prior to patching finish.

J. Finishes:

1. Finish surfaces as specified in individual Product sections.

2. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

K. Cleaning:

1. In addition, cleaning specified in **Section 01 77 00 “Closeout Procedures”**, clean Agency occupied areas of Work.

01 35 19 CONFINED SPACE ENTRY

A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Summary: If the work involves “Confined Space Entry” then the Owner has identified confined spaces associated with this project (see **Division 00 Section 00 30 00 “Available Information”**.), The Owner has established a permit-required, confined space entry program. Confined spaces that affect the Work of this Project will be defined in accordance with the requirements of OSHA, 29 CFR 1910.146 “Permit-Required Confined Spaces”, and the Owner's confined space Entry Plan. In the event that the Contractor must perform work within a permitted "confined space" as defined by Federal OSHA regulations, the Contractor will comply with all safety and monitoring requirements imposed by OSHA relative to work within the permitted confined space.

C. Definitions:

1. **Acceptable Entry Conditions:** means the conditions that must exist in a permit space to allow entry and to ensure that employees involved with a permit-required confined space entry can safely enter into and work within the space.

2. **Confined Space:** means a space that:

2.1 Is large enough and so configured that an employee can bodily enter and perform assigned work; and

2.2 Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and

2.3 Is not designed for continuous employee occupancy.

3. **Entry:** means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

4. **Permit-Required Confined Space** (Permit Space): means a confined space that has one or more of the following characteristics:

4.1 Contains or has a potential to contain a hazardous atmosphere;

4.2 Contains a material that has the potential for engulfing an entrant;

4.3 Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or

4.4 Contains any other recognized serious safety or health hazard.

5. **Permit-Required Confined Space Program** (Permit Space Program): means the employer's overall program for controlling, and, where appropriate, for protecting employees from, permit space hazards and for regulating employee entry into permit spaces.

6. **Permit System:** means the employer's written procedure for preparing and issuing permits for entry and for returning the permit space to service following termination of entry.

D. All proposed entries must be reviewed and approved, in advance, by the Owner and Construction Administrator prior to the Contractor's entry into a permitted confined space.

E. All such compliance measures will be at the Contractor's expense and performed with their own equipment. The Owner reserves the right to suspend the Contractor's operations for any violation of the above-mentioned confined space regulations.

F. The Contractor shall be responsible for obtaining the Permit at no additional cost to the Owner.

01 35 53 SECURITY PROCEDURES

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Provide a security program and facilities to protect work, existing facilities, and Owner's operations from unauthorized entry, vandalism, and theft. Coordinate with Owner's security program.

C. The General Contractor shall be solely responsible for damage, loss, or liability due to theft or vandalism.

D. **Identification Badges for General Contractor's Personnel and Visitors:**

1. The General Contractor will provide each person working or visiting at the site with an identification badge, bearing the name of the General Contractor, subcontractors, design professionals, and a number. As badges are assigns, a record shall be kept by the General Contractor and given to the Construction Administrator and User Agency Administrator. Update and correct the records of all badges issued on a semi-monthly basis.

2. Badges are to be worn on outer garment where visible at all times while at the construction site, return them to the General Contractor's field office at the end of each day and pick them up there each morning.

E. **Parking Stickers:** All vehicles parking in the General Contractor's parking lot and those used around the site require an ID sticker. They will be issued by the User Agency. Each General Contractor shall apply for parking stickers through the Construction Administrator no more than semi-monthly and shall keep record of all stickers issued.

END OF SECTION

i:\976710\02 design\specs\013000_administrativerequirements_dbb_minor_capital.docx

01 40 00 QUALITY REQUIREMENTS

A. **Summary:** Section 01 40 00 Quality Requirements contains the following Subsections:

01 42 16	**Definitions**	**Not Used** ☐
01 42 19	**Reference Standards**	**Not Used** ☐
01 45 00	**Quality Control**	**Not Used** ☐
01 45 23	**Testing for Indoor Air Quality, Baseline IAQ, & Materials**	**Not Used** ☒

01 42 16 DEFINITIONS

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Definitions**

1. **General:** Basic contract definitions are included in the General Conditions of the Contract for Construction.

2. **"Indicated":** The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, or other paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the reader locate the reference. Location is not limited to this term.

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

4. **"Approved":** The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.

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

6. **"Furnish":** The term "furnish" means supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.

7. **"Install":** The term "install" describes operations at the Project Site including the actual unloading, unpacking, assembly, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

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

9. **"Installer":** An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.

9.1 The term "experienced," when used with the term "installer," means having a minimum of ***five (5)*** previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of authorities having jurisdiction.

9.2 **Trades:** Using terms such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

9.3 **Assigning Specialists:** Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.

9.3.1 This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also

not intended to interfere with local trade-union jurisdictional settlements and similar conventions.

10. **"Project Site"**: Is the space available to the Contractor for performing construction activities, either exclusively or in conjunction, with others performing other Work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

11. **"Testing Agencies":** A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

01 42 19 REFERENCE STANDARDS

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Industry Standards:**

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

2. **Publication Dates:** Comply with the standards in effect as of the date of the Contract Documents unless a specific date is indicated in the Contract Documents or the governing regulations cited herein.

3. **Conflicting Requirements:** Where compliance with ***two (2)*** or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent and highest quality requirement. Request a decision from the Architect before proceeding on requirements that are different but apparently equal, and where it is uncertain which requirement is the most stringent.

4. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified shall be the minimum acceptable. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Request a clarification from the Architect regarding uncertainties before proceeding.

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

C. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source.

1. **Abbreviations and Names:** Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Thompson Gale's "Encyclopedia of Associations," available in most libraries.

D. **Governing Regulations and Authorities:**

1. **Copies of Regulations:** Obtain copies of the **"latest applicable State Codes"** and the following regulations and retain at the Project Site to be available for reference by parties who have a reasonable need during submittals, planning, and progress of the Work, until Substantial Completion.

1.1 **Connecticut State Building Code -** 2016.

1.1.1 CT Supplement - Errata No. 01 12/31/16.

1.1.2 International Building Code -2012.

1.1.3 International Existing Building Code - 2012.

1.1.4 International Mechanical Code - 2012.

1.1.5 International Plumbing Code - 2012.

1.1.6 International Energy Conservation Code - 2012.

1.1.7 National Electric Code (NFPA 70) - 2014.

1.1.8 ICC/ANSI A117.1-Accessible and Usable Buildings and Facilities - 2003.

1.2. Connecticut Fire Safety Code - 2016.

1.3. Occupational Safety and Health Administration (OSHA)

1.3.1 OSHA 29 CFR Part 1910 Occupational Safety and Health Regulations.

1.3.2 OSHA 29 CFR Part 1926 Occupational Safety and Health Regulations for Construction.

2. For a list of the **"latest applicable State Codes"** and how they can be obtained see www.ct.gov/dcs (Connecticut Department of Administrative Services – Division of Construction Services website) and click on "Office of State Building Inspector". Also visit the www.ctdol.state.ct.us Connecticut Department of Labor website.

E. Submittals:

1. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents.

01 45 00 QUALITY CONTROL

A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Summary

1. This Section includes administrative and procedural requirements for quality-control services.

2. Quality-Control services include fire alarm acceptance testing, inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by the Owner.

3. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

4. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.

4.1 Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

4.2 Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.

4.3 Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 01 Section **01 33 00 "Submittal Procedures"** specifies requirements for development of a schedule of required tests and inspections.

2. Division 01 Section **01 73 29 "Cutting and Patching"** specifies requirements for repair and restoration of construction disturbed by inspection and testing activities.

3. Division 01 Section **01 77 00 "Closeout Procedures**", specific requirements for contract closeout procedures.

D. Responsibilities

1. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, the Owner, through the Construction Administrator, shall provide inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. All tests required

by the individual specification sections are required to be scheduled and notification given to the Construction Administrator ***24 / 48*** hours in advance of the test/inspection as applicable. Costs for these services are not included in the Contract Sum.

1.1 Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are included in the Contract Sum.

1.2 Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Owner's responsibility, the Owner will employ and pay a qualified independent testing agency to perform those services.

1.2.1 Such services include Special Inspections as required by the latest edition of the "Connecticut State Building Code".

1.2.2 Where the Owner has engaged a testing agency for testing and inspecting part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner. The Owner will engage the services of a qualified Special Inspector for this project. The Special Inspector, as a representative of the Owner, shall document and confirm compliance with the provisions of the Connecticut State Building Code for Special Inspections.

1.2.3 Materials and assemblies for this project will be tested and construction operations inspected as the work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the State for final acceptance.

1.2.4 The Owner’s use of testing and inspection services shall in no way relieve the Contractor of the responsibility to furnish materials and finished construction in full compliance with the Contract Documents and the Connecticut State Building Code.

2. **Retesting:** The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.

2.1 The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated non-compliance with Contract Document requirements.

2.2 The Owner will issue a credit change order to cover all costs incurred related to all re-tests/re-inspections due to non-compliance to the Contract Documents, including but not limited to the Owner’s costs and the Consultant’s costs.

3. **Associated Services:** Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the Agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:

3.1 ***Provide access to the Work.***

3.2 ***Furnish incidental labor and facilities necessary to facilitate inspections and tests.***

3.3 ***Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.***

3.4 ***Provide facilities for storage and curing of test samples.***

3.5 ***Deliver samples to testing laboratories.***

3.6 ***Provide an approved design mix proposed for use for material mixes that require control by the testing agency.***

3.7 ***Provide security and protection of samples and test equipment at the Project Site.***

4. **Duties of the Testing Agency:** The independent testing agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Construction Administrator, Architect, and the Contractor in performance of the testing agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.

4.1 The testing agency shall notify the Construction Administrator and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

4.2 The testing agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.

4.3 The testing agency shall not perform any duties of the Contractor.

5. Owner will pay for the services of an independent testing agency laboratory to perform inspections, tests and other services required by the Specifications except as noted below, listed for which the Owner will issue a deduct change order to cover the cost associated with these tests:

5.1 When the Contractor notifies the Construction Administrator and/or Testing Agency less than ***24 hours*** before the expected time of testing.

5.2 When the Contractor requires testing for his own convenience.

5.3 When the Contractor schedules a test and is not ready for the required test.

6. Submit reports of tests that are part of the submittal requirements which indicate compliance or non-compliance with the specified standard.

7. See also General Conditions Article 16 "Inspections & Tests".

8. **Fire Alarm/Acceptance Testing Procedures:**

8.1 For buildings exceeding the threshold limit, the fire alarm testing shall be as the authority having jurisdiction shall dictate. This will be as determined by the CT DAS / DCS Office of State Fire Marshal.

8.2 For buildings that do not exceed the threshold limit, the fire alarm testing shall be as the authority having jurisdiction shall dictate. This will be determined by the DCS requirements as set below:

8.2.1 **Protective Signaling Systems:** All protective signaling systems shall meet with acceptance testing requirements of the applicable standards listed in Section 7-6.1.4, NFPA 101/2003 and NFPA 13/2002.

8.2.2 **Prior Test Notification:** At least five (5) working days prior to testing, the Fire Alarm Contractor shall notify (in writing) the following people of the proposed date the acceptance tests are to be performed (Also, see Part 2 of the DCS Certificate of Compliance).

.1 DCS Project Manager;

.2 General Contractor;

.3 Engineer of Record;

.4 Equipment Supplier Representative;

.5 Sprinkler Contractor.

8.2.3 **Certificates of Compliance:**

.1 A Fire Alarm System Inspection and Testing Certification and Description form shall be prepared for each system (See NFPA 72/2002 Chapter 7 and Figure 7-5.2.2).

.2 Parts 1 and 3 through 9, shall be completed after the system is installed and the installation of the wiring has been checked. Every alarm device must also be pre-tested to ensure proper operation and correct annunciation at each remote annunciator and control panel. Part 1 of the form (Certification of System Installation) shall be signed by the fire alarm contractor. The signed and completed preliminary copies of the Certification form shall be

forwarded to all parties along with the Prior Test Notification.

.3 Part 2, of each applicable form, shall be completed after the operational tests have been completed.

.4 After the completion of the operational acceptance tests and sign-off of test witness (with stipulations noted), final copies of the Certificates shall be forwarded to the DCS Project Manager.

8.2.4 Tests:

.1 All tests shall be conducted in accordance with the Manufacturer's Testing Recommendations.

.2 All testing equipment, apparatus (i.e. sound level decibel meter, 2-way radio communication, test devices, ladders, tools, lighting, etc.) and personnel shall be supplied by the Fire Alarm Contractor and Sprinkler Contractor.

8.2.5 System Documentation: Every system shall include the following documentation, which shall be delivered to the DCS Project Manager upon final acceptance of the system. An owner's manual or manufacturer's installation instructions covering all system equipment, including the following:

.1 A detailed narrative description of the system inputs, evacuation signaling, ancillary functions, annunciation, intended sequence of operations, expansion capability, application considerations, and limitations.

.2 Operator's instructions for basic systems operations including alarm acknowledgment, system reset, interpreting system output (LED's CRT display, and printout), operation of manual evacuation signaling and ancillary function controls, changing printer paper, etc.

.3 A detailed description of routine maintenance and testing as required and recommended and as would be provided under a maintenance contract, including testing and maintenance instructions for each type of device installed. This information should include:

.1 A listing of individual system components that require periodic testing and maintenance.

.2 Step by step instructions detailing the requisite testing and maintenance procedures and the intervals at which those procedures should be performed.

.3 A schedule that correlates the testing and maintenance procedures required by paragraph (2) above and with the listing required by paragraph (1) above.

.4 Detailed troubleshooting instructions for each type of trouble condition recognized by the system, including opens, grounds, parity errors, "loop failures," etc. These instructions should include a list of all trouble signals, and step by step instructions describing how to isolate those problems and correct them (or call for service as appropriate).

.5 A service directory, including a list of names and telephone numbers for those who should be called to service the system.

8.2.6 As-Built Drawings:

.1 The Contractor will produce ***two (2)*** sets of as-built drawings and specifications for the fire alarm system, indicating the location (and programmed address, if applicable) of all devices and appliances, the wiring

sequences, wiring methods, connection of the components, and sequence of operation of the protective signaling system as installed, shall be given to the DCS Project Manager. This shall be in Accordance with NFPA 72. Refer also to **Section 01 77 00 "Closeout Procedures".**

E. Submittals

1. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Construction Administrator. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.

1.1 Submit additional copies of each written report directly to the governing authority, when the authority so directs.

1.2 Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:

1.2.1 Date of issue.

1.2.2 Project title and number.

1.2.3 Name, address, and telephone number of testing agency.

1.2.4 Dates and locations of samples and tests or inspections.

1.2.5 Names of individuals making the inspection or test.

1.2.6 Designation of the Work and test method.

.1 Identification of product and Specification Section.

.2 Complete inspection or test data.

.3 Test results and an interpretation of test results.

.4 Ambient conditions at the time of sample taking and testing.

.5 Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.

.6 Name and signature of laboratory inspector.

.7 Recommendations on re-testing.

F. Quality Assurance

1. **Qualifications for Service Agencies:** Engage inspection and testing service agencies, including independent testing laboratories, that are pre-qualified as complying with the National Voluntary Laboratory Accreditation Program and that specialize in the types of inspections and tests to be performed.

1.1 Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

2. **Mockups:** Provide full-size, physical assemblies that are constructed on-site. Mockups will be used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not samples. ***Approved mockups establish the standard by which the Work will be judged.***

G. Repair and Protection

General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Division 01 **Section 01 73 29 "Cutting and Patching."**

1. Protect constructions exposed by or for quality-control service activities, and protect repaired construction.

2. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

01 45 23	**TESTING FOR INDOOR AIR QUALITY, BASELINE IAQ, & MATERIALS**	**NOT USED**

END OF SECTION

i:\976710\02 design\specs\014000_qualityrequirements_dbb_minor_capital.docx

01 50 00 TEMPORARY FACILITIES AND CONTROLS

A. **Summary:** Section 01 50 00 Temporary Facilities And Controls contains the following subsections:

01 51 13	**Temporary Electricity And Lighting**	**Not Used** ☐
01 51 16	**Temporary Fire Protection**	**Not Used** ☐
01 51 23	**Temporary Heating, Cooling And Ventilating**	**Not Used** ☐
01 51 33	**Temporary Telecommunications**	**Not Used** ☐
01 51 36	**Temporary Water**	**Not Used** ☐
01 52 13	**Field Offices And Sheds**	**Not Used** ☒
01 52 19	**Temporary Sanitary Facilities**	**Not Used** ☐
01 54 00	**Construction Aids**	**Not Used** ☐
01 55 13	**Temporary Access Roads**	**Not Used** ☐
01 55 16	**Haul Routes**	**Not Used** ☐
01 56 00	**Temporary Barriers And Enclosures**	**Not Used** ☐
01 56 43	**Temporary Protection**	**Not Used** ☐
01 57 19	**Temporary Environmental Controls**	**Not Used** ☐
01 57 21	**Environmental Management**	**Not Used** ☐
01 57 23	**Temporary Storm Water Control**	**Not Used** ☐
01 57 30	**Indoor Environmental Control**	**Not Used** ☐
01 57 40	**Construction Indoor Air Quality Management Plan**	**Not Used** ☐
01 58 13	**Temporary Project Signage**	**Not Used** ☐

01 51 13 TEMPORARY ELECTRICITY AND LIGHTING

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Connect to existing service, provide branch wiring and distribution boxes located to provide power and lighting by construction-grade extension cords. Owner will pay cost of energy used. Take measures to conserve energy. Provide lighting for construction operations. At the termination of construction, return the facilities to their original condition.

C. **Power Distribution System:** Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, AC 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

D. **Temporary Lighting:** When overhead floor or roof deck has been installed, provide temporary lighting with local switching. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.

01 51 16 TEMPORARY FIRE PROTECTION

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. The Contractor, during construction, shall be responsible for loss or damage by fire to the work until Acceptance of the Work. Any fire used within the structure for working purposes shall be extinguished when not in use. Bitumen or tar shall be melted on the ground only. No flammable material shall be stored in the structure in excess of amounts allowed by the authorities. No gasoline shall be stored in or close to the building at any time. The Contractor shall assign a responsible employee to be in charge of fire protection measures.

C. If an EPDM or other single-ply roof is included in the work that requires cleaning of mating surfaces of laps with gasoline, limit amount of gasoline on roof to two (2) gallons, which shall be in U.L. listed containers. Also provide one 30 B:C fire extinguisher within 75' of any point on the roof.

01 51 23 TEMPORARY HEATING, COOLING, AND VENTILATING

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Existing Heating System:**

1. The Contractor may use the existing heating system with temporary extensions, radiators or unit heaters, but such use is subject to the Owner's approval. Coordinate use of existing facilities with Owner. Provide additional, temporary extensions and units to satisfy the criteria given in the preceding paragraph. Owner will pay cost of energy used. Take measures to conserve energy. At the termination of construction, return the facilities to their original condition. Before operation of permanent facilities, verify that installation is approved for operation and that filters are in place.

01 51 33 TEMPORARY TELECOMMUNICATIONS

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Existing Telephone Service:** The Owner cannot guarantee General Contractor access to the existing telephone service. The General Contractor shall make use of cellular telephones and radios for communication while on site. Note that the cellular service is limited in and around the building.

1. Near the entrance to the General Contractor's field office, post a list of important telephone numbers, including but not limited to the following:

1.1 Local police and fire departments;

1.2 Ambulance service;

1.3 Contractor;

1.4 Architect & Engineers' offices;

1.5 Subcontractors;

1.6 Suppliers;

1.7 DCS Project Manager;

1.8 Construction Administrator;

1.9 OSBI and OSFM Inspectors; and

1.10 User Agency representative.

01 51 36 TEMPORARY WATER

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

1. **Sterilization:** Sterilize temporary water piping prior to use.

C. **Existing Water Service:** Water for construction purposes may be taken from the existing service. The Contractor shall provide connections, approved backflow prevention device, meter and pipe to the water main or nearest hydrant, subject to the approval of DCS. Upon completion of work, the Contractor shall remove the temporary connections and backfill if necessary. If new water service is installed before construction is complete, the new system may be used provided it is returned to the Owner in as-new condition. The Contractor shall pay for the water used, as metered.

01 52 13 FIELD OFFICES AND SHEDS

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B **Support Facilities Installation:**

1. **General:** Locate field offices, storage sheds, and other temporary construction and support facilities in areas designated by the Owner. Final placement of the field office is to be approved by the Construction Administrator.

1.1 Maintain support facilities until Acceptance of the Work. Remove prior to Acceptance of the Work with permission from the Owner.

2. Field Offices: Owner provided. Keep all offices clean and orderly, sweep weekly, and remove rubbish on a daily basis. Furnish and equip offices as follows:

C. General Contractor Provided Field Offices/Equipment: The General Contractor shall provide an office for their own use and a method to contact them by e-mail and telephone at any point and time. The General Contractor shall supply a water cooler for hot and cold water.

1. State User Agency Provided Field Offices:

The State User Agency will furnish, without charge, **one (1)** room for the General Contractor's use as an office in an existing building. The Owner and Construction Administrator will share space with the General Contractor. The General Contractor shall provide and install a 5-lb ABC fire extinguisher and an approved first aid kit. The General Contractor shall be responsible for furniture and shall keep this area clean and return it to its original condition after use. The General Contractor shall provide the following furniture and Equipment, which will remain his property. The furniture may be used but shall be in good condition as judged by the Owner and Construction Administrator.

1.1	**The General Contractor shall provide a lockable chemical toilet(s) with toilet tissue for the owners' use. The General Contractor shall maintain the facility in a sanitary condition. (See 01 52 19 Temporary Sanitary Facilities).**
1.2	**One (1) Lockable, double-pedestal, office desk, with an executive chair.**
1.3	**One (1) Plan table.**
1.4	**One (1) Plan rack.**
1.5	**Six (6) Conference chairs and a conference table (approx. 5' x 12').**
1.6	**One (1) Side tables (approx. 3' x 5').**
1.7	**One (1) Wall mounted, cork display boards (4' x 6').**
1.8	**One (1) Wall mounted, white, wipe-off board, with markers (3' x 4').**
1.9	**Two (2) File cabinets (lockable four drawer letter size).**
1.10	**Two (2) Bookshelves each with 10 linear feet x 12'-wide shelving.**
1.11	**Two (2) Large capacity waste receptacles.**
1.12	**One (1) Plain paper, Fax Machine with dedicated telephone line approved by Owner.**
1.13	**Two (2) Telephones with telephone lines and voice mail.**
1.14	**One (1) Telephones lines (dedicated to computer use) with high-speed Internet connection (minimum of DSL or cable modem service).**

2. Field Office Computer System

The General Contractor shall provide **one (1)** Field Office Computer access point for the Department's exclusive use for each field office specified. The General Contractor has the option to provide **either** a desktop **or** a laptop computer system in accordance with the minimum requirements listed below.

Field Office Desktop Computer System:

2.1.	**Network/Wireless:**	Ethernet or wireless card to be compatible with the selected internet and office network connections;

3. Computer Software:

The General Contractor shall provide software for the computer system in accordance with the minimum requirements listed below.

3.1	All software shall include the most current updates and patches at the time the computer system is provided to the Owner. The General Contractor shall provide for installation of updates and patches for the operating system, productivity and security software during the term of use of the computer system by the Owner. Updates and patches shall be provided by an automatic update method.

3.2	The Owner may install and maintain proprietary software on the computer in order to run the Owner's construction management programs.

4. Miscellaneous Computer Requirements

The initial condition of the computer system shall be nearly pristine. All owner installed e-mail accounts, games, spyware, online services, applications, network or other profiles previously set up on the system shall be removed prior to placement in the field office. If the system was provided for a previous DCS contract, all software not specified shall be removed prior to placement in the current field office.

4.1 The General Contractor shall provide an uninterruptible power supply (UPS) and full-time surge suppression for each field office computer system specified in this Section.

4.2 The General Contractor shall provide all cables, connections and software required to connect the field office computer system to the printer and the scanner.

4.3 When more than one computer system is specified for a field office, the General Contractor shall provide either an Ethernet or wireless office network to allow all computer systems in the field office to access the field office internet service, the printer and the scanner.

4.4 The General Contractor shall provide appropriate dust covers for all field office desktop computer systems.

4.5 The General Contractor shall provide all manuals necessary for operation of the computer system and software with the system and shall include all documentation normally furnished with the equipment and software when purchased.

4.6 The Owner will be utilizing the computer system to run or access Owner provided construction management software applications. These applications are known to run on Intel and AMD compatible equipment when using the Windows operating system. If the Owner experiences problems running these applications due to hardware or software compatibility, the General Contractor shall replace the equipment to ensure compatibility to the satisfaction of the Owner within **five (5)** business days.

4.7 The computer system shall be maintained in good working order. If a portion of the system becomes defective, inoperable, damaged, or stolen, that portion shall be repaired or replaced within **five (5)** business days after the General Contractor is notified by the Owner. If the computer system and related accessories are not maintained by the General Contractor as required, the Owner may withhold partial payments until the computer system is operational to the Owner's satisfaction.

5. Field Office Internet Service:

The General Contractor shall provide broadband internet service for the field office.

D. Storage and Fabrication Sheds: Install storage and fabrication sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on-site.

1. Storage sheds for tools, materials and equipment shall be weathertight with heat, lighting and ventilation for products requiring controlled conditions.

2. Remove temporary materials, equipment services and construction before Substantial Completion.

3. Clean and repair damage caused by installation or use of temporary facilities. Restore existing facilities used during construction to be specified or to original condition.

01 52 19 TEMPORARY SANITARY FACILITIES

A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Contractor's Construction Work: Provide toilet facilities for General Contractor's and subcontractor's employees engaged on the Project, including employees of other contractors in accordance with the OSHA Table D-1 (29CFR CH.XVII, OSHA Standard 1926.51) below. Locate toilets where directed and maintain them in a sanitary condition.

Number of Employees	Minimum Number of Facilities*
20 or less	1 toilet
20 or more	1 toilet and 1 urinal per 40 employees
200 or more	1 toilet and 1 urinal per 50 employees
*Toilet/Urinal Combinations shall count as only one facility.	

1. Job sites, not provided with a sanitary sewer, shall be provided with one of the following toilet facilities unless prohibited by State Codes:

1.1 Chemical toilets;

1.2 Recirculating toilets;

1.3 Combustion toilets.

2. Locate toilet facilities no more than 1000 feet from any work location.

C. The General Contractor shall provide, where directed, chemical toilets with toilet tissue, plus wash basins with water, soap and paper towels. The General Contractor shall maintain the facilities in a sanitary condition.

D. If women are employed in the work, provide separate, designated facilities for them of the same kind. Provide an adequate number of each kind of facility for each gender.

01 54 00 CONSTRUCTION AIDS

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. The General Contractor shall furnish tools, apparatus and appliances, hoists and/or cranes and power for same, scaffolding, runways, ladders, temporary supports and bracing and similar work or material necessary to insure convenience and safety in the execution of the Contract Documents except where this is otherwise specified in any Technical Specification Section. All such items shall meet the approval of DCS but responsibility for design, strength, and safety shall remain with the General Contractor. All such items shall comply with Federal OSHA regulations and applicable codes, statutes, rules, and regulations, including compliance with the requirements of the current edition of the "Manual of Accident Prevention in Construction" published by the A.G.C. (Associated General Contractors of America) and the standards of the Connecticut Department of Labor (DOL).

C. Staging/laydown areas, exterior, and interior, required for the execution of the Contract Documents, shall be furnished, erected, relocated if necessary, and removed by the general Contractor. Staging/laydown shall be maintained in a safe condition without charge to the Owner and for the use of all trades as needed.

01 55 13 TEMPORARY ACCESS ROADS

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Temporary Roads and Paving:** Construct and maintain temporary roads and paving to support the indicated loading adequately and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Construction Administrator and Architect.

1. Provide paving for pedestrian access and parking for field offices.

2. Coordinate temporary paving development with sub-grade grading, compaction, installation and stabilization of sub-base and installation of base and finish courses of permanent paving.

3. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.

4. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.

01 55 16 HAUL ROUTES

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. The General Contractor may use on-site paved roads and parking areas but shall not encumber same or their access. Public highways shall not be blocked by standing trucks, parked cars, material storage, and construction operations or in any other manner.

C. Public roads and existing paved roads, drives and parking areas on Owner's property shall be kept free from scrap or debris due to construction operations and any damage to their surface caused by the General Contractor shall be repaired by him at his own expense.

D. If the work of the Contract affects public use of any street, road, highway, or thoroughfare, the General Contractor shall confer with the police authority having jurisdiction to determine if and how many police are needed for public safety in addition to any barriers and signals that may be needed. The General Contractor will be responsible for payment of any needed police services.

01 56 00 TEMPORARY BARRIERS AND ENCLOSURES

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Provide barriers to prevent public entry into construction areas and to protect existing facilities from damage by construction operations.

C. Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated on the Construction Documents, or enclose the entire construction site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.

1. **Chain Link Fence:** Provide chain link construction fencing with posts set in a compacted mixture of gravel and earth. Use a ***6'***-high (minimum) chain link fence with top rail and filter fabric screening. At completion of the project, the Contractor must remove the construction fence completely, including all portions of below-ground footings. Fence posts must be removed, not sawn-off flush with the soil line.

2. **Security Enclosure and Lockup:** Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Provide keys to the Construction Administrator.

3. **Storage/laydown areas:** Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

D. Provide covered walkways as required by governing authorities for public rights-of-way and for public access to existing buildings.

E. Provide barriers around **all** trees and plants designated to remain. Protect against vehicular traffic, materials' dumping, chemically injurious materials, puddles, or running water.

F. Provide temporary, insulated, weathertight closures at openings to the exterior to provide acceptable working conditions and protection for materials, to allow for temporary heating and to prevent entry of unauthorized persons. Provide doors with self-closing hardware and locks.

G. Barriers and enclosures shall be in conformance with code requirements. Do not block egress from occupied buildings unless necessary to further the work of the Contract. In this case, secure the Department's approval of an alternate egress plan.

H. See also **Division 00 General Condition, Article 19 "Protection of the Work, Persons, and Property.**

01 56 43 TEMPORARY PROTECTION

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Protect buildings, equipment, furnishings, grounds, and plantings from damage. Any damage shall be repaired or otherwise made good at no expense to the State.

C. Provide protective coverings and barricades to prevent damage. The General Contractor shall be held responsible for, and must make good at his own expense, any water, or other type of damage due to improper coverings. Protect the public and building personnel from injury.

D. Provide temporary protection for installed products. Control traffic in immediate area to minimize damage.

E. Provide protective coverings for walls, projections, jambs, sills and soffits of openings. Protect finished floors and stairs from traffic, movement of heavy objects and storage. Prohibit traffic and storage on waterproofed and roofed surfaces and on lawn and landscaped areas.

F. See also **Division 00 General Condition, Article 19 "Protection of the Work, Persons, and Property.**

01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Temporary Environmental Controls:** General Contractor is to provide the following controls.

1. **Rodent and Pest Control:** Before deep foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Employ this service to perform extermination and control procedures at regular intervals so the Project will be free of pests and their residues at materials.

2. Dust Control (construction and demolition);

3. Noise Control;

4. Erosion and Sediment Control;

5. Pollution Control;

6. Traffic Control.

01 57 21 ENVIRONMENTAL MANAGEMENT

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Summary:**

1. This Section includes the following:

1.1 Special requirements for environmental management during construction operations.

1.2 Monitoring requirements.

C. **Related Sections:** The following Sections contain requirements that relate to this Section:

1. Division 01 **Section 01 45 00 "Quality Control"** for Meetings and project coordination.

D. **Definitions:**

1. Definitions pertaining to sustainable development: As defined in ASTM E2114.

2. Environmental pollution and damage: The presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade the utility of the environment for aesthetic, cultural, or historical purposes.

E. **Preconstruction Meeting**

1. After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner and Architect to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection.

2. Schedule meeting in conjunction with preconstruction meeting for Environmental Regulatory Requirements.

3. Verify procedures and requirements necessary to ensure implementation of Environmental Protection Plan is coordinated with applicable environmental regulatory requirements.

F. Submittals

1. **Environmental Protection Plan:** Not less than ***ten (10)*** days before the Pre-construction meeting, prepare and submit an Environmental Protection Plan.

1.1 **Format:** At a minimum, address the following elements:

.1 ***Identification of Project;***

.2 ***Identification and contact information for Environmental Manager;***

.3 ***General site information;***

.4 ***Summary of Plan;***

.5 ***Procedures to address water resources;***

.6 ***Procedures to address land resources;***

.7 ***Procedures to address air resources;***

.8 ***Procedures to address fish and wildlife resources;***

.9 ***Monitoring procedures.***

1.2 Revise and resubmit Plan as required by Owner.

.1 Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.

2. Reports for Field Quality Control.

G. Environmental Protection

1. **Protection of natural resources:** Comply with applicable regulations and these specifications. Preserve the natural resources within the Project boundaries and outside the limits of permanent Work performed under this Contract in their existing condition or restore to an equivalent or improved condition as approved by Owner.

1.1 Confine demolition and construction activities to work area limits indicated on the Drawings.

1.1.1 Disposal operations for demolished and waste materials that are not identified to be salvaged, recycled or reused:

.1 Remove debris, rubbish, and other waste materials resulting from demolition and construction operations, from site.

.2 No burning permitted.

.3 Transport materials with appropriate vehicles and dispose off-site to areas that are approved for disposal by governing authorities having jurisdiction.

.4 Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways. Remove spillage and sweep, wash, or otherwise clean project site, streets, or highways.

1.2 **Water resources**: Protect groundwater resources from contaminants.

1.2.1 Comply with requirements of the National Pollutant Discharge Elimination System (NPDES) and the State Pollutant Discharge Elimination System (SPDES).

1.2.2 Oily substances: Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water.

.1 Store and service construction equipment at areas designated for collection of oil wastes.

1.2.3 Mosquito abatement: Prevent ponding of stagnant water conducive to mosquito breeding habitat.

1.2.4 Prevent run-off from site during demolition and construction operations.

1.2.5 Stream Crossings: Equipment will not be permitted to ford live streams.

1.3 **Land resources:** Prior to construction, identify land resources to be preserved within the Work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and landforms without permission from Owner.

1.3.1 Conserve distinctive topographical features and character

1.3.2 **Earthwork:** As specified in the applicable Specification Section under Division 31 Earth Work and as follows:

.1 **Erodible soils:** Plan and conduct earthwork to minimize the duration of exposure of unprotected soils, except where the constructed feature obscures borrow areas, quarries, and waste material areas. Clear areas in reasonably sized increments only as needed to use the areas developed. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.

.2 Delineate work zones so as to restrict compaction of soil elsewhere.

.3 Delineate buffer zones around moist areas.

.4 Erosion and sedimentation control devices: Construct or install temporary and permanent erosion and sedimentation control features as required.

1.3.3 **Tree and plant protection:**

.1 Prior to start of construction, tag each tree and plant scheduled to remain with value as approved by Owner. In the event of damage to tree or plant, Owner may at Owner's discretion, deduct the indicated value of the damaged tree or plant from the Contract Sum.

1.4 **Air Resources**: Comply with IAQ Management Plan and as follows:

1.4.1 Prevent creation of dust, air pollution, and odors.

1.4.2 Sequence construction to avoid disturbance to site to the greatest extent possible.

1.4.3 Use mulch, water sprinkling, temporary enclosures, and other appropriate methods to limit dust and dirt rising and scattering in air to lowest practical level.

.1 Do not use water when it may create hazardous or other adverse conditions such as flooding and pollution.

1.4.4 Store volatile liquids, including fuels and solvents, in closed containers.

1.4.5 Properly maintain equipment to reduce gaseous pollutant emissions.

1.5 **Fish and Wildlife Resources:** Manage and control construction activities to minimize interference with, disturbance of, and damage to fish and wildlife.

1.5.1 Do not disturb fish and wildlife.

1.5.2 Do not alter water flows or otherwise significantly disturb the native habitat related to the project and critical to the survival of fish and wildlife, except as indicated or specified.

1.5.3 Identify and conserve wildlife corridors that intersect the site.

H. **Field Quality Control**

1. **General:**

1.1 Comply with requirements of agencies having jurisdiction and as specified herein.

1.2 Provide field practices, shipping, and handling of samples in accordance with ASTM D4840.

2. **Field Quality Control Reports:** Provide in accordance with approved Environmental Protection Plan.

01 57 23 TEMPORARY STORM WATER CONTROL

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Summary:**

1. Assume responsibility for storm water pollution control by completing and submitting to the Connecticut Department of Energy and Environmental Protection (DEEP) a "General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities" (DEEP-WPED-GP-015) registration and the Stormwater Pollution Control Plan (SPCP); and conform to the general permit requirements. The Contractor shall serve as the Developer, Permittee, Registrant, and Applicant, as the case may be.

2. The Contractor shall submit to DEEP the general permit registration form and the SPCP at least sixty (60) days prior to the commencement of activity involving total soil disturbance area of one (1) to twenty (20) acres or ninety (90) days prior to the commencement of activity involving a total soil disturbance area greater than twenty (20) acres. The Contractor shall submit the registration and SPCP to DEEP prior to Contract Award and within the applicable timeframes listed above. The Owner shall be responsible for the registration fee.

3. Conform to the SPCP included in the Contract Documents or use another plan, prepared at the Contractor's expense, which has been approved by the Owner and the DEEP.

4. The "General Permit for the Discharge of Stormwater and Dewatering Wastewater from Construction Activities" "draft" registration and SPCP are attached to the technical Section 31 20 05 Sedimentation and Erosion Control.

5. At the completion of the construction project, the Contractor shall submit to the DEEP a “Notice of Termination” (DEEP-PED-NOT-015) per the general permit. Concurrent with this Notice of Termination, the Contractor shall submit a “License Transfer Form” (DEEP-APP-006) to DEEP transferring the registration to the Agency.

5.1 The Contractor shall be responsible for preparing and obtaining the necessary information and signatures for the License Transfer Form. The proposed transferee (new registrant) shall be the Agency. The new billing contact shall be the Owner. The Owner shall be responsible for the transfer fee.

6. Prior to submitting the Notice of Termination, the Contractor shall submit to the Agency copies of the SPCP, all reports required by the general permit, all inspection records, and records of all data used to complete the registration for the general permit.

7. For sites involving total soil disturbance of less than one (1) acre, the Contractor shall be responsible for sediment and erosion control and utilize best management practices as identified in the “2002 Connecticut Guidelines for Soil Erosion and Sediment Control” (DEEP Bulletin 34), as amended, and any sediment and erosion control plans prepared for the project.

01 57 30 INDOOR ENVIRONMENTAL CONTROL

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Summary:**

1. This Section includes the following:

1.1 Microbial and fungal contamination control.

1.2 Indoor air quality and pollution control.

1.3 Heating, ventilating, and air conditioning.

2. **Related Sections:** The following Sections contain requirements that relate to this Section:

2.1 Division 01 **Section 01 45 23 "Testing for IAQ, Baseline IAQ & Materials"** for building flush out requirements.

2.2 Division 01 **Section 01 57 40 "Construction IAQ Management Plan"** for a description of the IAQ management plan.

C. References:

1. ASTM International (ASTM):

1.1 ASTM D5116-2006, Standard Guide for Small-Scale Environmental Chamber Determination of Organic Emissions From Indoor Materials/Products.

D. Microbial and Fungal Contamination Control:

1. Perform, schedule, and sequence Work as required to limit conditions supporting formations of microbes, molds, and fungi.

1.1 Control water penetration, dampness, and humidity to prevent products not treated for exterior use from becoming soaked or damp.

1.2 Enclose building prior to installing interior materials and finishes.

1.3 Do not install interior products subject to moisture absorption until building is enclosed and wet work generating moisture and humidity is complete.

2. When visible formations are observed and when formations cannot be completely removed by non-abrasive surface cleaning:

2.1 Remove and replace materials identified as food sources for microbes, molds, and fungi.

2.2 Correct conditions supporting microbial, mold, and fungal growth.

3. Remove interior products and finishes, identified as food sources that have absorbed sufficient moisture to become damp whether or not microbial, mold, or fungal growth is observed. Include:

3.1 Gypsum board cores.

3.2 Organic materials composed of cellulose fiber or paper.

3.3 Materials containing sucrose or other binders identified as supporting microbial growth.

4. Remove fibrous insulation materials subject to retaining moisture such as duct liner, insulation, and other materials that are made wet or damp and cannot immediately be made dry.

5. Repair or replace ductwork, pans, and other conditions subject to moisture condensation, water penetration, or other water source not drained and made dry.

5.1 Remove conditions that have become an environment for microbes, molds, or fungi.

5.2 Do not permit conditions leading to standing water.

6. Install wet work and allow time needed to dry and cure prior to installing materials such as carpet, acoustical material, textiles, and other material of type that may attract and retain moisture.

E. Indoor Air Quality and Pollution Control:

1. Product Emission Rate Standards: Test to ASTM D5116 for maximum indoor air concentration levels.

1.1 Formaldehyde:

1.1.1 0.03 parts per million where no other requirements are specified.

1.1.2 0.005 parts per million where products are specified as formaldehyde free.

1.2 Total VOC Emissions for Carpet Tile, Adhesives, and Sealers: 0.05 mg/m^2 per hour.

1.3 4 Phenyl Cyclohexene (4-PC) Particulate Emissions for Carpet: One (1) part per billion.

1.4 Total Particulate Emission Rate Levels: 50 ug/m^3.

1.5 Primary and Secondary Regulated Pollutants: Conform to USEPA, Code of Federal Regulations, Title 40, Part 50 National Air Ambient Air Quality Standard. Refer to EPA Web Site:

http://www.epa.gov/epahome/rules.html#codified.

1.6 Other Pollutants Not Listed: Not greater than 1/10 of Threshold Limit Value - Time Weighted Average (TLV-TWA) industrial workplace standard.

2. **Architectural Coatings - Volatile Organic Compound (VOC) Content Limits:** Conform to US Environmental Protection Agency (EPA) Federal Register 48886/Vol. 63, No.176 Friday, September 11, 1998/ Rules and Regulations. Refer to EPA Web Site: http://www.epa.gov/ttn/atw/eparules.html.

3. Do not use products in combination with or in contact with other products that can be identified as combining to form toxic fumes or sustained odors.

4. Do not use solvents within interior areas that may penetrate and be retained in absorptive materials such as concrete, gypsum board, wood, cellulose products, fibrous material, and textiles.

5. Protect construction materials from contamination and pollution from contact with construction dust, debris, fumes, solvents, and other environmentally polluting materials.

6. Allow furnishings and materials such as carpet, floor tile, acoustical tile, textiles, office furniture, and casework, to air out in clean environment prior to installation.

F. **Heating, Ventilating, and Air Conditioning (HVAC)**

1. Do not run permanent HVAC system during course of construction. Seal ductwork intake and exhaust vents.

2. Heat, dehumidify, and ventilate building during course of Work as necessary to maintain environmental conditions suitable for drying and curing materials and for prevention of conditions suitable for mold and mildew growth.

2.1 Ventilate building to remove moisture, dust, fumes, and odors.

2.2 Temper and dehumidify air as needed to remove excess moisture.

2.3 Do not use propane heaters and other moisture generating heating systems.

3. Flush out building prior to commissioning. Refer to **Section 01 45 23 Testing for Indoor Air Quality, Baseline IAQ, & Materials** for procedure.

4. Inspect ductwork for refuse, contaminants, moisture and other foreign contamination prior to commissioning. Notify Commissioning Authority (CxA) of satisfactory inspection prior to beginning of Commissioning.

5. Clean underfloor plenum at access flooring acting as supply air duct, prior to occupancy.

G. **Remedial Action:**

1. Promptly take action as necessary to inspect and remediate conditions suspected of supporting microbial, fungal or mold conditions and where contaminated by indoor air pollution.

2. Notify and consult with Architect prior to beginning remedial action where contamination by hazardous chemicals, microbes, and fungi is suspected.

01 57 40 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT PLAN

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 specification sections, apply to this section.

B. **Summary:**

1. This Section includes:

1.1 Description of a Construction Indoor Air Quality (IAQ) Management Plan.

1.2 IAQ construction requirements.

2. **Related Sections:** The following Sections contain requirements that relate to this Section:

2.1 Divisions 01 through 49 sections for green building rating system requirements specific to the Work of each of those sections. These requirements may or may not include reference to LEED.

2.2 Division 01 Section 01 45 23 "Testing for IAQ, Baseline IAQ, & Materials."

2.3 Division 01 Section 01 57 30 "Indoor Environmental Control."

2.4 Division 01 Section 23 05 93 "Testing, Adjusting and Balancing for HVAC" for additional requirements for baseline testing for IAQ.

2.5 Division 01 Section 23 05 93 "Testing, Adjusting and Balancing for HVAC" for cleaning of HVAC system including ductwork, air intakes and returns, and changing of filters.

C. References:

1. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):

1.1 ASHRAE Standard 52.1 INT1-2007, Gravimetric and Dust Spot Procedures for Testing Air Cleaning Devices in General Ventilation for Removing Particulate Matter.

2. ASTM International, Inc. (ASTM):

2.1 ASTM D5116-2006, Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.

3. Sheet Metal and Air Conditioning National Contractors' National Association (SMACNA):

3.1 IAQ Guidelines for Occupied Buildings Under Construction ANSI/SMACNA 008-2008.

D. Indoor Air Quality:

1. Goals: The Owner has set the following indoor air quality goals for jobsite operations on the project, within the limits of the construction schedule, Contract Sum, and available materials, equipment, products and services. Goals include:

1.1 Protect workers on the site from undue health risks during construction.

1.2 Prevent residual problems with indoor air quality in the completed building.

E. Submittals:

1. Indoor Air Quality Plan: Within fourteen (14) Calendar Days after receipt of Notice of Award and prior to any waste removal from the project, develop and submit for review a healthy indoor air quality plan. The plan shall include:

1.1 List of IAQ protective measures to be instituted on the site.

1.2 Schedule for inspection and maintenance of IAQ measures.

F. Quality Assurance:

1. Perform material tests and report results in accordance with ASTM D5116.

G. Substitutions:

1. Should the Contractor desire to use procedures, materials, equipment, or products that are not specified but meet the intent of the specifications to protect indoor air quality on the site, the Contractor shall propose these substitutions in accordance with **Section 01 60 00 "Product Requirements."**

H. Materials:

1. Low emitting products have been specified in appropriate sections.

I. Construction IAQ Management Plan:

1. Meet or exceed the minimum requirements of the **SMACNA "IAQ Guidelines for Occupied Buildings Under Construction ANSI/SMACNA 008-2008."**

1.1 Protect the ventilation system components from contamination, OR provide cleaning of the ventilation components exposed to contamination during construction prior to occupancy.

1.2 If building occupancy is to occur before completion of the flush-out, deliver a minimum of 3500 cu ft of outdoor air per sq ft of floor area to the space. Once the space is occupied, ventilate it at a minimum rate of 0.30 cfm/sq ft of outside air or the design minimum outside air rate determined in accordance with the applicable Sections of **ANSI/ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality** or applicable local code, whichever is more stringent. During each day of the flush-out period, begin ventilation a minimum of three (3) hours prior to occupancy and continue during occupancy. Maintain these conditions until a total of 14000 cu ft/sq ft of outside air has been delivered to the space.

2. Conduct regular inspection and maintenance of indoor air quality measures including ventilation system protection, and ventilation rate.

01 58 13 TEMPORARY PROJECT SIGNAGE

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B **Project Sign:** General Contractor shall engage an experienced sign painter to apply graphics. The General Contractor shall request the Construction Administrator shall provide the General Contractor with all of the detailed illustration of the sign of the project sign, including but limited, format, wording, font size, color selection, and State Seal. Within seven (7) Calendar Days of the Date of the Commencement of the Work the General Contractor shall erect a Project Sign at the construction site, in a location designated by the DCS Project Manager and Construction Administrator.

1. **Project Sign**: The General Contractor shall fabricate the Project Sign as follows:

1.1 3/4", exterior grade, A-B Fir plywood;

1.2 mounted on preservative treated fir posts;

1.3 painted both sides and all edges of sign and the posts with two coats of exterior, white, alkyd primer;

1.4 borders and letters painted with "bulletin" (sign) paint;

1.5 have a self-adhesive decal of the State seal to be provided by the Construction Administrator;

2. **Project Sign Detail:** Sign letter sizes, fonts, colors and related information are shown in the illustration available for download from the on-line DCS Library (3000 Series – Design Phase Forms).

C. The General Contractor shall remove and properly dispose of the Project Sign within **seven (7)** Calendar days after Acceptance of the Work of the project.

END OF SECTION

i:\976710\02 design\specs\015000_temporaryfacilitiesandcontrols_dbb_minor_capital.docx

01 60 00 PRODUCT REQUIREMENTS

A. **Summary:** Section 01 60 00 Product Requirements contains the following subsections:

01 60 00	**Product Requirements**

01 60 00 PRODUCT REQUIREMENTS

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Materials and Equipment:** Shall be delivered, stored and handled to prevent intrusion of foreign matter and damage by weather or breakage. Packaged materials shall be delivered and stored in original, unbroken packages.

1. Promptly inspect shipments to assure that products comply with requirements, that quantities are correct and products are undamaged.

2. Packages, materials and equipment showing evidence of damage will be rejected and replaced at no additional cost to the Owner.

C. **Storage and Protection:**

1. Store products in accordance with manufacturers' instructions with seals and labels intact and legible. Store sensitive products in weathertight enclosures; maintain within temperature and humidity range required by manufacturer.

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

3. Store loose granular material on solid surfaces in a well-drained area; prevent mixing with foreign matter.

4. Arrange storage to provide access for inspection. Periodically inspect to insure products are undamaged and are maintained under required conditions. Keep log showing date, time and problems, if any.

5. Stone, masonry units and similar materials shall be stored on platforms or dry skids and shall be adequately covered and protected against damage.

6. The Contractor shall prepare, as directed by the Owner, one area or space in the building for storage of State-owned equipment.

END OF SECTION

i:\976710\02 design\specs\016000_productrequirements_dbb_minor_capital.docx

01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS

A. **Summary:** Section 01 70 00 Execution and Closeout Procedures contains the following subsections:

01 71 23	**Field Engineering**	**Not Used** ☐
01 73 29	**Cutting and Patching**	**Not Used** ☐
01 74 13	**Progress Cleaning**	**Not Used** ☐
01 74 19	**Construction Waste Management & Disposal**	**Not Used** ☐
01 75 00	**Starting And Adjusting**	**Not Used** ☐
01 77 00	**Closeout Procedures**	**Not Used** ☐
01 78 23	**Operation And Maintenance Data**	**Not Used** ☐
01 78 30	**Warranties And Bonds**	**Not Used** ☐

01 71 23 FIELD ENGINEERING

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. The General Contractor shall provide field engineering services to establish and record grades, lines, and elevations.

C. The General Contractor shall retain a Professional Engineer or Land Surveyor registered by the State of Connecticut to lay out the building, underground utility lines, and other site work from the horizontal and vertical control information furnished by the Owner and to establish and record the necessary elevations, at no additional cost to the State.

D. The General Contractor shall forward a letter from his Land Surveyor or Professional Engineer stating that the control information furnished by the Owner is accurate or shall identify inaccuracies, if they exist. The General Contractor shall not take advantage of errors, which may be included in the control information. Stakes and markings shall be preserved.

01 73 29 CUTTING AND PATCHING

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. It is the responsibility of the Contractor to provide chases, channels or openings where needed.

C. The Contractor shall install sleeves, inserts, and hangers furnished by the trades needing same.

D. After installing work into openings, channels, and/or chases, the Contractor shall close same. If finishes are to be restored, the new work shall match the original and shall be done by the trade customarily responsible for the particular kind of work.

E. Written permission shall be obtained from the Contractor before cutting beams, arches, lintels or other structural members.

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

1. Contractor shall obtain written approval from the Architect/Engineer of the cutting and patching proposal before cutting and shall submit all Architect/Engineer approval letters to the Construction Administrator before patching the following structural elements:

1.1 Foundation construction.

1.2 Bearing and retaining walls.

1.3 Structural concrete.

1.4 Structural steel.

1.5 Lintels.

1.6 Structural decking.

1.7 Miscellaneous structural metals.

1.8 Exterior curtain-wall construction.

1.9 Equipment supports.

1.10 Piping, ductwork, vessels, and equipment.

1.11 Structural systems of special construction in Division 13 Sections.

G. Do cutting and patching to integrate all elements of the work. Provide penetrations of existing surfaces. Provide samples for testing. Seal penetrations through floors, walls, ceilings, and roofs, as applicable; restore or preserve fire-rated and smoke-barrier construction. Construction and finishes shall match original work.

H. The Contra shall verify dimensions for built-in work and/or work adjoining that of other trades before ordering any material or doing any work. Discrepancies shall be submitted to the Construction Administrator before proceeding with the work.

I. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

J. Also see Division 00 General Conditions **Article 23 "Cutting, Fitting, Patching, and Digging".**

01 74 13 PROGRESS CLEANING

A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. This Section includes:

1. Cleaning requirements during construction operations.

2. Final cleaning prior to turning the project over to the Owner.

C. Quality Assurance

1. Coordinate with **Section 01 57 21 – Environmental Management.**

2. Coordinate with **Section 01 77 00 – Closeout Procedures.**

2.1 Contractor shall provide progress cleaning that minimizes sources of food, water, and harborage available to pests.

D. Utilize non-toxic cleaning materials and methods.

1. Use natural cleaning materials where feasible. Natural cleaning materials include:

1.1 abrasive cleaners: substitute 1/2 lemon dipped in borax.

1.2 ammonia: substitute vinegar, salt and water mixture, or baking soda and water.

1.3 disinfectants: substitute 1/2 cup borax in gallon water.

1.4 drain cleaners: substitute 1/4 cup baking soda and 1/4 cup vinegar in boiling water.

1.5 upholstery cleaners: substitute dry cornstarch.

E. Maintain areas under the General Contractor's control free of waste materials, debris, and rubbish. Maintain in a clean and orderly condition.

F. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces before closing the space.

G. Periodically clean interior areas before start of surface finishing and continue cleaning on an as-needed basis.

H. The General Contractor shall control cleaning operations so that dust and other particulates will not adhere to wet or newly-coated surfaces.

I. Remove waste materials, debris, and rubbish from site daily and dispose of legally off-site. No scrap/debris shall remain inside the building or anywhere on site upon final acceptance of the project.

J. Final Cleaning:

1. At completion of Work, remove all remaining waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all exposed surfaces; leave Project clean and ready for occupancy.

1.1 After review of trees to remain by Architect and Owner, remove tree tags.

1.2 Provide final cleaning in accordance with ASTM E1971 and the approved Integrated Pest management (IPM) plan.

K. See also **Division 00 General Conditions, Article 24 "Cleaning Up".**

01 74 19 CONSTRUCTION WASTE MANAGEMENT & DISPOSAL

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Summary:** This Section includes requirements for waste management goals, waste management plan and waste management plan implementation.

C. **Related Sections:** The following Sections contain requirements that relate to this Section:

1. Division 01 **Section 01 11 00 "Summary of Work".**

2. Division 01 **Section 01 20 00 "Contract Considerations".**

3. Division 01 **Section 01 25 00 "Substitution Procedures".**

4. Division 01 **Section 01 31 19 "Project Meetings".**

5. Division 01 **Section 01 33 00 "Submittal Procedures".**

6. Division 01 **Section 01 45 00 "Quality Control".**

7. Division 01 **Section 01 50 00 "Temporary Facilities and Controls".**

8. Division 01 **Section 01 60 00 "Product Requirements".**

9. Division 01 **Section 01 77 00 "Closeout Procedures".**

10. Division 01 **Section 01 81 13 "Sustainable Design Requirements".**

D. **Definitions:**

1. **Construction Waste:** Solid wastes such as building materials, packaging and rubble resulting from construction, paving and infrastructure.

E. **Demolition Waste:** Solid wastes such as concrete, wood, brick, plaster, roofing materials, wallboard, metals, carpeting, insulation, and clean fill resulting from demolition or selective demolition of structures.

F. **Recyclable Materials:** Products and materials that can be recovered and remanufactured into a new product. Recyclable materials include, but are not limited to, the following:

1. Metals (ferrous and non-ferrous), including banding, metal studs, ductwork, and piping.

2. Asphaltic concrete paving.

3. Portland cement concrete.

4. Gypsum products.

5. Paper and cardboard.

6. Wood products, including structural, finish, crates, and pallets.

7. Brick and masonry.

8. Carpet and padding.

9. Plastics.

10. Copper wiring.

G. **Recycling Facility:** A business that specializes in collecting, handling, processing, distributing, or remanufacturing waste materials generated by new construction projects, into products or materials that can be used for this project or by others.

H. **Salvage and Reuse:** Existing usable product or material that can be saved and reused in some manner on the project site. Materials for reuse must be approved by the Architect. Materials that can be salvaged and reused must comply with applicable technical specifications and include, but are not limited to, the following:

1. Dimensional lumber and other wood products.

2. Structural steel.

3. Soil.

4. Masonry products.

5. Plants.

I. **Salvage for Resale:** Existing usable product that can be saved and removed intact (as is) from the project site to another site for resale to others without remanufacturing.

J. **Waste Management Goals:**

1. The Owner has established that this Project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.

2. The General Contractor shall use all means available to divert the greatest extent practical and economically feasible, construction waste from landfills and incinerators.

3. Of the inevitable waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled. Waste disposal in landfills shall be minimized.

4. With regard to these goals the General Contractor shall develop, for the Architect's and Owner's Construction Administrator's review, a Waste Management Plan for this Project.

5. Take a pro-active, responsible role in management of construction waste and require all subcontractors, vendors, and suppliers to participate in the effort. Establish a construction waste management program that includes the following categories:

5.1 Minimizing packaging waste.

5.2 Salvage and reuse.

5.3 Salvage for resale or donation.

5.4 Recycling.

5.5 Disposal.

K. Submittals:

1. **Draft Waste Management Plan:** Within ***thirty (30)*** Calendar days after receipt of Notice of Award of Bid, or prior to any waste removal, whichever occurs sooner, the general Contractor shall submit ***three (3)*** copies of a Draft Waste Management Plan to the Construction Administrator.

2. **Final Waste Management Plan:** Once the Owner has determined which of the recycling options addressed in the Draft Waste Management Plan are acceptable, the general Contractor shall submit within ***ten (10)*** Calendar days ***three (3)*** copies of a Final Waste Management Plan.

3. **Progress Reports:** Submit ***three (3)*** copies of monthly progress reports, at the same time as the Application for Payment, documenting the following:

3.1 ***Material category.***

3.2 ***Point of waste generation.***

3.3 ***Total quantity of waste in tons.***

3.4 ***Quantity of waste salvaged, in tons.***

3.5 ***Quantity of waste recycled, in tons.***

3.6 ***Total quantity of waste recovered (salvaged plus recycled) in tons.***

3.7 ***Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.***

4. **Calculations:** Submit ***three (3)*** copies of calculations indicating the end-of-project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Project prior to Substantial Completion.

5. **Record Submittals:**

5.1 **Donations:** Indicate which salvageable materials were donated, who they were donated to, and whether the recipient is tax exempt. Submit documentation indicating receipt of donations.

5.2 **Sales:** Indicate which salvageable materials were sold, who they were sold to, and whether the recipient is tax exempt. Submit documentation indicating receipt of materials.

5.3 **Recycling:** Indicate which materials were recycled and the name of the facility licensed to accept them. Submit documentation such as manifests, weight tickets, receipts, and invoices.

5.4 **Waste Disposal:** Indicate which materials were accepted as waste by landfills and incinerator facilities licensed to accept them. Submit documentation indicating receipt of materials.

L. **Quality Assurance:**

1. **Regulatory Requirements:** Comply with regulations of State of Connecticut Department of Energy and Environment Protection, Waste Management Bureau Recycling Program.

2. **Waste Management Conference:** Review and discuss the waste management plan, requirements for documenting quantities of each type of waste and its disposition, procedures for materials separation, procedures for periodic collection and transportation to recycling and disposal facilities. Review waste management requirements for each trade. Verify availability of containers and bins needed to avoid delays.

M. **Waste Management Plan:**

1. **Draft Waste Management Plan:** Include the following in the Draft Plan:

1.1 Analysis of the proposed jobsite waste to be generated, including types and quantities.

1.2 **Landfill Options:** The name of the landfill(s) where trash will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all Project waste in the landfill(s).

1.3 **Alternatives to Landfilling:** A list of each material proposed to be salvaged, reused, or recycled during the course of the Project, the proposed local market for each material, and the estimated net cost savings or additional costs resulting from separating and recycling (versus landfilling) each material. "Net" means that the following have been subtracted from the cost of separating and recycling:

1.3.1 Revenue from the sale of recycled or salvaged materials and

1.3.2 Landfill tipping fees saved due to diversion of materials from the landfill. The list of these materials is to include, at a minimum, the following materials:

.1 ***Cardboard.***

.2 ***Clean dimensional wood.***

.3 ***Beverage containers.***

.4 ***Land clearing debris.***

.5 ***Concrete.***

.6 ***Bricks.***

.7 ***Concrete Masonry Units (CMU).***

.8 ***Asphalt.***

.9 ***Metals from banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.***

N. **Resources for Development of Waste Management Plan:** The following sources may be useful in developing the Draft Waste Management Plan:

1. **Recycling Haulers and Markets:** Local haulers and markets for recyclable materials. For more information, contact the State of Connecticut Department of Energy and Environmental Protection, Waste Management Bureau Recycling Program, (860) 424-3366:

http://www.ct.gov/deep/cwp/view.asp?a=2714&q=324884&depNav_GID=1645&deepNav=|.

O. **Final Waste Management Plan:** The Final Waste Management Plan shall contain the following:

1. Analysis of the proposed jobsite waste to be generated, including types and quantities.

2. **Landfill Options:** The name of the landfill(s) where trash will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all Project waste in the landfill(s).

3. **Alternatives to Landfilling:** A list of the waste materials from the Project that will be separated for reuse, salvage, or recycling.

4. **Meetings:** A description of the regular meetings to be held to address waste management. Refer to **Section 01 31 19 "Project Meetings".**

5. **Materials Handling Procedures:** A description of the means by which any waste materials identified in item (3) above will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.

6. **Transportation:** A description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site) and destination of materials.

P. Waste Management Plan Implementation:

1. **Manager:** The General Contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the Project.

2. **Distribution:** The General Contractor shall distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, the Owner, and the Architect.

3. **Instruction:** The General Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.

4. **Separation Facilities:** The General Contractor shall lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.

5. **Hazardous Wastes:** Hazardous wastes shall be separated, stored, and disposed of according to local regulations.

6. **Application for Progress Payments:** The General Contractor shall submit with each Application for Progress Payment a Summary of Waste Generated by the Project. Failure to submit this information shall render the Application for Payment incomplete and shall delay Progress Payment. The Summary shall be submitted on a form acceptable to the Owner and shall contain the following information:

   6.1 The amount (in tons or cubic yards) of material landfilled from the Project, the identity of the landfill, the total amount of tipping fees paid at the landfill, and the total disposal cost. Include manifests, weight tickets, receipt, and invoices.

   6.2 For each material recycled, reused, or salvaged from the Project: the amount (in tons or cubic yards), the date removed from the jobsite, the receiving party, the transportation cost, the amount of any money paid or received for the recycled or salvaged material, and the net total cost or savings of salvage or recycling of each material shall be indicated. Attach manifests, weight tickets, receipts, and invoices.

Q. Plan Implementation:

1. Implement the waste management plan as approved by Owner and Construction Administrator.

2. Provide training of workers, contractors, subcontractors, and suppliers on proper waste management procedures.

   2.1 Distribute waste management plan to all parties involved in the Project within ***three (3)*** Calendar Days of submittal return.

   2.2 Distribute plan to parties when they first begin working on the Project site. Review plan procedures and locations established for salvage, recycling, and disposal.

R. Separation of Recyclable Waste Materials:

1. Provide the necessary containers and bins, to facilitate the waste management program, that are clearly and appropriately marked. Prevent contamination of recyclable materials from incompatible products and materials. Separate construction waste at the project site by one of the following methods:

1.1 **Source Separated Method:** Waste products and materials, that are recyclable, are separated from trash and sorted into appropriately marked separate containers and then transported to the respective recycling facility for further processing. Trash is transported to a landfill or incinerator.

1.2 **Co-Mingled Method:** All construction waste is placed into a single container and then transported to a recycling facility where the recyclable materials are sorted and processed and the remaining trash is transported to a landfill or incinerator.

1.3 Other methods proposed by the Contractor and approved by the Owner, Construction Administrator.

01 75 00 STARTING AND ADJUSTING

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Summary:**

1. This Section includes administrative and procedural requirements for handling requests for building system start up and system demonstration and includes the following:

1.1 Starting Systems.

1.2 Demonstration and instructions.

1.3 Testing, adjusting, and balancing.

C. **Related Sections:** The following Sections contain requirements that relate to this Section:

1. Division 01 **Section 01 45 00 "Quality Control"** specifies quality assurance and inspecting services.

2. Division 01 **Section 01 77 00 "Closeout Procedures"** specifies requirements for contract close out requirements for system operation and maintenance data and extra materials.

3. Division 01, **Section 01 91 00 "Commissioning"** specifies process requirements for system commissioning.

D. **Starting Systems:**

1. Coordinate schedule for start-up of various equipment and systems.

2. Provide written notification to the Owner's Construction Administrator **thirty (30)** Calendar Days prior to start-up of each item.

3. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, and control sequence for other conditions that may cause damage.

4. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

5. Verify that wiring and support components are complete and tested.

6. Execute the start-up under supervision of manufacturer's representative, in accordance with manufacturer's instructions.

7. When referenced in individual specification sections, require manufacturer to provide an authorized representative to be present at the site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

8. Submit a written report in accordance with Division 01 **Section 01 45 00 "Quality Control**" that the equipment or system has been properly installed and is functioning properly.

E. **Demonstration and Instructions:**

1. Demonstrate operation and maintenance of Products to Owner and Agency Personnel ***fourteen (14)*** Calendar Days prior to substantial completion.

2. Demonstrate Project equipment and instruct in a classroom environment at location designated by the Construction Administrator and instructed by a qualified manufacturer's representative who is knowledgeable about the Project.

3. For equipment or systems requiring seasonal operation perform demonstration for season within **six (6)** months.

4. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner and Agency Personnel in detail to explain all aspects of operation and maintenance.

5. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, and maintenance, and shutdown of each item at agreed upon scheduled time and at equipment or designated location.

6. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during demonstration.

7. Starting and adjusting equipment does not constitute acceptance by the owner since commissioning is a requirement of this contract. Additionally, the warrantee does not begin until substantial completion has been granted for that specific item.

F. Testing, Adjusting, and Balancing:

1. The Contractor will employ and pay for the testing services of an independent consultant to verify the testing, adjusting, and balancing.

1.1 Comply with the requirements of Division 01 **Section 01 91 00 "Commissioning"** as they relate to the Work of this Section.

2. Reports will be submitted by the independent testing consultant to the Construction Administrator indicating observations and results of tests and indicating compliance or non-compliance with the requirements of the Contract Documents.

3. The Owner may employ and pay for the services of an independent consultant to verify testing, adjusting, and balancing which was performed by the Contractor.

01 77 00 CLOSEOUT PROCEDURES

A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Substantial Completion:

1. Upon completion of the work, the General Contractor shall submit to the State a Certificate of Substantial Completion wherein the General Contractor certifies that all conditions of the Contract Documents have been met, and that the facility is ready for occupancy by the Agency. Issuance of a Certificate of Substantial Completion by the Owner shall be a pre-condition for payment by the Owner.

1.1 Preliminary Procedures: Before requesting inspection for Certification of Substantial Completion, complete the following. List exceptions in the request.

1.2 In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent (100%) completion for the portion of the Work claimed as substantially complete.

1.2.1 Include supporting documentation for completion as indicated in the Contract Documents and a statement showing all accounting of the Contract Documents.

1.2.2 If 100 percent (100%) completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete shall be provided as well as a schedule for completion of work.

1.3 Advise the Owner of pending insurance changeover requirements.

1.4 Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.

1.5 Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

1.6 Submit as-built record drawings, maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.

1.7 Deliver tools, spare parts, extra stock, and similar items.

1.8 Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.

1.9 Demonstration, through operation and testing, the functions of all systems and/or equipment to the satisfaction of the Owner for compliance to the contract. Complete testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.

1.10 Complete final cleanup requirements, including touchup painting.

1.11 Touch up and otherwise repair and restore marred, exposed finishes.

1.12 Compliance with other terms as outlined in the Contract Documents.

1.13 List of all the General Contractor's suppliers, sub-contractors, etc. Include name of firm, address, FEIN number and CT Tax I.D. number.

2. **Inspection Procedures:** The General Contractor shall be ready and prepared when they request a Substantial Completion inspection. If the inspection reveals that the work is not complete, there are extensive punchlist items and as the items listed above are not complete, the Construction Administrator, Owner, and Agency will determine the inspection has failed.

3. The General Contractor is responsible for all costs to re-inspect due to a failed inspection.

3.1 The General Contractor will repeat inspection when requested and assured that the Work is substantially complete.

3.2 Results of the completed inspection will form the basis of requirements for Acceptance of the Work.

C. Acceptance of the Work

1. **Preliminary Procedures:** Before requesting a Final Inspection and Certificate of Acceptance and Final Payment, complete the following. List exceptions in the request.

1.1 Submit a request for the Final Inspection and Certificate of Acceptance**,** with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

1.2 Submit a certified copy of the Architect's Final Inspection list of items to be completed or corrected, endorsed and dated by the Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Architect.

1.3 Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.

1.4 Submit consent of surety to Final Payment.

1.5 Submit evidence of final, continuing insurance coverage complying with insurance requirements.

D. **Reinspection Procedure:** The Inspection Group will re-inspect the Work upon receipt of notice from the Construction Administrator that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Owner.

1. Upon completion of re-inspection, the Construction Administrator will prepare a Certificate of Acceptance for issuance by the Owner. If the Work is incomplete, the Construction Administrator will advise the General Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for Acceptance.

E. Issuance of a Certificate of Acceptance, in accordance with CGS § 4-61(b)(2) as amended, by the Owner does not alter the responsibility of the General Contractor to complete all Work in accordance with the Contract Documents.

F. General Contractor's As-Built Drawings Submittal:

1. General: The General Contractor shall not use the As-Built Drawings for construction purposes. Protect General Contractor's As-Built Drawings from deterioration and loss in a secure, fire-resistant location. Provide access to the As-Built Drawings for Owner's and Construction Administrator's reference during normal working hours. Keep documents current; do not permanently conceal any work until required information has been recorded. Failure to keep documents current is sufficient cause to withhold progress payments.

1.1 The General Contractor shall also engage the services of a Surveyor registered in the State of Connecticut to conduct a final survey to determine the location of exterior underground utility lines and to record the results, and update existing electronic media.

1.2 The record of exterior underground utilities shall be made at the time of installation on Mylar film drawing and AutoCAD (latest version) compatible disks. The drawing shall bear the seal of the Land Surveyor and a statement of accuracy.

2. General Contractor's As-Built Drawings: The General Contractor shall maintain one clean, complete undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. **Failure to keep As-built Documents current is sufficient cause to withhold progress payments.**

2.1 Mark record sets with erasable pencil to distinguish between variations in separate categories of the Work.

2.2 Mark all new information that is not shown on Contract Drawings.

2.3 Note related Agreement Amendments where applicable.

2.4 Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

2.5 Upon completion of the work, the General Contractor shall submit Record Drawings to the Construction Administrator for the Owner's Records who will pass them on to the Architect or Engineer for transferring the changes to the Record Drawing Mylar Tracings.

2.6 Submit electronic format data of all Coordination Drawing drawings as required by the owner.

2.7 Refer to Section **01 45 00 "Quality Control"** Paragraph **8.3.6** for required as-built drawings and specifications for fire alarm systems.

2.8 Upon completion of the work, the General Contractor shall submit Record Drawings to the Architect and/or Engineer for transferring the changes to the Record Drawings.

G. General Contractor's Record Documents: Within **thirty (30)** Calendar Days after receipt of the General Contractor's "As-Built Drawings" the Architect/Engineers shall convert the General Contractor "As-Built" information into an electronic CADD format as required by the Owner, using the original Architect/Engineer contract documents as base drawings. The Architect shall produce "Record Documents" that show all of the significant modifications made during the course of the project. The Architect's shall produce ***two (2)*** sets of electronic CADD format "Record Documents" on electronic media as required by the Owner and (1) set of reproducible Mylar's "Record Documents". The original Mylar "Cover Sheet" that includes the original Architect/Engineer Team Members dated signatures and professional seals shall be the Record Documents Cover Sheet. The Architect's final "Record Documents" (electronic media and reproducible Mylar's) shall be made at the Architect's expense and shall become the property of the State.

H. General Contractor's Record Specifications: The General Contractor shall maintain one complete copy of the Project Manual, Include with the Project Manual one copy of other written construction documents, such modifications issued in printed form during construction.

1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.

2. Give particular attention to the Technical Specifications and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.

3. Note related record drawing information and Product Data.

4. Upon completion of the Work, submit record Specifications to the Construction Administrator for the Owner's records.

I. **General Contractor's As-Built Product Data:** The General Contractor shall maintain one copy of each As-Built Product Data submittal and a markup of record drawings and As-Built Specifications.

1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.

2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.

3. Upon completion of markup, submit complete set of As-Built Product Data to the Construction Administrator for the Owner's records.

4. The Architect and Engineers will be responsible for the accuracy of As-Built Drawings.

J. **General Contractor's Record Sample Submitted:** Immediately prior to Substantial Completion, the appropriate Architect/Engineer Team Members shall meet with the Owner, Construction Administrator, and the Agency's personnel at the Project Site to determine which Samples are to be transmitted to the Owner for record purposes. Comply with the Owner/Agency instructions regarding delivery to the Owner/Agency Sample storage area.

K. **General Contractor's Miscellaneous Record Submittals:** Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to the Construction Administrator for the Owner's records.

L. **Maintenance Manuals:** Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, ***2", three (3)***-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder according to Section **01 78 23 "Operation and Maintenance Data"**. The manual shall include, but not be limited to, the following types of information:

1. ***Emergency instructions.***

2. ***Spare parts list.***

3. ***Copies of warranties.***

4. ***Wiring diagrams.***

5. ***Recommended "turn-around" cycles.***

6. ***Inspection procedures.***

7. ***Shop Drawings and Product Data.***

8. ***Fixture lamping schedule.***

9. ***List of vendors and addresses.***

M. **Closeout Procedures:**

1. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Agency's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:

1.1 ***Maintenance manuals.***

1.2 ***Record documents.***

1.3 ***Spare parts and materials.***

1.4 ***Tools.***

1.5 Lubricants.

1.6 Fuels.

1.7 Identification systems.

1.8 Control sequences.

1.9 Hazards.

1.10 Cleaning.

1.11 Warranties and bonds.

1.12 Maintenance agreements and similar continuing commitments.

2. As part of instruction for operating equipment, demonstrate the following procedures:

2.1 Startup.

2.2 Shutdown.

2.3 Emergency operations.

2.4 Noise and vibration adjustments.

2.5 Safety procedures.

2.6 Economy and efficiency adjustments.

2.7 Effective energy utilization.

N. Final Cleaning:

1. General: The Contract Documents require general cleaning during construction. Regular site cleaning is included in **Section 01 74 13 "Progress Cleaning".**

2. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion and Certification of Occupancy.

3. Interior:

3.1 Remove labels that are not permanent labels.

3.2 Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Remove paint spots; wash and polish glass.

3.3 Clean exposed interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

3.4 Wash washable surfaces of mechanical, electrical equipment and fixtures and replace filters, clean strainers on mechanical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

3.5 Clean and polish finish hardware.

3.6 Clean and polish tile and other glazed surfaces.

3.7 Clean floors; wax and buff resilient tile. Clean vinyl or rubber base.

3.8 Vacuum and/or dust walls, ceilings, lighting fixtures, ceiling diffusers and other wall and ceiling items.

3.9 Remove defacements, streaks, fingerprints, and erection marks.

4. Exterior:

4.1 Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth, even-textured surface.

4.2 Clean exposed exterior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances

4.3 Clean roofs, gutters and downspouts.

4.4 Remove waste and surplus materials, rubbish and construction equipment and facilities from the site, and deposit it legally elsewhere.

4.5 Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Remove paint spots; wash and polish glass.

5. **Pest Control:** Engage an experienced, licensed exterminator to make a final inspection and rid the work of rodents, insects, and other pests.

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

7. **Compliance:** Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Agency's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.

7.1 Where extra materials of value remain after completion of associated Work, they become the Agency's property. Dispose of these materials as directed by the Construction Administrator.

7.2 Leave building clean and ready for occupancy. If the Design Builder fails to clean up, the Owner may do so, with the cost charged to the Developer.

O. **Prerequisites to Functional Completion**

1. All TAB work and the commissioning of systems must be complete prior to Functional Completion, unless approved in writing by the DCS Project Manager. Exceptions to this are the planned control system training performed after occupancy and any required seasonal or approved deferred testing. This includes for all systems, but is not limited to:

1.1 Completed and signed start-up and prefunctional checklist documentation;

1.2 Requested trend log data;

1.3 Submission of final approved TAB report;

1.4 Completion of all functional testing;

1.5 Required training of Owner personnel completed and approved;

1.6 Submission of the approved O&M manuals;

1.7 All identified deficiencies have been corrected or are approved by the Owner to be accepted from this milestone.

2. The DCS Project Manager and Construction Administrator will determine the date of Functional Completion after reviewing the Commissioning Authority (CxA) Agent's recommendation for Functional Completion.

01 78 23 OPERATION AND MAINTENANCE DATA

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Summary:** This Section includes administrative and procedural requirements for operation and maintenance manuals, including the following:

1. Preparing and submitting operation and maintenance manuals for building operating systems and equipment.

2. Preparing and submitting instruction manuals covering the care, preservation, and maintenance of architectural products and finishes.

C. **Related Sections:** The following sections contain requirements that relate to this Section:

1. Division 01 Section **01 33 00 "Submittal Procedures"** specifies preparation of Shop Drawings and Product Data.

2. Division 01 Section **01 75 00 "Starting and Adjusting"** specifies instruction of the Owner and Agency operating personnel in the operation and maintenance of building

systems and equipment and the general requirements for starting-up equipment and systems.

3. Division 01 Section **01 77 00 "Closeout Procedures"** specifies general closeout requirements.

4. Division 01 Section **01 78 30 "Warranties and Bonds"** specifies requirements for submittal of warranties and bonds.

5. Division 01 Section **01 81 13 "Sustainable Design Requirements"** specifies requirements for submittals related to green building certification.

6. Appropriate Sections of the Divisions 02 through 49 specify special operation and maintenance data requirements for specific pieces of equipment or building operating systems.

D. Quality Assurance

1. **Maintenance Manual Preparation:** In preparation of maintenance manuals, use personnel thoroughly trained and experienced in operation and maintenance of equipment or system involved.

1.1 Where maintenance manuals require written instructions, use personnel skilled in technical writing where necessary for communication of essential data.

1.2 Where maintenance manuals require drawings or diagrams, use draftsmen capable of preparing drawings clearly in an understandable format.

2. **Instructions for the Owner and Agency Personnel:** The Contractor must use experienced instructors thoroughly trained and experienced in operation and maintenance of equipment or system involved, to instruct the Owner's operation and maintenance personnel.

E. Submittals:

1. **Submittal Schedule:** Comply with the following schedule for submitting operation and maintenance manuals:

1.1 Before Substantial Completion, when each installation that requires operation and maintenance manuals is nominally complete, submit ***two (2)*** draft copies of each manual to the Construction Administrator for review. Include a complete index or table of contents of each manual.

1.1.1 The Construction Administrator will return ***one (1)*** copy of the draft with comments within **twenty-one (21)** Calendar Days of receipt.

1.1.2 Submit ***three (3)*** copies of data in final form at least **twenty (21)** Calendar Days before final inspection. The Construction Administrator will return ***one (1)*** copy within **twenty (21)** Calendar Days after final inspection, with comments.

2. After final inspection, make corrections or modifications to comply with the Architect's comments. Submit final copies to the Construction Administrator within **twenty (21)** Calendar Days of receipt of the Architect's comments.

3. **Form of Submittal:** Prepare operation and maintenance manuals in the form of an instructional manual for use by the Owner's operating personnel. Organize into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder.

4. **Binders:** For each manual, provide heavy-duty, commercial-quality, ***three (3)***-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to receive ***8-1/2" x 11"*** paper. Provide a clear plastic sleeve on the spine to hold labels describing contents. Provide pockets in the covers to receive folded sheets.

4.1 Where ***two (2)*** or more binders are necessary to accommodate data, correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-reference other binders where necessary to provide essential information for proper operation or maintenance of the piece of equipment or system.

4.2 Identify each binder on front and spine, with the printed title **"OPERATION AND MAINTENANCE MANUAL"**, Project title or name, and subject matter covered. Indicate volume number for multiple volume sets of manuals.

5. **Dividers:** Provide heavy paper dividers with celluloid-covered tabs for each separate section. Mark each tab to indicate contents. Provide a typed description of the product and major parts of equipment included in the section on each divider.

6. **Protective Plastic Jackets:** Provide protective, transparent, plastic jackets designed to enclose diagnostic software for computerized electronic equipment.

7. **Text Material:** Where maintenance manuals require written material, use the manufacturer's standard printed material. If manufacturer's standard printed material is not available, provide specially prepared data, neatly typewritten, on ***8-1/2" x 11", 20-lb/sq ft*** white bond paper.

8. **Drawings:** Where maintenance manuals require drawings or diagrams, provide reinforced, punched binder tabs on drawings and bind in with text.

8.1 Where oversize drawings are necessary, fold drawings to the same size as text pages and use as a foldout.

8.2 If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in front or rear pocket of binder. Insert a typewritten page indicating drawing title, description of contents, and drawing location at the appropriate location in the manual.

F. Manual Content

1. In each manual include information specified in the individual Specification Section and the following information for each major component of building equipment and its controls:

1.1 General system or equipment description.

1.2 Design factors and assumptions.

1.3 Copies of applicable shop drawings and product data.

1.4 System or equipment identification, including:

1.4.1 Name of manufacturer.

1.4.2 Model number.

1.4.3 Serial number of each component.

1.5 Operating instructions.

1.6 Emergency instructions.

1.7 Wiring diagrams.

1.8 Inspection and test procedures.

1.9 Maintenance procedures and schedules.

1.10 Precautions against improper use and maintenance.

1.11 Copies of warranties.

1.12 Repair instructions including spare parts listing.

1.13 Sources of required maintenance materials and related services.

1.14 Manual index.

2. Organize each manual into separate sections for each piece of related equipment. As a minimum, each manual shall contain a title page; a table of contents; copies of product data, supplemented by drawings and written text; and copies of each warranty, bond, and service contract issued.

2.1 **Title Page:** Provide a title page in a transparent, plastic envelope as the first sheet of each manual. Provide the following information:

2.1.1 Subject matter covered by the manual.

2.1.2 Name and address of the Project.

2.1.3 Date of submittal.

2.1.4 Name, address, and telephone number of the Contractor.

2.1.5 Name and address of the Architect and Construction Administrator.

2.1.6 Cross-reference to related systems in other operation and maintenance manuals.

2.2 **Table of Contents**: After title page, include a typewritten table of contents for each volume, arranged systematically according to the Project Manual format. Include a list of each product included, identified by product name or other appropriate identifying symbol and indexed to the content of the volume.

2.2.1 Where a system requires more than one volume to accommodate data, provide a comprehensive table of contents for all volumes in each volume of the set.

2.3 Provide a general information section immediately following table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the subcontractor or Installer and the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities. Include a local source for replacement parts and equipment.

2.4 **Product Data:** Where the manuals include manufacturer's standard printed data, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where the Project includes more than ***one (1)*** item in a tabular format, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation, and delete references to information that is not applicable.

2.5 **Written Text**: Prepare written text to provide necessary information where manufacturer's standard printed data is not available, and the information is necessary for proper operation and maintenance of equipment or systems. Prepare written text where it is necessary to provide additional information or to supplement data included in the manual. Organize text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operation or maintenance procedure.

2.6 **Drawings:** Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems or to provide control or flow diagrams. Coordinate these drawings with information contained in project record drawings to assure correct illustration of the completed installation.

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

2.7 **Warranties and/or Bonds:** Provide a copy of each warranty and/or bond in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to follow in the event of product failure. List circumstances and conditions that would affect validity of warranty or bond.

G. Material and Finishes Maintenance Manual:

1. Submit ***four (4)*** copies of each manual, in final form, on material and finishes to the Construction Administrator for distribution. Provide ***one (1)*** section for architectural products, including applied materials and finishes. Provide a second section for products designed for moisture protection and products exposed to the weather.

1.1 Refer to individual Specification Sections for additional requirements on care and maintenance of materials and finishes.

2. **Architectural Products:** Provide manufacturer's data and instructions on care and maintenance of architectural products, including applied materials and finishes.

2.1 **Manufacturer's Data:** Provide complete information on architectural products, including the following, as applicable:

2.1.1 Manufacturer's catalog number.

2.1.2 Size.

2.1.3 Material composition.

2.1.4 Color.

2.1.5 Texture.

2.1.6 Reordering information for specially manufactured products.

2.2 **Care and Maintenance Instructions:** Provide information on care and maintenance, including manufacturer's recommendations for types of cleaning agents to be used and methods of cleaning. Provide information on cleaning agents and methods that could prove detrimental to the product. Include manufacturer's recommended schedule for cleaning and maintenance.

3. **Moisture Protection and Products Exposed to the Weather:** Provide complete manufacturer's data with instructions on inspection, maintenance, and repair of products exposed to the weather or designed for moisture-protection purposes.

3.1 **Manufacturer's Data:** Provide manufacturer's data giving detailed information, including the following, as applicable:

3.1.1 ***Applicable standards.***

3.1.2 ***Chemical composition.***

3.1.3 ***Installation details.***

3.1.4 ***Inspection procedures.***

3.1.5 ***Maintenance information.***

3.1.6 ***Repair procedures.***

H. **Equipment and Systems Maintenance Manual:**

1. Submit ***four (4)*** copies of each manual, in final form, on equipment and systems to the Construction Administrator for distribution. Provide separate manuals for each unit of equipment, each operating system, and each electric and electronic system.

1.1 Refer to individual Specification Sections for additional requirements on operation and maintenance of the various pieces of equipment and operating systems.

2. **Equipment and Systems:** Provide the following information for each piece of equipment, each building operating system, and each electric or electronic system.

2.1 **Description:** Provide a complete description of each unit and related component parts, including the following:

2.1.1 ***Equipment or system function.***

2.1.2 ***Operating characteristics.***

2.1.3 ***Limiting conditions.***

2.1.4 ***Performance curves.***

2.1.5 ***Engineering data and tests.***

2.1.6 ***Complete nomenclature and number of replacement parts.***

2.2 **Manufacturer's Information:** For each manufacturer of a component part or piece of equipment, provide the following:

2.2.1 ***Printed operation and maintenance instructions.***

2.2.2 ***Assembly drawings and diagrams required for maintenance.***

2.2.3 ***List of items recommended to be stocked as spare parts.***

2.3 **Maintenance Procedures:** Provide information detailing essential maintenance procedures, including the following:

2.4 **Operating Procedures:** Provide information on equipment and system operating procedures, including the following:

2.4.1 ***Startup procedures.***

2.4.2 ***Equipment or system break-in.***

2.4.3 ***Routine and normal operating instructions.***

2.4.4 ***Regulation and control procedures.***

2.4.5 ***Instructions on stopping.***

2.4.6 ***Shutdown and emergency instructions.***

2.4.7 ***Summer and winter operating instructions.***

2.4.8 ***Required sequences for electric or electronic systems.***

2.4.9 Special operating instructions.

2.5 **Servicing Schedule:** Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.

2.6 **Controls:** Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.

2.7 **Identification Drawings:** Provide each Contractor's Identification Drawings.

2.7.1 Provide as-installed, color-coded, piping diagrams, where required for identification.

2.8 **Valve Tags**: Provide charts of valve-tag numbers, with the location and function of each valve.

2.9 **Circuit Directories:** For electric and electronic systems, provide complete circuit directories of panel boards, including the following:

2.9.1 Controls.

2.9.2 Communication.

3. Electronic Media:

3.1 For equipment which requires maintenance by operational personnel, provide a professionally developed ***DVD*** for the use of maintenance training for the facility. Each ***DVD*** will be accompanied by a written index which can be utilized to find any specific item of information by time or place on the ***DVD.***

3.2 The General Contractor is responsible for this production. This ***DVD*** will be provided to the Construction Administrator at the same time as the delivery of the other maintenance material.

3.3 The ***DVD*** must be able to be edited for future changes to the equipment and modifications as they occur.

01 78 30 WARRANTIES AND BONDS

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Summary:** This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the General Contractor's period for correction of the Work.

C. **Related Sections:** The following Sections contain requirements that relate to this Section:

1. Division 01 Section **01 33 00 "Submittal Procedures"** specifies procedures for submitting warranties.

2. Division 01 **Section 01 77 00 "Closeout Procedures"** specifies contract closeout procedures.

3. Division 01 **Section 01 78 23 "Operation and Maintenance Data"** specifies required operation and maintenance data.

4. The Divisions 02 through 49 Sections for specific requirements for warranties on products and installations specified to be warranted.

5. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

D. **Disclaimers and Limitations**: Manufacturer's disclaimers and limitations on product warranties do not relieve the General Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve the suppliers, manufacturers, and subcontractors required to countersign special warranties with the General Contractor.

E. **Related Damages and Losses:** When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

F. **Reinstatement of Warranty:** When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

G. **Replacement Cost:** Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The General Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

H. **Owner's Recourse:** Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. **Rejection of Warranties:** The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

I. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the General Contractor presents evidence that entities required to countersign such commitments are willing to do so.

J. The General Contractor shall warranty all materials and workmanship for a period of **eighteen (18)** months from the date of Substantial Completion. In addition, the General Contractor shall furnish the warranties listed below. Submit four copies of each to the Architect in the supplier's standard form or in the form given below if there is no standard form available.

K. **Specification/Warranty Table:** The General Contractor shall provide for all warranties as shown in the Specification/Warranty table:

Specification / Warranty Table

Item No.	Section No.		Specification Product/Warranty
1.	**04**	**04 01 20**	**Masonry repairs:** **2** year, material and workmanship.
2.	**05**	**05 50 00**	**Step over ladders and platforms:** **2** year material & workmanship.
3.	**07**	**06 10 00**	**Rough Carpentry:** **2** year General Contractor's warranty for installation.
4.	**07**	**07 01 50**	**Roof Restoration:** **10** year unlimited, materials and installation [the manufacturer's no dollar limit (NDL) warranty], and; **2** year General Contractor's warranty for installation.
5.	**07**	**07 22 00**	**Roof and Deck Insulation:** **2** year General Contractor's warranty for installation.
6.	**07**	**07 51 13**	**Roof Repairs and Maintenance:** **2** year General Contractor's warranty for installation.
7.	**07**	**07 60 00**	**Flashing and Sheet Metal:** **10 year unlimited materials and installation on coated aluminum** **10 year unlimited materials and installation on waterproof coating** **2** year General Contractor's warranty for installation.
8.	**07**	**22 20 00**	**Roof Drains:** **5** year unlimited materials and installation [the manufacturer's no dollar limit (NDL) warranty], and; **2** year General Contractor's warranty for installation

L. Submit certification that finish materials are fire rated as specified.

M. Form of Warranty: Warranties shall be submitted in following format:

Warranty

Commissioner: *(Insert Commissioner's Name)*
Department of Administrative Services
Division of Construction Services
165 Capitol Avenue
Hartford, Connecticut 06106

Project Number: *(Insert DAS Project Number)*
Project Title: *(Insert Project Title)*

I (We) hereby warranty

the _____ ***work on the referenced project for a period of*** _____ ***years***

from _____ ***, 20*** _____ ***against failures of workmanship and materials in accordance***

with the requirements of Section _____ ***, Page*** _____ ***, Paragraph*** _____ ***, of the Specifications.***

Installer ☐ | ***Subcontractor*** ☐ | ***Vendor/Suppliers*** ☐ | ***Manufacturer*** ☐

Installer or Subcontractor or Vendor/Suppliers or Manufacturer Name: _____

Installer or Subcontractor or Vendor/Suppliers or Manufacturer Signature: _____

General Contractor's Name _____

General Contractor's Signature: _____

or

General Contractor's Authorized Agent Signature: _____

N. Bonds shall be by approved Surety Companies, made out to the Commissioner, Department of Administrative Services on companies' standard form.

O. Warranties, Guarantees, or bonds supplied by the General Contractor's Subcontractors or Vendors/Suppliers or Manufacturers shall reference the project name, number, and location and be certified by the General Contractor to be for the product and installation on the project and must be countersigned by the General Contractor.

P. **Submittals**:

1. Submit written warranties prior to the date certified for Substantial Completion. If the General Contractor's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Owner.

2. Forms for special warranties are included in this Section. Prepare a written document utilizing the appropriate form, ready for execution by the General Contractor's, and by the General Contractor's subcontractor or vendor/supplier, or manufacturer. Submit a draft to the Owner, through the Construction Administrator, for approval prior to final execution.

2.1 Refer to the Divisions 02 through 48 Sections for specific content requirements and particular requirements for submitting special warranties.

3. **Form of Submittal:** At Acceptance of the Work compile ***two (2)*** copies of each required warranty properly executed by the General Contractor, and by the General Contractor's subcontractor or vendor/supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

4. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive ***8-1/2" x -11" (115-by-280-mm)*** paper.

4.1 Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed

description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.

4.2 Identify each binder on the front and spine with the typed or printed title "WARRANTIES," DCS Project Number, Project Title, name of the General Contractor, and name of General Contractor's subcontractor or vendor/supplier, or manufacturer.

4.3 When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

END SECTION

i:\976710\02 design\specs\017000_executionandcloseout procedures_dbb_minor_capital.docx

01 90 00 LIFE CYCLE ACTIVITIES

A. **Summary:** Section 01 90 00 Life Cycle Activities contains the following Subsections:

01 91 00	**Commissioning**

01 91 00 COMMISSIONING

A. **Related Documents:** Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. **Summary**

1. This Section includes equipment and system commissioning, including the following:

1.1 Completion of commissioning procedures on specific equipment and systems as indicated under "Related Sections" below.

1.2 Verification of operational and functional performance of specific equipment and systems for compliance with the “Design Intent” as described in the "Related Sections" indicated below.

C. **Related Sections**: The following Sections contain requirements that relate to this Section:

1. **Division 01 Section 01 33 00 "Submittal Procedures"** specifies procedures for submittal of Product Data and Quality Assurance Submittals.

2. **Division 01 Section 01 77 00 "Closeout Procedures"** specifies general closeout requirements.

D. **Definitions:**

1. **Advanced Construction Administration:** The process of verifying and documenting that the installation and performance of selected building systems meet or exceed the specified design criteria and therefore satisfy the design intent.

2. **Deficiencies and Resolutions List:** List of noted deficiencies discovered as result of advanced construction administration.

3. **Physical Inspection Process:** On-site inspection and review of related system components for conformance to the specifications.

E. **Description of Construction Phase Commissioning Process:**

1. Once the General Contractor and their subcontractors have provided the Engineer with written verification indicating completion of installation and startup procedures, the Engineer will conduct an on-site physical inspection of the specific systems and equipment.

2. Upon confirmation of system readiness, the Engineer will schedule with the contractors to perform functional compliance with the project specifications and drawings. The Engineer will oversee the process and will provide the format and documentation for these tests.

3. Deficiencies noted during these tests will be documented on the Deficiencies and Resolutions list. When corrected, issues will be resolved at the time of discovery. The responsible General Contractor and their subcontractors will resolve all other issues at a later date. All deficiencies will be noted by the Engineer as either resolved or pending resolution.

4. The construction commissioning process will be complete when all noted deficiencies have been corrected, proved to be in compliance with the project specifications, or otherwise resolved to the satisfaction of the Owner.

F. **Advanced Construction Administrator’s Duties and Responsibilities:**

1. Develop testing, adjusting, and balancing (TAB) specifications. Review the TAB report and request spot verification as required.

2. Perform site inspections and verify contractor readiness for the functional testing process. Document deficiencies for future resolution.

3. Witness contractor performed functional testing process as appropriate to verify contractor compliance with the functional testing procedures. Document deficiencies for future resolution.

4. Provide the Owner, Construction Administrator, and General Contractor and their subcontractors with a report to document the process and to verify that the process is complete.

G. Duties and Responsibilities of Others for Commissioning:

1. The advanced construction administration process will require the active participation of persons qualified to represent the Owner, the Mechanical Engineer, Electrical Engineer, General Contractor, Equipment Manufacturers' Representatives, Mechanical Contractor, HVAC Contractor, Controls Contractor, TAB Contractor, Electrical Contractor, and other specific subcontractors, as deemed appropriate. The Engineer will witness the final functional performance process. Participants shall include in their contracts all costs necessary to participate in and complete the process.

2. The General Contractor will assure the participation and co-operation of the subcontractors, as required to complete the commissioning process.

3. The Owner will assure the participation of their chosen representatives as required to complete the commissioning process.

4. The Engineer will assure the participation of necessary representatives from their Design Team as required to complete the commissioning process. Design team members will provide prompt replies to requests for information issued during the commissioning process.

5. It is the General Contractor's specific responsibility to complete their respective start-up and checkout procedures, and to insure the complete readiness of equipment and systems, prior to the start of the functional performance testing phase. The Engineer shall request written confirmation of system readiness for performance testing, from the General Contractor and the appropriate subcontractor. Once the Engineer is provided with confirmation of all related systems completion, the actual date and times for the functional performance testing process will be confirmed. The General Contractor and their subcontractors shall provide sufficient time, and qualified representatives, to complete this process at no additional cost to the State.

6. After a second failure of a system to successfully meet the criteria as set forth in the functional performance testing process, the General Contractor shall reimburse the Owner for all costs associated with any additional re-testing efforts made necessary due to remaining Contractor related system deficiencies previously reported by the General Contractor as corrected. These costs shall also include the costs (where applicable) for the Engineer.

7. Training on related systems and equipment operation and maintenance shall only be scheduled to commence after final performance commissioning is satisfactorily completed, and systems are verified to be **100** percent complete and functional.

H. Submittals:

1. Refer to **Section 01 33 00 "Submittal Procedures"**.

2. **Equipment Manufacturer's Startup Forms:** Submit ***two (2)*** completed copies of the installation and startup checklists provided by the equipment manufacturers to the Engineer.

3. **Test Reports:** Submit ***two (2)*** copies of test reports for equipment and systems to the Engineer.

4. **Control Schematics:** Submit ***two (2)*** copies of the control schematics for equipment, systems, and subsystems to the Engineer.

5. **Inspection Records:** Submit ***two (2)*** copies of the records of inspections for code compliance, and approved permits and licenses to operate the equipment and systems to the Engineer.

6. **Operating Data:** Submit ***two (2)*** copies of equipment and system operating data including all necessary instructions to facilitate operation to specified performance standards to the Owner.

7. **Maintenance Data:** Submit ***two (2)*** copies of equipment and system maintenance data including all necessary information required to maintain the equipment and systems in continuous operation, such as the testing, balancing and adjusting report and the as-built drawings.

END SECTION

PART 1 - GENERAL

1.01 SCOPE

A. The work specified herein shall be the removal of asbestos-containing roofing materials by persons who are knowledgeable, qualified, licensed, and trained in the removal, treatment, handling, and disposal of asbestos-containing roofing material, and the subsequent cleaning of the affected environment. The Contractor shall have a Competent Person in control on the job site with authority to take prompt corrective measures at all times during roofing removal work. This person must comply with applicable Federal, State, and Local regulations, which mandate work practices, and be capable of performing the work of this contract.

B. The State will retain the services of a Project Monitor for protection of its interests and those using the building. Area air sampling and a visual inspection to ensure proper clean-up of the work area will be conducted as deemed necessary.

C. Deviations from this Specification require the written approval of the State of Connecticut.

1.02 DESCRIPTION OF WORK

A. The Contractor shall supply all labor, materials, equipment, services, insurance (with specific coverage for asbestos), and incidentals which are necessary or required to perform the work in accordance with applicable governmental regulations and these specifications.

B. The Contractor will pay for and coordinate material testing of the existing roofing and flashing to verify asbestos-containing materials. Report findings to the Owner and Engineer.

C. The Contractor shall remove and dispose of the asbestos-containing roofing material contained within the roofing and flashing assemblies of the existing roofs. Refer to the attached asbestos roofing inspection report for additional information.

1.03 DEFINITIONS

A. AGENCY - The authoritative force, usually at the state level, or their representative.

B. ASBESTOS-CONTAINING MATERIAL (ACM) - Any material containing more than one percent asbestos.

C. COMPETENT PERSON - In addition to the definition in 29 CFR 1926.32(f), one who is in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f); in addition, for Class I and Class II work who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR Part 763) for Supervisor, or its equivalent.

D. HIGH-EFFICIENCY PARTICULATE AIR (HEPA): A filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles 0.3 microns in diameter.

E. LEAK-TIGHT: - Solids or liquids cannot escape or spill out. It also means dust-tight.

F. REGULATED AREA: - Area established by the Competent Person to demarcate areas where airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed, the Permissible Exposure Limit.

G. NON-FRIABLE REGULATED ASBESTOS -CONTAINING MATERIAL – means any material containing more than 1 percent asbestos as determined using the method specified in appendix A, subpart F, 40 CFR part 763, section I, Polarized Light Microscopy, that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

H. REGULATED ASBESTOS -CONTAINING MATERIAL (RACM) – means (a) Friable asbestos material, (b) Category I nonfriable ACM that has become friable, (c) Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or (d) Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations regulated by this subpart.

1.04 REFERENCES

A. The current issue of each document shall govern. Where conflict among requirements or with these specifications exists, the more stringent requirements shall apply.

1. Occupational Safety and Health Administration (OSHA) 29 CFR 1926.1101 - Asbestos

2. Environmental Protection Agency (EPA) 40 CFR 61, Subpart M - National Emission Standards for Hazardous Air Pollutants; Asbestos NESHAP Revision; Final Rule. 40 CFR 763, Appendix C to Subpart E - Asbestos Model Accreditation Plan (MAP)

3. State of Connecticut, Department of Public Health Regulations (DPH) Section 19a-332a-1 through 19a-332a-16 - Standards for Asbestos Abatement

1.05 SUBMITTALS AND NOTICES

A. Prior to commencement of asbestos abatement work, submit to the A/E and Construction Coordinator and receive approval and/or acknowledgment of following:

1. Testing report for confirmation of ACM.

2. State notifications (when applicable).

3. Asbestos worker medical clearance to wear a respirator documentation.

4. Asbestos worker and Competent Person training documentation.

5. Asbestos worker respiratory fit testing documentation.

B. Within 35 days following the date the asbestos waste trailer leaves the job site, submit to the A/E and DPW Construction Coordinator:

1. Waste shipment record for disposal of asbestos roofing material.

1.06 PERSONNEL PROTECTION

A. Provide and require all workers to wear protective clothing and half face respirators when present in the Regulated Area established by the Competent Person.

1.07 WORKER TRAINING REQUIREMENTS

A. Training for the Competent Person, Supervisor, and Workers shall meet the requirements of Federal and State Regulations.

PART 2 PRODUCTS

2.01 MATERIALS

A. Polyethylene sheeting and disposal bags shall be 6-mil.

B. Labels and signs shall conform to applicable regulations.

2.02 TOOLS AND EQUIPMENT

A. Air monitoring equipment of the type and quantity required to monitor operations and conduct personnel exposure surveillance per OSHA requirements.

B. Protective clothing, respirators, filter cartridges, air filters and sample filter cassettes shall be provided in sufficient quantities for the project.

C. Waste Containers shall be lined with two (2) layers of 6-mil polyethylene sheeting and 1 layer of polypropylene burlap.

PART 3 EXECUTION

3.02 TESTING

A. Contractor shall coordinate and provide testing of the existing roofing and flashings for ACM. Sampling ACM at all work areas. Perform a minimum of ten (10) tests.

B. Issue a report from the testing agency that summarizes the findings and locates the samples on a roof area plan.

3.02 PREPARATION OF WORK AREA

A. Post warning signs meeting the specifications of OSHA 29 CFR 1910 and 29 CFR 1926.1101 at each Regulated Area. In addition, signs shall be posted at all approaches to Regulated Areas so that an employee may read the sign and take the necessary protective steps before entering the area.

B. Prior to start of work, and as needed during the job, the Competent Person shall inspect the work site and determine whether the roofing material is non-friable asbestos containing material and will likely remain non-friable asbestos containing material during removal activities.

C. Shut down and seal (with duct tape and 6-mil. poly sheeting) windows & roof level heating and ventilation air intakes that are in position to entrain dust or vapors from the roofing activities. Coordinate shut down of mechanical systems with Agency personnel. Where intake shutdown is not feasible (as determined by Agency), supply and install horizontal or vertical extensions to relocate the opening of the air intake outside or above the regulated area so as not to entrain dust and vapor emissions from the roofing removal and re-roofing activity.

3.03 ASBESTOS-CONTAINING ROOFING MATERIAL REMOVAL

A. All work shall be performed in accordance with OSHA Construction Industry Standard (29 CFR 1926.1101) and EPA NESPHAP Standard (40 CFR 61) and applicable State of Connecticut Regulations.

B. A Competent Person shall be on the job at all times to ensure proper work practices throughout the project.

C. The Contractor shall utilize methods, which do not sand, grind, cut or abrade the Asbestos-Containing Roofing Material. Should roofing materials be identified as regulated asbestos-containing material additional federal and state regulations will apply.

D. Pick up or HEPA vacuum asbestos-containing roofing debris from non-intact roofs prior to removal of the roofing. Bag debris for disposal.

E. Utilize wet methods to remove asbestos-containing roofing materials unless such wet methods are not feasible or will create safety hazards, as determined by the competent person, in writing.

F. HEPA vacuum asbestos-containing dust and debris left after the removal of asbestos-containing roofing. Where asbestos-containing built-up roofing is removed, HEPA vacuum the roof decking following roofing removal. Bag dust and debris for disposal.

G. Remove asbestos-containing flashings and associated cements or mastics using manual methods (such as axe, knife, or shovel). Do not sand, abrade or grind these materials.

H. Asbestos-containing roofing material shall be carried or passed to the ground by hand or lowered to the ground by crane or hoist. Do not drop asbestos-containing roofing material to the ground or into the dumpster. Transfer lowered asbestos-containing roofing material to the leak tight disposal dumpster carefully so as not to disperse dust.

3.04 DISPOSAL OF ASBESTOS-CONTAINING ROOFING MATERIAL

A. Disposal of asbestos-containing and/or asbestos contaminated material shall occur at an authorized site and must be in compliance with the requirements of, and authorized by the Office of Solid Waste Management, Department of Environmental Protection, State of Connecticut, or other designated agency having jurisdiction over solid waste disposal.

B. Asbestos warning signs must be attached to containers used to transport asbestos-containing waste. Warning signs shall be posted during loading and unloading of disposal containers. The signs must be posted so that they are plainly visible.

C. Label containers of asbestos-containing waste material or wrapped asbestos-containing waste material using warning labels specified by OSHA 29 CFR 1926.1101. Label asbestos-containing waste material destined for off-site transport with the name of the waste generator and the location where the waste was generated.

3.05 CONTRACTOR PERSONAL AIR MONITORING RESPONSIBILITY

A. Conduct air sampling to assure that workers are using appropriate respiratory protection in accordance with OSHA Construction Industry Standard 1926.1101. Documentation of air sampling results must be recorded at the work site within twenty-four (24) hours and shall be available for review until the job is complete.

B. Produce a written initial asbestos exposure assessment prior to starting asbestos roofing removal work in compliance with OSHA Standard 1926.1101. Keep the exposure assessment on site for review by all concerned parties.

END OF SECTION

i:\976710\02 design\specs\bi-rd-298_976710_section 02 82 13 asbestos containing roofing material abatement.docx

PART 1- GENERAL

1.01 IN GENERAL

The General Conditions, and all parts of the Bid and Contract Documents are made part of this Section as if fully repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 05 50 00 - Miscellaneous Metals
B. Section 06 10 00 - Rough Carpentry
C. Section 07 01 50 - Roof Restoration
D. Section 07 22 00 - Roof and Deck Insulation
E. Section 07 51 13 - Roof Repairs and Maintenance
F. Section 07 60 00 - Flashing and Sheet Metal
G. Section 22 20 00 - Roof Drains
H. Division 23 - Heating, Ventilating, and Air Conditioning
I. Division 26 - Electrical

1.03 SUMMARY OF WORK

In general, the Contractor shall supply all labor, additional materials, accessories, equipment, temporary protection, tools, and appliances necessary for the proper completion of the work in this Section, as required in the Specifications, in accordance with good roofing practice, and as required by the materials manufacturer, as amended. The work under this Section generally includes the following:

A. Remove and infill existing brick masonry at new penetrations through penthouse walls above Roof Area A. Coordinate with scheduled MEP work.

B. Remove existing brick masonry at the roof to wall below the skylight above Roof Area P, both sides. Remove excess mortar, and store for reinstallation.

C. New brick units for replacement of damaged units.

D. New copper fabric flashing and copper pan at through-wall flashing repairs above Roof Area P. Reinstall brick masonry following installation of new through-wall flashings.

E. Mortar joint color and profile to match the existing construction.

F. Provide full-height baffle weeps in every other head joint.

G. Clean all surfaces where masonry renovations are performed.

1.04 DIMENSIONS AND QUANTITIES

All dimensions and quantities shall be determined or verified by the Contractor. The Specifications have been compiled from various sources and may not reflect the actual condition at the moment of construction. The Contractor is cautioned to take all precautions and make all investigations necessary to install the proposed work. The Owner will not consider unfamiliarity with the job conditions as a basis for additional compensation.

1.05 JOB CONDITIONS

A. Do not leave partially completed sections exposed to the elements overnight. Provide all devices necessary to maintain areas at the correct temperature and humidity for proper curing of mortar.

B. To prevent staining of adjacent construction during the work, immediately remove mortar or coating which comes in contact with exterior surfaces. Protect all building components from damage or staining during construction.

C. Prepare, install, and cure all materials in accordance with these Specifications, the Brick Industry Association (B.I.A.) Technical Notes, and the Manufacturer's Printed Instructions. In the case of a discrepancy, the Specifications prevail.

D. The Contractor shall supply, install, and maintain all shoring, supports, barriers, protection, warning lines, lighting and personnel required to support the structure, fixtures and facilities affected by his work and segregate the work area(s) from pedestrian or vehicular traffic, as well as to prevent damage to the building, occupants, and the surrounding landscaped and paved areas. The buildings have numerous mechanical, electrical, and plumbing systems, which must remain in operation during renovations. Contractor must submit in writing for approval, the proposed means, and methods for temporary protection of these systems.

E. The Contractor shall use dust collection vacuums (HEPA vacuums) to limit airborne dust associated with grinding the existing mortar joints. All costs associated with additional power generators shall be the Contractor’s responsibility.

F. Coordinate the work in this section with the work by other trades to ensure the orderly progress of the work. No brick masonry or repointing work shall be installed until it has been reviewed and approved by the Engineer for technical acceptability and by the Owner for acceptability as to appearance, color, and texture match.

G. Repoint mortar joints and repair masonry only when air and surface temperature is between 40 and 90^{o}F (4 and 32^{o}C) and is predicted to remain so for at least 7 days after completion of work.

H. Cold Weather Application - (Applies only to rebuilding, no repointing shall be completed when air temperature is less than 40^{o}F) The Contractor shall comply with

the following cold weather masonry construction requirements at no change in contract price:

1. The cold weather construction and protection requirements shall be closely followed.
2. Construction materials shall be received, stored, and protected in ways that prevent water from entering the materials.
3. If climatic conditions warrant, temperatures of construction materials should be measured. Frozen sand and wet masonry units must be thawed. Masonry units below 20°F must be heated above 20°F without overheating.
4. Sufficient mortar ingredients should be heated to produce mortar temperatures between 40°F and 120°F. Every effort should be made to produce consecutive batches of mortar with the same temperatures falling within this range. The mortar temperature after mixing and before use should be above 40°F, maintainable either by auxiliary heaters under the mortarboard or by more frequent mixing of mortar batches. Heated mortar on mortarboards should not become excessively hot (greater than 120 °F).
5. During below-normal temperatures, masonry should be placed only on sound unfrozen foundations. Masonry should never be placed on a snow or ice-covered surface, because of the danger of movement when the base thaws and the possibility of very little bond being developed between the mortar and the supporting surface.
6. At the end of each day, the top surface of all masonry should be protected to prevent moisture, as rain, snow, or sleet, from entering the masonry. This protection must cover the top surface and should extend a minimum of 2' down all sides of the masonry.

WORK DAY TEMPERATURE	CONSTRUCTION REQUIREMENT	PROTECTION REQUIREMENT
Above 40ºF	**Normal masonry procedures.**	*Cover walls with plastic or canvas at end of workday to prevent water entering masonry.*
40ºF – 32ºF	**Heat mixing water to produce mortar temperatures between 40ºF – 120ºF.**	*Cover walls and materials to prevent wetting and freezing. Covers should be plastic or canvas.*
32ºF – 25ºF	**Heat mixing water and sand to produce mortar temperatures between 40ºF – 120ºF.**	*With wind velocities over 15 mph provide windbreaks during day and cover walls and materials at the end of the workday to prevent wetting and freezing.*
25ºF – 20ºF	**Mortar on boards should be maintained above 40ºF.**	*Maintain masonry above freezing*

WORK DAY TEMPERATURE	CONSTRUCTION REQUIREMENT	PROTECTION REQUIREMENT
		for 16 hours using auxiliary heat or insulated blankets.
20ºF – 0ºF and below	**Heat mixing water and sand to produce mortar temperatures between 40ºF – 120ºF.**	*Provide enclosures and supply sufficient heat to maintain masonry enclosure above 32ºF for 24 hours.*

Note: Construction requirements, while work is in progress, are based on *ambient* temperatures. Protections requirements, after masonry is placed, are based on *mean* daily temperatures.

7. Hot Weather Application - The Contractor shall keep the areas being built sufficiently moist at all times during the operations. Mortar mixed and ready for application shall be used within one hour's time and continually remixed to prevent excessive evaporation of moisture from the mortar. Discard all mortar, which has begun to set or is not used within two (2) hours' time. Water for tempering shall be available at all times.

I. Under no circumstances shall the Contractor remove existing materials and systems to the ground in an uncontrolled manner. Machinery or devices used shall be manufactured for this purpose. Adjacent building and property areas shall be protected from airborne debris.

J. All areas of existing brick masonry or flashings removed shall be replaced or made secure and weather tight during the same day. No building interiors, whether new or existing shall be left exposed to the weather at the end of each workday.

K. During removal operations, the Contractor is responsible for the containment of all dust, dirt, debris, overspray, and run-off resulting from the work. The Contractor shall collect and contain all materials and repair any resulting damage to adjacent surfaces, site fixtures, or personal property. Specific attention is drawn to the use of chemicals and cleaners.

L. No brick masonry shall be installed until it has been reviewed and approved by the Owner for acceptability as to appearance and color match.

M. Fully charged, inspected, and approved fire extinguishers shall be on site at all times. No cutting, grinding, or welding of any kind shall proceed without an approved fully charged fire extinguisher.

N. The general nature, approximate quantity, and surface area of the various work items are shown on the Contract Drawings.

O. Hot Weather Concreting:

1. Conform to ACI 305-72, "Recommended Practice for Hot Weather Concreting." Take precautions when the ambient air temperature is 90°F or above. Temperature of the concrete when placed shall not exceed 80°F. Cool reinforcing to a maximum of 90°F by spraying with water prior to placing concrete. Do not use cement that has reached temperatures in excess of 170°F.
2. Prevent plastic shrinkage cracking due to rapid evaporation of moisture. Do not place concrete when the evaporation rate (actual or anticipated) equals or exceeds 0.20 pounds per square foot per hour, as determined by Figure 2.1.4 of ACI 305.
3. Set-retarding admixtures may be used with Owner's approval when the ambient air temperature is 90°F or above to off-set the accelerating effects of high temperatures.

1.06 ROOF AND BUILDING PROTECTION

A. Above roofline masonry renovations shall be completed prior to installation of new roofing systems. Schedule mock-ups, curing times, cleaning, and time for Owner/Engineer approvals prior to beginning roof replacement.

B. The existing roof and building systems shall be protected during the renovations. The Contractor is responsible for any damages to the existing building systems.

C. Install canvas over all wall penetrations, grills, vents and over roof systems during brick masonry repair work and cleaning. Secure Owner’s approval to temporarily shut down equipment prior to covering vents and grills.

D. Provide 1” polyisocyanurate insulation covered with 1/2” plywood for roof protection at low slope roofing areas.

E. The Contractor is responsible for the prompt repair of any damage to the building systems resulting from the work at the project at no additional cost to the Owner.

F. All labor, equipment, and materials on the Roof Areas shall not exceed 30 pounds per square foot.

1.07 SUBMITTALS

A. The Contractor shall submit the following items with their submittal package.

1. Methods of removal of materials
2. Operation sequence plan
3. Temporary protection procedures
4. Shoring design for masonry removals
5. Staging/set-up procedures
6. Program for containment of cleaning chemicals

B. Submit certification that aggregates for masonry mortar complies with specified requirements including void ratio, color, size, and grading requirements.

1. Submit aggregate sample.

C. Provide mortar joint mock-up for review by the Owner. Mock up shall be as described in the Test Area section of this specification.

D. Submit mortar mixture ratio to the Owner/Engineer upon receipt of an approved color scenario.

E. Submit drawings and written description of shoring procedures for masonry rebuilding work, including extent of removals and method of support, to the Engineer.

1. Submit shoring procedures with the seal of a licensed Professional Engineer who has reviewed the drawings and written description.

F. Submit certificates attesting compliance with the applicable specifications for the grades, types, and classes of brick masonry.

G. Submit brick samples: six (6) units showing complete range of color. New bricks shall match the color, texture, and size of existing cleaned brick. Submit in person, on site for visual review compared to existing.

H. Submit size, shape, and profile of replacement brick types.

I. Submit brick test results from independent testing laboratory (ASTM C67):

1. Compressive strength
2. Absorption: 24-hour cold-water test
3. Absorption: 5-hour boiling-water test
4. Initial rate of absorption

J. Submit proposed method of providing a dust proof site (dust removal) during masonry demolition work.

K. Submit proposed method of protection for building interior, adjacent building, landscaping, pavement, walkways, site plantings, and related site work from damage.

L. The buildings have numerous mechanical, electrical, and plumbing systems, which must remain in operation during renovations. Contractor must submit in writing for approval, the proposed means, and methods for temporary protection of these systems.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store cement in watertight enclosures and protect against dampness, contamination, and warehouse set.

B. Stock pile aggregates to prevent segregation, or contamination with other materials or other sizes of aggregates. Use only one supply source for each aggregate stockpile.

C. Store rubber and plastic materials for chair supports in a cool place away from direct sunlight.

D. Handle and store materials to prevent contamination and contact with the ground.

1.09 QUALITY ASSURANCE

A. Ensure that all personnel engaged in the Work of this Section are qualified masonry journeymen, who may be assisted by masonry apprentices qualifying for their journeyman status.

1. Common labor may be used for tasks not requiring journeyman skills.

1.10 REFERENCE STANDARDS

A. ASTM C144-11 Specification for Aggregate for Masonry Mortar

B. ASTM C150/C150M-12 Specification for Portland Cement

C. ASTM C207-06(2011) Specification for Hydrated Lime for Masonry Purposes

D. ASTM C270-14a Standard Specification for Mortar for Unit Masonry

E. ASTM C67-14 Test Methods of Sampling and Testing Brick and Structural Clay Tile

F. ASTM C114-13 Test Methods for Chemical Analysis of Hydraulic Cement

G. ASTM C62-13a Specification for Building Brick (Solid Masonry Units made from Clay or Shale)

H. ASTM C216-15 Specification for Facing Brick (Solid Masonry Units made from Clay or Shale)

I. BIA (Brick Industry Association) Technical Notes

1.11 TEST AREAS

A. Test Areas: Provide field samples on the building to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of

materials and execution. Test areas shall be performed prior to the commencement of the full scope of work and shall be reviewed by the Owner, and Engineer as to acceptability of quality, color, texture, and appearance match with the existing construction.

1. Provide in-place mortar mock-up for acceptance of color, texture, placement, and profile for a match to the existing. Three (3) square feet minimum.

2. Coordinate with sheet metal work to provide through wall flashing test areas as specified in Section 07 62 00, Sheet Metal Roofing. Sheet metal test areas must be approved prior to covering with masonry.

B. Prepare, install, and cure all materials in accordance with these specifications and the manufacturer's instructions. Allow samples to cure for at least seven (7) days (or longer if recommended by the manufacturer) before obtaining Owner's approval for color match. Install samples as far in advance as possible of scheduled Work.

C. Test areas shall be repeated until acceptable results are obtained, at no additional cost to the Owner. The accepted work shall be a standard for all subsequent work and may become part of the completed work if undisturbed at time of Substantial Completion.

1.12 WARRANTY

A. Upon completion of the work, and prior to final payment, the Contractor shall submit a Guarantee of his work to be free from defect in materials and workmanship. This Guarantee shall be for a period of **two (2) years**, and shall be signed by a Principal of the Contractor's firm, and sealed if a corporation.

PART 2 - MATERIALS

2.01 REUSE OF EXISTING BRICK

A. It is the intent of the masonry work to remove and reinstall the existing brick in order to replace through wall flashing. If needed, supplement with new brick units as required that match the exiting units in size, texture, color, etc. Replacement units to be reviewed and approved by the Engineer.

2.02 REPLACEMENT BRICK UNITS

A. Brick masonry shall conform to ASTM C 216, Grade SW, and Type FBS specification. Type FBA brick may be allowed pending review of samples to match existing.

B. Brick size shall match existing. Contractor to verify if existing brick is modular or standard size. Brick shall be solid with mortar frogs.

C. All brick shall be submitted to the Owner for acceptability as to color and appearance match with the existing brick. The Contractor may be required to submit additional brick samples for approval. No brick shall be purchased or installed until approval by the Owner is obtained.

2.03 MORTAR

A. Mortar for brick masonry repointing and veneer rebuilding shall be a Type N, conforming to ASTM C270 specifications and shall closely match the existing in color, texture, and appearance.

B. Mortar for load bearing brick masonry rebuilding shall be a Type S, conforming to ASTM C270 specifications and shall closely match the existing in color, texture, and appearance.

C. Cement: Portland cement, Type I, ASTM C150.

1. The same brand and color of cement shall be used throughout the Work.
2. Provide White Portland Cement as required to match existing adjacent mortar colors.

D. Lime: Hydrated Lime, Type S, ASTM C207.

E. Aggregate: ASTM C144. All aggregate used in the brick masonry work shall be from the same source in order to produce mortar of uniform color and texture throughout the Work.

1. Aggregate for us in the new mortar shall match the original mortar sand in color, texture, and size. The mortar producer shall verify existing sand type, color and if possible, origin.
2. Aggregate shall be free of organic contaminants. Chloride ions shall not exceed 50 parts per million.
3. Sand gradation shall match the following:

Sieve Size	**% Passing (By Weight)**
#4	100
#8	95-100
#16	70-100
#30	40-75
#50	20-40
#100	10-25
#200	0-10

F. Water: From municipal water supply, clean, potable, and free of all contaminants that might adversely affect the set, cure, and performance of mortar, masonry units, and embedded anchors and accessories.

G. Coloring pigment: The intent of this specification is to match the color of the existing mortar through colored sand and the cementitious materials. If this is not possible after trial batches, a mineral oxide pigment shall be non-fading, lime proof, inorganic, and 10% of the cement content by weight may be utilized in the mix.

1. If coloring is found to be required due to restrictions on sand availability, the pigment colors will be selected by the Owner. The selected colors shall be incorporated into the test panel for final pigment selection.
2. Use mortar mix identical to that of accepted test panel area.

2.04 WEEPS

A. Masonry weep baffles to be installed in full head joint weeps of brick masonry shall be 3/8'' x 2-1/2'' x 3-3/8'' baffle such as Wire Bond – Cell Vent No. 3601 as manufactured by Masonry Reinforcing Corporation of America, Quadro-Vent by Hohmann & Barnard, Inc., Cell Vent No. DA1006 as manufactured by Dur-O-Wal or approved equal.

2.05 ANCHORS

A. Anchors for tieback of new exterior wythes of masonry to existing brick back up material shall be stainless steel.

1. Acceptable Manufacturers
   a. *Dur-O-Wal*
   b. *Heckmann Building Products*
   c. *Hohmann & Barnard*
2. Type: Vertically adjustable pintel anchors
3. Fasteners for use with masonry anchors shall be 16 ga. Stainless-steel, pan-head masonry screws long enough to penetrate sound substrate 1=1/2".
4. Gage: 16 ga.

2.06 CLEANERS AND ACCESSORIES

A. Cleaner for newly rebuilt, replaced, or repointed brick masonry shall be a cleaner specifically designed for removing excess mortar stains and new efflorescence from masonry. Cleaner shall be Hydroclean HT455 Excess Mortar Remover by Hydrochemical Techniques, Inc., No. 101 Lime Solvent as manufactured by Pro-So-Co, 200 Lime Solvent as manufactured by Diedrich Technologies, or approved equal.

B. Masking materials shall be commercially available masking or duct tape of appropriate width. Self-adhesive materials shall be completely strippable, leaving no adhesive residue when removed.

C. Plastic sheet for masking tape areas shall be 6-mil thick minimum polyethylene sheet of appropriate size to cover the required areas.

2.07 SHEET METAL FLASHINGS

A. Refer to Section 07 60 00 Flashing and Sheet Metal.

2.08 SEALANTS

A. Perimeter Sealant shall be a two-part polyurethane conforming to ASTM C 920 Type S, Grade NS, Class 25 Uses NT, M, A, and O Specifications such as manufactured by Tremco, Pecora, DOW, or approved equal.

B. Backer rod shall be continuous length, closed cell polyethylene foam, as recommended by the sealant manufacturer. Backer rod shall be compressible, resilient, non-waxing, non-extruding, and non-staining. Backer rod shall be of sufficient size to be compressed 30% of maximum joint width and shall be totally compatible with the sealant, primer, and substrates. Backers shall conform to the requirements of ASTM C 962 - Type A, ASTM D 1622, ASTM D 1623, and ASTM D 5249 such as Green Rod by Nomaco, Sonofoam by Sonneborn, ITP soft type backer rod or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Follow all applicable local, state, and federal requirements regarding construction of scaffolding and protection of the public safety. Specific reference should be made to OSHA Construction Safety Regulations.

B. Set up of scaffolding or similar access and location of on-site storage areas shall be subject to review and approval by the Owner.

C. Provide temporary protection of subgrade drainage/catch basins to capture mortar wash.

D. Masonry work including cleaning shall be performed prior to replacement of the roofing beneath. The entire roof adjacent to masonry work must be protected with 1/2” minimum rigid insulation with plywood atop.

E. During the removal of any existing component, the Contractor shall report to the Owner any areas of damaged, deteriorated, or otherwise unsuitable framing, wood blocking, or wall materials uncovered during the work. Do not cover unacceptable areas until reviewed by the Owner and Engineer. Provide temporary protection to the area in question.

F. The Contractor shall lay-up replacement brick masonry units plumb, level, and true to the lines and dimensions at the existing walls. Chipped or broken units shall not be used. If any such units are placed in the finished wall, they shall be removed and replaced with new units at no additional cost to the Owner.

G. Refer to Brick Industry Association (BIA) technical notes for standard practice for masonry repointing, rebuilding and repair.

3.02 SHORING

A. It is the responsibility of the Contractor to design and carry out shoring procedures sufficient to comply with applicable regulations, securely support all masonry or other elements left unsupported by the required removals, and permit the work of other trades to proceed.

1. Ensure that shoring procedures are submitted to the Engineer in advance of the work.
2. If cracks occur in mortar joints of brick intended to remain, cut out the damaged joint area and repoint it after removal of shoring. Remove and replace displaced units.
3. Point all holes left in mortar by withdrawal of shore fastenings.
4. Completely remove shoring system when no longer needed.
5. Notify the Owner 48 hours in advance of installation of shoring.
6. Ensure that shoring complies with submittal bearing the seal of licensed Professional Engineer as specified above.

3.03 BRICK REMOVAL

A. Remove existing brick units in a manner that allows for reinstallation.

B. Thoroughly clean out all loose brick or mortar particles, sand, dust, and other deleterious materials.

1. All mortar shall be removed from the ends, tops, and bottoms of brick intended to remain.

C. Whenever practical, removals made adjacent to brick to remain shall be raked back, not toothed.

D. Do not damage existing flashing or other materials intended to remain.

E. Report unsuitable or otherwise damaged back up masonry substrates to Engineer prior to proceeding with work.

F. At through wall flashing locations, prepare the existing masonry substrate to receive new copper pan and fabric flashing. Rebuild, repoint, or reset the masonry back-up as required to provide smooth, level surfaces for flashings and terminations.

3.04 MORTAR

A. Mortar proportions shall be determined by independently testing mortar samples.

B. Mortar may be mixed by hand or rotary mixing machine. Empty mortar container and clean out moist or loose dry mortar before charging.

1. Accurately measure, **by volume**, all materials before their introduction into the container. Measurement by shovelfuls is not acceptable.
2. Mortar mixing procedure:

a. Follow the mortar manufacturer's required mortar mixing procedures.
b. Do not vary constituents from those specified in the mortar mix.

3.05 BRICK RE-SETTING

A. For brick with an initial rate of absorption (per ASTM C67) in excess of 30 mg/30 sq. in./min.: soak brick with water 24 hours prior to use so that they are saturated, surface dry. In hot, dry weather drench brick three (3) hours prior to use.

B. Lay all masonry true to line and dimensions, plumb and square, following existing coursings as closely as practicable.

1. Hot Weather (also see above): Spread mortar beds not more than 4' ahead of masonry units. Lay masonry unit within one (1) minute of spreading mortar. Protect mortar in tubs from the effects of wind and temperature. Do not allow mortar temperature to exceed 120° F.

C. For courses of new brick: do not furrow bed joints. Butter ends of brick with sufficient mortar to fill the head joints.

1. Shove mortar beds and heads to level units in true alignment with the course plane and to eliminate any front-to-rear bevel.
2. Equalize horizontal and vertical joints.
3. Place brick in correct alignment; do not move brick after mortar has achieved initial set. Remove and rebuild with new mortar if initial set is interrupted.

D. For courses of new brick adjacent to existing brick above: at the top course of new work, do not apply mortar to the brick unit to be set. Mortar the underside of the existing course above, and the top and ends of brick already in place.

1. Add, by pointing, additional mortar as required to develop fully packed bed, head, and vertical joints.

E. Tool joints when mortar is “thumb-print hard”, or, alternatively, when sufficient water has left the mortar to allow tooling without bringing excessive paste to the surface.

1. Tool the joints, by hard shoving, to a covered joint edging the brick either side of the joint.

F. Totally clean the areas of masonry rebuilding only after the rebuilding is completed and the mortar has been allowed to cure for eight (8) days minimum. Clean surfaces free of all dust, dirt and mortar stains as described in this section.

G. Visually inspect the Work and correct items not conforming to the Contract Documents, including cutting out and pointing all defective mortar joints. Ensure that weep holes or weep tubes are not plugged.

H. Profile of finished brick masonry joints shall closely match that of surrounding weathered brick mortar joints. Form the profile of the sandstone mortar joints as indicated on the Contract Drawings and to the Owners satisfaction.

3.06 CLEANING

A. Clean all existing, repaired, rebuilt, or repointed masonry areas of all construction stains and excess mortar. Do not perform any cleaning until mortar joints are fully cured, and the cleaning mock-up has been performed and approved.

B. Rinse all cleaner from the wall with water applied at the manufacturer’s recommended flow and pressure. High pressure washing equipment may be required. Any acid-neutralizing agent required by the manufacturer shall be applied as part of this rinse. Ensure that effluent does not accumulate at ground level, and fully rinse all effluent from sidewalks, streets and landscaping each day.

C. The Contractor must provide sufficient site protection to prevent the cleaning effluent from draining into the adjacent storm drains. The contractor will provide a narrative as to how the site protection will be performed.

D. Prior to acceptance of the masonry work covered in this section, the Contractor shall perform a thorough clean-up of the work site, building surfaces, landscaping, etc. Any plantings or other items damaged shall be repaired or replaced to the satisfaction of and at no additional cost to the Owner.

END OF SECTION

PART 1- GENERAL

1.01 IN GENERAL

The General Conditions, and all parts of the Bid and Contract Documents are made part of this Section as if fully repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 04 01 20 - Maintenance of Unit Masonry
B. Section 06 10 00 - Rough Carpentry
C. Section 07 01 50 - Roof Restoration
D. Section 07 22 00 - Roof and Deck Insulation
E. Section 07 51 13 - Roof Repairs and Maintenance
F. Section 07 60 00 - Flashing and Sheet Metal
G. Section 22 20 00 - Roof Drains
H. Division 23 - Heating, Ventilating, and Air Conditioning
I. Division 26 - Electrical

1.03 SUMMARY OF WORK

This Section specifies requirements for the following Scope of Work:

A. New steel members at cooling tower support dunnage.

B. Prepare and paint existing steel dunnage to remain.

C. Prepare and paint existing steel and cast-iron penetrations to remain (support posts, vent pipes, etc.).

D. Deck and augmenting frame removal and patching at multi-zone unit.

E. Replace existing wood cross-over platforms with new, pre-fabricated aluminum platforms, anchored through the roof into the existing deck.

1.04 JOB CONDITIONS

A. The building will be occupied during construction. The Contractor shall provide all protection, barriers, and guards necessary to segregate their work area, and the areas below, from building occupants.

B. The Contractor is cautioned that electrical conduits, plumbing, and mechanical lines are in close proximity to the existing members. The Contractor will be responsible for all disconnects/reconnects associated with exposing the elements to be strengthened.

C. The Contractor shall utilize skilled and experienced specialty workers to install the work. Experienced trade workers shall be utilized for all aspects of the work.

D. Coordinate the work in this section with the work by other trades to ensure the orderly progress of the work.

1. Should field welding be required, the Contractor shall use caution in the use of welding equipment. The Contractor shall supply a minimum of two (2) fully charged fire extinguishers and enough fire blankets to protect all combustible surfaces. A fire watch must be provided for a minimum of one (1) hour after completion of welding. All welding shall be performed on the ground prior to installing steel. No welding shall be performed adjacent to or in contact with timber framing.

E. Welding must be performed with the electric arc process (where applicable) and in accordance with AWS "Code for Arc and Gas Welding in Building Construction."

1.05 HOT WORK PROCEDURES

A. A HOT WORK Permit is required for any operation that involves open flames or producing heat and/or sparks. This includes, but is not limited to: brazing, cutting, grinding, soldering, and welding.

B. Fully charged, inspected, and approved fire extinguishers shall be on site at all times. No cutting, grinding, or welding of any kind shall proceed without an approved fully charged fire extinguisher.

C. Make sure construction in the area is non-combustible including insulation.

D. Remove combustible contents or cover with FM approved blankets or pads.

E. Follow procedures outlined under FM Global Resources 'Don't Get Burned by Hot Work' and 'Hot Work Permit Form – F2360'.

1.06 BUILDING PROTECTION

A. The existing building systems shall be totally protected during the repair work. The Contractor is responsible for the prompt repair of any damage to the building systems resulting from the work at the project at no additional cost to the Owner.

1.07 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

A. AISC 326-02 Detailing for Steel Construction

B. AISC 303-05 Code of Standard Practice for Steel Buildings and Bridges

C. ASTM A36 Standard Specification for Carbon Structural Steel

D. ASTM A307-10 Specification for Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength

E. ASTM A563-07a Specification for Carbon and Alloy Steel Nuts

F. ASTM F844-07a Specification for Washers, Steel, Plain (Flat), Unhardened for General Use

G. AWS A2.4 Standard Symbols for Welding, Brazing, and Nondestructive Examination

AMERICAN WELDING SOCIETY (AWS)

H. AWS D1.1 Structural Welding Code – Steel

I. AWS D1.3 Structural Welding Code – Sheet Steel

STEEL DECK INSTITUTE (SDI)

J. DDM03 – Diaphragm Design Manual

K. MOC2 – SDI Manual of Construction with Steel Deck

L. SDI Publication No. 27 – Design Manual for Composite Decks, Form Decks, and Roof Decks

1.08 SUBMITTALS

Shop Drawings and Submittals shall be made in accordance with the General Conditions and Section 01 30 00 Administrative Requirements. An addition, the following shall be submitted:

A. Drawings: Shop and erection details of all framing elements including members (with their connections) not shown on the contract drawings. Welds shall be indicated by standard welding symbols in accordance with AWS A2.4.

B. Engineered Shop Drawings: Shop drawings by a professional engineered licensed in the state of the project. Include plans, elevations, sections, full sized details (at a minimum scale of 3" = 1'-0"), and attachments to other work. Show member lengths, joints, terminations, and erection sequence. Details shall illustrate the anchorage system, welds, and interfacing with building construction.

C. Certificates: Certified copies of mill test reports for structural steel, structural bolts, nuts, washers, and other related structural steel items.

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.1.

A copy of the AISC certificate indicating that the fabrication plant meets the specified structural steelwork category.

1.09 BUILDING PROTECTION

The existing building systems shall be totally protected during the repair work. The Contractor is responsible for the prompt repair of any damage to the building systems resulting from the work at the project at no additional cost to the Owner.

1.10 DIMENSIONS AND QUANTITIES

A. All dimensions and quantities shall be determined or verified by the Contractor. The Contract Drawings have been compiled from various sources and may not reflect the actual condition at the moment of construction. The Contractor is cautioned to take all precautions and make all investigations necessary to install the proposed work. The Owner will not consider unfamiliarity with the job conditions as a basis for additional compensation.

1.11 WARRANTY

A. Manufacturer's warranty: **five (5)** year fabrication warranty.

B. Upon completion of the work, and prior to final payment, the Contractor shall submit a Guarantee of his work to be free from defect in materials and workmanship. This Guarantee shall be for a period of **two (2) years**, and shall be signed by a Principal of the Contractor's firm, and sealed if a corporation.

PART 2 - MATERIALS

2.01 STRUCTURAL STEEL

A. Steel Channels, Angles, Plates, and Bars: ASTM A36 with minimum yield strength of 36 ksi. Refer to Contract Drawings for steel size and shape requirements.

B. Electrodes for Welding: Comply with most current AWS Code. E70xx series unless otherwise noted.

C. Holes to be shop drilled in steel to 1/16" greater diameter than fastener diameter unless otherwise noted.

2.02 STEEL DECK

A. Deck units shall conform to SDI Publication No 28.

B. Steel for Galvanized Metal Roof Decking Units: ASTM A446, grade as required to comply with SDI Specifications.

C. Replacement metal roof decking base bid work and unit price work shall be:

Depth	Gauge	Type	Finish	Min S_p
1-1/2”	20	Type B, or as required to match existing.	Galv.	0.234 in 3/ft

D. Sheet Metal Accessories: ASTM A526, commercial quality, galvanized.

E. Galvanizing: ASTM A525, G60.

F. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A780.

G. Flexible Closure Strips: Manufacturer’s standard vulcanized, closed-cell, synthetic rubber, profiled to fit tight to the decking.

H. Metal Deck Fasteners: FM Global Approved Heavy Gauge #14 Self-Drilling Screws with Drill Point #5 at connections into the roof structure. At side lap conditions, use FM Global Approved Heavy Gauge #10 Self-Drilling Screws with Drill Point #3.

2.03 ADJUSTING PLATES

A. Adjusting plates or segments of deck units shall be provided in locations too narrow to accommodate full-size units. As far as practical, the plates shall be two (2) gauges heavier than the deck units.

2.04 CLOSURE PLATES

A. Voids above interior walls shall be closed with sheet metal where shown. Open deck cells at parapets, end walls, eaves, and openings through roofs shall be closed with sheet metal. Sheet metal shall be two (2) gauges heavier than the deck units.

B. Cover plates to close panel edge and end conditions and where panels change direction or abut. Butt joints in composite steel deck may receive a tape joint cover.

C. Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

2.05 ACCESSORIES

A. The manufacturer's standard accessories shall be furnished as necessary to complete the deck installation.

B. Metal accessories shall be of the same material as the deck.

2.06 PRE-FABRICATED STEP OVER LADDER AND PLATFORM

A. On Roof Area A, provide prefabricated step over ladders and platforms system as indicated within the Contract Documents and that meets the following requirements:
1. OSHA Compliant
2. Equal steps on each side, serrated treads
3. 500-pound minimum capacity
4. Platform size: minimum 36" W x 90" L x 40" H (verify in field)
5. 40" min clearance over pipes
6. Stair Angle: 70 degrees

2.07 ALUMINUM WELDED CONNECTIONS FOR LADDERS

A. All connections shall be welded in accordance with the following AWS Standards:

1. Aluminum: AWS D1.2

B. Welds exposed to view in the finished work shall be uniformly made and shall be ground smooth.

C. Welding rods and bare electrodes shall be selected in accordance with AWS specifications for the metal alloy to be welded.

D. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.

2.08 HIGH-PERFORMANCE STEEL COATING

A. Industrial coating shall be a direct-to-metal, durable, rust and corrosion-resistant coating specifically formulated for exterior use in protection of metal substrates.
1. 8000 Series Acrylic High Gloss Enamel by Conco
2. Pro Industrial DTM Acrylic by Shewin-Williams
3. Series 1029 Acrylic polymer coating by Tnemec

B. Primer(s) shall be as required by the coating manufacturer.

PART 3 - EXECUTION

3.01 FABRICATION

A. Codes and Standards: Comply with the latest provisions of the following:
1. AISC 303 Code of Standard Practices for Steel Buildings and Bridges.

2. AWS Structural Welding Code-Steel D1.1.

B. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings.

C. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

D. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.

E. Bolt Holes: Provide pre-drilled holes as indicated on Contract Drawings and as shown on final shop drawings.

F. Cut, drill or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning.

3.02 ERECTION

A. Erection of structural steel shall be in accordance with the applicable provisions of AISC.

B. Preparation of Existing Structural Members: Prepare and verify that the existing framing member to receive supplemental strengthening has been prepared to receive the supplemental members. Clean and remove existing paint and coatings from all mating surfaces. Clean steel in accordance with the latest edition of Steel Structures Painting Council (SSPC) as follows:

1. SP-06: Surface Preparation Specification No. 6 “Commercial Blast Cleaning” – for existing steel

C. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made.

D. Field Assembly: Set steel strengthening members accurately to lines and elevations indicated. Align and adjust various members before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

E. All personnel shall be currently certified for the welding which they perform.

F. Splice members only where indicated and accepted on shop drawings.

G. Do not enlarge un-aligned holes in members by burning or by use of drift pins. Ream holes that must be enlarged to admit bolts.

H. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

I. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

3.03 BOLT INSTALLATION

A. Install bolts where indicated on Contract Drawings. Torque all existing thru-bolts to AISC specifications using accurately calibrated torque wrenches. Replace all rusted or deteriorated bolts.

B. After all bolts shall be torqued to AISC specifications using accurately calibrated torque wrenches. Provide minimum four (4) exposed threads; apply specified epoxy over exposed threads to prevent nuts from “backing-off” bolt.

3.04 METAL DECK REPAIR AT INFILL

A. Prepare and prime areas of existing metal decking or framing that show signs of surficial rusting.

B. Scrape and wire brush surficial rusted surfaces down to sound metal. Remove all rust and corrosion to reveal 100% bare metal.

C. Apply two coats of the specified cold galvanizing compound. Apply by brush or roller. Apply to all surfaces including bottoms of flutes.

D. Allow compound to dry to the touch prior to installing roof system components.

3.05 METAL DECK REPLACEMENT AND RE-ATTACHMENT

A. Erection of deck and accessories shall be in accordance with SDI MOC2 and the approved detail drawings.

B. Damaged deck and accessories including material which is permanently stained or contaminated, with burned holes or deformed shall not be installed.

C. The deck units shall be placed on secure supports, properly adjusted, and aligned at right angles to supports before being permanently secured in place.

D. General: Install deck units and accessories in accordance with manufacturer’s recommendations, shop drawings, FM Global requirements and as specified herein.

1. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.

2. Decking units shall be applied only over supports which have accurately been aligned and secured in position. Install new deck over two (2) span minimum.

3. Align deck units for entire length of run of cells and with close alignment between cells at ends of abutting units.

4. Place deck units flat and square, secured to adjacent framing without warp or deflection.

5. Do not use deck units for storage or working platforms.

6. Deck closures shall be provided at all deck edges.

E. Fastening Metal Roof Deck Units:

1. Minimum roof deck fastening shall be FM Global approved fasteners, spaced not more than 12 inches on center at supports.

2. Secure deck to each supporting member in ribs where side laps occur.

3. Mechanically fasten side laps of adjacent deck units between supports, at intervals not exceeding 18 inches on center.

F. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to decking.

G. Closure Strips: Provide metal closure strips at open, uncovered ends and edges of roof decking, and in voids between decking and other construction. Weld into position to provide a complete decking installation.

1. Provide flexible closure strips instead of metal closures, at Contractor's option, wherever their use will ensure complete closure. Install with adhesive in accordance with manufacturer's instructions.

H. Touch-Up Painting: After decking installation, wire brush, clean, and paint scarred areas, welds, and rust spots on top and bottom of surfaces of decking units and supporting steel members.

1. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.

I. Holes and similar defects will not be acceptable.

J. Deck ends shall be lapped a minimum of 2 inches. All partial or segments of deck units shall be attached to structural supports in accordance with Section 2.5 of SDI MOC2.

K. End bearing shall be 1.5 inches minimum over supporting framing.

3.06 STEP-OVER LADDERS AND PLATFORMS

A. Remove existing roofing system at support locations to install the required blocking. Coordinate height of blocking relative to roof surface and platform clearance.

B. Install roof flashing up and over blocking prior to setting ladders.

C. Set ladders in place and anchor to blocking, sealing the anchor penetrations.

3.07 STEEL COATING

A. Protect the existing roof, equipment screens, mechanical and electrical services, and equipment, and building exterior during preparation and application of the protective coating.

B. Surface preparation: Hand-tool Clean per SSPC-SP2, Remove all oil and grease per SSPC-SP1. Apply primer(s) in accordance with manufacturer's recommendations.

C. Apply two (2) coats of coating to prepared steel at the manufacturer's required film thickness. Following the installation, review for deficiencies and perform repairs.

D. Verify and report the applied coating thickness.

E. Clean spills and spatters immediately with soap and warm water.

3.08 QUALITY CONTROL

A. Any material or workmanship which is rejected by the Engineer either in the mill, shop or field shall be replaced promptly to the satisfaction of the Engineer.

B. Corrective Work:

1. Structural steel members or assemblages having fabrication errors exceed permissible tolerances, or which inspections or laboratory test reports have indicated to be not in compliance with specifications, shall not be allowed in the finished work. Such members or assemblages may be corrected if permitted by the Engineer or the testing agency.

2. Perform additional test, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

3. Corrective work is to be done preferably in the shop, and in accordance with AISC and AWS requirements. When requested by the Engineer,

submit shop drawings, “for approval”, showing details of proposed corrective work.

C. Welding: The Owner will engage an independent testing agency to inspect and test during fabrication and erection of structural steel assemblies, as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.

D. Perform visual inspection of welds.

3.09 CLEAN UP

A. Site clean-up shall be complete and performed daily to the satisfaction of the Owner. Roof, building (interior and exterior), hardscape, and adjacent areas shall be cleaned of all trash, debris, and dirt caused by, or associated with, the work.

B. All trash and debris shall be completely removed from the site daily during the work and at the completion of the work. All debris shall be legally disposed of off-site.

END OF SECTION

I:\976710\02 Design\specs\BI-RD-298_976710_Section 05 50 00 Miscellaneous Metals.doc

PART 1- GENERAL

1.01 IN GENERAL

The General Conditions, and all parts of the Bid and Contract Documents are made part of this Section as if fully repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 04 01 20 - Maintenance of Unit Masonry
B. Section 05 50 00 - Miscellaneous Metals
C. Section 07 01 50 - Roof Restoration
D. Section 07 22 00 - Roof and Deck Insulation
E. Section 07 51 13 - Roof Repairs and Maintenance
F. Section 07 60 00 - Flashing and Sheet Metal
G. Section 22 20 00 - Roof Drains
H. Division 23 - Heating, Ventilating, and Air Conditioning
I. Division 26 - Electrical

1.03 SUMMARY OF WORK

This Section specifies requirements for the following Scope of Work:

A. Re-secure existing wood blocking at roof penetrations, parapets, perimeters, expansion joints, and roof-to-wall locations where wood can remain.

B. Provide new wood blocking at new roof access platforms and scuppers and to replace existing, deteriorated blocking, where encountered.

C. Conform to FM Global Loss Prevention Data Sheet 1-49 for all blocking attachment requirements.

1.04 JOB CONDITIONS

A. All surfaces to receive the new wood blocking shall be thoroughly dry. Should surface moisture such as dew exist, the General Contractor shall provide the necessary equipment to dry the surface prior to application. Do not dry with open flames.

B. Do not leave any newly installed wood blocking exposed. Cover and protect all newly installed wood daily with the new flashing system or temporary covers until the roof/flashing systems are installed.

C. Protect all existing and new wood stored on site to prevent moisture absorption. Use tarps over the wood pile (top, sides, and bottom) elevated on pallets (one side lower to shed water).

D. If delays in the project exceeding one (1) week are anticipated due to inclement weather (or due to any other project condition), all wood shall be stored in

weatherproof box trailers or storage sheds, provided by the Contractor, in locations to be designated by the Owner.

1.05 SUBMITTALS

A. Submittals shall be made in accordance with the Division 1.

B. The Contractor shall submit the following items with their submittal package.
1. Specified product data including wood blocking, plywood sheathing, bolts, anchors, screws, and fasteners.

C. Submit all proposed wood species, grades, grading agency, certificates, and source information to the engineer for written approval prior to ordering any materials.

D. All dimensional lumber shall be field tested for moisture content prior to installation. Contractor shall submit test results of each board to Engineer for approval prior to installation.

1.06 QUALITY CONTROL

A. All dimensional lumber shall be maintained and installed at a moisture content less than 19%. All lumber shall be field tested for moisture content by the Contractor. Contractor shall submit test results of each board to Engineer for approval prior to roofing or flashing installation.

1.07 DIMENSIONS AND QUANTITIES

A. All dimensions and quantities shall be determined or verified by the Contractor. The Contract Drawings have been compiled from various sources and may not reflect the actual condition at the time of construction. The Contractor is advised to take all precautions and make all investigations necessary to install the proposed work. The Owner will not consider unfamiliarity with the job conditions as a basis for additional compensation.

1.08 WARRANTY

A. Upon completion of the work, and prior to final payment, the Contractor shall submit a Guarantee of his work to be free from defect in materials and workmanship. This Guarantee shall be for a period of **two (2) years**, and shall be signed by a Principal of the Contractor's firm, and sealed if a corporation.

PART 2 - MATERIALS

2.01 DIMENSIONAL LUMBER

A. All dimensional lumber for roofs shall be construction-grade, Southern Yellow Pine No. 1 or better, formed as required for proper installation of the new work.

B. All new exterior perimeter woodwork, nailers, and wood blocking used on the building shall be minimum 6"-wide, except where otherwise detailed.

C. All roof woodwork shall be kiln-dried with a maximum moisture content of 19% by weight on a dry weight basis.

2.02 PLYWOOD

A. Plywood shall be APA Rated Sheathing, Grade CD, Exterior, minimum 1/2” thick or as required to match existing thicknesses, unless designated otherwise on the detail drawings.

2.03 WOOD CANTS

A. Solid wood cants shall be construction-grade, pressure-treated, Southern Yellow Pine No. 2 or better, formed as required for proper installation of the new work.

2.04 WOOD SHIMS

A. Wood shims for sloping and setting of wood blocking shall be cedar clapboard. Size as needed for the application.

2.05 FASTENERS AND ANCHORS:

A. In general, all fasteners, anchors, nails, straps, and other accessories shall be of stainless-steel Series 300 or galvanized steel as amended below. Galvanizing shall be hot dip in accordance with ASTM A153 Specifications G-185. Electro-galvanized items shall not be used.

B. Stainless-steel fasteners shall be Type 304/316.

C. Fasteners for securing plywood and wood blocking to wood blocking shall be stainless-steel annular threaded-ring shank nails. Fasteners shall be of sufficient length to penetrate the receiving member 1-1/4" minimum, except full depth into plywood.

D. All nails shall be stainless-steel, annular ring nails. Nails shall be sized as required for system attachment including 8d (minimum 0.131” diameter by 1-1/2” long), 10d (minimum 0.148 diameter by 3” long), and 16d (minimum 0.162” diameter by 3-1/2” long).

E. Fasteners for securing wood blocking to masonry substrates shall be one piece and minimum 1/4” diameter self-tapping threaded fasteners as manufactured by the Star Fasteners, Tapcon, Olympic Manufacturing Group, Powers Fasteners Company. Fasteners shall be of sufficient length to penetrate the receiving substrate 1-1/2” minimum.

F. Fasteners for securing wood blocking to structural steel shall be FM Global Approved Heavy Gauge Self-Drilling Self-Tapping Screws with Drill Point #5.

2.06 HIGH-TEMPERATURE BATT INSULATION

A. Unfaced Mineral Wool BATT Insulation: ASTM C 665, ASTM E 136, Type I, Non-combustible, Flame Spread = 0, Smoke Developed = 0.

PART 3 - EXECUTION

3.01 GENERAL

A. Prepared surfaces must be clean and dry. Fill, chip, or grind as required to provide a smooth, uniform surface.

B. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Refer to FM Data Sheet 1-49 concerning fastener spacing requirements for perimeter blocking anchorage. All anchors and fasteners that attach wood blocking to the structure shall have their spacing halved in corner zones. The corner zones are defined by a **10'x10'** area at exterior corners of the perimeter. **Maximum fastener spacing shall be 2' on-center and 1' on-center within the corner zone.**

E. All butt joints in woodwork shall be flush to provide a smooth, uniform line with no irregularities. Built-up blocking shall have butt joints staggered 4' minimum layer to layer. The minimum length of any individual piece of woodwork shall be 2'. All lengths of woodwork shall have a minimum of four (4) fasteners. Layers of wood blocking at corners shall be interlocked to provide additional stability.

F. During removal and replacement of woodwork, the Contractor shall report to the Engineer any existing wood blocking designated to remain, or structural supports which are deteriorated or unsuitable. Do not cover unacceptable areas until reviewed by the Engineer, but provide temporary protection to the area in question.

G. The perimeter wood blocking shall be installed at a consistent, even height throughout that roof area(s) to provide a flush transition from insulation to blocking and provide an even and continuous line for metal fascia installation.

3.02 REMOVAL OF WOOD BLOCKING

A. Remove and dispose of all deteriorated wood blocking and all blocking scheduled to be removed and replaced in accordance with the Contract Drawings and this Specification.

B. During removal and replacement of woodwork, the Contractor shall report to the Owner and Engineer any existing wood blocking designated to remain, which is deteriorated or unsuitable. Do not cover unacceptable areas until reviewed by the Engineer, and provide temporary protection to the area in question.

3.03 ROOF PERIMETER BLOCKING

A. Existing wood blocking and curbs may be required to be cut back or trimmed to provide an even flush assembly as shown on the Detail Drawings. This shall be accomplished with power or hand tools. Should cutting of existing components reduce or eliminate securement of their components, the Contractor shall re-secure with the appropriate fasteners.

3.04 FASTENING OF WOODWORK

A. Wood blocking to wood blocking connections shall be made using the specified nails spaced 12” on-center maximum and staggered off the centerline of the woodwork being secured. Nails shall be of sufficient length to penetrate the receiving member 1-1/4” minimum.

B. Wood blocking to masonry connections shall be made using the specified fasteners spaced at 12” o.c. maximum and staggered off the centerline of the woodwork being secured. Fasteners shall be of sufficient length to penetrate the receiving substrates 1-1/2” minimum. Predrilling of fastener holes at masonry areas will be required prior to installing fasteners.

C. Plywood shall be fastened to vertical concrete or masonry, surfaces with the specified fasteners spaced 8” on-center vertically and horizontally. Fasteners shall be of sufficient length to penetrate the receiving substrates 1-1/2” minimum. Predrilling of fastener holes at masonry areas will be required prior to installing fasteners.

D. Wood blocking to steel connections shall be made with the specified fasteners at 12” o.c. maximum, and staggered off the centerline of woodwork being secured.

E. **Existing blocking scheduled to remain shall be re-secured with two (2), appropriate fasteners spaced 24” on-center and 1’ on-center within the corner zone for each roof area.**

F. Fasten blocking within 6” of each end and building corners.

3.05 CLEAN UP

A. Site clean-up shall be complete and performed daily to the satisfaction of the Owner. Roof, building (interior and exterior), hardscape, and adjacent areas shall be cleaned of all trash, debris, and dirt caused by, or associated with, the work.

B. All trash and debris shall be completely removed from the site daily during the work and at the completion of the work. All debris shall be legally disposed of off-site.

END OF SECTION

I:\976710\02 Design\specs\BI-RD-298_976710_Section 06 10 00 Rough Carpentry.doc

PART 1- GENERAL

1.01 IN GENERAL

The General Conditions, and all parts of the Bid and Contract Documents are made part of this Section as if fully repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 04 01 20 - Maintenance of Unit Masonry
B. Section 05 50 00 - Miscellaneous Metals
C. Section 06 10 00 - Rough Carpentry
D. Section 07 22 00 - Roof and Deck Insulation
E. Section 07 51 13 - Roof Repairs and Maintenance
F. Section 07 60 00 - Flashing and Sheet Metal
G. Section 22 20 00 - Roof Drains
H. Division 23 - Heating, Ventilating, and Air Conditioning
I. Division 26 - Electrical

1.03 SUMMARY OF WORK

This Section specifies requirements for the following Scope of Work:

A. Remove loose gravel surface 100% from Roof Areas A, B, C, and D.

B. Cut out and replace roof system beneath existing dunnage at Area A. Replace insulation and include new tapered insulation crickets. Tie new roofing into existing at perimeter of repair.

C. Repair defects at Roof Areas A, B, C, and D as described in Section 07 51 13 – Lower Roof Repairs and Maintenance.

D. Remove and install new sheet metal copings and replace membrane perimeter/base flashings at Roof Areas A, B, C, and D.

E. Remove and install new insulation, flashings, and substrates and perimeters, penetrations, and parapets, typical at Roof Areas A, B, C, and D. Provide new two (2)-ply membrane flashings.

F. Replace flashings at existing roof curbs, perimeters, and penetrations, including drain sumps at Roof Areas A, B, C, and D.

G. Provide new pourable sealer boxes and flashings at steel support post penetrations at Roof Area A.

H. Apply restoration coating with new gravel surface at Roof Areas A, B, C, and D. Sweep and vacuum after cure to remove loose gravel.

I. Coordinate the roof restoration work with the scheduled MEP work. Sequence roofing work after MEP work is complete.

J. Clean and restore all areas affected by the work.

1.04 JOB CONDITIONS

SPECIAL NOTE: Portions of the existing roof membrane flashings and mastics have been found to contain asbestos containing materials (ACM). The Contractor shall comply with the National Emission Standard for Hazardous Air Pollutants (NESHAP) regulation published in the Federal Register under 40 CFR, Part 61, subpart M. Specific attention is directed to Appendix A of this regulation entitled, Interpretive Rule Governing Roof Removal Operations. In addition to these regulations, the Contractor shall comply with OSHA Regulation (29 CFR Parts 1910 et al – Occupational Exposure to Asbestos; Final Rule) and all other State and Local guidelines regarding asbestos containing material removal and disposal. For clarification, refer to Section 02 82 13 Asbestos Containing Roofing Material Abatement.

A. It is the responsibility of the Contractor to arrange for the membrane manufacturer's technical representative to accept the substrate prior to membrane installation and to inspect and accept the completed membrane restoration system.

B. The Owner shall review the Contractor's work schedule submittal prior to the start of any work in this Section. It shall be the responsibility of the Contractor to inform the Owner if his work location(s) for each day is different from the schedule and to update any changes into the schedule.

C. Do not deliver to site or install a material or system that has not been approved. Remove materials installed without prior approval upon Owner's request at no additional charge to the Owner.

D. All new and temporary construction, including equipment and accessories, shall be secured from vandalism, abuse, and damage.

E. Membranes shall not be applied when ambient temperature is less than 32 degrees Fahrenheit, unless approved in writing by the Engineer and membrane manufacturer.

F. Do not apply materials when precipitation is imminent or forecasted within 24 hours.

G. Materials, which have a temperature other than the application temperature requirements of the manufacturer, shall not be applied.

H. All surfaces to receive the new roofing assembly shall be thoroughly dry. Should surface moisture such as dew exist, the Contractor shall provide the necessary equipment to dry the surface prior to application. Do not dry with open flames.

I. Prior to and during application, all dirt, debris, and dust shall be removed from surfaces by vacuuming, sweeping, blowing with compressed air, and/or by similar methods.

J. Fully charged, inspected, and approved fire extinguishers shall be on site at all times. No cutting, grinding, or welding of any kind shall proceed without an approved fully charged fire extinguisher.

K. Liquid materials such as solvents and adhesives shall be stored and used away from open flames, sparks, and excess heat. Red label materials shall be brought to the site, and removed from the site, daily.

L. Completed membrane areas shall not be trafficked prior to the installation of the protection layers. Work shall be coordinated to prevent this situation by working towards the edges and access ways. Should trafficking of the membrane be necessary, the Contractor shall provide plywood-ballasted 2”-thick rigid insulation over the newly installed membrane for the anticipated trafficked areas. Damaged materials or work will be rejected. Rejected materials or work must be immediately removed and replaced with new materials, at no additional cost to the Owner.

M. Melting equipment for membrane material shall be a double jacketed, heat-transfer oil bath kettle utilizing a mechanical agitator.

N. Adhesives contain petroleum distillates and are extremely flammable. Do not breathe vapors or use near an open fire. Do not use in confined areas without adequate ventilation. Consult container or packaging labels and Material Safety Data Sheets (MSDS) for specific safety information.

O. Do not allow waste products (petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, etc.) to come in contact with the roofing membrane. Any exposure to foreign materials or chemical discharges must be presented to membrane manufacturer for evaluation to determine any impact on the membrane assembly short or long-term performance.

P. Coordinate the work in this section with the work by other trades to ensure the orderly progress of the work.

1. Field welding will be required; the Contractor shall use caution in the use of welding equipment. The Contractor shall supply a minimum of two (2) fully charged fire extinguishers and enough fire blankets to protect all combustible surfaces. A fire watch must be provided for a minimum of one (1) hour after completion of welding. All welding shall be performed on the ground prior to installing steel. No welding shall be performed adjacent to or in contact with timber framing.

Q. Welding must be performed with the electric arc process (where applicable) and in accordance with AWS “Code for Arc and Gas Welding in Building Construction.”

1.05 PERFORMANCE REQUIREMENTS

A. Membrane restoration to include a recoated roofing membrane and base flashings that remain watertight, do not permit the passage of water, and resist exposure to weather without failure.

B. Material compatibility: Provide roofing materials and accessories that are compatible with one another under conditions of service and application required.

1.06 SUBMITTALS

Submittals shall be made in accordance with the Division 1.

A. Manufacturer's data for each item specified in Part 2 of this Section.

B. Shop Drawings – submit for: Typical installation details, showing details at drains, at reinforcing flashings, at terminations, at joints in structure below, at intersection of horizontal and vertical surfaces, at penetrations in membrane systems.

C. Submit samples for the following items:

1. Restoration coating, cured sample

1.07 QUALIFICATIONS

A. Contractors: All work of this Section shall be performed by an Installer who is approved by the manufacturer of the roofing materials.

B. Qualifications of Installers: The Contractor shall be a licensed and approved applicator of the specified membrane roofing system. Foreman shall have a minimum of five (5) years of previous roofing membrane installation experience. The Contractor shall notify the membrane manufacturer prior to initiating the construction.

C. Installer shall submit letter from manufacturer of roofing material stating that contractor is approved by the manufacturer for the application of the roofing system specified for the Project. The letter shall certify that the Installer has satisfactorily applied the roofing system specified herein under the manufacturer's supervision. The letter shall be on manufacturer's letterhead and shall be signed by an officer of the company.

1.08 PRODUCT HANDLING

A. Deliver materials in original unopened containers or packaging clearly labeled with manufacturer's name, brand name, instructions for use, all identifying numbers, and UL labels.

B. Materials shall be stored in a neat, safe manner, not to exceed the allowable structural capacity of the storage area.

C. Store materials in a clean, dry area protected from water and direct sunlight.

D. Store all adhesives at temperatures between 60° F and 80° F. If exposed to lower temperatures, restore materials to 60° F minimum temperature before using. Do not allow materials to freeze.

E. Do not use materials damaged in handling or storage.

1.09 FIELD INSPECTION SERVICES

A. The Contractor shall require the roofing coating manufacturer's representative to provide field instructions and supervision for the installation of the roofing coating system at the start of the work of this Section.

B. The Contractor shall require the manufacturer's representative to make sure that the Contractor's workmen are fully instructed and trained in the handling and application of all the materials, and shall see that the materials are correctly installed.

C. Manufacturer's technical representative shall provide the following inspections of the membrane application:

1. Job start inspection at the beginning of each phase of the project, to review special detailing conditions and substrate preparation.

2. Periodic in-progress inspections throughout the duration of the project to evaluate membrane and flashing application.

3. Final punch-list inspection at the completion of each phase of the project prior to installation of any surfacing or overburden materials.

4. Warranty inspection to confirm completion of all punch list items, surfacing, and overburden application.

1.10 WARRANTY

A. Manufacturer's standard warranty for restoration coating: Materials shall be free of defects in material and workmanship for a period of **ten (10) years** from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

B. Upon completion of the work, and prior to final payment, the Contractor shall submit a Guarantee of his work to be free from defect in materials and workmanship. This Guarantee shall be for a period of **two (2) years**, and shall be signed by a Principal of the Contractor's firm, and sealed if a corporation.

PART 2 - MATERIALS

2.01 GENERAL

A. Reconstruction surfacing, repair, reinforcement, and membrane patching materials to be compatible with components of the existing membrane roof system.

2.02 RESTORATION COATING

A. Water-based, low odor, asbestos-free, low-VOC, cold-applied restorative coating and aggregate adhesive that is compatible with asphalt and coal tar roofing membranes. Acceptable manufacturers:
   1. Tremco; Ecolastic
   2. Garland; Weatherscreen
   3. Soprema; TBD

2.03 GRAVEL SURFACING

A. Aggregate: White, reflective, kiln-dried marble roofing aggregate, provided or as recommended by the membrane manufacturer. Basis of design properties are: 3/8”-diameter (nominal), specific gravity of 2.86, and hardness of 3.5 to 4.5 Mohs.

2.04 REPLACEMENT ROOFING

A. Refer to Section 07 51 13 - Roof Repairs and Maintenance for roof replacement repairs.

B. Provide tapered insulation at new roof area beneath cooling towers. Tapered insulation shall be in accordance with Section 07 51 13.

2.05 THERMAL INSULATION, COVER BOARD, AND ADHESIVES

A. Refer to Section 07 22 00 Roof and Deck Insulation.

2.06 FLASHINGS

A. Refer to Section 07 51 13 - Roof Repairs and Maintenance for flashing materials.

B. Surface Conditioner: As recommended by membrane manufacturer.

C. Adhesives: Contact adhesive used to bond flashing to approved substrates and to bond flashings together shall be as approved by manufacturer.

   1. Sealant: Sealant used to seal flashing laps shall be as approved by membrane manufacturer.

2.07 WALKWAY PADS

A. Granule-surfaced, reinforced, slip-resistant pads as manufactured or recommended by the roof coating manufacturer. Minimum size is 24" by 24" and 1/2"-thick.

2.08 POURABLE SEALER BOX COMPONENTS

A. Inorganic filler for pourable sealer boxes shall be a pre-mixed spray applied polyurethane foam such as Froth-Pak by Insta-Foam Products, Inc., or approved equal.

B. Pourable sealer for boxes shall be two-part, fluid applied polyurethane based material of 100% solids as manufactured by the membrane manufacturer.

2.09 SPLASHBLOCKS

A. Splash blocks for installation below downspouts which discharge water onto roof membrane shall be precast concrete, 18" square by 2" thick. Splashblock concrete shall have a 5,000-psi minimum compressive strength. Splash blocks shall be in smooth forms with bottom edges rounded or chamfered to prevent abrasion or puncturing of the roof membrane. Splash blocks shall be installed on manufacturer's walkway pad.

2.10 PRE-FABRICATED STEP OVER LADDER AND PLATFORM

A. On Roof Area A, provide prefabricated step over ladders and platforms system as indicated within the Contract Documents and that meets the following requirements:
   1. OSHA Compliant
   2. Equal steps on each side, serrated treads
   3. 500-pound minimum capacity
   4. Platform size: minimum 36" W x 90" L x 40" H (verify in field)
   5. 40" min clearance over pipes
   6. Stair Angle: 70°

PART 3 - EXECUTION

3.01 GENERAL

A. Maintain existing roof drains and scuppers in functioning conditions for the duration of the repair work.

B. Do not deliver to site or install any material or system that has not been approved. Materials installed without approval may be required to be removed.

C. The prepared substrate must be dry, clean, and smooth. All deteriorated, damaged, or wet areas of wood blocking shall be removed prior to installing the

new roofing and flashing membrane. Provide dryers, if necessary, to dry deck surfaces prior to installing new work. Open flame devices shall not be used.

D. Comply with the manufacturer's written instructions and these Specifications for all renovations and associated work.

E. Flashings shall be installed prior to or along with the membrane to assure weather-tight termination.

F. Partial or unmarked materials cannot be used.

G. Handle materials to prevent damage to building components and project site areas.

H. Keep covers tightly sealed on all canned and evaporative products to prevent premature curing.

I. The Contractor is cautioned to investigate all existing conditions and materials of construction.

3.02 SURFACE PREPARATION

A. Remove the embedded gravel surfacing from the existing membrane prior to performing repairs. Perform removals using a power broom and vacuum.

B. Remove surface coatings, dirt, paints, fungus, and other surface contaminants in preparation for installation of new roofing.

3.03 ROOF REPLACEMENT BELOW COOLING TOWERS

A. Perform roof replacement repair in accordance with Section 07 51 13 – Roof Repairs and Maintenance.

B. Apply the restoration coating over the new roof membrane.

3.04 FLASHINGS

A. Perform base flashing work in accordance with Section 07 51 13 – Roof Repairs and Maintenance.

B. Apply the restoration coating and gravel over the new flashings.

3.05 ROOF DRAINS

A. Remove the existing roof system at drains for construction of new sumps and flashings.

B. Remove strainers, clamping rings, and hardware from the existing roof drains. Remove bitumen and other contaminants from the drain bowl body.

C. All roof drains shall be flashed by coating the entire sump with a full, 1/8"-thick trowel application of roof cement.

D. Center the sump pan flashing over the drain bowl and embed the sheet into the roof cement/adhesive.

E. Install four (4)-ply roofing and tie-in to the existing roof assembly.

F. Install two (2)-ply drain sump flashing with two (2)-ply strip flashing at the perimeter.

G. Install and tighten new drain clamping rings with new hardware.

3.06 POURABLE SEALER BOXES

A. Pourable sealer pockets shall be filled with pourable elastomeric sealer and tooled along the top surface to shed water. Pockets shall extend 8" minimum above the roof surface.

B. Inorganic fillers may be used to provide a sealant depth of 2" minimum. See Detail Drawings.

3.07 RESTORATION COATING

A. Remove gravel and complete repairs to the existing roof membrane, and indicated roof replacement work prior to applying the restoration coating.

B. Broom clean the existing roof surface and verify that the existing roof is dry using a moisture meter.

C. Promptly after preparing the substrate, apply primer and flood-coat the roof surface with the restoration coating material and the manufacturer's required application rate.

3.08 GRAVEL SURFACING

A. Cast five (5) pounds square foot of aggregate while the restoration flood-coat is still fluid.

B. Ensure that the flood coat is completely covered by the aggregate.

C. Remove loose gravel once flood coat has cured.

3.09 WALKWAY PADS

A. Sweep away loose gravel and set walkway pads in cold-applied adhesive.

B. Allow adhesive to cure for a minimum of 14 days before walking on the pads.

C. Install pads before installing gravel surfacing.

D. Provide a walkway pad below concrete splash blocks on lower roofs.

3.10 CLEAN-UP

A. All floor and adjacent areas, both interior and exterior, damaged, or stained by the installation of the roofing work shall be repaired and cleaned of all dust, debris, and any other materials to the Owner's satisfaction.

B. The Contractor shall not demobilize the site until the completed work is toured by the Owner and Architect/Engineer. Any unsatisfactory items observed will be reported in "punch-list" form. These items shall be corrected immediately by the Contractor prior to demobilization from the job site. Final payment will not be made until all punch list items are complete and guarantees have been received.

C. All scaffolding, barriers, temporary facilities, and the like shall be removed upon completion of the work. Areas damaged as a result of the Contractors equipment shall be restored to their original condition, all to the satisfaction of the Owner.

END OF SECTION

I:\976710\02 Design\specs\BI-RD-298_976710_Section 07 01 50 Roof Restoration.doc

PART 1- GENERAL

1.01 IN GENERAL

The General Conditions, and all parts of the Bid and Contract Documents are made part of this Section as if fully repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 04 01 20 - Maintenance of Unit Masonry
B. Section 05 50 00 - Miscellaneous Metals
C. Section 06 10 00 - Rough Carpentry
D. Section 07 01 50 - Roof Restoration
E. Section 07 51 13 - Roof Repairs and Maintenance
F. Section 07 60 00 - Flashing and Sheet Metal
G. Section 22 20 00 - Roof Drains
H. Division 23 - Heating, Ventilating, and Air Conditioning
I. Division 26 - Electrical

1.03 SUMMARY OF WORK

This Section specifies requirements for the following Scope of Work:

A. New polyisocyanurate flat stock and tapered insulation, and coverboard at Roof Area A replacement areas and cut and replace roof repairs at Roof Areas B, C, and D.

B. **Supplemental Bid No. 1** - New polyisocyanurate flat stock and tapered insulation with coverboard at cut and replace roof repairs, **Roof Areas E through II.**

1.04 JOB CONDITIONS

A. Roof insulation is to be installed in parallel with Factory Mutual **FM 1-105** uplift rating. Specific manufacturer's requirements to be followed. Ten (10') foot-wide roof perimeter and corners shall be installed in compliance with **FM 1-165** and **1-240** respectively. Provide perimeter and corner enhanced securement per **Data Sheet 1-29**. Note that the corner zone for securement of new blocking and reattachment of existing blocking shall be 10'-wide.

B. All surfaces to receive new insulation, membrane or flashings shall be thoroughly dry. Should surface moisture such as dew exist, the Contractor shall provide the necessary equipment to dry the surface prior to application. No open flames shall be permitted on the roof at any time.

C. Equipment required to hoist materials to the roof and remove debris from the roof shall be supplied, maintained, and operated by the Contractor.

D. Remove rubbish and debris from the project site daily; do not allow accumulations inside or outside the buildings.

E. Remove the plastic packaging for the insulation and cover boards immediately upon receipt of delivery. Failure to remove the plastic packaging may result in entrapment of condensation or moisture. If the boards are stored outside they must be stored level, off the ground, and protected by a breathable waterproof cover. A means for air circulation around and under stored bundles should be provided. The cover boards should not be installed during rain, heavy fog, and any other conditions that my deposit moisture on the surface. The presence of free moisture can have a detrimental effect on the performance of the insulation and the installation of the roof membrane, allowing adhesive not to dry properly ultimately leading to a roof failure. Do not install any cover boards exposed to moisture during this project.

F. Ensure roof insulation boards are set on pallets or dunnage and are protected from the weather and sunlight prior to installation. Do not allow plastic to cover the insulation as it can allow condensation. A breathable material such as canvas is recommended. Do not install any insulation exposed to moisture during this project.

G. The Contractor shall remove only as much roofing, flashing, and associated components and other exterior waterproofing components as can be completely replaced in a given day's work, including all flashings and associated components as required to maintain the roof in a watertight, secure condition throughout the duration of the project. Should unforeseen conditions be encountered, the Contractor will be responsible for temporary protection and weather tightness until a solution is determined by the Engineer and implemented by the Contractor.

H. Roofing shall not be applied when ambient temperature is less than 40° F unless approved in writing by the Engineer and membrane manufacturer. Cold weather adhesives, delivery, and storage systems will be required.

I. All new and temporary construction, including equipment and accessories, shall be secured from wind damage or blow-off.

J. Temporary water stops shall be installed at the end of each day's work and shall be removed before proceeding with the next day's work. Water stops shall be compatible with all materials and shall not emit dangerous or incompatible fumes.

1.05 SUBMITTALS

Submittals shall be made in accordance with the Division 1.

A. Manufacturer's data for each item specified in Part 2 of this Section.

B. Provide documentation indicating that the Contractor is a Certified Installer of the materials to be used.

C. Submit shop drawings for tapered insulation areas, including proposed cross sections.

1.06 WARRANTY

A. Upon completion of the work, and prior to final payment, the Contractor shall submit a Guarantee of his work to be free from defect in materials and workmanship. This Guarantee shall be for a period of two (2) years, and shall be signed by a Principal of the Contractor's firm, and sealed if a corporation.

PART 2 - MATERIALS

2.01 THERMAL INSULATION

All roof insulations proposed for this project shall be approved in writing by the membrane manufacturer for use with their membrane and as required to achieve the required roofing warranty.

A. Flat stock and tapered isocyanurate insulation shall be skinned with factory-applied fiberglass facers as supplied and approved by the membrane manufacturer.

1. The isocyanurate insulation shall have an average aged R-Value of 5.7 per inch as required to meet the Long Term Thermal Resistance (LTTR) value in accordance with ASTM C518. The minimum insulation coverage across the roof, shall be 4" (3-1/2" flat stock and 1/2" coverboard).

2. At drain sumps, provide 1/2" per foot tapered insulation sumps with 1/2"-thick coverboard. Insulation thickness, including coverboard at perimeter of sumps shall be 4".

3. Tapered insulation shall be as required to provide a minimum 1/4" per foot slope to drainage system; 1/2" per foot at crickets, and around mechanical rooftop units; and meet the required LTTR value in accordance with ASTM C518 as described above.

4. The isocyanurate board size (maximum) for adhered installation, shall be 4' x 4' and of uniform dimension and thickness.

5. The isocyanurate insulation board shall conform to ASTM Specification C 1289, Type II, Class 1, Grade 3 (compression strength shall be 25 psi minimum).

6. Isocyanurate insulation shall be approved in writing by the insulation and membrane manufacturer that the methods of attachment are covered under the membrane manufacturer's labor and material warranty. Copies of the written acceptance shall be forwarded to the Engineer.

B. Wood fiberboard insulation:

1. Fiberboard shall be high-density; non-asphalt impregnated and conforms to ASTM C208 and C209, Standard Specification and Standard Test Methods, respectively, for Cellulosic Fiber Insulating Board.

2. Tapered edge strips shall be 18”-wide and 1-5/8”-thick, tapering to a feathered edge.

3. Fiberboard insulation shall be approved in writing by the membrane manufacturer. A copy of the written acceptance shall be forwarded to the Engineer prior to initiating the roofing process.

2.02 COVER BOARD

A. Coverboard insulation shall be 1/2” minimum thickness, closed-cell, high-density, polyisocyanurate core with coated glass facers as recommended by the roof membrane manufacturer. The boards shall be a maximum of 4’ x 4’ in size and shall conform to ASTM E84. Boards shall be square with uniform thickness and dimensions. The board shall be approved in writing by the membrane manufacturer. A copy of the written acceptance shall be forwarded to the Engineer.

2.03 COLD ADHESIVE FOR BOARD SECUREMENT

A. Adhesive to adhere the cover board system shall be a two (2) component, cold-process, asbestos free, low-rise polyurethane foam adhesive conforming to ASTM D276, D2556, D1875, D429, D816, D1876, and D412. Adhesive and ribbon spacing shall meet the specified FM rating, with enhancements in corners and perimeter zones and shall be approved in writing by the membrane manufacturer and included as part of the warranty coverage and FM Global approvals. Proper cold-weather application processes shall be used as required by the manufacturer.

2.04 FASTENERS

A. Fasteners for securing base sheet of insulation to steel deck shall be 3” diameter galvanized fastening plates with #12 minimum screws of sufficient length to penetrate the upper flute only of the steel deck by 5/8” minimum and 1-1/4” maximum.

B. Fasteners shall be in conformance with FM 4470 corrosion specifications.

PART 3 - EXECUTION

3.01 GENERAL

A. Do not deliver to site or install any material or system that has not been approved. Materials installed without approval may be required to be removed.

B. The prepared roof deck surface must be dry, clean, and smooth. All loose, poorly adhered, or deteriorated materials shall be removed prior to installing the new insulation. Personnel shall be free of bitumen contaminants when installing the new roof membrane. Provide dryers, if necessary, to dry deck surfaces prior to installing new work. Open-flame devices shall not be used.

C. Maintain temporary protection of the new and existing roof system. The roof system will be cleaned to the satisfaction of the Owner and Engineer prior to final payment. All areas of stained membrane will be cut out and replaced at no additional cost to the Owner. Multiple patches in close proximity will not be acceptable and will require one large patch.

D. Comply with the manufacturer's written instructions and these Specifications for all renovations and associated work.

E. Handle materials to prevent damage to building components and project site areas.

3.02 PREPARATION

A. Allow moist deck sections to dry prior to application of roof insulation. Open flames are strictly prohibited from the roof areas.

B. Ensure that deck surface is clean of all debris and roofing materials.

3.03 INSULATION BASE LAYER

A. Attach the base layer of insulation to the existing steel deck using plates and screws.

B. Insulation and coverboard shall be mechanically fastened to the roof deck at the minimum rate of one fastener and plate per every four (4) square feet (minimum of 4 fasteners in a 4’ x 4’ board) or as required to meet the listed FM uplift ratings and manufacturer requirements to prevent cover board cupping.

3.04 INSTALLATION OF BOARDS IN ADHESIVE

A. The multi-layered polyisocyanurate insulation and cover board system shall be installed on properly prepared clean, dry surfaces.

B. Comply with membrane roofing system manufacturers and FM Global written instructions for installing roof system.

C. Insulation boards shall be free of defects including but not limited to, broken corners, improperly adhered facers, excessive moisture, dimensional irregularities, and the like. Defective insulation boards shall be marked and immediately removed from the site.

D. Install the insulation boards in cold adhesive atop the previously installed base layer(s). Stagger all end joints to the middle of the long dimension of adjacent insulation boards and stagger insulation layer to layer.

E. The minimum dimension on cut insulation boards shall be 12" with a minimum surface area of two (2) square feet. Maximum size of adhered insulation is 4'x 4'. Only full-sized insulation boards shall be used at roof perimeters and corners.

F. All insulation boards shall be installed tightly butted to adjacent insulation, roof to walls, or wood blocking. If gaps greater than 1/8" exist between boards the board shall be cut out and replaced.

G. Both layers of insulation board shall utilize cold adhesive for system attachment. Install the insulation boards atop the properly prepared vapor retarder and apply the adhesives as recommended by the adhesive manufacturer. Upon installation of the insulation boards, immediately "walk" the insulation into place to spread the adhesive for maximum contact.

H. Ballast the boards to prevent cupping until adhesive set is achieved. Redistribute ballast to ensure full bonding of the system. Poorly adhered insulation shall be removed and replaced at no additional cost to the Owner.

I. Remove a section of newly installed insulation board to confirm adhesion to the prior layer of insulation. The Contractor shall have the manufacturer's representative on site at the start of construction to confirm application rates and compatibility of the products.

J. Construct tapered insulation where shown on the Contract Drawings as required direct all run-off water to roof drainage scuppers. Set tapered insulation in cold adhesive prior to setting cover boards, or as otherwise required by the roof membrane manufacturer to maintain the specified warranty.

K. Utilize fiberboard tapered edge strips and polyisocyanurate fillers to match insulation thicknesses as needed.

L. Install cover board in cold adhesive applied in strict accordance with the adhesive manufacturer's printed installation instructions to achieve the required warranty.

M. Install the cover board and immediately "walk" the system into place to spread the adhesive for maximum contact. Stagger all end joints to the middle of the long dimension of adjacent boards, 24" minimum. Continue to "walk" the cover board every five (5) to seven (7) minutes until firm adhesion is achieved. Ballast the boards to prevent cupping. Redistribute ballast to ensure full bonding of the system. Poorly adhered cover boards shall be removed and replaced at no additional cost to the Owner.

N. Ensure that boards are fully adhered prior to application of roof membrane.

3.05 CLEAN-UP

A. All floor and adjacent areas, both interior and exterior, damaged, or stained by the installation of the roofing work shall be repaired and cleaned of all dust, debris, and any other materials to the Owner's satisfaction.

B. The Contractor shall not demobilize the site until the completed work is toured by the Owner and Engineer. Any unsatisfactory items observed will be reported in "punch-list" form. These items shall be corrected immediately by the Contractor prior to demobilization from the job site. Final payment will not be made until all punch list items are complete and guarantees have been received.

C. All scaffolding, barriers, temporary facilities, and the like shall be removed upon completion of the work. Areas damaged as a result of the Contractors equipment shall be restored to their original condition, all to the satisfaction of the Owner.

D. Refer to the Close-Out Procedures described in Division One for additional information.

END OF SECTION

I:\976710\02 Design\specs\BI-RD-298_976710_Section 07 22 00 Roof and Deck Insulation.doc

PART 1- GENERAL

1.01 IN GENERAL

The General Conditions, and all parts of the Bid and Contract Documents are made part of this Section as if fully repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 04 01 20 - Maintenance of Unit Masonry
B. Section 05 50 00 - Miscellaneous Metals
C. Section 06 10 00 - Rough Carpentry
D. Section 07 01 50 - Roof Restoration
E. Section 07 22 00 - Roof and Deck Insulation
F. Section 07 60 00 - Flashing and Sheet Metal
G. Section 22 20 00 - Roof Drains
H. Division 23 - Heating, Ventilating, and Air Conditioning
I. Division 26 - Electrical

1.03 SUMMARY OF WORK

This Section specifies requirements for the following Scope of Work for repairs to the existing Roof Areas. The repairs described below correspond to the defects indicated on the Contract Drawings. **Note that the Base Bid Scope of Work is limited to Roof Areas A, B, C, and D only and repairs to Roof Areas E through II are Supplemental Bid No. 1**:

A. Clean debris from existing roof areas.

B. Remove and **replace/supplement existing gravel** surface, in new asphalt adhesive, as required to perform repairs and replacements. Repairs may be made with hot or cold-process adhesives.

C. Cut out and **replace roofing** and insulation at Roof Area A beneath cooling tower framing, as indicated on the Contract Drawings.

D. Cut out and **replace roofing** and insulation at blisters and unadhered roofing, and tie-in to existing sound and dry roofing.

E. Provide **strip flashing** repairs over open flashings, punctures, field sheet seams, etc.

F. Repair the **membrane surface** with new cap membrane and gravel at worn areas, exposed felts, alligatoring, etc.

G. **Build-up** the existing roof surface with new coating and gravel surface at local low-points in order to alleviate ponding water.

H. Tie-in the roof repairs to the existing multi-ply roof assembly.

I. Coordinate work in this Section with through wall flashing replacement in accordance with Section 07 01 20 Maintenance of Unit Masonry and Section 07 60 00 Flashing and Sheet Metal.

1.04 JOB CONDITIONS

SPECIAL NOTE: Portions of the existing roof membrane flashings and mastics have been found to contain asbestos containing materials (ACM). The Contractor shall comply with the National Emission Standard for Hazardous Air Pollutants (NESHAP) regulation published in the Federal Register under 40 CFR, Part 61, subpart M. Specific attention is directed to Appendix A of this regulation entitled, Interpretive Rule Governing Roof Removal Operations. In addition to these regulations, the Contractor shall comply with OSHA Regulation (29 CFR Parts 1910 et al – Occupational Exposure to Asbestos; Final Rule) and all other State and Local guidelines regarding asbestos containing material removal and disposal. For clarification, refer to Section 02 82 13 Asbestos Containing Roofing Material Abatement.

A. Do not deliver to site or install a material or system that has not been approved. Remove materials installed without prior approval upon Owner's request at no additional charge to the Owner.

B. All new and temporary construction, including equipment and accessories, shall be secured from vandalism, abuse, and damage.

C. Roof repair materials shall not be applied when ambient temperature is less than 32 degrees Fahrenheit, unless approved in writing by the Engineer and membrane manufacturer.

D. Do not apply materials when precipitation is imminent or forecasted within 24 hours.

E. Materials, which have a temperature other than the application temperature requirements of the manufacturer, shall not be applied.

F. All surfaces to receive the repairs shall be thoroughly dry. Should surface moisture such as dew exist, the Contractor shall provide the necessary equipment to dry the surface prior to application. Do not dry with open flames.

G. Prior to and during application, all dirt, debris, and dust shall be removed from surfaces by vacuuming, sweeping, blowing with compressed air and/or by similar methods.

H. Fully charged, inspected, and approved fire extinguishers shall be on site at all times. No cutting, grinding, or welding of any kind shall proceed without an approved fully charged fire extinguisher.

I. Liquid materials such as solvents and adhesives shall be stored and used away from open flames, sparks, and excess heat. Red label materials shall be brought to the site, and removed from the site, daily.

J. Melting equipment for membrane material shall be a double jacketed, heat transfer oil bath kettle utilizing a mechanical agitator.

K. Adhesives contain petroleum distillates and are extremely flammable. Do not breathe vapors or use near an open fire. Do not use in confined areas without adequate ventilation. Consult container or packaging labels and Material Safety Data Sheets (MSDS) for specific safety information.

L. Do not allow waste products (petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, etc.) to come in contact with the roofing membrane. Any exposure to foreign materials or chemical discharges must be presented to membrane manufacturer for evaluation to determine any impact on the membrane assembly short or long-term performance.

1.05 SUBMITTALS

Submittals shall be made in accordance with the Division 1.

A. Manufacturer's data for each item specified in Part 2 of this Section.

B. Submit samples for the following items:
1. Ply and Cap sheets, cured sample.
2. UV resistant flashing

1.06 QUALIFICATIONS

A. Contractors: All work of this Section shall be performed by an Installer who is approved by the manufacturer of the roofing materials.

B. Qualifications of Installers: The Contractor shall be a licensed and approved applicator of the specified membrane system. Foreman shall have a minimum of 5 years of previous roofing membrane installation experience. The Contractor shall notify the membrane manufacturer prior to initiating the construction.

C. Installer shall submit a letter from the roofing material manufacturer stating that contractor is approved by the manufacturer for the application of the roofing system specified for the Project. The letter shall certify that the Installer has satisfactorily applied the roofing system specified herein under the manufacturer's supervision. The letter shall be on manufacturer's letterhead and shall be signed by an officer of the company.

1.07 PRODUCT HANDLING

A. Deliver materials in original unopened containers or packaging clearly labeled with manufacturer's name, brand name, instructions for use, all identifying numbers, and UL labels.

B. Materials shall be stored in a neat, safe manner, not to exceed the allowable structural capacity of the storage area.

C. Store materials in a clean, dry area protected from water and direct sunlight.

D. Store all adhesives at temperatures between 60 degrees F and 80 degrees F. If exposed to lower temperatures, restore materials to 60 degrees F minimum temperature before using. Do not allow materials to freeze.

E. Do not use materials damaged in handling or storage.

1.08 WARRANTY

A. Upon completion of the work, and prior to final payment, the Contractor shall submit a Guarantee of his work to be free from defect in materials and workmanship. This Guarantee shall be for a period of **two (2) years**, and shall be signed by a Principal of the Contractor's firm, and sealed if a corporation.

PART 2- MATERIALS

Note: While the materials for each roof area may differ, excluding insulation, coverboard, and adhesives, the intent is to provide compatible materials from a single source manufacturer for roof repairs at all areas (repair and restoration roofs).

2.01 BITUMINUOUS ROOFING AND FLASHING MATERIALS

A. Roofing and flashing plies: High-strength, asphalt-coated sheet that meets or exceeds ASTM D2178, Type IV.

B. Two-ply stripping and base flashing membrane shall consist of one (1) ply of asphalt-coated sheet and one (1) ply of the roof membrane manufacturer's, granular-surfaced, SBS modified, polyester and/or fiberglass-mat reinforced bitumen cap sheet. Thickness of modified bitumen membrane shall be not less than 120 mils.

C. Base Sheet: Asphalt fiberglass base sheet conforming to ASTM D4601, Type II.

D. Non-perforated, saturated organic felt shall be ASTM D226, Type I.

E. Membrane Reinforcing Sheet:

1. Field sheet reinforcing for horizontal and vertical applications shall be spun bonded polyester reinforcing.

F. Surface Conditioner: As recommended by membrane manufacturer.

G. Adhesives: Contact adhesive used to bond flashing to an approved substrate and to bond flashings together shall be as approved by manufacturer. Cold or hot adhesive is permitted.

1. Adhesive for insulation materials shall be in accordance with Section 07 60 00.

2. Adhesive for stripping membrane and for base flashing membrane shall be vertical grade, modified bitumen adhesive, Type I, specifically manufactured for vertical surface applications

3. Sealant: Sealant used to seal laps of neoprene flashing shall be as approved by membrane manufacturer.

H. Acceptable manufacturers for modified bitumen system components listed above are:

1. Tremco
2. Garland
3. W.P. Hickman

2.02 REPLACEMENT ROOFING

A. Full-depth roof replacement to include insulation and coverboard materials in accordance with Section 07 22 00 – Roof and Deck Insulation.

B. Provide four (4)-ply roof membrane and two (2)-ply flashings at replacement areas.

2.03 GRAVEL SURFACING

A. Aggregate: White marble roofing aggregate, ASTM D1863, hard, durable, washed stone, provided or as recommended by the membrane manufacturer.

2.04 THERMAL INSULATION AND COVER BOARD

A. Refer to Section 07 22 00 Roof and Deck Insulation.

2.05 FASTENERS

A. In general, fasteners, straps and other hardware shall be copper, brass, stainless steel, galvanized steel, or fluorocarbon coated steel. Galvanizing shall be hot dip in

accordance with ASTM A153 specifications. Electro-galvanized items shall not be used.

B. All accessories, including, but not limited to nails, screws, clips, fastening strips, etc. shall be completely compatible with the material being fastened to prevent galvanic reaction and premature deterioration.

C. Insulation fasteners for wood deck areas shall be self-drilling, self-tapping screws installed through minimum 3-1/2" diameter, 26-gauge hot dipped galvanized stress plates, such as Dekfast plates as manufactured by Construction Fasteners, Inc. Screws shall be of sufficient length to penetrate the deck by 1-1/4" maximum. Fasteners shall be in conformance with FM 4470 corrosion specifications.

D. Nails for membrane termination shall be hot dip galvanized or stainless steel, large head annular ring roofing nails of sufficient length to penetrate the wood blocking 1-1/4" minimum.

E. Fasteners for terminating roof membrane and flashing at masonry substrates shall be minimum 1-1/2" long drive pins in zinc sheaths as manufactured by Star, Rawl or equal. Embedment into substrate shall be 1-1/4" minimum.

F. Nails for flashing securement at wood substrates shall be No. 12 Stubbs gauge, large head, threaded shank, stainless steel nails, of sufficient length for 1-1/4" embedment.

G. Fasteners for securing fan and vent unit covers, expansion joint bellows and termination bars to existing wood construction shall be stainless steel hex head self-drilling screws. Use stainless steel capped EPDM washers of the next larger size than the existing fastener to resecure existing fan unit covers.

2.06 SEALANT AND ACCESSORIES

A. Sealant for sheet metal flashings and other exposed locations shall be a one-part polyurethane conforming to ASTM C920-87, Type S, Grade NS, Class 25, Uses NT, M, A, and O such as manufactured by Tremco, BASF-Sonneborn, Sika Corp., or approved equal.

B. Backer rod shall be continuous length, close-cell polyethylene foam, as recommended by the sealant manufacturer. Backer rod shall be compressible, resilient, non-waxing, non-extruding, and non-staining. Backer rod shall be of sufficient size to be compressed 30% of maximum joint width and shall be totally compatible with the sealant, primer, and substrates. Backers shall conform to the requirements of ASTM C 962, Type A, such as Green Rod as manufactured by Nomaco, Sonofoam as manufactured by Sonneborn, ITP soft type backer rod as manufactured by ITP Corporation, or approved equal.

C. Hose clamps for vent pipes shall be stainless steel 1/2"-wide screw adjustable or as required by the membrane manufacturer.

PART 3 - EXECUTION

3.01 GENERAL

Note: This section relates to isolated repairs and replacement areas and does not prescribe full roof replacement of any one roof area. As such, the Contactor must take measures to protect areas of the existing roof system where repairs are **not** indicated. Include protection against foot traffic across the roof areas.

A. Maintain existing roof drains and scuppers in functioning conditions for the duration of the repair work.

B. Do not deliver to site or install any material or system that has not been approved. Materials installed without approval may be required to be removed.

C. The prepared substrate must be dry, clean, and smooth. All deteriorated, damaged, or wet areas of wood blocking shall be removed prior to installing the new roofing and flashing membrane. Provide dryers, if necessary, to dry deck surfaces prior to installing new work. Open flame devices shall not be used.

D. Comply with the manufacturer's written instructions and these Specifications for all renovations and associated work.

E. Flashings shall be installed prior to or along with the membrane to assure weather tight termination.

F. Partial or unmarked materials cannot be used.

G. Handle materials to prevent damage to building components and project site areas.

H. Keep covers tightly sealed on all canned and evaporative products to prevent premature curing.

I. The Contractor is cautioned to investigate all existing conditions and materials of construction.

3.02 SURFACE PREPARATION

A. Remove the embedded gravel surfacing from the existing membrane prior to performing repairs. Perform removals using a power broom and vacuum.

B. Remove surface coatings, dirt, paints, fungus, and other surface contaminants in preparation for installation of new roofing.

3.03 REMOVAL OF EXISTING SYSTEM

A. Where indicated, and to the extent shown, remove existing roofing and flashings, insulation, bituminous built-up roofing, base flashings, and edge flashings down to

the top surface of the roof deck. Scrape and sweep clean the exposed roof deck, masonry walls and penetration surfaces. Notify the Engineer of any areas of unsuitable roof deck or associated components.

B. Remove only as much existing roofing and flashings as can be replaced and made weathertight the same day with the new work. Arrange each day's termination point to prevent interruption of rooftop drainage.

C. Clean deck surfaces using brooms, air spray or other means necessary to provide a clean, smooth, uniform deck. Report any areas of deteriorated deck to the Engineer and allow for review of the condition(s). Provide temporary protection as needed.

3.04 DECK PREPARATION

A. Remove, replace, or repair areas of unsuitable gypsum, cementitious wood fiber and metal decking as described in Sections 03510 – Gypsum Deck Repairs and Replacement, Section 03550 - Cementitious Wood Fiber Repair and Replacement, Section 05300 – Metal Deck Repair and Replacement and Section 06100 – Rough Carpentry, and this section.

B. Allow moist deck sections to dry prior to application of roof insulation. Open flames are strictly prohibited from the roof areas.

C. Ensure that deck surface and joints are clean of all debris and roofing materials.

D. Fill all cracks, spalls, or uneven surfaces of the deck to provide a smooth finish for insulation. Allow repairs to cure prior to installing primer and insulation. Follow manufacturers application rates and procedures.

E. Tape cracks and joints in deck to prevent adhesive seepage to building interior.

3.05 MEMBRANE INSTALLATION

A. It is the intent of this Specification Section to provide the Owner with a fully adhered membrane, bonded to the existing concrete deck, of sufficient bond strength to resist FM Global uplift pressures of 45 psf, 67 psf, and 96 psf in the field, perimeter, and corner zones, respectively.

B. Surface Conditioner: After preparation of surfaces but prior to installation of reinforcing flashing and membrane, apply surface conditioner to the substrate surfaces at rate of 300 to 600 square feet per gallon depending on the concrete surface texture and as recommended by membrane manufacturer. Allow conditioner to dry prior to membrane installation. Protect surface conditioner from rain until dry.

C. Over properly installed and prepared insulation surface, install a new 4-ply built-up gravel surfaced membrane.

D. Starting at the low point, spray-apply a uniform coating of cold adhesive over the properly installed insulation system at the rate of no less than 2.5 gal/100 s.f. or as required by the membrane manufacturer.

E. Embed 9", 18", 27", and 36" starter plies to start and finish roof membrane along roof edges and terminations. Overlap starter plies 29" and each succeeding ply 27.5". Place ply sheets to ensure water will flow over or parallel to; but, never against exposed edges.

F. Overlap starter strips 29" with the next ply. Then overlap all succeeding plies 27.5".

G. Lap ply sheet ends 6", minimum. Stagger end laps 6" minimum.

H. Apply cold process adhesive no more than 10' ahead of each roll being embedded (less in cold weather). All plies shall be solidly coated with adhesive over the full width. Nowhere shall felt be allowed to contact another ply of felt.

I. Extend all plies to top edge of cant strips, across wood blocking and onto drain rims.

J. Broom all plies to ensure complete and continuous seal and contact between adhesive and ply sheets. Broom ends, edges and laps without wrinkles, fish mouths, or blisters. Reduce construction traffic on the plies until adhesives have fully cured.

K. Repair of defects:

1. Installations or details noted as deficient during final inspection must be repaired and/or corrected by applicator within five (5) working days.

2. All job-related debris shall be completely removed from jobsite within five (5) days upon job completion.

L. Daily water stops/tie-ins

1. Remove roofing and insulation a minimum of 6" from daily termination site.

2. Adhere 12" and 18" wide ply sheets (non-perforated and saturated organic felt) from exposed deck to existing roofing with a continuous 1/16" thick application of asphalt mastic. Extend 18" wide felt 3" either side 12" felt.

3. Extend roofing system at least 12" onto prepared area of adjacent roofing. Seal edge with alternate courses of ply sheet set in asphalt mastic.

4. At beginning of next day's work remove temporary connection by cutting felts evenly along edge of existing roof system.

5. Comply with instructions and recommendations of the roof membrane materials manufacturer's as amended by these specifications.

M. No bare spots or wrinkles will be accepted. Cut and reset all fish mouths and patch with an additional ply.

N. When installing felt, do not use any rolls with frayed edges, oval shaped rolls, or similar defects that inhibit embedment.

O. All detailing and flashing work at repair areas shall be completed before installing the repair membrane over the field of the substrate. Use surface conditioner on detail areas prior to membrane installation. Reinforcing flashing (neoprene flashing sheet) shall be installed in long lengths with minimum number of splices. Splices in reinforcing flashing shall be made by lapping reinforcing flashing 4" minimum and sealing lap with adhesive specified herein. Make splices prior to installing reinforcing flashing. Reinforcing flashing shall be embedded in roofing membrane coating while still warm and tacky, and then covered with roofing membrane on the same day.

3.06 INSTALLATION OF BASE FLASHINGS

A. Replace existing base flashings at curbs, penetrations, rising walls, etc. (Note: at roof areas receiving only repairs, replace flashings at vent pipes and indicated curbs only).

B. Base flashings must extend at least 8" above the finished roof membrane surface and 3" minimum above the bottom of the counter flashings. Seal new flashings at end laps, corners, and where flashing ends on existing, primed roof membrane.

C. Pre-cut flashing sheet to useable lengths (not more than 8') and lay flat on roof surface (to "relax" rolled surfaces) for 1/2-hour minimum.

D. Coat the area to receive flashing with a smooth, uniform trowel coating of the specified adhesive/roof cement. Coat the back side of the first ply sheet with a continuous application of flashing adhesive and set in place with a "dry trowel" to assure total uniform embedment. Lap flashing sheet past cant and onto roof membrane at least 6". Make side laps in the sheets 3" minimum, and stagger side laps 24" minimum, ply to ply.

E. Coat installed ply sheet with a uniform trowel coat of flashing adhesive. Coat the back side of the top ply with flashing adhesive and press firmly in place with a "dry trowel" to assure total uniform embedment. Lap flashing sheet past cant and onto roof membrane at least 10", (at least 4" past the flashing sheet underneath). Make side laps in the sheets 3" minimum, and stagger side laps 24" minimum, ply to ply.

F. Fasten base flashing sheets along the top of the flashings and on vertical side laps 4" on center with specified fasteners. Keep side lap fasteners at least 4" above the top of the cant. Cover end laps and side laps for entire length with two plies of 6"-wide, asphalt-saturated fiberglass mesh set in flashing adhesive. Set base flashing in butyl sealant and fasten through a termination bar.

G. Take care to avoid over-spray or drips of adhesive on systems and materials to remain. Transition to self-adhered membrane at top of parapet.

3.07 REPLACEMENT / BLISTER REPAIRS

A. At blister locations, confirm the extent of membrane blistering prior to cutting.

B. At Roof Area A, replace the existing roof to the approximate extent(s) indicated on the Contract Drawings.

C. Remove gravel in accordance with this Section 12" minimum beyond the affected/designated area.

D. Cut out the existing roof assembly down to the existing roof deck a minimum of 6" beyond the affected/designated area in order to tie-in repairs to the existing roof.

E. Install mechanically attached insulation base layer, adhered insulation, and adhered cover board materials in accordance with Section 07 22 00 Roof and Deck Insulation. Match the existing insulation thickness (varies).

F. Install new four (4)-ply reinforced roof membrane and tie-in to existing, primed and prepared built-up roofing.

G. Install new gravel surface over new membrane application.

3.08 ROOF REPLACEMENT BELOW COOLING TOWERS

A. Coordinate the work beneath the cooling towers with the mechanical scope at and around the towers and structural scope at the steel framing.

B. Remove and replace roofing as described in this section.

C. Apply the restoration coating and gravel over the new roof membrane in accordance with Section 07 01 50 – Roof Restoration.

3.09 STRIP REPAIRS

A. Remove gravel in accordance with this Section, as required to extend 12" beyond past the affected seam and/or 12" onto the field of roof lengthwise, and 8" minimum widthwise on either side of the affected seam.

B. Prime and prepare the existing roof membrane to receive strip flashing.

C. Apply strip flashing (6” wide min.) centered over the open seam. Apply a second layer at 10” wide, min., centered over the first layer.

D. Install new gravel surface over newly installed flashing membranes, where present in the existing roof system (i.e. not on vertical surfaces).

3.10 SURFACE BUILD-UP REPAIRS

A. Confirm the extent of local low-spots in the existing roof prior to repairs.

B. Remove gravel in accordance with this Section 12” minimum beyond the affected area.

C. Apply roof membrane to the affected area and build up to an increased thickness. Multiple applications may be required.

D. Install new gravel surface over new membrane application.

3.11 GRAVEL SURFACING

A. Prime the repaired membrane surface as required by the membrane manufacturer and apply a flood-coat of roof membrane at a minimum application rate of seven (7) gallons per 100 square feet, or as recommended by the membrane manufacturer.

B. Cast five (5) pounds square foot of aggregate while the flood-coat is still fluid.

C. Ensure that the flood coat is completely covered by the aggregate.

3.12 VENT PIPES

A. Vent pipes shall be flashed with shop fabricated copper sleeve. Slide flashings down over pipe and roofing membrane. Flange shall be set in a full application of roof cement. Fasten flashing flange to wood blocking/deck at 3" on center staggered along the outside edge.

B. Install membrane flashings as shown on the Detail Drawings and described herein.

3.13 CLEAN-UP

A. All floor and adjacent areas, both interior and exterior, damaged, or stained by the installation of the roofing work shall be repaired and cleaned of all dust, debris, and any other materials to the Owner’s satisfaction.

B. The Contractor shall not demobilize the site until the completed work is toured by the Owner and Architect/Engineer. Any unsatisfactory items observed will be reported in “punch-list” form. These items shall be corrected immediately by the Contractor prior to demobilization from the job site. Final payment will not be made until all punch list items are complete and guarantees have been received.

C. All scaffolding, barriers, temporary facilities, and the like shall be removed upon completion of the work. Areas damaged as a result of the Contractors equipment shall be restored to their original condition, all to the satisfaction of the Owner.

END OF SECTION

I:\976710\02 Design\specs\BI-RD-298_976710_Section 07 51 13 Roof Repairs and Maintenance.doc

PART 1- GENERAL

1.01 IN GENERAL

The General Conditions, and all parts of the Bid and Contract Documents are made part of this Section as if fully repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 04 01 20 - Maintenance of Unit Masonry
B. Section 05 50 00 - Miscellaneous Metals
C. Section 06 10 00 - Rough Carpentry
D. Section 07 01 50 - Roof Restoration
E. Section 07 22 00 - Roof and Deck Insulation
F. Section 07 51 13 - Roof Repairs and Maintenance
G. Section 22 20 00 - Roof Drains
H. Division 23 - Heating, Ventilating, and Air Conditioning
I. Division 26 - Electrical

1.03 SUMMARY OF WORK

This Section specifies requirements for the following Scope of Work:

A. Stainless-steel cap flashings at roof sleepers, Roof Area A.

B. Coated aluminum skirt counterflashing flashings at rooftop fan units and curbs.

C. Coated aluminum coping-cap flashings at the upper roof restoration areas.

D. Lead-coated copper counterflashings at perimeters.

E. Roof drain pan flashings at upper roof restoration areas.

F. Aluminum scuppers and downspouts at Roof Areas B and C.

G. Aluminum through-wall scupper at Roof Area D.

H. Apply waterproof coating to existing copper chimney cap and fascia at Roof Area C.

I. Lead-coated copper vent pipe flashings.

1.04 JOB CONDITIONS

A. Coordinate the work in this Section with the work in other sections to maintain a watertight condition and to ensure the orderly progress of work.

B. All surfaces to receive flashings shall be thoroughly dry. Should surface moisture such as dew exist, the Contractor shall provide the necessary equipment to dry the surface prior to application. Do not dry with open flames.

C. System shall accommodate movement of components without buckling, failure of joint seals, undue stress on fasteners, or other detrimental effects when subjected to seasonal temperature changes and live loads.

D. Design system capable of withstanding building code requirements for negative wind pressure.

1.05 REFERENCES

A. CDA Copper Design Manual, published by the Copper Development Association. See also “Copper and Common Sense – Sheet Copper Design Principles and Construction Techniques Manual”, Published by Revere Copper Products.

B. SMACNA - Architectural Sheet Metal Manual of the Sheet Metal and Air Conditioning Contractors National Association, Inc.

1.06 SUBMITTALS

A. Submittals shall be made in accordance with Division 1 and Section 01 33 00 – Submittal Procedures.

B. The Contractor shall submit the following procedural items with their submittal package:

1. Methods of removal of materials
2. Temporary protection procedures
3. Fire watch procedures
4. List of local emergency numbers
5. Staging/set-up procedures

C. The Contractor shall submit the following samples with their submittal package:

1. 3”x3” samples of each type of metal and flashing to be used.
2. 12”x12” sample for verification of through-wall flashing fabric.

D. Provide manufacturer’s color chart(s) for sheet metal and coating products for selection by the Owner.

E. Shop drawings for each shop or field fabricated sheet metal component.

F. Submit complete, detailed large scale (min 3: = 1’-0”) shop drawings indicating through-wall flashing, pan flashing, profiles, seams, terminations, dimensions, interface with other materials and substrates.

1.07 TEST AREAS

A. Before full scale work is commenced, execute the following work for trial work areas to be located and reviewed by the Engineer as to acceptability of installation:

1. Five (5) linear feet of through wall flashing with integral end dams and weeps and at least one seam.
2. Five (5) linear feet of copper fabric cavity flashing with termination and sealed laps.
3. One (1) scupper and downspout system.
4. Copper coping cap including cleats, underlayment, and at least one (1) seam.

B. Trial areas shall be repeated until acceptable results are obtained. The accepted work shall be a standard for all subsequent work.

1.08 PERFORMANCE REQUIREMENTS

A. System shall accommodate movement of components without buckling, failure of joint seals, undue stress on fasteners, or other detrimental effects when subjected to seasonal temperature changes and live loads.

B. Sheet metal coping assembly must be fabricated and installed in accordance with ANSI/SPRI ES-1 and be tested in accordance with Test Methods RE-1, RE-2, and RE-3. Contractor shall submit an approved NRCA edge metal detail that is rated to meet or exceed wind uplift pressures.

1.09 DIMENSIONS AND QUANTITIES

A. All dimensions and quantities shall be determined or verified by the Contractor. The Contract Drawings have been compiled from various sources and may not reflect the actual condition at the time of construction. The Contractor is advised to take all precautions and make all investigations necessary to install the proposed work. The Owner will not consider unfamiliarity with the job conditions as a basis for additional compensation.

1.10 WARRANTY

A. Manufacturer's Warranty: The manufacturer of coated aluminum materials shall guarantee the finish from chalking, cracking, peeling, blistering, loss of adhesion, and color change for a period of **ten (10) years**, minimum.

B. Manufacturer's Warranty: The manufacturer of waterproof coating materials and accessory shall guarantee the installation be free of material and workmanship deficiencies for a period of **ten (10) years**, minimum.

C. Upon completion of the work, and prior to final payment, the Contractor shall submit a Guarantee of his work to be free from defect in materials and workmanship. This

Guarantee shall be for a period of **two (2) years**, and shall be signed by a Principal of the Contractor's firm, and sealed if a corporation.

PART 2 - MATERIALS

2.01 SHEET METAL FLASHINGS

A. Copper shall be minimum 16 oz. per square foot conforming to ASTM B370. Copper shall be 1/8th hard, Temper H00 except Temper 060 where hand forming is required. Refer to Fabrication Schedule for requirements.

B. Stainless steel shall be 20 and 24-gauge AISI 18-8 type 304, 2D finish. Sheet length shall be 8' maximum.

C. Aluminum shall be 0.040" and 0.050" thick, or as required for ANSI/SPRI ES-1 detail requirements. Aluminum shall have a mill finish for concealed items. Provide a Polyvinylidene Fluoride finish for exposed aluminum. Aluminum shall be 3003 alloy, H-14 temper. Color shall be selected by the Owner.

D. In general, except for expansion/contraction joints, copper and stainless steel shall be locked and soldered. Joining of copper or stainless steel shall be done by lapping, riveting, and soldering.

E. All accessories, including but not limited to nails, screws and clip strips shall be stainless steel and completely compatible with the surrounding metal to prevent galvanic reaction.

F. Nails for flashing securement at wood substrates shall be No. 12 Stubbs gauge, large head, threaded shank, copper, or galvanized steel nails minimum 1.25" long.

G. Rivets shall be 3/16" diameter copper or stainless steel as required by the metal being secured.

H. Sealant required incidental to sheet metal and flashing work shall be one-part non-skinning butyl.

I. Fabrication Schedule:

1. 16-ounce Red Copper
   a. Through wall Pan Flashing
   b. Counter flashing
   c. End Dams (soldered)

2. 20 Ounce Red Copper
   a. Counterflashing Clips
   b. Cleats for securing 16 oz. coppers

3. 0.040” Polyvinyl Fluoride Finished Aluminum
   a. Coping caps
   b. Scuppers
   c. Downspout Leaders

4. 0.050” Mill Finish Aluminum
   a. Cleats for securing aluminum flashings

5. 18 Gauge Stainless Steel
   a. Cleats for securing 20-Gauge stainless steel

6. 20 Gauge Stainless Steel
   b. Mechanical sleeper cap flashings

J. Joints shall conform to the following requirements:

1. Flat-lock joints shall finish not less than 3/4”-wide.
2. Lap joints subject to stress shall finish not less than 1”-wide and shall be soldered and riveted.
3. Unsoldered lap joints shall finish not less than 4”-wide.

K. Soldering:

1. Pre-tin both mating surfaces with solder for a width not less than 1-1/2” of uncoated copper or stainless steel.
2. Treat other sheet metal required to be soldered in accordance with metal producer’s recommendations.
3. Completely remove acid and flux after soldering is completed.
4. All lap or lock seams shall be pre-tinned.

L. Expansion and Contraction Joints:

1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
2. Space expansion and contraction joints for copper and stainless steel at intervals not exceeding 24’.
3. Fabricate joint covers of same thickness materials as sheet metal served.

M. Securement Clips:

1. Provide securement clips to secure flashing and sheet metal work over 12” wide and where specified.
2. Form securement clips of same metal and one weight heavier as the sheet metal being installed.
3. Fabricate securement clips from 2”-wide strips. Form end with not less than 3/4”-wide loose lock to item for anchorage. Fold clips over flashing and crimp tightly.

N. Edge Strips or Continuous Cleats:

1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Use material compatible with sheet metal to be secured by the edge strip.
3. Fabricate in 10’ maximum lengths with not less than 3/4” loose lock into metal secured by edge stip.
4. Fabricate strips for fascia anchorage to extend below the supporting wood construction to form a drip and allow the flashing to be hooked over the lower edge at least 3/4”.
5. Fabricate anchor edge maximum width of 3” or of sufficient width to provide adequate bearing area to insure a rigid installation using 0.031-inch-thick stainless steel.

O. Gravel Stops

1. Fabricate in lengths of not less than 8’ long and maximum of 10’.
2. Fabricate internal and external corners as one-piece with legs not less than 2’ or more than 4’ long.
3. Fabricate roof flange not less than 4” wide.
4. Fabricate lower edge outward at an angle of 45° to form drip and as fascia or as counterflashing as shown.
5. Fabricate of one-piece material of suitable width for fascia height of 8” maximum or counterflashing lap of not less than 4” over base flashing.
6. Provide backer and cover plates at joints in the gravel stop with in-seam sealant between all layers.

P. Flat and lap joints shall be made in direction of flow.

Q. Sheet metal flashings shall be shop fabricated. All breaks, bends and hems shall be uniform, clean, straight lines.

1. Flanges shall be 4’’ wide minimum
2. Drip edges shall be hemmed 3/4” wide minimum and break at a 30-degree angle.
3. Clips shall be 2” wide.
4. Where cleats and clips are fastened to substrate, edge of metal shall be folded back over the fastener head.
5. All flanges to be covered with roofing or flashing membrane shall have a 1/4” minimum hem on the edge.
6. Seams shall be formed of a pre-tinned, single-lock, crimped and soldered.
7. End dams and rear legs shall be 2” tall minimum unless otherwise noted.
8. Expansion joints within the brick veneer shall be overlapped 6” with double row of in-seam butyl sealant.
9. Blind nailers shall be 4” wide and hemmed on both edges, folded to 2” wide final dimension.

2.02 FASTENERS AND ACCESSORIES

A. All accessories, including but not limited to nails, screws, straps, hangers, and clips shall be stainless steel and completely compatible with the surrounding metal to prevent galvanic reaction.

B. Termination Bars – Stainless Steel or Copper

1. 1/8" x 1" x 10'-0" lengths
2. Fastener holes located at 8" on center, maximum
3. 3/8" flange as sealant receiver

2.03 THROUGHWALL FLASHING AND ACCESSORIES

A. Plain red copper shall be 16 oz. per square foot sheet conforming to ASTM B370. Sheet length shall be 8' maximum.

B. Copper fabric flashing shall consist of a full 7 oz. copper sheet permanently bonded between two layers polymer fabric laminated to the copper face with non-asphalt adhesive. Primers and mastic adhesive required for the proper installation of the fabric flashing shall be as specifically recommended by the fabric flashing manufacturer. Fabric flashing shall be as manufactured by York Manufacturing, Inc., Advanced Building Products, Inc., Sandell Manufacturing Company, Inc.

C. Waterproof mastics for use with copper fabric flashing shall be as provided or recommended by the fabric flashing manufacturer.

D. Solder and flux for sheet copper shall be 50% block tin and 50% pig lead conforming to ASTM B32.

E. Solder and flux for sheet stainless steel shall be a tin-silver solder with at least 50% tin content, and a phosphoric acid-based flux.

F. Self-Adhering Modified Bitumen Flashing Membrane: ASTM D 1970, 60 mil thick minimum with 4 mil, high-density polyethylene film and release paper backing formulated for high temperature installation.

G. All accessories, including but not limited to, nails, screws, and rivets shall be copper, brass, stainless steel, or galvanized steel and completely compatible with the surrounding metal to prevent galvanic reaction.

2.04 DOWNSPOUTS AND ACCESSORIES

A. Replace downspouts at penthouse roofs.

B. New downspouts shall be sized to the dimensions of the existing downspouts. Provide elbows to form downspout around existing building profile conditions.

C. Upper ends of the downspouts shall be riveted to the scupper outlet tube.

D. Provide concrete splash blocks at lower limits of the downspouts.

2.05 WATERPROOF COATING

A. Water-based, spray-applied liquid coating, curing to a 16-mil (wet), seamless acrylic elastomeric membrane over existing copper substrates.

B. The selection and use of primer(s) shall be as recommended by the coating manufacturer.

C. Provide manufacturer's recommended flashing-grade membrane and reinforcement at detail areas such as seams, penetrations, holes, etc.

D. Basis of design is: TopCoat Membrane by GAF. Color to be selected by Owner.

PART 3 - EXECUTION

3.01 GENERAL

A. Refer to the publication, "CDA Copper Design Manual", "Copper and Common Sense" by Revere Copper and Brass and all recommendations of the Sheet Metal and Sheet Metal and Air Conditioning Contractors National Association (SMACNA) concerning methods and materials to be used in the fabrication and construction of sheet metal flashings.

1. All sheet metal sections that are to rest over modified bitumen membranes shall be separated by a slip sheet.

B. It is the intent of this Specification to utilize the most effective joint configuration possible to properly install strong, weather tight metal flashings. Comply with the following standards unless otherwise specified when fabricating metal components to be joined:

1. Prefabricate corners of flashings in one-piece sections with minimum lengths of 18" in each dimension from the corner whenever possible.

2. Whenever one-piece construction is not possible, solderable metals shall utilize interlocked, crimped, and fully soldered seams and joints.

3. Seams and joints of non-solderable metals shall be interlocked, riveted, and completely filled with sealant. Strip in concealed flashing locations with modified bitumen membrane.

4. Provide sheet metal closure components at transitions to rising walls and similar changes in plane for edge metal, expansion joint covers and other

termination flashings. Fully crimp and seal closures to continuous blind nailed cleats.

C. Shop fabricate sheet metal flashings to the fullest extent possible. Fabricate all breaks, bends and hems with uniform, clean, straight lines.

D. It is the intent of this Specification to have as few seams as is practical in order to properly install strong, watertight metal flashings. Joints shall be interlocked and crimped where possible. Flanges which extend onto the roof surface shall always be hemmed. All corners shall be lapped, riveted, and sealed to provide a waterproof connection.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

F. Do not install bent, twisted, scratched, or otherwise damaged sheet metal fabrications.

G. Erect sheet metal plumb and level without bulges or waves.

H. Provide watertight joints to accommodate thermal expansion and contraction.

I. Fit sheet metal fabrications tight in place. Make corners square, and surfaces true and straight in planes.

J. Secure sheet metal in place using concealed fasteners unless shown otherwise. Lap and seal all joints.

K. Protect finishes of exposed to view sheet metal fabrications. Avoid gouging, scratching, and denting. Use cotton gloves when handling and installing unprotected sheet metal in order to avoid soiling exposed to view surfaces.

3.02 EDGE METAL FASCIA

A. Extend flashing membrane over wood blocking and onto the sloped perimeter roof.

B. Backer and cover plates shall be installed behind all edge metal joints. Sealant shall be applied with full beads between backer plates, edge metal, and cover plates.

C. Provide blind nailers at exposed ends where thermoplastic clad fascias meet rising walls as necessary and other locations as required to provide an aesthetic watertight termination of metal flashings.

3.03 ALUMINIUM COPING FLASHING

A. Coordinate the installation of continuous shims on top of the existing parapet with Section 06 10 00 – Rough Carpentry.

B. Fabricate coping flashings in accordance with the submitted and approved NRCA coping detail.

C. Install continuous hook strips with 3/4" kicks, bent out at a 45° angle on both side of the parapet and secure to the wood blocking with the specified fasteners spaced at 6" on center/staggered.

D. Fabricate the cap with a 45° open bend at the kick on the interior side to allow for field-crimping to the continuous cleat once the exterior side has been engaged.

E. Install backer plates underneath the parapet cap at all splice joints. Fasten the backer plates with four fasteners minimum per side.

F. Install parapet cap over continuous hook strips with splice joints at 8'-0" on center maximum. Splice joints are to have minimum and maximum widths of 1/8" and 1/4", respectively.

G. Set each end of parapet cover plates in two continuous beads of mastic.

3.04 DOWNSPOUTS

A. Replace downspouts at penthouse roofs.

B. Upper ends of the downspouts shall be riveted to the scupper outlet tube.

C. Provide concrete splash blocks at lower limits of the downspouts.

3.05 SCUPPERS

A. Fabricate and install scupper as shown on the detail drawings. Hem all edges 1/2'' minimum.

B. Secure the flange of the scupper to perimeter blocking with nails spaced 3'' on center, maximum. Apply a full bead of sealant between the fascia metal and the scupper where they overlap.

C. Extend and fully adhered roof membrane flashing over scupper flange and extend as shown on the Contract Drawings.

D. Provide closure flashings where scupper transitions to coping.

3.06 THROUGHWALL FLASHING

A. Through wall flashing to be placed at the same elevation as the existing flashing.

B. Fabricate and install new copper and copper fabric flashing over properly installed steel lintels or masonry substrates as shown on the Contract Drawings.

C. Set base of copper flashing in a continuous bed of sealant over the steel lintel or masonry. Extend rear hemmed leg of the copper flashing (two) 2" minimum up the back-up wall and fasten in place, over a continuous bead of mastic, at 8" on center with the specified fasteners through termination bars. Copper shall be continuous across lintel and roof to wall transition. Seams in copper flashings shall be constructed of a single lock, crimped, and soldered.

D. Finish exposed flashing edges so that the reveal extends beyond the exterior face of the brick masonry with no sharp edges. Bend exposed flashing edge down at a 30° angle to provide a kick and securement for skirt flashing at roof to wall locations.

E. Copper fabric shall be installed in continuous lengths across each pan flashing. Extend rear leg of flashing 8" minimum up the back-up wall surface. Secure rear leg of the flashing fabric to the back-up wall using the specified fasteners spaced 8" on center and termination bars. Provide full bead sealant to top of flashing and tool to shed water. Cut fabric flashing flush with exterior face of brick masonry veneer.

3.07 CONTINUOUS CLEATS AND HOOK STRIPS

A. Form continuous cleats/hook strips with 3/4" kicks, bent out at a 30° angle to the face or wall. Height of continuous cleats/hook strips shall be as indicated on the Detail Drawings.

B. Secure continuous cleats/hook strips to wood blocking with the specified fasteners spaced at 6" on center.

C. Continuous cleats/hook strips shall be the same gauge than the metal being secured.

D. Provide 1/8" butt joints between hook strip sections.

3.08 SECUREMENT CLIPS

A. Secure clips to substrate with the specified fasteners at minimum 8" on center, or as indicated on the Detail Drawings. Use same holes utilized for termination bar attachment. Install clips concurrently with membrane terminations. Clips are located on the roof side of the parapet.

B. Clips shall be one gauge heavier than the metal being secured.

C. Bend clips a minimum of 1" over bottom drip edge of parapet cap and crimp tightly.

3.09 SKIRT/COUNTERFLASHING

A. Install sheet metal skirt and counter-flashings where indicated at translucent wall panel side of parapet cap, unit curbs, etc. Skirt metal flashings shall be fastened with the specified fasteners.

B. All fasteners shall be concealed. Secure bottom edges of skirt flashings and counter-flashings with clips spaced at 6" on center.

3.10 ENCLOSED DOWNSPOUTS

A. Provide downspouts where shown on the Contract Drawings and install per the manufacturer's specifications.

B. Downspouts shall be 4" x 5" rectangular (or round) and extend the full height of the building elevation from collection box outlet to shoe. Seams shall be located along the back side.

C. The upper end of the downspout shall be riveted to the drainage outlet tube.

D. Install 2" wide securement straps with 1/2" hemmed edges every 4' on center to secure downspouts. Downspouts shall have three (3) straps minimum. Straps shall be installed at top, bottom, and middle of each 10' section. Secure straps back to the adjacent substrate.

E. Provide downspout collars at the lower limits of the downspouts where the units enter the sub-grade drainage system and cast-iron boots.

F. Cast iron boots shall be similar to that shown on the Contract Drawings and be constructed of gray cast iron. Provide two (2) styles of cast iron boots:

1. Outlet sized to fit into existing soil pipe bell and inlet sized to fit new aluminum downspouts.

2. 45-degree outlet to discharge onto splash block with inlet sized to fit new aluminum downspouts.

3.11 WATERPROOF COATING

A. Examine substrates to receive new coating and prepare in accordance with the manufacturer's instructions. Preparation to include: repair of dented/damaged panels, re-crimp fascia to cleats, clean/remove existing paints and coatings, treatment of holes, priming, etc.

B. Execute flashing details prior to applying the coating to the field of the roof. At seams, transitions, and penetrations, install 6" flashing and reinforcement fabric. Cut the fabric so that it lies flat. Feather the edges of the coating in the direction of water flow.

C. Contractor to verify and report that application coating thickness(es) are in accordance with the manufacturer's requirements.

D. Spray-apply a base coat of the waterproofing over the detailed areas and field of roof. Allow base coat to dry for a minimum of 24 hours. Inspect the coating and repair any deficiencies prior to proceeding.

E. Spray-apply the finish coat of waterproofing over clean and dry base-coat application. Allow finish to dry for a minimum of 24 hours and inspect the coating. Flat seams should not be visible after the completion of the work.

F. Repair all unsatisfactory area using the manufacturer's recommended flashing and fabric reinforcement.

3.12 CLEAN-UP

A. Remove protective film (if any) from exposed surfaces promptly upon installation. Strip with care to avoid damage to finishes.

B. Clean exposed surfaces, removing substances that might cause abnormal discoloration of metal.

C. Upon completion of each area of soldering, carefully remove flux and other residue from surfaces. Neutralize acid flux by washing with baking soda solution, and then flushing with clear water rinse. Use special care to neutralize and clean crevices.

D. Clean exposed metal surfaces of substances that would interfere with uniform oxidation and weathering.

E. All floor and adjacent areas, both interior and exterior, damaged, or stained by the installation of the roofing work shall be repaired and cleaned of all dust, debris, and any other materials to the Owner's satisfaction.

F. The Contractor shall not demobilize the site until the Owner and Engineer tour the completed work. Any unsatisfactory items observed will be reported in "punch-list" form. These items shall be corrected immediately by the Contractor prior to demobilization from the job site. Final payment will not be made until all punch list items are complete and guarantees have been received.

G. Remove all scaffolding, barriers, temporary facilities, and the like upon completion of the work. Restore areas damaged as a result of the Contractors equipment to their original condition to the satisfaction of the Owner.

H. Refer to the Close-Out Procedures described in Division One for additional information.

END OF SECTION

PART 1- GENERAL

1.01 IN GENERAL

The General Conditions, and all parts of the Bid and Contract Documents are made part of this Section as if fully repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 04 01 20 - Maintenance of Unit Masonry
B. Section 05 50 00 - Miscellaneous Metals
C. Section 06 10 00 - Rough Carpentry
D. Section 07 01 50 - Roof Restoration
E. Section 07 22 00 - Roof and Deck Insulation
F. Section 07 51 13 - Roof Repairs and Maintenance
G. Section 07 60 00 - Flashing and Sheet Metal
H. Division 23 - Heating, Ventilating, and Air Conditioning
I. Division 26 - Electrical

1.03 SUMMARY OF WORK

This Section specifies requirements for the following Scope of Work:

A. Existing drain bowls to remain. During replacement work, provide temporary drain sleeves with flashing to the temporary roof or completed roof drain assemblies.

B. Provide new cast iron roof drain clamping rings, strainers, and hardware.

C. Test each new drain bowl and leader assembly.

D. Clean drain bowls of debris, adhesives, etc.

E. Replace, patch, seal, and repair all existing construction assemblies removed, damaged, or cut to allow for the installation of the new drain accessories.

F. Tighten under deck clamps.

1.04 JOB CONDITIONS

A. Coordinate the work in this Section with the work by other trades to ensure a watertight condition and the orderly progress of the Work.

B. Notify the Owner at least 72 hours in advance of doing any demolition work so that the Owner may coordinate with occupants and/or provide entry into required areas.

C. The Contractor is required to remove and replace drain components as part of the new roof system. Existing drain bowls are to be cleaned, re-secured, and reused in the new work.

D. If sections of the existing building finishes will require removal in order to properly install the new work, these areas should be reviewed with the Owner and Engineer prior to removal. Work areas shall be clearly defined and closed off from building occupants. Areas of finish removal shall be as small as possible to effectively install the work. Any finishes damaged, including pipe insulation shall be repaired or replaced by the Contractor at no cost to the Owner.

E. The Contractor is cautioned to take all necessary precautions and make investigations necessary to install the Work. Owner will not consider unfamiliarity with the job conditions as a basis for additional compensation.

F. The Contractor is responsible to verify the size and type of roof drain components for the existing building.

G. The plumbing work shall be coordinated with the roof work in such a manner that no interior portions of the building are left exposed to the elements at the end of a day's work. All drains should be in working order at the end of each work day.

1.05 REFERENCES

A. ASTM A 74 Cast Iron Soil Pipe and Fittings

B. ASTM C 564 Rubber Gaskets for Cast Iron Soil Pipe and Fittings

C. ASTM A 888 Standard Specification for Hub-less Cast-Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

D. ASTM C 1277 Standard Specification for Shielded Couplings Joining Hub-less Cast-Iron Soil Pipe and Fittings

E. CISPI Standard 301 Standard Specification for Hub-less Cast-Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

F. CISPI Standard 310 Specification for Coupling for Use in Connection With Hub-less Cast-Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

1.06 SUBMITTALS

A. Manufacturer’s literature shall be submitted on all items specified in Part 2 of this section and in conformance with the Supplemental General Conditions.

1.07 QUALITY ASSURANCE

A. The plumbing shall be performed by licensed tradesmen.

1.08 WARRANTY

A. Manufacturer's standard warranty: Materials shall be free of defects in material and workmanship for a period of **five (5) years** from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

B. Upon completion of the work, and prior to final payment, the Contractor shall submit a Guarantee of his work to be free from defect in materials and workmanship. This Guarantee shall be for a period of **two (2) years from the date of substantial completion**, and shall be signed by a Principal of the Contractor's firm, and sealed if a corporation.

PART 2 - MATERIALS

2.01 ROOF DRAIN ACCESSORIES

A. All accessories necessary for the proper installation of the new drain bowl assemblies, including but not limited to strainers, and clamping rings with integral gravel stops, shall be coated cast iron of the same manufacturer as the drain bowls and be completely compatible with the existing piping and surrounding materials.

B. All replacement hardware shall be stainless steel hardware.

C. Acceptable manufacturers for drain accessories are: Josam, Zurn, and Jay R. Smith Manufacturing Company.

PART 3 - EXECUTION

3.01 REPLACEMENT ROOF DRAIN COMPONENTS

A. Existing drain bowls to remain in place. Roof drainage system to remain functional for the duration of the project.

B. Remove and discard existing drain strainers, membrane clamping rings, and associated hardware.

C. Clean the existing drain bowls to remove roofing, adhesives, aggregate, and residue.

D. During re-roofing operations, provide and install temporary drain inserts and flashing between the inserts and the roof membrane.

E. Coordinate with the installation of drain sump flashings.

F. With the clamping ring removed, apply roof membrane around the drain from the edge of the drain bowl to the edge of the sump. While the membrane is fluid, set the drain sump pan flashing, centered around the drain bowl.

G. Install two-ply drain sump flashing membrane and tie-in to the field of roof, with two (2)-ply strip flashings.

H. Install the drain clamping ring with new hardware and properly tighten the bolts.

I. Re-tighten existing underdeck clamps at all drains.

3.02 CLEAN UP

A. Site clean-up shall be complete and performed daily to the satisfaction of the Owner. Roof, building (interior and exterior), hardscape, and adjacent areas shall be cleaned of all trash, debris, and dirt caused by, or associated with, the work.

B. All trash and debris shall be completely removed from the site daily during the work and at the completion of the work. All debris shall be legally disposed of off-site.

END OF SECTION

I:\976710\02 Design\specs\BI-RD-298_976710_Section 22 20 00 Roof Drains.doc

SECTION 23 05 00 - HVAC GENERAL CONDITIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The Contractor, Subcontractor and/or supplier providing goods or services referenced in or related to this Section shall also be bound by the Related Documents identified in Division 01 Section "Summary".

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

C. The Contractor and each Subcontractor and/or supplier providing goods or services referenced in or related to this Section shall also be bound by the Documents identified in Division 01 Section "Summary", Paragraph 1.1A, entitled "Related Documents."

1.02 DESCRIPTION

A. The General Conditions and Supplementary General Conditions are a part of this Division and are to be considered a part of this Contract.

B. Where items of the General Conditions and Supplementary General Conditions are repeated in other Sections of the Specifications, it is merely intended to qualify or to call particular attention to them. It is not intended that any other parts of the General Conditions and Supplementary General Conditions shall be assumed to be omitted if not repeated therein.

C. This Section applies equally and specifically to all Contractors supplying labor and/or equipment and/or materials as required under each Section of this Division.

D. The following information contains specifications of Work in connection with, and in addition to, this Division:

1. All drawings associated with the project.
2. All specifications associated with the project.

E. Division of work responsibilities shall be as defined and directed by the Bidding Agent and/or the Bidding General Contractor.

1.03 INTENT

A. It is the intent of the Specifications and Drawings to call for finished work, tested and ready for operation.

B. Furnish, deliver and install any apparatus, appliance, material or Work not shown on Drawings but mentioned in the Specifications, or vice versa, or any incidental accessories necessary to make the Work complete and perfect in all respects and ready for operation, even if not particularly specified, under their respective Section without additional expense to the Owner.

C. Include in the work minor details not usually shown or specified but necessary for proper installation and operation, as though they were hereinafter shown or specified.

D. Provide Engineer written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of Work omitted. In the absence of such written notice, it is mutually agreed that Work under each Section has included the cost of all required items for the accepted, satisfactory functioning of the entire system without extra compensation.

E. The Work indicated is diagrammatic. The Architect and/or Engineer may require as part of this Contract, the relocation of devices to reasonable distances from the general locations shown.

F. Verbal clarifications of the Drawings or Specifications during the bid period are not to be relied upon. Refer any questions or clarifications to the Engineer at least five Working days prior to bidding to allow for issuance of an addendum. After the five-day deadline, Bidder must make a decision and qualify the Bid, if the Bidder feels it necessary.

1.04 DRAWINGS

A. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. (Do not scale the Drawings.) Consult the Architectural Drawings and Details for exact location of fixtures and equipment; where same are not definitely located, obtain this information from the Architect.

B. Closely follow Drawings in layout of Work; check Drawings of other Divisions to verify spaces in which work will be installed. Maintain maximum headroom. Where space conditions appear inadequate, Engineer shall be notified before proceeding with installations.

C. Engineer may, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades and/or for proper execution of the work.

D. Where variances occur between the Drawings and Specifications or within either of the Documents, include the item or arrangement of better quality, greater quantity or higher cost in the Contract price. The Engineer shall decide on the item and the manner in which the work shall be installed.

1.05 SURVEYS AND MEASUREMENTS

A. Before submitting a Bid, the Contractor shall visit the site and shall become thoroughly familiar with all conditions under which the work will be installed. Contractor will be held responsible for any assumptions, omissions or errors made as a result of failure to become familiar with the site and the Contract Documents.

B. Base all measurements, both horizontal and vertical, from established bench marks. All Work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the Work.

C. Should the Contractor discover any discrepancies between actual measurements and those indicated which prevent following good practice or the intent of the Drawings and Specifications, notify the Engineer do not proceed with that Work until instructions have been received from the Engineer.

1.06 CODES AND STANDARDS

A. The Codes and Standards listed below apply to all Work. Where Codes or Standards are mentioned in these Specifications, follow the latest edition or revision.

B. The current adopted editions of the following State or local Codes apply:

1. 2012 International Building Code
2. 2016 Connecticut State Building Code
3. 2012 International Mechanical Code
4. 2012 International Plumbing Code
5. 2014 National Electrical Code (NFPA 70)
6. 2012 International Energy Conservation Code
7. ICC/ANSI A117.1-2009 Accessible and Usable Buildings and Facilities

C. All materials furnished and all work installed shall comply with the rules and recommendations of the NFPA, the requirements of the local utility companies, the recommendations of the fire insurance rating organization having jurisdiction and the requirements of all Governmental departments having jurisdiction.

D. Include in the Work, without extra cost to the Owner, any labor, materials, testing, services, apparatus and Drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on Drawings and/or specified.

1.07 PERMITS AND FEES

A. Give all necessary notices, obtain all permits; pay all Government and State sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with the Work. File all necessary Drawings, prepare all Documents and

obtain all necessary approvals of all Governmental and State departments having jurisdiction, obtain all required certificates of inspections for Work and deliver a copy to the Engineer before request for acceptance and final payment for the Work.

1.08 COORDINATION

A. Carry out all work in conjunction with other trades and give full cooperation in order that all work may proceed with a minimum of delay and interference. Particular emphasis is placed on timely installation of major apparatus and furnishing other Contractors, especially the General Contractor or Construction Manager, with information as to openings, chases, sleeves, bases, inserts, equipment locations, panels, access doors, etc. required by other trades, and to allow for serviceable access to equipment.

B. Mechanical contractors' shall initiate coordination drawings and sections clearly showing how the work is to be installed in relation to the work of other trades, at no extra charge to the Owner. The Contractors' shall prepare coordination drawings at a scale no less than 1/4"=1'-0", showing the work of all trades, including but not limited to, the following: proposed ductwork installation in detail, including ceiling heights, approved structural steel shop drawings, duct heights, access doors, light fixtures, registers and diffusers, sprinkler piping, electrical distribution conduits, wires, panels and any other electrical work which may conflict with the sheet metal ducts or piping, waste and vent piping, water piping, storm piping, and rain leaders. Provide elevation details showing connections and equipment layout and configuration based on approved submittals. Each shall use a different color code. A coordination meeting of all Contractors involved is then to be held and all possible conflicts are to be resolved. All trades shall sign acceptance of the drawings and then shall submit two (2) prints of each drawing to the Engineer for record.

C. Contractors are required to examine all of the Project Drawings and mutually arrange Work so as to avoid interference. In general, ductwork, heating piping, sprinkler piping and drainage lines take precedence over water, gas and electrical conduits. The Engineer regarding the arrangement of Work, which cannot be agreed upon by the Contractors, will make final decisions. Service of equipment will take precedence.

D. Where the Work of the Contractor will be installed in close proximity to or will interfere with Work of other trades, assist in working out space conditions to make a satisfactory adjustment.

E. If Work is installed before coordinating with other Divisions or so as to cause interference with Work of other Sections, the Contractor causing the interference will make necessary changes to correct the condition without extra charge to the Owner.

F. Initial contact and coordination has been conducted with utility entities for the purpose of the preparation of Bid Documents. The Contractor shall coordinate all final specific utility requirements.

1.09 ACCEPTANCES

A. The equipment, materials, Workmanship, design and arrangement of all Work installed are subject to the review of the Engineer.

B. Within 30 days after the awarding of a Contract, submit to the Engineer for review a list of manufacturers of equipment proposed for the Work. The intent to use the exact makes specified does not relieve the Contractor of the responsibility of submitting such a list.

C. If extensive or unacceptable delivery time is expected on a particular item of equipment specified, notify the Engineer, in writing, within 30 days of the awarding of the Contract. In such instances, deviations may be made pending acceptance by the Engineer or the Owner's representative.

D. Where any specific material, process or method of construction or manufactured article is specified by reference to the catalog or model number of a manufacturer, the Specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the Drawings. In all cases, verify the duty specified with the specific characteristics of the equipment offered for review. Equipment characteristics are to be used as mandatory requirements where the Contractor proposes to use an acceptable equivalent.

E. If material or equipment is installed before shop drawing review, liability for its removal and replacement is assumed by the Contractor, at no extra charge to the Owner, if, in the opinion of the Engineer, the material or equipment does not meet the intent of the Drawings and Specifications.

F. Failure on the part of the Engineer to reject shop drawings or to reject Work in progress shall not be interpreted as acceptance of Work not in conformance with the Drawings and/or Specifications. Correct Work not in conformance with the Drawings and/or Specifications whenever non-conformance is discovered.

1.10 EQUIPMENT DEVIATIONS

A. Where the Contractor proposes to deviate (substitute or provide an equivalent) from the equipment or materials as hereinafter specified, he shall do so by making a request in writing a minimum of 14 calendar days prior to submitting his bid. The request shall include a detailed description of the proposed deviation, manufacturer's equipment cuts, copy of manufacturer's warranty and a line-by-line comparison detailing how the proposed product differs from the specified product. The proposed deviation must be equivalent or better than the specified product as judged by the Engineer.

1. The Base Bid shall be based on using the materials and equipment as specified and scheduled with no exceptions. Equipment Manufacturers Scheduled on Drawings are considered Base Product Specification and any other acceptable manufacturers listed in the specifications is considered an equipment deviation and subject to the requirements above. When any alternate manufacturer does not

qualify acceptable, as determined by the Engineer, provide the Base Product manufacturer at no additional cost to Owner.

2. Where an equivalent manufacturer is listed in the specifications, it may or may not indicate that there is an equal product available. Any products must meet all criteria of the Base Product Specification as determined by the Engineer.

B. Substitutions and Equipment Deviations will not be considered if they have a direct bearing on the changing or revising of Contract Documents or if it involves other Contractor's scope of work or their equipment. Coordination with all trades is required and must be acceptable to all other involved Contractors.

C. Substitutions may be considered for one of the following:

1. Substitution for Cause: Changes proposed by the Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of warranty terms.

2. Substitutions for Convenience: Changes proposed by the Contractor that are not required in order to meet other Project requirements, but may offer advantage to either the Owner or Contractor.

D. In these Specifications and on the accompanying Drawings, one or more makes of materials, apparatus or appliances may have been specified for use in this installation. This has been done for convenience in fixing the standard of workmanship, finish and design required for installation. In the event that only one (1) manufacturer of a product is specified and it is found that the manufacturer has discontinued the product, the Contractor shall use an acceptable equivalent product that meets the requirements of an equivalent product, as noted below, and has all the features of the originally specified product. The details of workmanship, finish and design, and the guaranteed performance of any material, apparatus or appliance which the Contractor desires to deviate for those mentioned herein shall also conform to these standards.

E. Where no specific make of material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be submitted for the Engineer's review.

F. Where two or more names are given as equivalents or where one name only is used and is followed by the words "or acceptable equivalent", the Contractor must use the item named or he may apply for an equipment deviation through the prescribed manner in accordance with this Specification.

G. Equipment, material or devices submitted for review as an "accepted equivalent" shall meet the following requirements:

1. The equivalent shall have the same construction features such as, but not limited to:

2. Material thickness, gauge, weight, density, etc.

3. Welded, riveted, bolted, etc., construction

4. Finish, undercoatings, corrosion protection
5. The equivalent shall perform with the same or better operating efficiency.
6. The equivalent shall have equal or greater reserve capacity.
7. The equivalent shall be locally represented by the manufacturer for service, parts and technical information.
8. The equivalent shall bear the same labels of performance certification as is applicable to the specified item, such as AMCA or ARI labels.

H. Where the Contractor proposes to use an item of equipment other than specified or detailed on the Drawings which requires any redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical or architectural layout, all such redesign and all new drawings and detailing required therefore shall be prepared by the Designers of Record at the expense of the Contractor and at no additional cost to the Owner.

I. Where such accepted deviation or substitution requires a different quantity and arrangement of piping, ductwork, valves, pumps, insulation, wiring, conduit and equipment from that specified or indicated on the Drawings, the Contractor shall, with the acceptance by the Engineer, furnish and install any such additional equipment required by the system at no additional cost to the Owner, including any costs added to other trades due to the substitution.

J. The Engineer shall determine if an "accepted equivalent" to a manufacturer listed in the Specifications is considered acceptable.

1.11 SHOP DRAWINGS

A. Refer to individual specification sections for additional submittal information.

B. The Contractor shall submit for review detailed shop drawings of all equipment and material specified in each section and coordinated ductwork layouts. No material or equipment may be delivered to the job site or installed until the Contractor has received shop drawings for the particular material or equipment which have been properly reviewed.

C. Shop drawings shall be submitted within 60 days after award of Contract before any material or equipment is purchased. The Contractor shall submit for review copies of all shop drawings to be incorporated in the Contract. Refer to the General Conditions and Supplementary General Conditions for the quantity of copies required for submission. Where quantities are not specified, provide seven (9) copies for review.

D. Provide shop drawings for all devices specified under equipment specifications for all systems, materials, equipment and/or devices. Shop drawings shall include manufacturers' names, catalog numbers, cuts, diagrams and other such descriptive data as may be required to identify and accept the equipment. A complete list in each category (example: all fixtures) of all shop drawings, catalog cuts, material lists, etc.,

shall be submitted to the Engineer at one time. No consideration will be given to a partial shop drawing submittal. Partial submissions shall be rejected.

E. Equipment shop drawings shall contain full range performance curves, graphs, tables or other pertinent data which clearly indicates operational range of a given unit size. Computer generated/plotted curves, based solely on design performance, will not be accepted.

F. All specific options and/or alternatives shall be clearly indicated. Failure to do so shall be grounds for rejection.

G. Submittals shall be marked with the trade involved, i.e., HVAC, plumbing, fire protection, etc. and the specific associated specification section.

H. Where multiple quantities or types of equipment are being submitted, provide a cover sheet (with a list of contents) on the submittal identifying the equipment or material being submitted.

I. Failure to submit shop drawings in ample time for review shall not entitle the Contractor to an extension of Contract time. Contractor must allow for a one week review at the Engineer's office plus normal delivery time to the G.C., Architect, Engineer, and return to the Architect, and G.C. No claim for extension by reason of such default will be allowed, nor shall the Contractor be entitled to purchase, furnish and/or install equipment which has not been reviewed by the Engineer. The Contractor shall incur all costs associated with delay of construction due to equipment and/or materials arriving late due to late or improper shop drawing submittal.

J. The Contractor shall furnish all necessary templates, patterns, etc., for installation work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as required.

K. Acceptance rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, review does not indicate that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications. Verify available space prior to submitting shop drawings.

L. Acceptance of shop drawings shall not apply to quantity nor relieve Contractor of his responsibility to comply with intent of Drawings and Specifications.

M. Acceptance of shop drawings is final and no further changes will be allowed without the written consent of the Engineer.

N. Shop drawing submittal sheets which may show items that are not being furnished shall have those items crossed off to clearly indicate which items will be furnished.

O. Bidders shall not rely on any verbal clarification of the Drawings and/or Specifications. Any questions shall be referred to the Engineer at least five (5) working days prior to Bidding to allow for issuance of an Addendum. After the five (5) day deadline, Bidder shall make a decision and qualify the Bid, if the Bidder deems if necessary.

P. Contractor shall make any corrections required by Engineer and shall resubmit required number of corrected copies of shop drawings or new samples until accepted. Contractor shall direct specific attention in writing or on resubmitted shop drawings to revisions other than corrections requested by Engineer on previous submissions. Engineer shall review no more than one resubmittal of any shop drawing or sample at Owner's expense. The fees for review of additional resubmittals shall be paid by the Contractor at the Engineer's standard rates.

1.12 CHANGES IN WORK

A. A Change Order is a written order to the Contractor signed by the Owner and the Architect, issued after Contracts have been awarded, authorizing a change in the work or an adjustment in the Contract sum or the Contract time. A Change Order signed by the Contractor indicates his agreement therewith, including the adjustment in the Contract sum or the Contract time.

B. All changes in the work shall follow the recommendations of the AIA "General Conditions of the Contract for Construction", Article 12.

1.13 MANUFACTURER'S IDENTIFICATION

A. All component parts of each item of equipment or device shall bear the manufacturer's nameplate giving name of manufacturer, description, size, type, serial and model number, electrical characteristics, etc., in order to facilitate maintenance or replacement. Nameplate data shall not be obstructed. The nameplate of a Contractor or distributor will not be acceptable.

B. All material and equipment for the electrical portion of the mechanical systems shall bear the label of or be listed by UL, or other accredited authoritative agencies or testing organizations approved by the authority having jurisdiction.

1.14 RECORD DRAWINGS

A. Maintain at the job site a record set of Mechanical Drawings on which any changes in location or routing of all equipment, materials and access panels shall be recorded.

B. At the end of construction, the Contractor shall provide the Owner with a complete set of As-Built Drawings, including all updated coordination drawings, ductwork and piping plans. As-Builts shall be drawn on the latest version of Autocad or compatible software, approved in writing, prior to submittal.

1.15 MATERIALS AND WORKMANSHIP

A. All materials and apparatus required for the work, except as otherwise specifically indicated, shall be new, of first-class quality, and shall be furnished, delivered, erected, connected and finished in every detail and be so selected and arranged as to fit properly into the building spaces. Where no specific type or quality of material is given, a first-class standard article as accepted by industry standards shall be furnished.

B. The Contractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work together with all skilled workmen, fitters, metal workers, welders, helpers and laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.

C. Unless otherwise specifically indicated on the Drawings or Specifications, all equipment and materials shall be installed with the acceptance of the Engineer and in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

D. All labor for installation of mechanical systems shall be performed by experienced, skilled tradesmen under the supervision of a licensed journeyman foreman. All work shall be of a quality consistent with good trade practice and shall be installed in a neat, workmanlike manner. The Engineer reserves the right to reject any work which, in his opinion, has been installed in a substandard, dangerous or unserviceable manner. The Contractor shall replace said work in a satisfactory manner at no extra cost to the Owner.

1.16 PROTECTION OF MATERIALS AND EQUIPMENT

A. Work under each Section shall include protecting the work and material of all other Sections from damage by work or workmen and shall include making good all damage thus caused.

B. The Contractor shall be responsible for work and equipment until the facility has been accepted by the Owner. Protect work against theft, injury or damage and carefully store material and equipment received on site which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of foreign material.

C. Work under each Section includes receiving, unloading, uncrating, storing, protecting, setting in place and completely connecting equipment supplied under each Section. Work under each Section shall also include exercising special care in handling and protecting equipment and fixtures, and shall include the cost of replacing any of the equipment and fixtures which are missing or damaged.

D. Equipment and material stored on the job site shall be protected from the weather, vehicles, dirt and/or damage by workmen or machinery. Insure that all electrical or absorbent equipment or material is protected from moisture during storage.

1.17 BASES AND SUPPORTS

A. Unless otherwise specifically noted, the Contractor shall furnish all necessary supports, rails, framing, bases and piers required for all equipment furnished under this Division.

B. Unless otherwise indicated in individual trade Sections, pumps, fans, air handlers, boilers, chillers, tanks, compressors and other rotating machinery shall be mounted on a minimum of six (6") inch high concrete pads which shall be furnished and installed per Division 3. All pads shall be extended six (6") inches beyond machine base in all directions with top edge chamfered. Shop drawings of all foundations and pads shall be submitted to the Engineer for review before they are constructed. The Mechanical Contractor shall field coordinate all required dimensional and necessary loading information.

C. Construction of foundations, supports, pads, bases and piers where mounted on the floor shall be of the same finish quality as the adjacent and surrounding flooring material.

D. Unless otherwise shown, all equipment shall be securely attached to the building structure in an acceptable manner. Attachments shall be of a strong and durable nature; any attachments that are insufficient, in the opinion of the Engineer, shall be replaced as directed without extra cost to the Owner.

E. All equipment supports shall be designed and constructed such that the equipment will be capable of resisting both vertical and horizontal movement. The equipment shall be positively anchored to the bases or supports to resist vertical movement. The equipment and its supports shall be provided with suitable restraints to resist horizontal movement from any direction as dictated by applicable seismic Codes.

1.18 SLEEVES, INSERTS AND ANCHOR BOLTS

A. The Contractor shall provide, set in place and be held responsible for the location of all sleeves, inserts and anchor bolts required for the work. In the event that failure to do so requires cutting and patching of finished work, it shall be done at the Contractor's expense.

B. All pipes and conduits passing through floors, walls or partitions shall be provided with sleeves having an inside diameter one (1") inch larger than the outside diameter of the pipe, conduit or insulation enclosing the pipe.

C. Piping insulation shall run continuous through sleeve.

D. Penetrations through fire-rated walls, ceilings and all floors (except slab on grade) in which piping or ducts pass shall be filled solidly with acceptable fire-stopping material. Sleeves shall be steel or a UL / FM listed and approved assembly.

E. When ducts, piping or conduit penetrate the floor of a mechanical room located above an occupied space, such penetrations shall be made completely watertight, such that a liquid leak shall not pass through the penetration.

1.19 FIRE-STOPS AND SEALS

A. Refer to Division 7 Specification for additional and more specific information.

B. Fire-stopping systems shall be submitted as shop drawing.

C. Penetrations through fire-rated walls, ceiling or floors shall be sealed with a UL approved fire-stop fitting classified for an hourly rating equivalent to the fire rating of the wall, ceiling or floor.

D. Thruwall and floor seals shall be used to provide a positive means of sealing pipes or ducts which pass through the concrete foundation of a structure below grade or below ground water level. Seals shall also be used at entry points through concrete walls or floors which must be sealed.

1.20 CUTTING AND PATCHING

A. All cutting and patching shall be done per Division 1 requirements. The Contractor shall furnish sketches showing the location and sizes of all openings, chases, etc., required for the installation of work.

B. Work under this Division shall include furnishing, locating and setting inserts and/or sleeves required before the floors and walls are built or be responsible for cutting, drilling or chopping where sleeves and inserts were not installed or correctly located. The Contractor shall do all drilling required for the installation of hangers.

C. Exercise extreme caution when core drilling or punching openings in concrete floor slabs in order to avoid cutting or damaging structural members. No structural members or structural slabs/floors shall be cut without the written acceptance of the Structural Engineer and all such cutting shall be done in a manner directed by him.

1.21 SCAFFOLDING, RIGGING, HOISTING

A. The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises any equipment and apparatus furnished under this Division. Remove same from premises when no longer required.

1.22 EXCAVATION AND BACKFILLING

A. Excavation and backfilling shall be done per Division 2 of the Specifications.

B. It is the responsibility of the Contractor to coordinate sizes, depths, fill and bedding requirements and any other excavation work required under this Division per code and local utility requirements.

1.23 WATERPROOFING

A. Where any work pierces waterproofing, including waterproof concrete and floors in wet areas, the method of installation shall be reviewed by the Engineer before work is done. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings absolutely watertight.

1.24 ACCESSIBILITY AND ACCESS PANELS

A. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate thickness of partitions, and the adequate clearance in double partitions and hung ceilings for the proper installation of the work.

B. Locate all equipment which must be serviced, operated or maintained in fully accessible positions. Equipment shall include, but not be limited to: motors, controllers, coil, valves, switchgear, drain points, etc. Access doors shall be furnished if required for better accessibility. Minor deviations from the Drawings may be made to allow better accessibility, but changes of magnitude or which involve extra cost shall not be made without the acceptance of the Engineer.

C. Access doors in walls, ceilings, floors, etc., shall be field coordinated. It is the responsibility of the Contractor to coordinate and provide information regarding the sizes and quantities of access doors required for his work. The Contractor shall arrange his work in such a manner as to minimize the quantity of access doors required, such as grouping shutoff valves in the same area. Where possible, locate valves in already accessible areas, such as lay-in ceilings, etc.

D. On a clean set of prints, the Contractor shall mark in red pencil the location of each required access door, including its size and fire rating (if any), and shall submit the print to the Architect for review before access doors are purchased or installed.

E. Upon completion of the Project, the Contractor shall physically demonstrate that all equipment and devices installed have been located and/or provided with adequate access panels for repair, maintenance and/or operation. Any equipment not so furnished shall be relocated or provided with additional access panels by the installing Contractor at no additional cost to the Owner. All access panel or door locations shall be indicated on Owner's final as-built record drawings.

F. Permanent ladders for access to equipment when shown on Plans shall be furnished and installed. Coordinate exact requirements in field.

1.25 TEMPORARY OPENINGS

A. The Contractor shall ascertain from an examination of the Drawings whether any special temporary openings in the building will be required for the admission of apparatus provided under this Division and shall coordinate the requirements accordingly. In the event of failure of the Contractor to give sufficient notice in time to arrange for these

openings during construction, the Contractor shall assume all costs of providing such openings thereafter.

1.26 SHUTDOWNS

A. When installation of a new system requires the temporary shutdown of an existing operating system, the connection of the new system shall be performed at such time as designated by the Owner's representative.

B. The Engineer and the Owner shall be notified of the estimated duration of the shutdown period at least ten (10) days in advance of the date the work is to be performed.

C. Work shall be arranged for continuous performance whenever possible. The Contractor shall provide all necessary labor, including overtime if required, to assure that existing operating services will be shut down only during the time actually required to make necessary connections.

1.27 ESCUTCHEONS

A. The Contractor shall provide escutcheons on pipes wherever they pass through floors, ceilings, walls or partitions in finished visible locations.

1.28 PAINTING

A. All finish painting in completed areas shall be performed per Division 9 of the Specifications.

B. All materials shipped to the job site under this Division, such as grilles, registers and/or radiation covers, shall have standard manufacturer's finish, unless otherwise specified by Architect.

C. The Contractor shall paint the interior of all ducts wherever the interior of the duct can be seen through a register or louver. Paint shall be flat black, rust preventative type.

D. All outdoor piping, fittings and hangers shall be properly primed with zinc-rich primer and finished with a minimum of two (2) coats of high grade exterior enamel.

1.29 PIPE EXPANSION

1.30 ELECTRICAL CONNECTIONS

A. Unless otherwise specified, all wiring shall be furnished and installed per Division 26 Specifications.

B. All motor controllers not factory mounted on mechanical equipment shall be furnished, mounted, and installed by the Division 26 contractor, and shall be coordinated with this contractor. Provide properly sized overload heaters and all required accessories with

all motor controllers. See Division 26 Motor Controllers for motor controller requirements.

C. All power wiring shall be furnished and installed per Division 26 complete from power source to motor or equipment junction box including power wiring through the motor controller and proper means of disconnect per NEC and Division 26. The Division 26 Contractor shall provide all disconnects, unless noted otherwise.

1.31 QUIET OPERATION

A. If noise level is deemed objectionable by the Owner/Engineer, the Contractor shall test and record sound levels in the presence of the Owner/Engineer. The sound level shall be observed on the "A" weighting network of a sound level or sound survey meter. The ASHRAE "Guide and Data Book" provides a means to determine sound level of mechanical equipment when the total of background plus equipment sound levels exceeds the minimum acceptable equipment sound level.

B. If objectionable noises or vibrations of any magnitude are produced and transmitted to occupied portions of the building by apparatus, piping, ducts or other parts of the mechanical work, the Contractor shall make such changes or additions as necessary without extra cost to the Owner.

1.32 MAINTENANCE

A. The Contractor shall provide the necessary skilled labor to assure the proper operation and to provide all required current and preventative maintenance for all equipment and controls provided under this Division until final acceptance of the building by the Owner. The Contractor shall not assume acceptance of the building by the Owner until he receives written notification.

B. The Contractor shall receive calls for any and all problems experienced in the operation of the equipment provided under this Division and he shall take steps to immediately correct any deficiencies that may exist.

C. The Contractor shall provide a check list and shall put a copy of it in the boiler or main mechanical room. The check list shall itemize each piece of equipment furnished under his Section.

D. The Contractor shall certify on this check list that he has examined each piece of equipment and that, in his opinion, it is operating as intended by the manufacturer, it has been properly lubricated, and that all necessary current and preventative maintenance has been performed as recommended by the manufacturer and by good and accepted practice.

E. The Contractor shall check all controls in the building to ascertain that they are functioning as designed. This shall apply to all thermostats, aquastats, humidistats, freezestats and firestats, etc. This portion of the work shall be performed by the Contractor who installed the controls.

F. During construction, the Contractor shall ensure that all filters are in place on all equipment. If the equipment is operated during construction (see restrictions section of this specification), strict attention shall be paid to maintaining clean and effective filters and cleaning ductwork and equipment. Filters shall be new and/or clean when the system testing and balancing takes place. The Contractor shall bear the cost of all filters and media during construction until final acceptance by the Owner. This requirement shall apply equally to fluid filters and strainers.

G. Where normal preventative maintenance for any piece of equipment requires special tools, the Contractor shall furnish the appropriate tools for that piece of equipment (i.e., special filter removal hooks, valve wrenches, etc.).

1.33 DEMOLITION

A. All required demolition work shall be performed by the Contractor. All demolition work shall be performed in a neat and orderly fashion.

B. Demolition work, if indicated on the drawings, is intended for general information only and is not intended to describe the full extent of demolition work required under this Contract. All existing mechanical work and systems, including but not limited to piping, equipment, ductwork, wiring, controls, hangers, and supports, made obsolete by this project, shall be removed in their entirety under this Contract, unless noted otherwise.

C. After piping, ductwork, equipment, etc., has been removed, neatly cap remaining ductwork and piping, and insulate caps to match the existing adjacent ductwork and piping. In finished areas, all ductwork and piping shall be cut back to a concealed location, i.e., within walls, above ceilings, etc., before capping.

D. Before submitting his Bid, the Contractor shall visit the site with the Contract Documents in hand, and shall inspect all existing systems to determine the extent of demolition work involved. Particular attention is drawn to the removal of existing walls or portions of existing walls. In those areas, all exposed and concealed piping, ductwork, equipment, etc., running across or through affected areas shall be removed as required. Piping and ductwork shall then be either capped, or, if required for the proper continuing operation of an existing system to remain, piping and ductwork shall be rerouted around the affected areas and reconnected as required.

E. In general, it shall be the responsibility of the Contractor to remove demolished equipment, piping, ductwork, etc., from the site and properly dispose of it. If the Owner shall so request, however, the Contractor shall turn over demolished equipment, etc., to the Owner for the Owner's use. Unless otherwise noted, demolished work shall not be abandoned in place. Contractor shall make safe all utilities pertaining to this section.

1.34 AIR ELIMINATION

A. The Contractor shall be responsible for bleeding all air from closed hydronic piping systems after the system has been filled, and thereafter rebleeding as often as required to completely eliminate all air from the system.

B. Where work on an existing piping system has allowed air to enter that system, the Contractor shall also bleed that system even if no piping work was done in the area where air has developed.

C. Where air cannot be bled from any piping due to the absence of an air vent, the Contractor shall install a manual air vent in locations required to successfully bleed such air.

D. Where the piping layout would require an air vent in an inaccessible location, the Contractor shall install an extended 1/4-inch copper bleed line and petcock to an accessible location such as a closet, mechanical room, above lay-in ceiling, etc.

1.35 LUBRICATION

A. All equipment installed under this Contract having moving parts and requiring lubrication shall be properly lubricated according to manufacturer's recommendations prior to testing and operation. Any such equipment discovered to have been operated before lubrication by the Contractor is subject to rejection and replacement at no additional cost to the Owner. Units furnished with sealed bearings are exempted.

B. The Contractor shall furnish and install, as appropriate on all equipment requiring lubrication, Zerk pressure gun grease fittings or sight gravity-feed oilers equipped with shutoff and needle valve adjustment. Units furnished with sealed bearings and lifetime lubrication are exempted. All fittings and oilers are to be fully accessible for lubrication with equipment which does not require special adapters. Where fittings would be otherwise inaccessible, furnish and install extended grease lines.

1.36 CLEANING

A. The Contractor shall be responsible for keeping the jobsite clean, safe and neat throughout the duration of construction. The Contractor shall clean up his own debris daily and shall coordinate removal of rubbish and debris with the General Contractor/Construction Manager.

B. No debris, construction materials, cigarette butts, coffee cups, etc., shall be left above suspended ceilings.

C. Terminal equipment and plumbing fixtures shall cleaned at substantial completion.

D. If any part of a system should be stopped or damaged by any foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected wherever necessary to locate and/or remove obstructions. Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.

E. During the course of construction, all ducts and pipes shall be capped in an acceptable manner to insure adequate protection against the entrance of foreign matter.

F. Upon completion of all work under the Contract, the Contractor shall remove from the premises all rubbish, debris and excess materials left over from his work. Any oil or grease stains on floor areas caused by the Contractor shall be removed and floor areas left clean.

1.37 OPERATING INSTRUCTIONS

A. Upon completion of all work and tests, the Contractor shall furnish the necessary skilled labor and helpers for operating his system and equipment for a period specified under each applicable Section of this Division. During this period, he shall fully instruct the Owner or the Owner's representative in the operation, adjustment and maintenance of all equipment furnished. The Contractor shall give at least 72 hour’s notice to the Owner and the Engineer in advance of this period.

B. The Contractor shall formally submit for delivery to the Engineer three (3) complete bound sets of typewritten or blueprinted instructions for operating and maintaining all systems and equipment included in this Division. All instructions shall be submitted in draft for review prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instruction.

C. The Contractor, in the above-mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this Division.

D. The appropriate Contractor shall physically demonstrate procedures for all routine maintenance of all equipment furnished under each respective Section to assure accessibility to all devices.

E. An authorized manufacturer's representative shall attest in writing that the equipment has been properly installed prior to startup of any major equipment. The following equipment will require this inspection: pumps; air conditioning equipment, controls, air handling equipment, boilers. These letters will be bound into the operating and maintenance books.

F. Refer to individual trade Sections for any other particular requirements related to operating instructions.

1.38 ADJUSTING AND TESTING

A. After all the equipment and accessories to be furnished are in place, they shall be put in final adjustment and subjected to such operating tests so as to assure the Engineer that they are in proper adjustment, the control operate as described in the sequence of operation and all systems are in satisfactory, permanent operating condition.

B. Where requested by the Engineer, a factory-trained service engineering representative shall inspect the installation and assist in the initial startup and adjustment to the equipment. The period of these services shall be for such time as necessary to secure proper installation and adjustments. After the equipment is placed in permanent operation, the service engineering representative shall supervise the initial operation of

the equipment and instruct the personnel responsible for operation and maintenance of the equipment. The service engineering representative shall notify the Contractor in writing that the equipment was installed according to manufacturer's recommendations and is operating as intended by the manufacturer.

1.39 COMMISSIONING

A. Where indicated in the equipment or commissioning specifications, engage a factory-authorized service representative, to perform startup service.

B. Complete installation, startup checks and functional tests according to manufacturer’s written instructions.

C. Operational Test: After electrical system has been energized, start units to confirm proper unit operation. Rectify malfunctions, replace defective parts with new ones and repeat the start up procedure.

D. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

E. Contractor shall replace all damaged components and components that failed the inspections at no additional charge.

F. This section shall in no way diminish the responsibility of the Contractors, Sub-contractors and Suppliers in performing all aspects of work and testing as outlined in the Contract Documents. Any requirements outlined in this section are in addition to requirements outlined in related specifications.

1.40 GUARANTEES

A. The Contractor shall guarantee all equipment, material and workmanship under these Specifications and the Contract for a period of one (1) year from the date of final acceptance by Owner, unless otherwise noted.

B. All refrigeration compressors shall have five (5) year guarantee from the date of final acceptance by the Owner unless otherwise noted.

C. During this guarantee period, all defects developing through faulty equipment, materials or workmanship shall be corrected or replaced immediately by the Contractor without expense to the Owner. Such repairs or replacements shall be made to the Engineer's satisfaction.

1.41 RESTRICTIONS

A. Mechanical equipment provided under this Division may not be used for temporary heating/cooling requirements due to premature wear and dirt/dust infiltration. Equipment shall be protected from dust and debris during construction. Duct opening shall be protected during construction to prevent dust and debris from being transported

through ductwork to equipment or other spaces and to ensure ductwork is clean and ready for use at the time of equipment start-up. Written approval may be obtained from the Owner only after submission of a written cleaning plan and guarantee/warranty extension.

B. Piping shall not be run in any concrete floor slab. Written approval from the Structural Engineer may be obtained only after submission and approval of a layout shop drawing.

PART 2 PRODUCTS - NOT USED.

PART 3 EXECUTION - NOT USED.

END OF SECTION

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Three phase electric motors.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.

D. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

E. Operation Data: Include instructions for safe operating procedures.

F. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of electric motors for HVAC equipment use use, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.

B. Conform to NFPA 70.

C. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of high efficiency motors.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for motors larger than 20 horsepower.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Baldor Electric Company/ABB Group: www.baldor.com.

B. Leeson Electric Corporation: www.leeson.com.

C. Regal-Beloit Corporation (Century): www.centuryelectricmotor.com.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:
   1. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
   2. Motors Larger than 1/2 Horsepower: 460 volts, three phase, 60 Hz.

B. Nominal Efficiency:
   1. Open Motor with Two Poles: 82.5.
   2. Open Motor with Four Poles: 82.5.
   3. Open Motor with Six Poles: 50.0.
   4. Enclosed Motor with Two Poles: 75.5.
   5. Enclosed Motor with Four Poles: 82.5.
   6. Enclosed Motor with Six Poles: 50.0.

C. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 104 degrees F environment.

3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

4. Motors with frame sizes 254T and larger: Energy efficient type.

D. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

E. Wiring Terminations:

1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.

2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

A. Motors located outdoors and in draw through cooling towers: Totally enclosed weatherproof epoxy-sealed type.

2.04 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 2913.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000

hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 1.

K. Part Winding Start Where Indicated: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

L. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

M. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

N. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

3.02 SCHEDULE

A. NEMA Open Motor Service Factors.

1. 1.5-150 hp:

a. 3600 rpm: 1.15.

b. 1800 rpm: 1.15.

B. Three Phase - Energy Efficient, Open Drip-Proof Performance:

1. 1800 rpm.

a. 3 hp:
1) NEMA Frame: 182T.
2) Minimum Percent Power Factor: 86.
3) Minimum Percent Efficiency: 86.

b. 5 hp:
1) NEMA Frame: 184T.

2) Minimum Percent Power Factor: 87.
3) Minimum Percent Efficiency: 87.

c. 7-1/2 hp:
1) NEMA Frame: 213T.
2) Minimum Percent Power Factor: 86.
3) Minimum Percent Efficiency: 88.

d. 10 hp:
1) NEMA Frame: 215T.
2) Minimum Percent Power Factor: 85.
3) Minimum Percent Efficiency: 89.

e. 15 hp:
1) NEMA Frame: 256T.
2) Minimum Percent Power Factor: 85.
3) Minimum Percent Efficiency: 91.

f. 20 hp:
1) NEMA Frame: 256T.
2) Minimum Percent Power Factor: 86.
3) Minimum Percent Efficiency: 91.

g. 25 hp:
1) NEMA Frame: 284T.
2) Minimum Percent Power Factor: 85.
3) Minimum Percent Efficiency: 91.

h. 30 hp:
1) NEMA Frame: 286T.
2) Minimum Percent Power Factor: 88.
3) Minimum Percent Efficiency: 92.

i. 40 hp:
1) NEMA Frame: 324T.
2) Minimum Percent Power Factor: 83.
3) Minimum Percent Efficiency: 92.

j. 50 hp:
1) NEMA Frame: 326T.
2) Minimum Percent Power Factor: 88.
3) Minimum Percent Efficiency: 93.

k. 60 hp:
1) NEMA Frame: 364T.
2) Minimum Percent Power Factor: 88.
3) Minimum Percent Efficiency: 93.

l. 75 hp:
1) NEMA Frame: 365T.
2) Minimum Percent Power Factor: 88.
3) Minimum Percent Efficiency: 93.

m. 100 hp:
1) NEMA Frame: 404T.
2) Minimum Percent Power Factor: 83.
3) Minimum Percent Efficiency: 93.

2. 3600 rpm.

a. 3 hp:
1) NEMA Frame: 145T.
2) Minimum Percent Power Factor: 85.
3) Minimum Percent Efficiency: 84.

b. 5 hp:
1) NEMA Frame: 182T.
2) Minimum Percent Power Factor: 86.
3) Minimum Percent Efficiency: 85.

c. 7-1/2 hp:
1) NEMA Frame: 184T.
2) Minimum Percent Power Factor: 88.
3) Minimum Percent Efficiency: 86.

d. 10 hp:
1) NEMA Frame: 213T.
2) Minimum Percent Power Factor: 86.
3) Minimum Percent Efficiency: 87.

e. 15 hp:
1) NEMA Frame: 215T.
2) Minimum Percent Power Factor: 89.
3) Minimum Percent Efficiency: 89.

f. 20 hp:
1) NEMA Frame: 254T.
2) Minimum Percent Power Factor: 89.
3) Minimum Percent Efficiency: 90.

g. 25 hp:
1) NEMA Frame: 256T.
2) Minimum Percent Power Factor: 92.
3) Minimum Percent Efficiency: 90.

h. 30 hp:
1) NEMA Frame: 284T.
2) Minimum Percent Power Factor: 91.
3) Minimum Percent Efficiency: 91.

i. 40 hp:
1) NEMA Frame: 286T.
2) Minimum Percent Power Factor: 92.
3) Minimum Percent Efficiency: 92.

j. 50 hp:
   1) NEMA Frame: 324T.
   2) Minimum Percent Power Factor: 89.
   3) Minimum Percent Efficiency: 93.

k. 60 hp:
   1) NEMA Frame: 326T.
   2) Minimum Percent Power Factor: 91.
   3) Minimum Percent Efficiency: 93.

l. 75 hp:
   1) NEMA Frame: 364T.
   2) Minimum Percent Power Factor: 88.
   3) Minimum Percent Efficiency: 93.

m. 100 hp:
   1) NEMA Frame: 365T.
   2) Minimum Percent Power Factor: 88.
   3) Minimum Percent Efficiency: 92.

C. Three Phase - Energy Efficient, Totally Enclosed, Fan Cooled Performance:

1. 1800 rpm.

a. 3 hp:
   1) NEMA Frame: 182T.
   2) Minimum Percent Power Factor: 83.
   3) Minimum Percent Efficiency: 87.

b. 5 hp:
   1) NEMA Frame: 184T.
   2) Minimum Percent Power Factor: 83.
   3) Minimum Percent Efficiency: 88.

c. 7-1/2 hp:
   1) NEMA Frame: 213T.
   2) Minimum Percent Power Factor: 85.
   3) Minimum Percent Efficiency: 89.

d. 10 hp:
   1) NEMA Frame: 215T.
   2) Minimum Percent Power Factor: 84.
   3) Minimum Percent Efficiency: 90.

e. 15 hp:
   1) NEMA Frame: 254T.
   2) Minimum Percent Power Factor: 86.
   3) Minimum Percent Efficiency: 91.

f. 20 hp:
   1) NEMA Frame: 256T.
   2) Minimum Percent Power Factor: 85.

3) Minimum Percent Efficiency: 91.

g. 25 hp:
1) NEMA Frame: 284T.
2) Minimum Percent Power Factor: 84.
3) Minimum Percent Efficiency: 92.

h. 30 hp:
1) NEMA Frame: 286T.
2) Minimum Percent Power Factor: 86.
3) Minimum Percent Efficiency: 93.

i. 40 hp:
1) NEMA Frame: 324T.
2) Minimum Percent Power Factor: 83.
3) Minimum Percent Efficiency: 93.

j. 50 hp:
1) NEMA Frame: 326T.
2) Minimum Percent Power Factor: 85.
3) Minimum Percent Efficiency: 93.

k. 60 hp:
1) NEMA Frame: 364T.
2) Minimum Percent Power Factor: 87.
3) Minimum Percent Efficiency: 93.

l. 75 hp:
1) NEMA Frame: 365T.
2) Minimum Percent Power Factor: 87.
3) Minimum Percent Efficiency: 93.

m. 100 hp:
1) NEMA Frame: 405T.
2) Minimum Percent Power Factor: 86.
3) Minimum Percent Efficiency: 94.

2. 3600 rpm.

a. 3 hp:
1) NEMA Frame: 182T.
2) Minimum Percent Power Factor: 87.
3) Minimum Percent Efficiency: 82.

b. 5 hp:
1) NEMA Frame: 184T.
2) Minimum Percent Power Factor: 88.
3) Minimum Percent Efficiency: 85.

c. 7-1/2 hp:
1) NEMA Frame: 213T.
2) Minimum Percent Power Factor: 86.
3) Minimum Percent Efficiency: 86.

d. 10 hp:
   1) NEMA Frame: 215T.
   2) Minimum Percent Power Factor: 86.
   3) Minimum Percent Efficiency: 87.

e. 15 hp:
   1) NEMA Frame: 254T.
   2) Minimum Percent Power Factor: 91.
   3) Minimum Percent Efficiency: 88.

f. 20 hp:
   1) NEMA Frame: 256T.
   2) Minimum Percent Power Factor: 89.
   3) Minimum Percent Efficiency: 89.

g. 25 hp:
   1) NEMA Frame: 284T.
   2) Minimum Percent Power Factor: 92.
   3) Minimum Percent Efficiency: 90.

h. 30 hp:
   1) NEMA Frame: 286T.
   2) Minimum Percent Power Factor: 92.
   3) Minimum Percent Efficiency: 91.

i. 40 hp:
   1) NEMA Frame: 324T.
   2) Minimum Percent Power Factor: 91.
   3) Minimum Percent Efficiency: 91.

j. 50 hp:
   1) NEMA Frame: 326T.
   2) Minimum Percent Power Factor: 92.
   3) Minimum Percent Efficiency: 90.

k. 60 hp:
   1) NEMA Frame: 364T.
   2) Minimum Percent Power Factor: 93.
   3) Minimum Percent Efficiency: 91.

l. 75 hp:
   1) NEMA Frame: 365T.
   2) Minimum Percent Power Factor: 91.
   3) Minimum Percent Efficiency: 91.

m. 100 hp:
   1) NEMA Frame: 405T.
   2) Minimum Percent Power Factor: 92.
   3) Minimum Percent Efficiency: 92.

END OF SECTION

SECTION 23 05 16 - EXPANSION FITTINGS AND LOOPS FOR PIPING

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data:

1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.

2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

C. Design Data: Indicate selection calculations.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

E. Maintenance Data: Include adjustment instructions.

F. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

1.03 REGULATORY REQUIREMENTS

A. Conform to UL (DIR) requirements.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturers:

1. Mercer Rubber Company: www.mercer-rubber.com.

2. The Metraflex Company: www.metraflex.com/#sle.

3. Substitutions: See Section 01 6000 - Product Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Single braided, stainless steel.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: Flanged.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

2.02 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Manufacturer:

1. Mercer Rubber Company: www.mercer-rubber.com.
2. The Metraflex Company: www.metraflex.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: Flanged.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

H. Application: Copper piping.

2.03 EXPANSION JOINTS - HOSE AND BRAID

A. Manufacturers:

1. The Metraflex Company; Metraloop: www.metraflex.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support bracket and air release or drain plug.

C. Provide flexible loops capable of movement in the x, y, and z planes. Flexible loops to impart no thrust loads to the building structure.

D. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.

1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.

2. End Connections: Same as specified for pipe jointing.

3. Provide necessary accessories including, but not limited to, swivel joints.

2.04 ACCESSORIES

A. Pipe Alignment Guides:

1. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inches travel.

B. Swivel Joints:

1. Fabricated steel body, double ball bearing race, field lubricated, with rubber (Buna-N) o-ring seals.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

C. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

D. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

E. Substitute grooved piping for vibration isolated equipment instead of flexible connectors. Grooved piping need not be anchored.

END OF SECTION

SECTION 23 05 19 - METERS AND GAGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gages and pressure gage taps.

B. Thermometers and thermometer wells.

C. Static pressure gages.

D. Filter gages.

1.02 RELATED REQUIREMENTS

A. Section 23 0923 - Direct-Digital Control System for HVAC.

B. Section 23 2113 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014.

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

C. Project Record Documents: Record actual locations of components and instrumentation.

1.05 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 PRESSURE GAGES

A. Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Moeller Instrument Company, Inc: www.moellerinstrument.com.
3. Omega Engineering, Inc: www.omega.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.
2. Size: 4-1/2 inch diameter.
3. Mid-Scale Accuracy: One percent.

2.02 PRESSURE GAGE TAPPINGS

A. Gage Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

2.03 STEM TYPE THERMOMETERS

A. Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Omega Engineering, Inc: www.omega.com.
3. Weksler Glass Thermometer Corp: www.wekslerglass.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish.

1. Size: 9 inch scale.

2. Window: Clear Lexan.
3. Stem: 1/4 inch brass.
4. Accuracy: 2 percent, per ASTM E77.
5. Calibration: Degrees F.

2.04 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

2.05 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

B. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gages, one gage adapters with 1/8 inch probes, two 1 inch dial thermometers.

2.06 STATIC PRESSURE GAGES

A. Manufacturers:
1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Omega Engineering, Inc: www.omega.com.
3. Veris Industries: www.veris.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

C. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure gage per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gage.

C. Install pressure gages with pulsation dampers. Provide gage cock to isolate each gauge. Extend nipples to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

E. Install thermometer sockets adjacent to controls system thermostat, transmitter, or sensor sockets. Refer to Section 23 0943.

F. Provide instruments with scale ranges selected according to service with largest appropriate scale.

G. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

H. Locate test plugs adjacent thermometers and thermometer sockets.

3.02 SCHEDULE

A. Pressure Gages, Location and Scale Range:

1. Pumps, 0 to 100 psi

B. Pressure Gage Tappings, Location:

1. Control valves 3/4 inch & larger - inlets and outlets.
2. Major coils - inlets and outlets.
3. Heat exchangers - inlets and outlets.
4. Chiller - inlets and outlets.

C. Stem Type Thermometers, Location and Scale Range:

1. Coil banks - inlets and outlets, 0 to 100 degrees F.
2. Chiller - inlets and outlets, 0 to 100 degrees F.

D. Thermometer Sockets, Location:

1. Control valves 1 inch & larger - inlets and outlets.

E. Static Pressure and Filter Gages, Location and Scale Range:

1. Built up filter banks, 0 to 2 inches W.C..

END OF SECTION

SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applications.

B. General requirements.

C. Ball valves.

D. Butterfly valves.

E. Check valves.

1.02 RELATED REQUIREMENTS

A. Section 23 0553 - Identification for Piping & Equipment.

B. Section 23 0719 - HVAC Piping Insulation.

C. Section 23 2113 - Hydronic Piping.

1.03 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Polytetrafluoroethylene.

G. RS: Rising stem.

H. TFE: Tetrafluoroethylene.

1.04 REFERENCE STANDARDS

A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.

B. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2009.

C. ASME B16.34 - Valves - Flanged, Threaded and Welding End; 2013.

D. ASME B31.9 - Building Services Piping; 2014.

E. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

F. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2014).

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2014).

H. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

I. MSS SP-67 - Butterfly Valves; 2011.

J. MSS SP-68 - High Pressure Butterfly Valves with Offset Design; 2011.

K. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends; 2011.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.06 QUALITY ASSURANCE

A. Manufacturer:

1. Obtain valves for each valve type from single manufacturer.

2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

B. Welding Materials and Procedures: Conform to ASME BPVC-IX.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
2. Protect valve parts exposed to piped medium against rust and corrosion.
3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
4. Secure check valves in either the closed position or open position.
5. Adjust butterfly valves to closed or partially closed position.

B. Use the following precautions during storage:

1. Maintain valve end protection and protect flanges and specialties from dirt.
   a. Provide temporary inlet and outlet caps.
   b. Maintain caps in place until installation.
2. Store valves in shipping containers and maintain in place until installation.
   a. Store valves indoors in dry environment.
   b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

C. Exercise the following precautions for handling:

1. Handle large valves with sling, modified to avoid damage to exposed parts.
2. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. See Drawings for specific valve locations.

B. Provide the following valves for the applications if not indicated on Drawings:

1. Isolation (Shutoff): Butterfly.
2. Swing Check (Pump Outlet):
   a. 2 NPS and Smaller: Bronze with bronze disc.

b. 2-1/2 NPS and Larger: Iron with lever and weight, lever and spring, center-guided metal, or center-guided with resilient seat.

3. Dead-End: Butterfly, single-flange (lug) type.

C. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

D. Chilled Water Valves:

1. 2-1/2 NPS and Larger, Iron Valves:

a. Single-Flange Butterfly: 2-1/2 NPS to 12 NPS, aluminum-bronze disc, EPDM seat, 200 CWP.

b. Grooved-End Butterfly: 2-1/2 NPS to 12 NPS, 175 CWP.

c. Butterfly: High performance, single flange, Class 150.

d. Swing Check: Metal seats, Class 125.

e. Grooved-End Check: 3 NPS to 12 NPS, 300 CWP.

E. Condenser Water Valves:

1. 2-1/2 NPS and Larger, Iron Valves:

a. Single-Flange Butterfly: 2-1/2 NPS to 12 NPS, aluminum-bronze disc, EPDM seat, 200 CWP.

b. Grooved-End Butterfly: 2-1/2 NPS to 12 NPS, 175 CWP.

c. Butterfly: High performance, single flange, Class 150.

d. Swing Check: Metal seats, Class 125.

e. Grooved-End Swing Check: 3 NPS to 12 NPS, 300 CWP.

F. Heating Hot Water Valves:

1. 2-1/2 NPS and Larger, Iron Valves:

a. Single-Flange Butterfly: 2-1/2 NPS to 12 NPS, aluminum-bronze disc, EPDM seat, 200 CWP.

b. Butterfly: High performance, single flange, Class 150.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:

1. Handwheel: Valves other than quarter-turn types.
2. Hand Lever: Quarter-turn valves 6 NPS and smaller.

D. Valves in Insulated Piping: Provide 2 NPS stem extensions and the following features:
1. Butterfly Valves: Extended neck.
2. Memory Stops: Fully adjustable after insulation is installed.

E. Valve-End Connections:
1. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.

F. General ASME Compliance:
1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Building Services Piping Valves: ASME B31.9.

G. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Lug type: Bi-directional dead end service without downstream flange.
1. Comply with MSS SP-67, Type I.
2. CWP Rating: 150 psig, and 200 psig.
3. Body Material: ASTM A126 cast iron or ASTM A536 ductile iron.
4. Stem: One or two-piece stainless steel.
5. Seat: NBR.
6. Disc: Coated ductile iron.

2.04 IRON, GROOVED-END BUTTERFLY VALVES

A. CWP Rating: 175 psig (1200 kPa), 300 psig (2070 kPa): 8 NPS (50 DN) or smaller, 200 psig (1389 kPa): 10 NPS (250 DN) or larger, and _____.
1. Comply with MSS SP-67, Type I.
2. Body: Coated ductile iron.
3. Stem: Stainless steel.
4. Disc: Coated ductile iron.
5. Disc Seal: EPDM.

2.05 HIGH-PERFORMANCE SINGLE FLANGE BUTTERFLY VALVES

A. Lug type: Bi-directional dead end service without downstream flange.
   1. Comply with MSS SP-68.
   2. Class 150: CWP Rating: 285 psig at 100 degrees F.
   3. Body: Provide cast iron or ductile Iron.
   4. Seat: Metal or reinforced PTFE.
   5. Offset stem: Stainless steel.
   6. Disc: Carbon steel.

2.06 IRON, FLANGED END SWING CHECK VALVES

A. Class 250: CWP Rating: 300 psig (2070 kPa) with Metal Seats.
   1. Comply with MSS SP-71, Type I.
   2. Design: Clear or full waterway with flanged ends.
   3. Body: Gray iron with bolted bonnet in accordance with ASTM A126.
   4. Trim: Bronze.
   5. Disc Holder: Bronze.
   6. Gasket: Asbestos free.

2.07 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

2.08 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP:
   1. 10 NPS to 12 NPS.
   2. CWP Rating: 300 psig.
   3. Body Material: ASTM A536, Grade 65-45-12 ductile iron.
   4. Seal: EPDM, Nitrile, or ____.
   5. Disc: Ductile iron.
   6. Coating: Black, non-lead paint.

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

D. Install check valves where necessary to maintain direction of flow as follows:

1. Lift Check: Install with stem plumb and vertical.
2. Swing Check: Install horizontal maintaining hinge pin level.

END OF SECTION

SECTION 23 05 33 - HEAT TRACING FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Self-regulating parallel resistance electric heating cable.

1.02 RELATED REQUIREMENTS

A. Section 23 0553 - Identification for Piping & Equipment.

B. Section 23 0719 - HVAC Piping Insulation.

C. Section 23 0923 - Direct-Digital Control System for HVAC.

D. Section 23 0993 - Sequence of Operations for HVAC Controls.

E. Section 23 2113 - Hydronic Piping.

F. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

G. Section 26 0526 - Grounding and Bonding for Electrical Systems.

H. Section 26 2717 - Equipment Wiring.

1.03 REFERENCE STANDARDS

A. IEEE 515.1 - IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications; 2012.

B. ITS (DIR) - Directory of Listed Products; current edition.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

B. Coordinate the work with other trades to provide ground fault protection for electric heat tracing circuits as required by NFPA 70.

C. Coordinate the work with other trades to provide circuit breaker ratings suitable for installed circuit lengths.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for electric heat tracing.

C. Shop Drawings: Indicate electric heat tracing layout, electrical terminations, thermostats, controls, and branch circuit connections.

D. Manufacturer's Installation Instructions: Indicate installation instructions and recommendations.

E. Field Quality Control Submittals: Indicate test reports and inspection reports.

F. Manufacturer's Qualification Statement.

G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions of equipment and controls, maintenance and repair data, and parts listings.

H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

I. Project Record Documents: Record actual locations of electric heat tracing lines.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 SELF-REGULATING PARALLEL RESISTANCE ELECTRIC HEATING CABLE

A. Manufacturers:

1. Chromalox, Inc: www.chromalox.com.
2. Pentair: www.pentairthermal.com.
3. Thermon Manufacturing Company: www.thermon.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Provide products listed, classified, and labeled by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction (AHJ).

C. Factory Rating and Testing: Comply with IEEE 515.1.

D. Heating Element:

1. Provide pair of parallel No. 16 tinned or nickel coated stranded copper bus wires embedded in cross linked conductive polymer core with varying heat output in response to temperature along its length.
2. Terminations: Waterproof, factory assembled, non-heating leads with connector at one end and water-tight seal at opposite end.
3. Capable of crossing over itself without overheating.

E. Insulated Jacket: Flame retardant polyolefin.

F. Cable Cover: Provide tinned copper and polyolefin outer jacket with UV inhibitor.

G. Maximum Power-On Operating Temperature: 150 degrees F.

H. Maximum Power-Off Exposure Temperature: 185 degrees F.

I. Electrical Characteristics:

1. 10 W/lineal ft.
2. 120 volts, single phase, 60 Hz.

2.02 OUTER JACKET MARKINGS

A. Name of manufacturer, trademark, or other recognized symbol of identification.

B. Catalog number, reference number, or model.

C. Month and year of manufacture, date coding, applicable serial number, or equivalent.

D. Agency listing or approval.

E. Applicable environmental or area use requirements, such as NEMA 4, Type 4, IP ratings, and hazardous (classified) location markings including temperature rating.

F. Any applicable warning/caution statements such as "WARNING: De-energize circuit before removing cover.

2.03 CONNECTION KITS

A. Name of manufacturer, trademark, or other recognized symbol of identification.

B. Provide power connection, splice/tee, and end seal kits compatible with the heating cable and without requiring cutting of the cable core to expose bus wires.

C. Furnish with NEMA 4X rating for prevention of corrosion and water ingress.

D. Provide UV stabilized components.

2.04 ACCESSORIES

A. Provide Accessories As Indicated or As Required for Complete Installation, Including but Not Limited To:

1. High temperature, glass filament tape for attachment of heating cable to metal piping.
2. Heat-conductive putty.
3. Cable ties.
4. Silicone end seals and splice kits.
5. Installation clips.
6. Warning labels for attachment to exterior of piping insulation. Refer to Section 23 0553.

2.05 CONTROLS

A. Pipe Mounted Thermostats:

1. Remote bulb on capillary, resistance temperature device (RTD) or thermistor for direct sensing of pipe wall temperature.
2. Control Enclosure: Corrosion resistant and waterproof.

B. Provide minimum 30 ampere contactor to indicate operational status and on/off control.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping are ready to receive work.

B. Verify field measurements are as indicated on shop drawings.

C. Verify required power is available, in proper location, and ready for use.

3.02 PREPARATION

A. Clean all surfaces prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer.

3.03 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Comply with installation requirements of IEEE 515.1 and NFPA 70, Article 427.

C. Apply heating cable linearly on pipe with fiberglass tape only after piping has successfully completed any required pressure testing.

D. Comply with all national and local code requirements.

E. Controls:

1. Digital Control: Refer to Section 23 0923.
2. Sequence of Operation: Refer to Section 23 0993.

F. Grounding: Refer to Section 26 0526.

G. Identification:

1. After thermal insulation installation, apply external pipeline decals to indicate presence of the thermal insulation cladding at intervals not to exceed 20 ft including cladding over each valve or other equipment that may require maintenance.
2. Refer to Section 22 0553.

H. Equipment Wiring: Refer to Section 26 2717.

I. Electrical Connections: Refer to Section 26 0519.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Perform start-up by factory technician or factory representative as per Owner's requirements.

C. Field Testing and Inspections:

1. Commission system in accordance with installation and operation manual.
2. Inspect for sources of water entry and proper sealing.
3. Inspect weather barrier to confirm that no sharp edges are contacting the trace heating.
4. Minimum Acceptable Insulation Resistance: 20 megohms or greater at a test voltage of 2500 VDC for polymer insulated trace heaters.
5. Test heating cable integrity with megohmmeter at the following intervals:
    a. Before installing the cable.
    b. After cable has been installed onto the piping.
    c. After installing the connection kits.
    d. After the installation of thermal insulation onto the piping.
    e. Prior to initial start-up (commissioning).
6. Measure voltage and current at each unit.
7. Controls:
    a. Verify control parameters are set to the application requirements.
    b. Verify factory provided digital temperature controller is correctly configured with the building automation system.
8. Submit written test report showing values measured on each test for each cable.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstrate operation of controls.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 23 05 48 - VIBRATION CONTROLS FOR PIPING & EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment support bases.

B. Vibration isolators.

C. Roof curbs.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data:

1. Provide manufacturer's product literature documenting compliance with PART 2 PRODUCTS.

C. Shop Drawings:

1. Provide schedule of vibration isolator type with location and load on each.
2. Fully dimensioned fabrication drawings and installation details for vibration isolation bases, member sizes, attachments to isolators, and supported equipment.
3. Include auxiliary motor slide bases and rails, base weights, inertia bases, concrete weights, equipment static loads, support points, vibration isolators, and detailed layout of isolator location and orientation with static and dynamic load on each isolator.
4. Include selections from prescriptive design tables that indicate compliance with the applicable building code and the vibration isolator manufacturer's requirements.
5. Clearly indicate the load and capacity assumptions selected. Include copies of any calculations.

D. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

1.04 QUALITY ASSURANCE

A. Perform design and installation in accordance with applicable codes.

B. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and registered and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1. Member of Vibration Isolation and Seismic Control Manufacturers Association (VISCMA).

D. Installer Qualifications: Company specializing in performing the work of this section and approved by manufacturer.

E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1. See Section 01 4533 for additional requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Kinetics Noise Control, Inc: www.kineticsnoise.com.

B. Mason Industries: www.mason-ind.com.

C. Vibration Eliminator Company, Inc: www.veco-nyc.com.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. General:

1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
2. Steel springs to function without undue stress or overloading.
3. Steel springs to operate in the linear portion of the load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
4. Lateral to vertical stiffness ratio to not exceed 0.08 with spring deflection at minimum 75 percent of specified deflection.
5. All equipment mounted on vibration isolated bases to have minimum operating clearance of 2 inches between the base and floor or support beneath unless noted otherwise.

2.03 EQUIPMENT SUPPORT BASES

A. Structural Bases:

1. Construction: Engineered, structural steel frames with welded brackets for side mounting of the isolators.
2. Frames: Square, rectangular or T-shaped.
3. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.

B. Concrete Inertia Bases:

1. Construction: Engineered, steel forms, with integrated isolator brackets and anchor bolts, welded or tied reinforcing bars running both ways in a single layer.
2. Size: 6 inches minimum depth and sized to accommodate elbow supports.
3. Mass: Minimum of 1.5 times weight of isolated equipment.
4. Connecting Point: Reinforced to connect isolators and snubbers to base including template and fastening devices for equipment.
5. Concrete: Filled on site with minimum 3000 psi concrete. See Section 03 3000 for additional requirements.

2.04 VIBRATION ISOLATORS

A. Non-Seismic Type:

1. All Elastomeric-Fiber Glass Pads:
   a. Configuration: Flat or molded.
   b. Thickness: 0.25 inch minimum.
   c. Assembly: Single or multiple layers using bonded, galvanized sheet metal separation plate between each layer with load plate providing evenly distributed load over pad surface.
2. Elastomeric Mounts:
   a. Material: Oil, ozone, and oxidant resistant compounds.
   b. Assembly: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
3. Steel Springs:
   a. Assembly: Freestanding, laterally stable without housing.
   b. Leveling Device: Rigidly connected to equipment or frame.
4. Restrained Steel Springs:
   a. Housing: Rigid blocking during rigging prevents equipment installed and operating height from changing during temporary weight reduction.

b. Equipment Wind Loading: Adequate means for fastening isolator top to equipment and isolator base plate to supporting structure.

5. Elastomeric Hangers:

a. Housing: Steel construction containing elastomeric isolation element to prevent rod contact with housing and short-circuiting of isolating function.

b. Incorporate steel load distribution plate sandwiching elastomeric element to housing.

6. Spring Hanger:

a. Housing: Steel construction containing stable steel spring and integral elastomeric element preventing metal to metal contact.

b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.

7. Combination Elastomeric-Spring Hanger:

a. Housing: Steel construction containing stable steel spring with elastomeric element in series isolating upper connection of hanger box to building structure.

b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.

8. Thrust Restraints:

a. Housing: Steel construction containing stable steel spring and integral elastomeric element installed in pairs to resist air pressure thrusts.

b. Bottom Openings: Sized to allow plus/minus 15 degrees rod misalignment.

2.05 ROOF CURBS

A. Vibration Isolation Curbs:

1. Non-Seismic Curb:

a. Location: Between structure and rooftop equipment.

b. Construction: Aluminum.

c. Integral vibration isolation to conform to requirements of this section.

d. Weather exposed components consist of corrosion resistant materials.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

B. Bases:

1. Set steel bases for one inch clearance between housekeeping pad and base.

2. Set concrete inertia bases for 2 inches clearance between housekeeping pad and base.
3. Adjust equipment level.

C. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

D. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

E. Support piping connections to equipment mounted on isolators using isolators or resilient hangers for scheduled distance.
1. Up to 4 Inches Pipe Size: First three points of support.
2. 5 to 8 Inches Pipe Size: First four points of support.
3. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect isolated equipment after installation and submit report. Include static deflections.

C. Perform testing and inspections of the installation in accordance with Section 01 4533.

3.03 SCHEDULE

A. Pipe Isolation Schedule.
1. 1 Inch Pipe Size: Isolate 120 diameters from equipment.
2. 2 Inch Pipe Size: Isolate 90 diameters from equipment.
3. 3 Inch Pipe Size: Isolate 80 diameters from equipment.
4. 4 Inch Pipe Size: Isolate 75 diameters from equipment.
5. 6 Inch Pipe Size: Isolate 60 diameters from equipment.

B. Equipment Isolation Schedule.
1. Provide vibration isolation devices for equipment in accordance with this specification and the requirements of ASHRAE Applications (2015), Chapter 48, Table 47 (including notes).

END OF SECTION

SECTION 23 05 53 - IDENTIFICATION FOR PIPING & EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Adhesive-backed duct markers.

D. Pipe markers.

E. Ceiling tacks.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2016.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Automatic Controls: Tags. Key to control schematic.

C. Control Panels: Nameplates.

D. Ductwork: Nameplates.

E. Heat Transfer Equipment: Nameplates.

F. Instrumentation: Tags.

G. Major Control Components: Nameplates.

H. Piping: Tags.

I. Pumps: Nameplates.

J. Small-sized Equipment: Tags.

K. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

A. Manufacturers:

1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com.
2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
4. Seton Identification Products, a Tricor Direct Company: www.seton.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Letter Color: White.

C. Letter Height: 1/4 inch.

D. Background Color: Black.

E. Plastic: Conform to ASTM D709.

2.03 TAGS

A. Manufacturers:

1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
2. Brady Corporation: www.bradycorp.com.
3. Brimar Industries, Inc: www.pipemarker.com/#sle.
4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.

5. Seton Identification Products, a Tricor Company: www.seton.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 ADHESIVE-BACKED DUCT MARKERS

A. Manufacturers:
1. Brimar Industries, Inc: www.pipemarker.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.

C. Style: Individual Label.

D. Color: Yellow/Black.

E. Size: 2" with 1/2" letters..

2.05 PIPE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradycorp.com.
2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
4. MIFAB, Inc: www.mifab.com.
5. Seton Identification Products, a Tricor Company: www.seton.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Color: Conform to ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Color code as follows:
1. Heating, Cooling, and Boiler Feedwater: Green with white letters.

2.06 CEILING TACKS

A. Manufacturers:

1. Craftmark: www.craftmarkid.com.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: Steel with 3/4 inch diameter color coded head.

C. Color code as follows:

1. HVAC Equipment: Yellow.
2. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Use tags on piping 3/4 inch diameter and smaller.

1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

E. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

F. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, & BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems. Air system balancing shall include balancing at AHU-1 & MZ-1 units only, to determine total and outside air flow at the unit.

B. Testing, adjustment, and balancing of hydronic systems.

C. Measurement of final operating condition of HVAC systems.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Employment of testing agency and payment for services.

1.03 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems; 2015, Eighth Edition.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit to Engineer
2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
3. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.

4. Include at least the following in the plan:

   a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.

   b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

   c. Identification and types of measurement instruments to be used and their most recent calibration date.

   d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.

   e. Final test report forms to be used.

   f. Detailed step-by-step procedures for TAB work for each system and issue, including:
      1) Total flow calculations.
      2) Rechecking.
      3) Diversity issues.

   g. Expected problems and solutions, etc.

   h. Details of how TOTAL flow will be determined; for example:
      1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
      2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.

   i. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.

   j. Confirmation of understanding of the outside air ventilation criteria under all conditions.

   k. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).

   l. Methods for making coil or other system plant capacity measurements, if specified.

   m. Time schedule for TAB work to be done in phases (by floor, etc.).

   n. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

   1. Submit under provisions of Section 01 4000.

   2. Revise TAB plan to reflect actual procedures and submit as part of final report.

3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Engineer and for inclusion in operating and maintenance manuals
4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
6. Units of Measure: Report data in I-P (inch-pound) units only.
7. Include the following on the title page of each report:
    a. Name of Testing, Adjusting, and Balancing Agency.
    b. Address of Testing, Adjusting, and Balancing Agency.
    c. Telephone number of Testing, Adjusting, and Balancing Agency.
    d. Project name.
    e. Project location.
    f. Project Engineer.
    g. Project Contractor.
    h. Project altitude.
    i. Report date.

E. Project Record Documents: Record actual locations of balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
1. AABC (NSTSB), AABC National Standards for Total System Balance.
2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
4. SMACNA (TAB).
5. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of three years documented experience.
3. Certified by one of the following:
    a. AABC, Associated Air Balance Council: www.aabc.com; upon completion submit AABC National Performance Guaranty.
    b. NEBB, National Environmental Balancing Bureau: www.nebb.org.
    c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Hydronic systems are flushed, filled, and vented.
11. Pumps are rotating correctly.
12. Proper strainer baskets are clean and in place.
13. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting and balancing operations. Make instruments available to Engineer to facillitate spot checks during testing.

C. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:

1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

D. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

E. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

F. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

G. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

3.07 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 SCOPE

A. Test, adjust, and balance the following:

1. HVAC Pumps.
2. Centrifugal Water Chillers.
3. Induced Draft Cooling Tower.
4. Air Coils.
5. Air Handling Units.
6. Air Filters.

3.09 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.

B. V-Belt Drives:

1. Identification/location.
2. Required driven RPM.
3. Driven sheave, diameter and RPM.
4. Belt, size and quantity.
5. Motor sheave diameter and RPM.
6. Center to center distance, maximum, minimum, and actual.

C. Pumps:

1. Identification/number.
2. Manufacturer.
3. Size/model.
4. Impeller.

5. Service.
6. Design flow rate, pressure drop, BHP.
7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
9. Suction pressure.
10. Total operating head pressure.
11. Shut off, discharge and suction pressures.
12. Shut off, total head pressure.

D. Chillers:

1. Identification/number.
2. Manufacturer.
3. Capacity.
4. Model number.
5. Serial number.
6. Evaporator entering water temperature, design and actual.
7. Evaporator leaving water temperature, design and actual.
8. Evaporator pressure drop, design and actual.
9. Evaporator water flow rate, design and actual.
10. Condenser entering water temperature, design and actual.
11. Condenser pressure drop, design and actual.
12. Condenser water flow rate, design and actual.

E. Cooling Tower:

1. Tower identification/number.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Rated capacity.
6. Entering air WB temperature, specified and actual.
7. Leaving air WB temperature, specified and actual.
8. Ambient air DB temperature.
9. Condenser water entering temperature.

10. Condenser water leaving temperature.
11. Condenser water flow rate.
12. Fan RPM.

F. Heat Exchangers (existing plate and frame heat exchanger):

1. Primary water entering temperature, design and actual.
2. Primary water leaving temperature, design and actual.
3. Primary water flow, design and actual.
4. Primary water pressure drop, design and actual.
5. Secondary water leaving temperature, design and actual.
6. Secondary water flow, design and actual.
7. Secondary water pressure drop, design and actual.

G. Cooling Coils:

1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Entering air DB temperature, design and actual.
7. Entering air WB temperature, design and actual.
8. Leaving air DB temperature, design and actual.
9. Leaving air WB temperature, design and actual.
10. Water flow, design and actual.
11. Water pressure drop, design and actual.
12. Entering water temperature, design and actual.
13. Leaving water temperature, design and actual.
14. Air pressure drop, design and actual.

H. Heating Coils:

1. Identification/number.
2. Location.
3. Service.

4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.
9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

I. Air Moving Equipment:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

J. Return Air/Outside Air:

1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.

7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

K. Duct Traverses:

1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

END OF SECTION

SECTION 23 07 13 - DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Insulation jackets.

1.02 RELATED REQUIREMENTS

A. Section 23 0553 - Identification for Piping & Equipment.

1.03 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2015.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:

1. Knauf Insulation: www.knaufinsulation.com.
2. Johns Manville: www.jm.com.
3. Owens Corning Corporation: www.ocbuildingspec.com.
4. CertainTeed Corporation: www.certainteed.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. 'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 1200 degrees F.

3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

A. Manufacturer:

1. Knauf Insulation: www.knaufinsulation.com.
2. Johns Manville: www.jm.com.
3. Owens Corning Corporation; 700 Series FIBERGLAS Insulation: www.ocbuildingspec.com/sle.
4. CertainTeed Corporation: www.certainteed.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: ASTM C612; rigid, noncombustible blanket.

1. 'K' Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent.
4. Maximum Density: 8.0 lb/cu ft.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.04 JACKETS

A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

1. Lagging Adhesive:

a. Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Insulated ducts conveying air below ambient temperature:

1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

3.03 SCHEDULES

A. Plenums (at outside air intake of AHU-1): Glass fiber board with vapor barrier.

B. Supply Ducts: Glass fiber, flexible with vapor barrier and canvas jacket.

C. Return and Relief Ducts in Mechanical Rooms: Glass fiber, flexible with vapor barrier and canvas jacket.

END OF SECTION

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 23 2113 - Hydronic Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

E. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2013).

F. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

G. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

A. Manufacturers:

1. CertainTeed Corporation: www.certainteed.com.
2. Johns Manville Corporation: www.jm.com.
3. Knauf Insulation: www.knaufinsulation.com.
4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/sle.

5. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.

1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

G. Fibrous Glass Fabric:

1. Cloth: Untreated; 9 oz/sq yd weight.
2. Blanket: 1.0 lb/cu ft density.
3. Weave: 5 by 5.

H. Indoor Vapor Barrier Finish:

1. Cloth: Untreated; 9 oz/sq yd weight.
2. Vinyl emulsion type acrylic, compatible with insulation, black color.

I. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

J. Outdoor Breather Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

K. Insulating Cement: ASTM C449.

2.03 JACKETS

A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

1. Lagging Adhesive: Compatible with insulation.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.

1. Thickness: 0.016 inch sheet.

2. Finish: Smooth.

3. Joining: Longitudinal slip joints and 2 inch laps.

4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature; insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.

2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

G. Glass fiber insulated pipes conveying fluids above ambient temperature.

1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.

2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

K. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

L. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULE

A. Heating Systems:

1. Heating Water Supply and Return: Glass fiber minimum 1.5" thick

B. Cooling Systems:

1. Chilled Water: Glass fiber minimum 1" thick with vapor barrier
2. Condenser Water: Glass fiber minimum 1" thick with vapor barrier and aluminum jacket for exterior piping.

END OF SECTION

SECTION 23 09 23 - DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Operator interface.

B. Controllers.

C. Power supplies and line filtering.

D. System software.

E. Controller software.

F. HVAC control programs.

G. Chiller control programs.

1.02 DESCRIPTION

A. All work of this Division shall be coordinated and provided by the single Building Management System (BMS) Contractor.

B. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 15 Sections for details.

C. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.

D. If the BMS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings, Product Data, and Samples

1. The BMS contractor shall submit a list of all shop drawings with submittals dates within 60 days of contract award.

2. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.

3. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BMS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.

4. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.

5. The BMS Contractor shall correct any errors or omissions noted in the first review.

6. At a minimum, submit the following:

a. BMS network architecture diagrams including all nodes and interconnections.

b. Systems schematics, sequences and flow diagrams.

c. Points schedule for each point in the BMS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.

d. Samples of Graphic Display screen types and associated menus.

e. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.

f. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.

g. Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type.

h. Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address

i. Details of all BMS interfaces and connections to the work of other trades.

j. Product data sheets or marked catalog pages including part number, photo and description for all products including software.

C. Shop Drawings:

1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.

2. List connected data points, including connected control unit and input device.

3. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration diskette containing graphics.

4. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

5. Indicate description and sequence of operation of operating, user, and application software.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

E. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.

1. Include submittals data in final "Record Documents" form.

F. Operation and Maintenance Manuals

1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BMS provided:

a. Table of contents.

b. As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.

c. Manufacturers product data sheets or catalog pages for all products including software.

d. System Operator’s manuals.

e. Archive copy of all site-specific databases and sequences.

f. BMS network diagrams.

g. Interfaces to all third-party products and work by other trades.

2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.

3. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.

4. Include keyboard illustrations and step-by-step procedures indexed for each operator function.

G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. General

1. The Building Management System Contractor shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated Building Management Systems.

2. The BMS Contractor shall be a recognized national manufacturer, installer and service provider of BMS.

3. The BMS Contractor shall have a branch facility within a 100-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis.

4. As evidence and assurance of the contractor’s ability to support the Owner's system with service and parts, the contractor must have been in the BMS business for at least the last ten (10) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.

5. The Building Management System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Management Systems, and shall be the manufacturer’s latest standard of design at the time of bid.

B. Workplace Safety and Hazardous Materials

1. Provide a safety program in compliance with the Contract Documents.

2. The FMS Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.

3. The Contractor and its employees and subtrades comply with federal, state and local safety regulations.

4. The Contractor shall ensure that all subcontractors and employees have written safety programs in place that covers their scope of work, and that their employees

receive the training required by the OSHA have jurisdiction for at least each topic listed in the Safety Certification Manual.

5. Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.

6. Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the General Contractor or the Owner within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.

7. The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors' company is in full compliance with the Project safety requirements.

8. The Contractor's safety program shall include written policy and arrangements for the handling, storage and management of all hazardous materials to be used in the work in compliance with the requirements of the AHJ at the Project site.

9. The Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

C. Perform work in accordance with NFPA 70.

D. Designer Qualifications: Perform design of system software under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

E. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

F. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

G. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Standard Material and Labor Warranty:

1. Provide a one-year labor and material warranty on the BMS.

2. If within twelve (12) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the BMS Contractor at the cost of the BMS Contractor.

3. Maintain an adequate supply of materials within 50 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BMS Contractor's normal business hours.

1.08 PROTECTION OF SOFTWARE RIGHTS

A. Prior to delivery of software, the Owner and the party providing the software will enter into a software license agreement with provisions for the following:

1. Limiting use of software to equipment provided under these specifications.
2. Limiting copying.
3. Preserving confidentiality.
4. Prohibiting transfer to a third party.

PART 2 PRODUCTS

2.01 GENERAL DESCRIPTION / SCOPE OF WORK

A. The Building Management System (BMS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communication protocol standards and integrate a wide variety of third-party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.

B. Scope of Work

1. This will be an extension of the existing Johnson Controls BMS System on campus. All new work associated with this project will be displayed on existing Operator Workstations and Server. New graphics will be provided/updated on the Operator Workstation for equipment added as part of this project.

C. The Building Management System shall consist of the following:

1. Network Automation Engine(s)
2. Field Equipment Controller(s)
3. Input/Output Module(s)

D. Acceptable Manufacturers

1. Subject to compliance with requirements, all controllers and workstation software shall be manufactured by the Western Connecticut State University's standardized manufacturer - Johnson Controls, Inc. - Corporate Office 27 Inwood Road Rocky Hill, CT - Metasys Extended Architecture System.

2. The Johnson Controls Metasys System for this project shall tie directly into the WCSU Midtown Campus Johnson Controls, Inc. IT Network and Servers. Please contact Chris Schoonerman at (860) 604-2014 for more information.

3. NO other manufacturers will be considered

E. The Building Management System (BMS) shall be a complete system designed for use with the enterprise IT systems. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. Contractor shall be responsible for coordination with the owner's IT staff to ensure that the FMS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.

F. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BMS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.

G. The work of the single BMS Contractor shall be as defined individually and collectively in all Sections of this Division's specification together with the associated Drawings and the associated interfacing work as referenced in the related documents.

H. The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.

I. Provide a complete, neat and workmanlike installation. Use only manufacturer employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.

J. Manage and coordinate the BMS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.

K. The BMS as provided shall incorporate, at minimum, the following integrated features, functions and services:

1. Operator information, alarm management and control functions.

2. Enterprise-level information and control access.

3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.

4. Diagnostic monitoring and reporting of BMS functions.

5. Offsite monitoring and management access.
6. Energy management
7. Standard applications for terminal HVAC systems.

2.02 ADDITIONAL REQUIREMENTS

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

E. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 OPERATOR INTERFACE

A. PC Based Work Station:

1. Resides on high speed network with building controllers.
2. Connected to server for full access to all system information.

B. Workstation, controllers, and control backbone to communicate using BACnet protocol and addressing.

C. BACnet protocol to comply with ASHRAE Std 135.

2.04 BMS ARCHITECTURE

A. Automation Network

1. The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard “off the shelf” products available through normal PC vendor channels.
2. The BMS shall network multiple user interface clients, automation engines, system controllers and application-specific controllers. Provide application and data server as required for systems operation.

3. The automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.
4. Network Automation Engines (NAE) shall reside on the automation network.
5. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.

B. Control Network

1. Network Automation Engines shall provide supervisory control over the control network and shall support all three (3) of the following communication protocols:
   a. BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9.
   b. The Johnson Controls N2 Field Bus.
2. Control networks shall provide either “Peer-to-Peer,” Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.
3. DDC Controllers shall reside on the control network.
4. Control network communication protocol shall be BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135.
5. A BACnet Protocol Implementation Conformance Statement shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.
6. The Conformance Statements shall be submitted 10 day prior to bidding.

C. Integration

1. Hardwired
   a. Analog and digital signal values shall be passed from one system to another via hardwired connections.
   b. There will be one separate physical point on each system for each point to be integrated between the systems.
2. Direct Protocol (Integrator Panel)
   a. The BMS system shall include appropriate hardware equipment and software to allow bi-directional data communications between the BMS system and 3rd party manufacturers’ control panels. The BMS shall receive, react to, and return information from multiple building systems, including but not limited to the chillers, boilers, variable frequency drives, power monitoring system, and medical gas.
   b. All data required by the application shall be mapped into the Automation Engine’s database, and shall be transparent to the operator.

c. Point inputs and outputs from the third-party controllers shall have real-time interoperability with BMS software features such as: Control Software, Energy Management, Custom Process Programming, Alarm Management, Historical Data and Trend Analysis, Totalization, and Local Area Network Communications.

3. BACnet Protocol Integration - BACnet

a. The neutral protocol used between systems will be BACnet over Ethernet and comply with the ASHRAE BACnet standard 135-2003.

b. A complete Protocol Implementation Conformance Statement (PICS) shall be provided for all BACnet system devices.

c. The ability to command, share point object data, change of state (COS) data and schedules between the host and BACnet systems shall be provided.

2.05 USER INTERFACE

A. Dedicated Web Based User Interface

1. Dedicated User Interface Architecture - The architecture of the computer shall be implemented to conform to industry standards, so that it can accommodate applications provided by the BMS Contractor and by other third party applications suppliers, including but not limited to Microsoft Office Applications. Specifically it must be implemented to conform to the following interface standards.

a. Microsoft Internet Explorer for user interface functions

b. Microsoft Office Professional for creation, modification and maintenance of reports, sequences other necessary building management functions

c. Microsoft Outlook or other e-mail program for supplemental alarm functionality and communication of system events, and reports

d. Required network operating system for exchange of data and network functions such as printing of reports, trends and specific system summaries.

2. Dynamic Color Graphics

a. The graphics application program shall be supplied as an integral part of the User Interface. Browser or Workstation applications that rely only upon HTML pages shall not be acceptable.

b. The graphics applications shall include a create/edit function and a runtime function. The system architecture shall support an unlimited number of graphics documents (graphic definition files) to be generated and executed.
1) The graphics shall be able to display and provide animation based on real-time data that is acquired, derived, or entered.

c. Graphics runtime functions - A maximum of 16 graphic applications shall be able to execute at any one time on a user interface or workstation with 4 visible to the user. Each graphic application shall be capable of the following functions:
1) All graphics shall be fully scalable

2) The graphics shall support a maintained aspect ratio.
3) Multiple fonts shall be supported.
4) Unique background shall be assignable on a per graphic basis.
5) The color of all animations and values on displays shall indicate if the status of the object attribute.

d. Operation from graphics - It shall be possible to change values (setpoints) and states in system controlled equipment by using drop-down windows accessible via the pointing device

e. Graphic editing tool - A graphic editing tool shall be provided that allows for the creation and editing of graphic files. The graphic editor shall be capable of performing/defining all animations, and defining all runtime binding.
1) The graphic editing tool shall in general provide for the creation and positioning of point objects by dragging from tool bars or drop-downs and positioning where required.
2) In addition, the graphic editing tool shall be able to add additional content to any graphic by importing backgrounds in the SVG, BMP or JPG file formats.

f. Aliasing - Many graphic displays representing part of a building and various building components are exact duplicates, with the exception that the various variables are bound to different field values. Consequently, it shall be possible to bind the value of a graphic display to aliases, as opposed to the physical field tags.

3. Historical trending and data collection

a. Each Automation Engine shall store trend and point history data for all analog and digital inputs and outputs, as follows:
1) Any point, physical or calculated, may be designated for trending. Three methods of collection shall be allowed:
(a) Defined time interval
(b) Upon a change of value
2) Each Automation Engine shall have the capability to store multiple samples for each physical point and software variable based upon available memory, including an individual sample time/date stamp. Points may be assigned to multiple history trends with different collection parameters.

b. Trend and change of value data shall be stored within the engine and uploaded to a dedicated trend database or exported in a selectable data format via a provided data export utility. Uploads to a dedicated database shall occur based upon one of the following: user-defined interval, manual command, or when the trend buffers are full. Exports shall be as requested by the user or on a time scheduled basis.

c. The system shall provide a configurable data storage subsystem for the collection of historical data. Data can be stored in either Microsoft Access or SQL database format.

4. Trend data viewing and analysis

    a. Provide a trend viewing utility that shall have access to all database points.

    b. It shall be possible to retrieve any historical database point for use in displays and reports by specifying the point name and associated trend name.

    c. The trend viewing utility shall have the capability to define trend study displays to include multiple trends

    d. Displays shall be able to be single or stacked graphs with on-line selectable display characteristics, such as ranging, color, and plot style.

    e. Display magnitude and units shall both be selectable by the operator at any time without reconfiguring the processing or collection of data. This is a zoom capability.

    f. Display magnitude shall automatically be scaled to show full graphic resolution of the data being displayed.

    g. Trend studies shall be capable of calculating and displaying calculated variables including highest value, lowest value and time based accumulation.

2.06 NETWORK AUTOMATION ENGINES (NAE)

A. Network Automation Engine (NAE --XX)

1. The Network Automation Engine (NAE) shall be a fully user-programmable, supervisory controller. The NAE shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Automation Engines.

2. Automation network - The NAE shall reside on the automation network and shall support a subnet of system controllers.

3. User Interface - Each NAE shall have the ability to deliver a web based User Interface (UI) as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.

    a. The web based UI software shall be imbedded in the NAE. Systems that require a local copy of the system database on the user's personal computer are not acceptable.

    b. The NAE shall support up a minimum of four (4) concurrent users.

    c. The web based user shall have the capability to access all system data through one NAE.

    d. Remote users connected to the network through an Internet Service Provider (ISP) or telephone dial up shall also have total system access through one NAE.

    e. Systems that require the user to address more than one NAE to access all system information are not acceptable.

f. The NAE shall have the capability of generating web based UI graphics. The graphics capability shall be imbedded in the NAE.

g. Systems that support UI Graphics from a central database or require the graphics to reside on the user's personal computer are not acceptable.

h. The web based UI shall support the following functions using a standard version of Microsoft Internet Explorer:
   1) Configuration
   2) Commissioning
   3) Data Archiving
   4) Monitoring
   5) Commanding
   6) System Diagnostics

i. Systems that require workstation software or modified web browsers are not acceptable.

j. The NAE shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems.

4. Processor - The NAE shall be microprocessor-based with a minimum word size of 32 bits. The NAE shall be a multi-tasking, multi-user, and real-time digital control processor. Standard operating systems shall be employed. NAE size and capability shall be sufficient to fully meet the requirements of this Specification.

5. Memory - Each NAE shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.

6. Hardware Real Time Clock - The NAE shall include an integrated, hardware-based, real-time clock.

7. The NAE shall include troubleshooting LED indicators to identify the following conditions:

   a. Power - On/Off

   b. Ethernet Traffic - Ethernet Traffic/No Ethernet Traffic

   c. Ethernet Connection Speed - 10 Mbps/100 Mbps

   d. FC Bus A - Normal Communications/No Field Communications

   e. FC Bus B - Normal Communications/No Field Communications

   f. Peer Communication - Data Traffic Between NAE Devices

   g. Run - NAE Running/NAE In Startup/NAE Shutting Down/Software Not Running

   h. Bat Fault - Battery Defective, Data Protection Battery Not Installed

   i. 24 VAC - 24 VAC Present/Loss Of 24VAC

   j. Fault - General Fault

k. Modem RX - NAE Modem Receiving Data

l. Modem TX - NAE Modem Transmitting Data

8. Communications Ports - The NAE shall provide the following ports for operation of operator Input/Output (I/O) devices, such as industry-standard computers, modems, and portable operator's terminals.

   a. Two (2) USB port

   b. Two (2) URS-232 serial data communication port

   c. Two (2) RS-485 port

   d. One (1) Ethernet port

9. Diagnostics - The NAE shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Automation Engine shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.

10. Power Failure - In the event of the loss of normal power, The NAE shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.

    a. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.

    b. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.

11. Certification - The NAE shall be listed by Underwriters Laboratories (UL).

12. Controller network - The NAE shall support the following communication protocols on the controller network:

    a. The NAE shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
       1) A BACnet Protocol Implementation Conformance Statement shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.
       2) The Conformance Statements shall be submitted 10 day prior to bidding.
       3) The NAE shall support a minimum of 100 control devices.

    b. The NAE shall support the Johnson Controls N2 Field Bus.
       1) The NAE shall support a minimum of 100 N2 control devices.
       2) The Bus shall conform to Electronic Industry Alliance (EIA) Standard RS-485.
       3) The Bus shall employ a master/slave protocol where the NAE is the master.
       4) The Bus shall employ a four (4) level priority system for polling frequency.

5) The Bus shall be optically isolated from the NAE.
6) The Bus shall support the Metasys Integrator System.

2.07 DDC SYSTEM CONTROLLERS

A. Field Equipment Controller (FEC X610)

1. The Field Equipment Controller (FEC) shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol.
2. The FEC shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
3. Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.
4. The FEC shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
5. The FEC shall include a removable base to allow pre-wiring without the controller.
6. The FEC shall include troubleshooting LED indicators to identify the following conditions:
    a. Power On
    b. Power Off
    c. Download or Startup in progress, not ready for normal operation
    d. No Faults
    e. Device Fault
    f. Field Controller Bus - Normal Data Transmission
    g. Field Controller Bus - No Data Transmission
    h. Field Controller Bus - No Communication
    i. Sensor-Actuator Bus - Normal Data Transmission
    j. Sensor-Actuator Bus - No Data Transmission
    k. Sensor-Actuator Bus - No Communication
7. The FEC shall accommodate the direct wiring of analog and binary I/O field points.
8. The FEC shall support the following types of inputs and outputs:
    a. Universal Inputs - shall be configured to monitor any of the following:
        1) Analog Input, Voltage Mode
        2) Analog Input, Current Mode
        3) Analog Input, Resistive Mode

4) Binary Input, Dry Contact Maintained Mode
5) Binary Input, Pulse Counter Mode

b. Binary Inputs - shall be configured to monitor either of the following:
1) Dry Contact Maintained Mode
2) Pulse Counter Mode

c. Analog Outputs - shall be configured to output either of the following
1) Analog Output, Voltage Mode
2) Analog Output, current Mode

d. Binary Outputs - shall output the following:
1) 24 VAC Triac

e. Configurable Outputs - shall be capable of the following:
1) Analog Output, Voltage Mode
2) Binary Output Mode

9. The FEC shall have the ability to reside on a Field Controller Bus (FC Bus).

a. The FC Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.

b. The FC Bus shall support communications between the FECs and the NAE.

c. The FC Bus shall also support Input/Output Module (IOM) communications with the FEC and with the NAE.

d. The FC Bus shall support a minimum of 100 IOMs and FEC in any combination.

e. The FC Bus shall operate at a maximum distance of 15,000 Ft. between the FEC and the furthest connected device.

f. f.

10. The FEC shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).

a. The SA Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.

b. The SA Bus shall support a minimum of 10 devices per trunk.

c. The SA Bus shall operate at a maximum distance of 1,200 Ft. between the FEC and the furthest connected device.

11. The FEC shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the FC Bus or the SA Bus.

12. The FEC shall support, but not be limited to, the following:

a. Hot water, chilled water/central plant applications

b. Built-up air handling units for special applications

c. C. Terminal units

d. Special programs as required for systems control

2.08 FIELD DEVICES

A. Input/Output Module (IOM X710)

1. The Input/Output Module (IOM) provides additional inputs and outputs for use in the FEC.
2. The IOM shall communicate with the FEC over either the FC Bus or the SA Bus using BACnet Standard protocol SSPC-135, Clause 9.
3. The IOM shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
4. The IOM shall have a minimum of 4 points to a maximum of 17 points.
5. The IOM shall support the following types of inputs and outputs:
   a. Universal Inputs - shall be configured to monitor any of the following:
      1) Analog Input, Voltage Mode
      2) Analog Input, Current Mode
      3) Analog Input, Resistive Mode
      4) Binary Input, Dry Contact Maintained Mode
      5) Binary Input, Pulse Counter Mode
   b. Binary Inputs - shall be configured to monitor either of the following:
      1) Dry Contact Maintained Mode
      2) Pulse Counter Mode
   c. Analog Outputs - shall be configured to output either of the following
      1) Analog Output, Voltage Mode
      2) Analog Output, current Mode
   d. Binary Outputs - shall output the following:
      1) 24 VAC Triac
   e. Configurable Outputs - shall be capable of the following:
      1) Analog Output, Voltage Mode
      2) Binary Output Mode
6. The IOM shall include troubleshooting LED indicators to identify the following conditions:
   a. Power On
   b. Power Off
   c. Download or Startup in progress, not ready for normal operation
   d. No Faults
   e. Device Fault
   f. Normal Data Transmission

g. No Data Transmission

h. No Communication

B. Networked Thermostat (TEC 26X6)

1. The Networked Thermostat shall be capable of controlling a four pipe fan coil system with multi-speed fan control.

2. The Networked Thermostat shall communicate over the Field Controller Bus using BACnet Standard protocol SSPC-135, Clause 9.

   a. The Networked Thermostat shall support remote read/write and parameter adjustment from the web based User Interfaceable through a Network Automation Engine.

3. The Networked Thermostat shall include an intuitive User Interface providing plain text messages.

   a. Two line, 8 character backlit display

   b. LED indicators for Fan, Heat, and Cool status

   c. Five (5) User Interface Keys
      1) Mode
      2) Fan
      3) Override
      4) Degrees C/F
      5) Up/Down

   d. The display shall continuously scroll through the following parameters:
      1) Room Temperature
      2) System Mode
      3) Schedule Status - Occupied/Unoccupied/Override
      4) Applicable Alarms

4. The Networked Thermostat shall provide the flexibility to support any one of the following inputs:

   a. Integral Indoor Air Temperature Sensor

   b. Duct Mount Air Temperature Sensor

   c. Remote Indoor Air Temperature Sensor with Occupancy Override and LED Indicator.

   d. Two configurable binary inputs

5. The Networked Thermostat shall provide the flexibility to support any one of the following outputs:

   a. Three Speed Fan Control

   b. Two On/Off

   c. Two Floating

d. Two Proportional (0 to 10V)

6. The Networked Thermostat shall provide a minimum of six (6) levels of keypad lockout.

7. The Networked Thermostat shall provide the flexibility to adjust the following parameters:

   a. Adjustable Temporary Occupancy from 0 to 24 hours

   b. Adjustable heating/cooling deadband from 2º F to 5º F

   c. Adjustable heating/cooling cycles per hour from 4 to 8

8. The Networked Thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.

C. Networked Thermostat (TEC 26X5)

1. The Networked Thermostat shall be capable of controlling a two pipe fan coil with a single speed fan.

2. The Networked Thermostat shall communicate over the FC Bus using BACnet Standard protocol SSPC-135, Clause 9.

   a. The Networked Thermostat shall be capable of remote read/write and parameter adjustment from the web based User Interface (UI) through an NAE.

3. The Networked Thermostat shall include an intuitive UI providing plain text messages.

   a. Two line, 8 character backlit display

   b. LED indicators for Fan, Heat, and Cool status

   c. Five (5) User Interface Keys
      1) Mode
      2) Fan
      3) Override
      4) Up
      5) Down

   d. The display shall continuously scroll through the following parameters:
      1) Room Temperature
      2) System Mode
      3) Schedule Status - Occupied/Unoccupied/Override
      4) Applicable Alarms

4. The Networked Thermostat shall provide the flexibility to support any one of the following inputs:

   a. Integral Indoor Air Temperature Sensor

   b. Duct Mount Air Temperature Sensor

   c. Indoor Air Temperature Sensor with Occupancy Override and LED Indicator.

d. Two configurable binary inputs

5. The Networked Thermostat shall provide the flexibility to support either of the following outputs:
   a. One (1) fan control
   b. One Proportional (0 to 10V)
6. The Networked Thermostat shall provide a minimum of six (6) levels of keypad lockout.
7. The Networked Thermostat shall provide the flexibility to adjust the following parameters:
   a. Adjustable Temporary Occupancy from 0 to 24 hours
   b. Adjustable heating/cooling deadband from 2º F to 5º F
   c. Adjustable heating/cooling cycles per hour from 4 to 8
8. The Networked Thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.

D. Network Sensors (NS-XXX700X)

1. The Network Sensors (NS) shall have the ability to monitor the following variables as required by the systems sequence of operations:
   a. Zone Temperature
   b. Zone setpoint
2. The NS shall transmit the zone information back to the controller on the Sensor-Actuator Bus (SA Bus) using BACnet Standard protocol SSPC-135, Clause 9.
3. The Network Sensors shall include the following items:
   a. Plain space mounted sensors with temperature sensing only.
4. The NS shall be available with either screw terminals or phone jack.
5. The NS shall be available in either surface mount or wall mount styles.

2.09 INPUT DEVICES

A. General Requirements

1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.

B. Temperature Sensors

1. General Requirements:

a. Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.
   1) The temperature sensor shall be of the resistance type, and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD.
   2) The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion:

b. Point Type Accuracy

c. Chilled Water + .5°F.

d. Room Temp + .5°F.

e. Duct Temperature + .5°F.

f. All Others + .75°F.

2. Room Temperature Sensors

   a. Room sensors shall be constructed for either surface or wall box mounting.
      1) Room sensors shall have the following options when specified:
         (a) Setpoint reset slide switch providing a +3 degree (adjustable) range.
         (b) A momentary override request push button for activation of after-hours operation.

3. Thermo wells

   a. When thermo wells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and Greenfield fitting.
      1) Thermo wells shall be pressure rated and constructed in accordance with the system working pressure.
      2) Thermo wells and sensors shall be mounted in a threadolet or 1/2” NFT saddle and allow easy access to the sensor for repair or replacement.
      3) Thermo wells shall be constructed of 316 stainless steel.

4. Outside Air Sensors

   a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
      1) Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
      2) Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.

5. Duct Mount Sensors

   a. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
      1) Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.

2) For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.

6. Averaging Sensors

a. For ductwork greater in any dimension that 48 inches and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
1) For plenum applications, such as mixed air temperature measurements, a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment.
2) Capillary supports at the sides of the duct shall be provided to support the sensing string.

7. Acceptable Manufacturers: Johnson Controls, Setra.

C. Humidity Sensors

1. The sensor shall be a solid-state type, relative humidity sensor of the Bulk Polymer Design. The sensor element shall resist service contamination.

2. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.

3. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH @ 77 Deg F unless specified elsewhere.

4. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealtite fittings and stainless steel bushings.

5. A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.

6. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.

7. Acceptable Manufacturers: Johnson Controls, Veris Industries, and Mamac.

D. Differential Pressure Transmitters

1. General Air and Water Pressure Transmitter Requirements:

a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
1) Pressure transmitters shall transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.
2) Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device, and shall be supplied with Tee fittings

and shut-off valves in the high and low sensing pick-up lines to allow the balancing Contractor and Owner permanent, easy-to-use connection.

3) A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.

2. Low Differential Water Pressure Applications (0” - 20” w.c.)

a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of flow meter differential pressure or water pressure sensing points.

1) The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
   (a) .01-20” w.c. input differential pressure range.
   (b) 4-20 mA output.
   (c) Maintain accuracy up to 20 to 1 ratio turndown.
   (d) Reference Accuracy: +0.2% of full span.
2) Acceptable Manufacturers: Setra and Mamac.

3. Medium to High Differential Water Pressure Applications (Over 21” w.c.)

a. The differential pressure transmitter shall meet the low pressure transmitter specifications with the following exceptions:

1) Differential pressure range 10” w.c. to 300 PSI.
   (a) Reference Accuracy: +1% of full span (includes non-linearity, hysteresis, and repeatability).
2) Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.
3) Acceptable Manufacturers: Setra and Mamac.

4. Building Differential Air Pressure Applications (-1” to +1” w.c.)

a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.

1) The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
   (a) -1.00 to +1.00 w.c. input differential pressure ranges. (Select range appropriate for system application)
   (b) 4-20 mA output.
   (c) Maintain accuracy up to 20 to 1 ratio turndown.
   (d) Reference Accuracy: +0.2% of full span.
2) Acceptable Manufacturers: Johnson Controls and Setra.

5. Low Differential Air Pressure Applications (0” to 5” w.c.)

a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
   1) The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
      (a) (0.00 - 1.00" to 5.00") w.c. input differential pressure ranges. (Select range appropriate for system application.)
      (b) 4-20 mA output.
      (c) Maintain accuracy up to 20 to 1 ratio turndown.
      (d) Reference Accuracy: +0.2% of full span.
   2) Acceptable Manufacturers: Johnson Controls and Setra.

6. Medium Differential Air Pressure Applications (5" to 21" w.c.)

   a. The pressure transmitter shall be similar to the Low Air Pressure Transmitter, except that the performance specifications are not as severe. Differential pressure transmitters shall be provided that meet the following performance requirements:
      1) Zero & span: (c/o F.S./Deg. F): .04% including linearity, hysteresis and repeatability.
         (a) Accuracy: 1% F.S. (best straight line) Static Pressure Effect: 0.5% F.S. (to 100 PSIG.
         (b) Thermal Effects: <+.033 F.S./Deg. F. over 40°F. to 100°F. (calibrated at 70°F.).
      2) Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.
      3) Acceptable manufacturers: Johnson Controls and Setra.
      4) Static Pressure Traverse Probe
         (a) Duct static traverse probes shall be provided where required to monitor duct static pressure. The probe shall contain multiple static pressure sensors located along exterior surface of the cylindrical probe.
         (b) Acceptable manufacturers: Cleveland Controls
      5) Shielded Static Air Probe
         (a) A shielded static pressure probe shall be provided at each end of the building. The probe shall have multiple sensing ports, an impulse suppression chamber, and airflow shielding. A suitable probe for indoor and outdoor locations shall be provided.

7. Water Flow Monitoring

   a. Water flow meters shall be electromagnetic type with integral microprocessor-Based electronics. The meter shall have an accuracy of 0.25%.
      1) Acceptable manufacturers: Onicon

E. Power Monitoring Devices

1. Current Measurement (Amps)

a. Current measurement shall be by a combination current transformer and a current transducer. The current transformer shall be sized to reduce the full amperage of the monitored circuit to a maximum 5 Amp signal, which will be converted to a 4-20 mA DDC compatible signal for use by the Facility Management System.

1) Current Transformer - A split core current transformer shall be provided to monitor motor amps.
   (a) Operating frequency - 50 - 400 Hz.
   (b) Insulation - 0.6 Kv class 10Kv BIL.
   (c) UL recognized.
   (d) Five amp secondary.
   (e) Select current ration as appropriate for application.
   (f) Acceptable manufacturers: Veris Industries

2) Current Transducer - A current to voltage or current to mA transducer shall be provided. The current transducer shall include:
   (a) 6X input over amp rating for AC inrushes of up to 120 amps.
   (b) Manufactured to UL 1244.
   (c) Accuracy: +.5%, Ripple +1%.
   (d) Minimum load resistance 30kOhm.
   (e) Input 0-20 Amps.
   (f) Output 4-20 mA.
   (g) Transducer shall be powered by a 24VDC regulated power supply (24 VDC +5%).
   (h) Acceptable manufacturers: Veris Industries

F. Refrigerant Monitor Controller

1. Provide and install a Honeywell Refrigerant Monitor Controller in chiller room.

a. Honeywell Model # 301EM-20 controller with horn/strobe. Infrared Refrigerant Gas Detectors at each chiller.

G. Smoke Detectors

1. Ionization type air duct detectors shall be furnished as specified elsewhere in Division 16 for installation under Division 15. All wiring for air duct detectors shall be provided under Division 16, Fire Alarm System.

H. Status and Safety Switches

1. General Requirements

a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BMS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

2. Current Sensing Switches

a. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.
   1) Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.
   2) Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.
   3) Acceptable manufacturers: Veris Industries

3. Air Filter Status Switches

   a. Differential pressure switches used to monitor air filter status shall be of the automatic reset type with SPDT contacts rated for 2 amps at 120VAC.
      1) A complete installation kit shall be provided, including: static pressure tops, tubing, fittings, and air filters.
      2) Provide appropriate scale range and differential adjustment for intended service.
      3) Acceptable manufacturers: Johnson Controls, Cleveland Controls

4. Air Flow Switches

   a. Differential pressure flow switches shall be bellows actuated mercury switches or snap acting micro-switches with appropriate scale range and differential adjustment for intended service.
      1) Acceptable manufacturers: Johnson Controls, Cleveland Controls

5. Air Pressure Safety Switches

   a. Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2 amps at 120VAC.
      1) Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.
      2) Acceptable manufacturers: Johnson Controls, Cleveland Controls

6. Water Flow Switches

   a. Water flow switches shall be equal to the Johnson Controls P74.

7. Low Temperature Limit Switches

   a. The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16 amps at 120VAC.
      1) The sensing element shall be a minimum of 15 feet in length and shall react to the coldest 18-inch section. Element shall be mounted horizontally across duct in accordance with manufacturers recommended installation procedures.

2) For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.
3) The low temperature limit switch shall be equal to Johnson Controls A70.

2.10 OUTPUT DEVICES

A. Actuators

1. Electronic Damper Actuators

a. Electronic damper actuators shall be direct shaft mount.

b. Modulating and two-position actuators shall be provided as required by the sequence of operations. Damper sections shall be sized Based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the sequences of operations. All actuators shall have external adjustable stops to limit the travel in either direction, and a gear release to allow manual positioning.

c. Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 15 VA, and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication. The feedback signal of one damper actuator for each separately controlled damper shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.

d. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as "quick acting," shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.

e. Acceptable manufacturers: Johnson Controls, Mamac.

2. Electronic Valve Actuators

a. Electronic valve actuators shall be manufactured by the valve manufacturer.

b. Each actuator shall have current limiting circuitry incorporated in its design to prevent damage to the actuator.

c. Modulating and two-position actuators shall be provided as required by the sequence of operations. Actuators shall provide the minimum torque required for proper valve close-off against the system pressure for the required application. The valve actuator shall be sized Based on valve manufacturer's

recommendations for flow and pressure differential. All actuators shall fail in the last position unless specified with mechanical spring return in the sequence of operations. The spring return feature shall permit normally open or normally closed positions of the valves, as required. All direct shaft mount rotational actuators shall have external adjustable stops to limit the travel in either direction.

d. Modulating Actuators shall accept 24 VAC or VDC and 120 VAC power supply and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal, and may be used to parallel other actuators and provide true position indication. The feedback signal of each valve actuator (except terminal valves) shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.

e. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Butterfly isolation and other valves, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop the associated pump or chiller.

f. Acceptable manufacturers: Johnson Controls or Bray.

B. Control Dampers

1. The BMS Contractor shall furnish all automatic dampers. All automatic dampers shall be sized for the application by the BMS Contractor or as specifically indicated on the Drawings.

2. All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear.

3. All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.

4. Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 60”. Damper blades shall be 16-gauge minimum and shall not exceed eight (8) inches in width. Damper frames shall be 16-gauge minimum hat channel type with corner bracing. All damper bearings shall be made of reinforced nylon, stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Dampers of 48”x48” size shall not leak in excess of 8.0 cfm per square foot when closed against 4” w.g. static pressure when tested in accordance with AMCA Std. 500.

5. Airfoil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5” w.g., but no more than 4000 FPM or 6” w.g. Acceptable manufacturers are Johnson Controls D-7250 D-1250 or D-1300, Ruskin CD50, and Vent Products 5650.

6. One piece rolled blade dampers with exposed or concealed linkage may be used with face velocities of 1500 FPM or below. Acceptable manufacturers are: Johnson Controls D-1600, Ruskin CD36, and Vent Products 5800.

7. Multiple section dampers may be jack-shafted to allow mounting of piston pneumatic actuators and direct connect electronic actuators. Each end of the jackshaft shall receive at least one actuator to reduce jackshaft twist.

C. Control Relays

1. Control Pilot Relays

a. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.

b. Mounting Bases shall be snap-mount.

c. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.

d. Contacts shall be rated for 10 amps at 120VAC.

e. Relays shall have an integral indicator light and check button.

f. Acceptable manufacturers: Johnson Controls, Lectro

D. Control Valves

1. All automatic control valves shall be fully proportioning and provide near linear heat transfer control. The valves shall be quiet in operation and fail-safe open, closed, or in their last position. All valves shall operate in sequence with another valve when required by the sequence of operations. All control valves shall be sized by the control manufacturer, and shall be guaranteed to meet the heating and cooling loads, as specified. All control valves shall be suitable for the system flow conditions and close against the differential pressures involved. Body pressure rating and connection type (sweat, screwed, or flanged) shall conform to the pipe schedule elsewhere in this Specification.

2. Chilled water control valves shall be modulating plug, ball, and/or butterfly, as required by the specific application. Modulating water valves shall be sized per manufacturer’s recommendations for the given application. In general, valves (2 or 3-way) serving variable flow air handling unit coils shall be sized for a pressure drop equal to the actual coil pressure drop, but no less than 5 PSI. Valves (3-way) serving constant flow air handling unit coils with secondary circuit pumps shall be sized for a pressure drop equal to 25% the actual coil pressure drop, but no less than 2 PSI. Mixing valves (3-way) serving secondary water circuits shall be sized for a pressure drop of no less than 5 PSI. Valves for terminal reheat coils shall be sized for a 2 PSIG pressure drop, but no more than a 5 PSI drop.

3. Ball valves shall be used for hot and chilled water applications, water terminal reheat coils, radiant panels, unit heaters, package air conditioning units, and fan coil units except those described hereinafter.

4. Modulating plug water valves of the single-seat type with equal percentage flow characteristics shall be used for all special applications as indicated on the valve schedule. Valve discs shall be composition type. Valve stems shall be stainless steel.

5. Butterfly valves shall be acceptable for modulating large flow applications greater than modulating plug valves, and for all two-position, open/close applications. In-line and/or three-way butterfly valves shall be heavy-duty pattern with a body rating comparable to the pipe rating, replaceable lining suitable for temperature of system, and a stainless steel vane. Valves for modulating service shall be sized and travel limited to 50 degrees of full open. Valves for isolation service shall be the same as the pipe. Valves in the closed position shall be bubble-tight.

6. Acceptable manufacturers: Johnson Controls

PART 3 EXECUTION

3.01 BMS SPECIFIC REQUIREMENTS

A. Graphic Displays

1. Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library.

2. User shall access the various system schematics via a graphical penetration scheme and/or menu selection. .

B. Actuation / Control Type

1. Primary Equipment

   a. Controls shall be provided by equipment manufacturer as specified herein.

   b. All damper and valve actuation shall be electric.

2. Air Handling Equipment

   a. All air handers shall be controlled with a HVAC-DDC Controller

   b. All damper and valve actuation shall be electric.

3. Terminal Equipment:

   a. Terminal Units (VAV, UV, etc.) shall have electric damper and valve actuation.

   b. All Terminal Units shall be controlled with HVAC-DDC Controller)

3.02 INSTALLATION PRACTICES

A. BMS Wiring

1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the BMS Contractor unless specifically shown on the Electrical Drawings under Division 16 Electrical. All wiring shall comply with the requirements of applicable portions of Division 16 and all local and national electric codes, unless specified otherwise in this section.

2. All BMS wiring materials and installation methods shall comply with BMS manufacturer recommendations.

3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BMS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.

4. Class 2 Wiring

   a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.

   b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5’ from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.

5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.

6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

B. BMS Line Voltage Power Source

1. 120-volt AC circuits used for the Building Management System shall be taken from panel boards and circuit breakers provided by Division 16.

2. Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.

3. DDC terminal unit controllers may use AC power from motor power circuits.

C. BMS Raceway

1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2”.

2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.

3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.

4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

5. BMS Identification Standards

6. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.

    a. Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

D. BMS Panel Installation

1. The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.

2. The BMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

E. Input Devices

1. All Input devices shall be installed per the manufacturer recommendation

2. Locate components of the BMS in accessible local control panels wherever possible.

F. HVAC Input Devices - Genera1

1. All Input devices shall be installed per the manufacturer recommendation

2. Locate components of the BMS in accessible local control panels wherever possible.

3. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.

4. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.

5. Outside Air Sensors

    a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.

    b. Sensors shall be installed with a rain proof, perforated cover.

6. Water Differential Pressure Sensors
    a. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.
    b. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.
    c. The transmitters shall be installed in an accessible location wherever possible.
7. Medium to High Differential Water Pressure Applications (Over 21” w.c.):
    a. Air bleed units, bypass valves and compression fittings shall be provided.
8. Building Differential Air Pressure Applications (-1” to +1” w.c.):
    a. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.
    b. The interior tip shall be inconspicuous and located as shown on the drawings.
9. Duct Temperature Sensors:
    a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
    b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
    c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
    d. The sensor shall be mounted to suitable supports using factory approved element holders.
10. Space Sensors:
    a. Shall be mounted per ADA requirements.
11. Low Temperature Limit Switches:
    a. Install on the discharge side of the first water or steam coil in the air stream.
    b. Mount element horizontally across duct in a serpentine pattern insuring each square foot of coil is protected by 1 foot of sensor.
    c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.
12. Air Differential Pressure Status Switches:
    a. Install with static pressure tips, tubing, fittings, and air filter.
13. Water Differential Pressure Status Switches:
    a. Install with shut off valves for isolation.

G. HVAC Output Devices

1. All output devices shall be installed per the manufacturer's recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.

2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.

3. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.

4. Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI. The maximum pressure drop for steam applications shall be 7 PSI.

5. Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Management System is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems

3.03 TRAINING

A. The BMS contractor shall provide the following training services:

1. Provide 8 hours of training by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BMS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.

3.04 COMMISSIONING

A. Fully commission all aspects of the Building Management System work.

B. Acceptance Check Sheet

1. Prepare a check sheet that includes all points for all functions of the BMS as indicated on the point list included in this specification.

2. Submit the check sheet to the Engineer for approval

3. The Engineer will use the check sheet as the basis for acceptance with the BMS Contractor.

3.05 SEQUENCES

A. Please see plans for control points and sketches….

END OF SECTION

SECTION 23 21 13 - HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water piping, above grade.

C. Heating water and glycol piping, above grade.

D. Chilled water piping, above grade.

E. Condenser water piping, above grade.

F. Equipment drains and overflows.

G. Pipe hangers and supports.

H. Unions, flanges, mechanical couplings, and dielectric connections.

I. Valves:

1. Ball valves.
2. Butterfly valves.
3. Check valves.

J. Flow controls.

1.02 RELATED REQUIREMENTS

A. Section 23 0516 - Expansion Fittings and Loops for Piping.

B. Section 23 0523 - General-Duty Valves for HVAC Piping.

C. Section 23 0548 - Vibration Controls for Piping & Equipment.

D. Section 23 0553 - Identification for Piping & Equipment.

E. Section 23 0719 - HVAC Piping Insulation.

F. Section 23 2114 - Hydronic Specialties.

G. Section 23 2500 - HVAC Water Treatment: Pipe cleaning.

H. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

E. ASME B31.9 - Building Services Piping; 2014.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

G. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service; 2015.

H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

I. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts; 2014.

J. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2017.

K. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

L. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

M. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.

N. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.

O. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications; 2012.

P. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2014).

Q. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2013).

R. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (with March 2016 Errata).

S. AWWA C606 - Grooved and Shouldered Joints; 2015.

T. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Scheduling: Coordinate installation with General Contractor. Work willl be accomplished in phases. See drawings for additional information..

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.

C. Product Data:

1. Include data on pipe materials, pipe fittings, valves, and accessories.
2. Provide manufacturers catalogue information.
3. Indicate valve data and ratings.
4. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.

D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

E. Project Record Documents: Record actual locations of valves.

F. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum three years of experience.

C. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

D. Date stamp all castings used for coupling housings, fittings, valve bodies, etc. for quality assurance and traceability.

E. Coupling Manufacturer:

1. Perform on-site training by factory-trained representative to the Contractor's field personnel in the proper use of grooving tools and installation of grooved joint products.
2. Periodic job site visits by factory-trained representative to ensure best practices in grooved joint installation.
3. A distributor's representative is not considered qualified to perform the training.

F. Welder Qualifications: Certify in accordance with ASME BPVC-IX.

1. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:

1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
3. Grooved mechanical joints may be used in accessible locations only.
    a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.

b. Grooved mechanical connections and joints comply with AWWA C606.
   1) Ductile Iron: Comply with ASTM A536, Grade 65-45-12.
   2) Steel: Comply with ASTM A106/A106M, Grade B or ASTM A53/A53M.

c. Use rigid joints unless otherwise indicated.

d. Use gaskets of molded synthetic rubber with central cavity, pressure responsive configuration and complying with ASTM D2000, Grade 2CA615A15B44F17Z for circulating medium up to maximum 230 degrees F or Grade M3BA610A15B44Z for circulating medium up to maximum 200 degrees F.

e. Provide steel coupling nuts and bolts complying with ASTM A183.

4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.

D. Valves: Provide valves where indicated:

1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.

2. On discharge of condenser water pumps, use spring loaded check valves.

3. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.

4. For throttling, bypass, or manual flow control services, use globe, ball, or butterfly valves.

5. For throttling and isolation service in chilled and condenser water systems, use only butterfly valves.

6. In heating water, chilled water, or condenser water systems, butterfly valves may be used interchangeably with gate and globe valves.

7. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.

E. Welding Materials and Procedures: Conform to ASME BPVC-IX.

2.02 HEATING WATER AND GLYCOL PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:

1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
2. Threaded Joints: ASME B16.3, malleable iron fittings.

2.03 CHILLED WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black; using one of the following joint types:

1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
2. Threaded Joints: ASME B16.3, malleable iron fittings.
3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.04 CONDENSER WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black.

1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings with finish matching piping; AWS D1.1/D1.1M welded.
2. Threaded Joints: ASME B16.3, malleable iron fittings with finish matching piping.
3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.05 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:

1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.
2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.06 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches and Greater: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
6. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
7. Wall Support for Pipe Sizes 4 Inches and Greater: Welded steel bracket and wrought steel clamp.
8. Vertical Support: Steel riser clamp.
9. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
10. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
11. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
12. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
13. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

C. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:

1. Bases: High density polypropylene.
2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
5. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

2.07 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches and Less:

1. Ferrous Piping: 150 psig malleable iron, threaded.
2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches and Greater:

1. Ferrous Piping: 150 psig forged steel, slip-on.
2. Gaskets: 1/16 inch thick preformed neoprene.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.

1. Dimensions and Testing: In accordance with AWWA C606.
2. Mechanical Couplings: Comply with ASTM F1476.
3. Housing Material: Ductile iron, galvanized complying with ASTM A536.
4. Gasket Material: Nitrile rubber suitable for operating temperature range from minus 20 degrees F to 180 degrees F.
5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
7. Manufacturers:
    a. Grinnell Products, a Tyco Business: www.grinnell.com.
    b. Victaulic Company: www.victaulic.com.
    c. Substitutions: See Section 01 6000 - Product Requirements.

D. Dielectric Connections:

1. Waterways:
    a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
    b. Dry insulation barrier able to withstand 600 volt breakdown test.
    c. Construct of galvanized steel with threaded end connections to match connecting piping.
    d. Suitable for the required operating pressures and temperatures.
2. Flanges:
    a. Dielectric flanges with same pressure ratings as standard flanges.

b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.

c. Dry insulation barrier able to withstand 600 volt breakdown test.

d. Construct of galvanized steel with threaded end connections to match connecting piping.

e. Suitable for the required operating pressures and temperatures.

2.08 BALL VALVES

A. See Section 230523 for characteristics and requirements for ball valves.

2.09 BUTTERFLY VALVES

A. See Section 230523 for characteristics and requirements for butterfly valves.

2.10 SWING CHECK VALVES

A. See Section 230523 for characteristis and requirements for swing check valves.

2.11 FLOW CONTROLS

A. Manufacturers:

1. Griswold Controls: www.griswoldcontrols.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Taco, Inc: www.taco-hvac.com.
4. Victaulic Company: www.victaulic.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems. Refer to Section 23 2500 for additional requirements.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install heating water, chilled water, and condenser water piping to ASME B31.9 requirements.

C. Route piping in orderly manner, parallel to building structure, and maintain gradient.

D. Install piping to conserve building space and to avoid interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Sleeve pipe passing through partitions, walls and floors.

G. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified _____.

H. Slope piping and arrange to drain at low points.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 0516

1. Flexible couplings may be used in header piping to accommodate thermal growth, thermal contraction in lieu of expansion loops.
2. Use flexible couplings in expansion loops.

J. Grooved Joints:

1. Install in accordance with the manufacturer's latest published installation instructions.
2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.

K. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.

2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.

L. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 0719.

M. Use eccentric reducers to maintain top of pipe level.

N. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

O. Install valves with stems upright or horizontal, not inverted.

3.03 SCHEDULES

A. Hanger Spacing for Copper Tubing.

1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.

B. Hanger Spacing for Steel Piping.

1. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
2. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
3. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
4. 6 inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.
5. 8 inches: Maximum span, 19 feet; minimum rod size, 5/8 inch.

END OF SECTION

SECTION 23 21 14 - HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air vents.

B. Strainers.

C. Suction diffusers.

D. Pump connectors.

E. Pressure-temperature test plugs.

F. Balancing valves.

G. Relief valves.

1.02 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

C. Project Record Documents: Record actual locations of flow controls.

D. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 AIR VENTS

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Taco, Inc: www.taco-hvac.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Type:

1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

D. Washer Type:

1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.02 STRAINERS

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com.
2. Flexicraft Industries: www.flexicraft.com.
3. Grinnell Products, a Tyco Business: www.grinnell.com.
4. The Metraflex Company; LPD Y Strainer: www.metraflex.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Size 2 inch and Under:

1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch:

1. Provide flanged or grooved iron body for 175 psi working pressure, Y pattern with 1/16 inch, or 3/64 inch stainless steel perforated screen.

D. Size 5 inch and Larger:

1. Provide flanged or grooved iron body for 175 psi working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.03 SUCTION DIFFUSERS

A. Manufacturers:

1. Anvil International, Inc: www.anvilintl.com.
2. Grinnell Products, a Tyco Business: www.grinnell.com.
3. ITT Bell & Gossett: www.bellgossett.com.
4. Victaulic Company of America: www.victaulic.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter openings, disposable 5/32 inch mesh strainer to fit over cylinder strainer, 20 mesh start up screen, and permanent magnet located in flow stream and removable for cleaning.

C. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping in side.

2.04 PUMP CONNECTORS

A. Manufacturers:

1. The Metraflex Company; Vane Flex: www.metraflex.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.

1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.
2. Accommodate the Following:
   a. Axial Deflection in Compression and Expansion: _____ inch.

b. Lateral Movement: _____ inch.

c. Angular Rotation: 15 degrees.

d. Force developed by 1.5 times specified maximum allowable operating pressure.

3. End Connections: Same as specified for pipe jointing.

4. Provide pump connector with integral vanes to reduce turbulent flow.

5. Provide necessary accessories including, but not limited to, swivel joints.

2.05 PRESSURE-TEMPERATURE TEST PLUGS

A. Manufacturers:

1. Ferguson Enterprises Inc: www.fnw.com.

2. Peterson Equipment Company Inc: www.petesplug.com.

3. Sisco Manufacturing Company Inc: www.siscomfg.com.

4. Substitutions: See Section 01 6000 - Product Requirements.

B. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.

C. Application: Use extended length plugs to clear insulated piping.

2.06 BALANCING VALVES

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com.

2. ITT Bell & Gossett: www.bellgossett.com.

3. Taco, Inc: www.taco-hvac.com.

4. Substitutions: See Section 01 6000 - Product Requirements.

B. Size 2 inch and Smaller:

1. Provide ball or globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections.

2. Metal construction materials consist of bronze or brass.

3. Non-metal construction materials consist of Teflon, EPDM, or engineered resin.

C. Size 2.5 inch and Larger:

1. Provide ball or butterfly style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged, grooved, or weld end connections.
2. Valve body construction materials consist of cast iron, carbon steel, or ductile iron.
3. Internal components construction materials consist of brass, aluminum bronze, bronze, Teflon, EPDM, NORYL, or engineered resin.

2.07 RELIEF VALVES

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Conbraco Industries: www.apollovalves.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Provide manual air vents at system high points and as indicated.

C. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

D. Provide valved drain and hose connection on strainer blow down connection.

E. Support pump fittings with floor mounted pipe and flange supports.

F. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.

G. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

H. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

END OF SECTION

SECTION 23 21 23 - HYDRONIC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vertical in-line pumps.

B. Base-mounted pumps.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 23 0513 - Common Motor Requirements.

C. Section 23 0548 - Vibration Controls for Piping & Equipment.

D. Section 23 0719 - HVAC Piping Insulation.

E. Section 23 2113 - Hydronic Piping.

F. Section 23 2114 - Hydronic Specialties.

G. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Millwright's Certificate: Certify that base mounted pumps have been aligned.

D. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

E. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Armstrong Pumps Inc: www.armstrongpumps.com.

B. Bell & Gossett, a Xylem Inc. brand: www.bellgossett.com.

C. Taco Pumps_____.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 HVAC PUMPS - GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Base Mounted Pumps: Aligned by qualified millwright.

C. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to Authority Having Jurisdiction as suitable for the purpose specified and indicated.

2.03 VERTICAL IN-LINE PUMPS

A. Type: Vertical, single stage, close coupled, radially or horizontally split casing, for in-line mounting, for 175 psi working pressure.

B. Casing: Cast iron, with suction and discharge gage port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.

C. Impeller: Bronze, fully enclosed, keyed directly to motor shaft or extension.

D. Shaft: Carbon steel with stainless steel impeller cap screw or nut and bronze sleeve.

E. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.

F. Performance:

1. See equipment schedules on drawings for capacities and electrical characteristics.

2.04 BASE-MOUNTED PUMPS

A. Type: Horizontal shaft, single stage, direct connected, radially or horizontally split casing, for 125 psi maximum working pressure.

B. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

C. Impeller: Bronze, fully enclosed, keyed to shaft.

D. Bearings: Oil lubricated roller or ball bearings.

E. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

F. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.

G. Drive: Flexible coupling with coupling guard.

H. Baseplate: Cast iron or fabricated steel with integral drain rim.

I. Performance:

1. See equipment schedules on drawings for capacities and electrical charactersitics.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close-coupled or base-mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

1. Refer to Section 23 0548.

D. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

E. Provide air cock and drain connection on horizontal pump casings.

F. Provide drains for bases and seals, piped to and discharging into floor drains.

G. Check, align, and certify alignment of base-mounted pumps prior to start-up.

H. Install close-coupled and base-mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 03 3000.

I. Lubricate pumps before start-up.

END OF SECTION

SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Casing and plenums.

1.02 RELATED REQUIREMENTS

A. Section 23 0593 - Testing, Adjusting, & Balancing for HVAC.

B. Section 23 0713 - Duct Insulation: External insulation and duct liner.

C. Section 23 3300 - Air Duct Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for low pressure systems.

D. Samples: Submit two samples of typical shop fabricated duct fittings.

E. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.06 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to NFPA 90A standards.

B. Ducts: Galvanized steel, unless otherwise indicated.

C. Low Pressure Supply (System with Cooling Coils): 1/2 inch w.g. pressure class, galvanized steel.

D. Return and Relief: 1/2 inch w.g. pressure class, galvanized steel.

E. Outside Air Intake: 1/2 inch w.g. pressure class, galvanized steel.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.

2. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

3. For Use With Flexible Ducts: UL labeled.

C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

2.05 CASINGS

A. Fabricate casings in accordance with SMACNA (DCS) and construct for operating pressures indicated.

B. Mount floor mounted casings on 4 inch high concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18 gage, 0.0478 inch expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.

C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

F. Use double nuts and lock washers on threaded rod supports.

G. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

END OF SECTION

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible duct connections.

B. Volume control dampers.

1.02 RELATED REQUIREMENTS

A. Section 23 0548 - Vibration Controls for Piping & Equipment.

B. Section 23 3100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:

1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: www.carlislehvac.com/sle.
2. Elgen Manufacturing: www.elgenmfg.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
   a. Net Fabric Width: Approximately 2 inches wide.
2. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.

2.02 VOLUME CONTROL DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.
2. Nailor Industries Inc: www.nailor.com.
3. Ruskin Company: www.ruskin.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

1. Blade: 18 gage, 0.0478 inch, minimum.

D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

E. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.

B. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

C. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

1. Refer to Section 23 0548.

D. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

END OF SECTION

SECTION 23 34 23 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Inline centrifugal fans.

1.02 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; http://www.amca.org/certified/search/company.aspx.

B. AMCA 99 - Standards Handbook; 2010.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2007.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

G. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.

B. Greenheck Fan Corporation: www.greenheck.com.

C. Loren Cook Company: www.lorencook.com.

D. PennBarry, Division of Air System Components: www.pennbarry.com.

E. Twin City Fan & Blower: www.tcf.com/#sle.

F. Substitutions: See Section 01 6000 - Product Requirements.

2.02 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Conform to AMCA 99.

E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.03 INLINE CENTRIFUGAL FANS

A. Performance Ratings: See schedules on drawings.

B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

C. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.

D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION

SECTION 23 64 16 - CENTRIFUGAL WATER CHILLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chiller package.

B. Charge of refrigerant and oil.

C. Controls and control connections.

D. Chilled water connections.

E. Condenser water connections.

F. Variable speed drives.

G. Starters.

H. Electrical power connections.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete housekeeping pads.

B. Section 23 0513 - Common Motor Requirements.

C. Section 23 0548 - Vibration Controls for Piping & Equipment.

D. Section 23 0553 - Identification for Piping & Equipment.

E. Section 23 0593 - Testing, Adjusting, & Balancing for HVAC.

F. Section 23 0923 - Direct-Digital Control System for HVAC.

G. Section 23 0993 - Sequence of Operations for HVAC Controls.

H. Section 23 2113 - Hydronic Piping.

I. Section 23 2123 - Hydronic Pumps.

J. Section 23 6513 - Forced-Draft Cooling Towers.

K. Section 26 2717 - Equipment Wiring.

1.03 REFERENCE STANDARDS

A. AHRI 550/590 (I-P) - Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle; 2011.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013, Including All Amendments and Errata.

D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2015.

E. IEEE 519 - IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems; 2014.

F. UL 508 - Industrial Control Equipment; Underwriters Laboratories Inc; Current Edition, Including All Revisions.

G. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

C. Shop Drawings: Indicate components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers, and thermostatic valves required for complete system.

D. Manufacturer's Certificate: Certify that components of package not furnished by manufacturer have been selected in accordance with manufacturer's requirements.

E. Test Reports: Indicate energy input versus cooling load output from 0 to 100 percent of full load at specified and minimum condenser water temperature.

F. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.

G. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

H. Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories. Include trouble- shooting guide.

I. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Provide certification of inspection for conformance to requirements of Authority Having Jurisdiction.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide a two year warranty to include coverage for compressor including materials only.

C. Variable Speed Drives: Provide manufacturer warranty for period of twelve months from date of installation or eighteen months from date of shipment (whichever comes first). Warranty to include parts, labor, travel costs, and living expenses incurred by manufacturer to provide factory-authorized on-site services.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp: www.carrier.com.

1. Carrier is Bais of Design; alternate manufacturer's shall meet all of the requirements of this portion of the specification, the requirements of the equipment schedules on the drawings, and shall fit is the space allocated on the drawings, including space for servicing and tube pull.

B. Trane, a brand of Ingersoll Rand: www.trane.com.

C. York International Corporation/Johnson Controls, Inc: www.york.com.

D. McQuay.

E. Substitutions: See Section 01 6000 - Product Requirements.

1. The chilled water system has been designed based on specific capacities and characteristics of equipment specified in this section and other sections.
2. When substitution of a different manufacturer or model number is desired, submit sufficient information to demonstrate to Architect that the substitute will have the same or better performance as that specified AND that the related equipment in the system will perform acceptably with the substitute.
3. If the related equipment must be modified to perform acceptably with the substitute, the entity proposing the substitution is responsible for all additional costs due to re-design and provision of different related equipment.

2.02 CHILLER APPLICATIONS

A. Chiller CH-1 & CH-2: Water-cooled,single compressor.

1. Basis of Design: Carrier 19XR with VFD.
2. Location: See plans.
3. Refrigeration Capacity: 200 tons.
4. Refrigerant: Microprocessor-controlled liquid chiller shall use a semi-hermetic centrigugal compressor using refrigeraant HFc-134a.
5. Rating: Energy Efficiency Rating (EER)/Coefficient of Performance (COP) not less than prescribed by ASHRAE Std 90.1 I-P.
6. Evaporator:
    a. Working Pressure: 150 psi.
    b. For capacities and characteristics see equipment schedules on drawings
7. Condenser Water:
    a. Working Pressure: 150 psi.
    b. For capacities and charactersitics see equipment schedules on drawings.
8. Compressor:
    a. For electrical characteristics and requirements, see equipment schedules on drawings
9. Overall Size:

2.03 CHILLERS

A. Chillers: Factory assembled and tested, packaged, water cooled, chillers consisting of centrifugal compressors, compressor motor, condenser, evaporator, refrigeration accessories, instrument and control panel including gages and indicating lights, auxiliary components and accessories, and variable frequency drive.

B. Rating: Conform to AHRI 550/590 (I-P).

C. Safety: Conform to UL 1995.

D. Conform to ASME BPVC-VIII-1 for construction and testing of centrifugal chillers.

E. Conform to ASHRAE Std 15 for safe construction and operation of centrifugal chillers.

F. Energy efficiency for electrically operated, water-cooled units:

1. Capacity: Greater than or equal to 150 tons and less than 300 tons:

a. Integrated Part Load Value:.45kw/ton.

b. Coefficient of Performance: 7.96kw/kw.

2.04 COMPRESSORS

A. Compressor Casing: Cast iron, horizontally or vertically split with machined passages and leak tested to 45 psig. Provide refrigerant sight glass.

B. Impellers: Single or multi-stage, in-line design, fully shrouded, statically and dynamically balanced, tested to 20 percent over operating speed, mounted on heat treated forged or rolled steel shaft, nonferrous, labyrinth seals between stages.

C. Guide Vanes: Modulating radial blade dampers, on each stage, with externally mounted electric operator, suitable for capacity reduction to 10 percent of specified load without hot gas bypass when supplied with design entering water quantity and temperature.

D. Bearings: Steel journal bearings, pressure lubricated.

E. Gear Box: Double helical design, symmetrical and center supported by spherically seated, self aligning bearing, arranged for inspection without disassembly.

1. Provide speed increasing transmissions for variable speed chillers to not exceed 10,000 rpm compressor speed.

F. Motor: Hermetically sealed, singled speed, low slip induction type. Refer to Section 23 0513.

G. Lubrication: Oil pump, with oil cooler, pressure regulator, oil filters, thermostatically controlled oil heater, and motor controls. Interlock to start before chiller motor and run after motor is shut down. Provide sight glass or electronic sensors for monitoring oil level.

H. Refrigerant: Factory charge with manufacturer standard refrigerant..

2.05 EVAPORATOR

A. Provide evaporator of shell and tube type, seamless or welded steel construction with cast iron or fabricated steel heads, seamless copper tubes or red brass tubes with integral fins, rolled or silver brazed into tube sheets. Position intermediate tube support sheets along length of shell to avoid contact and relative motion between adjacent tubes.

B. Test and, where applicable, stamp refrigerant side for 45 psig working pressure and water side for 150 psig working pressure, in accordance with ASME BPVC-VIII-1.

C. Insulate evaporator and cold surfaces with 0.75 inch minimum thick flexible expanded polyvinyl chloride insulation with maximum K value of 0.28.

D. Provide thermometer wells or thermistors for temperature controller and low temperature cutout.

E. Design and construct evaporator to prevent liquid refrigerant from entering the compressor.

F. Provide carbon rupture disc or relief valve on shell in accordance with ASHRAE Std 15.

G. Construction and materials shall conform to ASME BPVC-VIII-1 or ASHRAE Std 15 as applicable to chiller manufacturer and chiller model.

2.06 CONDENSERS

A. Provide condensers of shell and tube type, seamless or welded steel construction with cast iron or fabricated steel heads, seamless copper tubes or red brass tubes with integral fins, rolled or silver brazed into tube sheets. Position intermediate tube support sheets along shell length to avoid contact and relative motion between adjacent tubes.

B. Test and, where applicable, stamp refrigerant side for 45 psig working pressure and water side for 150 psig working pressure; in accordance with ASME BPVC-VIII-1.

C. Provide carbon rupture disc or relief valve on shell in accordance with ASHRAE Std 15.

D. Provide baffles to ensure even distribution of incoming gas and to concentrate non-condensible gases.

E. Construction and materials shall conform to ASME BPVC-VIII-1.

2.07 PURGE SYSTEM

A. Provide purge system on positive pressure units utilizing low pressure refrigerants, incorporating a low temperature refrigeration system to automatically remove non-condensibles, water, and air.

B. System discharge shall be maximum 0.60 pound of refrigerant per pound of air discharged.

2.08 CONTROLS

A. Disconnect Switch: Factory mount disconnect switch in starter control panel.

B. On or near chiller, provide microprocessor based control panel containing solid state, fully automatic operating and safety controls.

C. Provide the following manufacturer's standard safety controls, including the following minimum functions, so that operating any one will shut down machine and require manual reset:

1. Low evaporator refrigerant temperature.
2. High condenser refrigerant pressure.
3. Low oil pressure.
4. Low refrigerant (evaporator) pressure.

D. Provide the manufacturer's standard safety controls arranged so that operating any one will shut down machine and automatically reset.

E. Provide the following operating controls:

1. Solid state, chilled water temperature controller that controls electronic guide vane operator and hot gas bypass. Locate temperature sensor in entering chilled water.
2. Adjustable thirty minute off timer prevents compressor from short cycling.
3. Demand limit device to manually set maximum current infinitely between 40 percent and 100 percent of full load amperes.
4. Automatic start that determines demand for chilled water from proof of chilled water flow and temperature differential between chilled water set point and supply temperature.

2.09 VARIABLE SPEED DRIVE (VSD), UNIT MOUNTED

A. Furnish chiller with factory-mounted, liquid-cooled variable speed drive (VSD) shipped completely factory-assembled, wired, and tested.

B. Specifically design VSD to interface with the centrifugal water chiller controls and allow for the operating ranges and specific characteristics of the chiller. VSD control logic is to optimize chiller efficiency by coordinating compressor motor speed and compressor inlet guide vane position to maintain the chilled water setpoint while avoiding surge. If surge is detected, VSD surge avoidance logic is to make adjustments to move away from and avoid surge at similar conditions in the future.

C. VSD Efficiency: 97 percent or better at full speed and full load.

D. Fundamental Displacement Power Factor: Minimum of 0.96.

E. Provide voltage and current regulated, solid state, microprocessor-based pulse-width modulated (PWM) VSD. Output power devices to be IGBT transistors.

F. Provide liquid-cooled heatsink to cool the power semi-conductor and capacitor.

G. Provide cleanable shell and tube heat exchanger with water-cooled design. Do not provide plate and frame heat exchanger.

H. Furnish VSD in a NEMA Type 1 metal enclosure having a minimum short circuit withstand rating of 65,000 amps per UL 508. Include three phase input lugs plus a grounding lug for electrical connections, output motor connection via factory-installed bus bars and all components properly segregated and completely enclosed in a single, metal enclosure.

1. Enclosure to include a padlockable, door-mounted circuit breaker with shunt trip and AIC rating of 65,000 amps.
2. Entire chiller package to be listed by Underwriter's Laboratories Inc.

I. VSD to be tested according to UL 508 and listed by a Nationally Recognized Testing Laboratory (NRTL) as designated by OSHA.

J. Comply with recommendations stated in IEEE 519.

1. Include integrated active rectification control system to limit total demand distortion (TDD) in current at the VSD to less than or equal to 5 percent as measured at the VSD input. If active filters are used to meet this requirement, then the losses associated with the filter are to be included in the chiller performance on the selection.

K. Fundamental Displacement Power Factor: Minimum of 0.96.

L. Voltage Input: Nominal 480 volts, three phase, 60 hertz AC, plus or minus 10 percent of nominal voltage.

M. Line Frequency: 38 to 60 hertz.

N. VSD to include the following:

1. All control circuit voltages physically and electrically isolated from power circuit voltage.
2. 150 percent instantaneous torque available for improved surge control.
3. Soft start, adjustable linear acceleration, coast-to-stop.
4. Adjustable current limiting and UL approved electronic motor overload protection.
5. Insensitivity to incoming power phase sequence.

6. VSD and motor protection from the following faults:
    a. Output line-to-line short circuit.
    b. Line-to-ground short circuit.
    c. Phase loss at AFD input.
    d. Phase reversal/imbalance.
    e. Over-voltage.
    f. Under-voltage.
    g. Over-temperature.

O. Include the following VSD status indicators available to facilitate startup and maintenance:
    1. Output speed in hertz and rpm.
    2. Input line voltage.
    3. Input line kW.
    4. Output/load amps.
    5. Average current in percent RLA.
    6. Load power factor.
    7. Fault.
    8. VSD transistor temperature.

P. Service Conditions (at full output power; no external venting or heat exchangers required):
    1. Operating Ambient Temperature: Between 32 degrees F and 104 degrees F.
    2. Room Ambient Relative Humidity: Up to 95 percent.
    3. Elevation: Up to 3,300 feet. For every 300 feet above 3,300 feet, decrease the rated output current by one percent.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide for connection to electrical service.

C. Provide for connection of electrical wiring between starter and chiller control panel, oil pump, and purge unit.

D. Align chiller on concrete foundations, sole plates, and sub-bases. Level, grout, and bolt in place.

E. Install units on vibration isolation.

F. Provide evaporator connections to chilled water piping.

1. On inlet, provide:
    a. Thermometer well for temperature controller.
    b. Thermometer well and thermometer.
    c. Strainer.
    d. Nipple and flow switch.
    e. Flexible pipe connector.
    f. Pressure gage.
    g. Shut-off valve.
2. On outlet, provide:
    a. Thermometer well and thermometer.
    b. Flexible pipe connector.
    c. Pressure gage.
    d. Shut-off valve.

G. Furnish and install necessary auxiliary water piping for oil cooling units and purge condensers.

H. Provide condenser connection to condenser water piping.

1. On inlet, provide:
    a. Thermometer well for temperature controller.
    b. Thermometer well and thermometer.
    c. Strainer.
    d. Nipple and flow switch.
    e. Flexible pipe connector.
    f. Pressure gage.
    g. Shut-off valve.
2. On outlet, provide:
    a. Thermometer well and thermometer.
    b. Flexible pipe connector.

c. Pressure gage.

d. Shut-off valve.

I. Arrange piping for easy dismantling to permit tube cleaning.

J. Provide piping from chiller rupture disc to outdoors. Size as recommended by manufacturer.

3.02 SYSTEM STARTUP

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Provide services of factory trained representative for minimum of one day to leak test, refrigerant pressure test, evacuate, dehydrate, charge, start-up, and calibrate controls.

D. Supply initial charge of refrigerant and oil.

E. Demonstrate system operation and verify specified performance. Refer to Section 23 0593.

3.03 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Train operating personnel in operation and maintenance of units.

D. Provide the services of the manufacturer's field representative to conduct training.

3.04 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Furnish service and maintenance of complete assembly for one year from Date of Substantial Completion.

END OF SECTION

SECTION 23 65 13 - FORCED-DRAFT COOLING TOWERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cooling tower.

1.02 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

B. Section 23 0513 - Common Motor Requirements.

C. Section 23 0548 - Vibration Controls for Piping & Equipment.

D. Section 23 0593 - Testing, Adjusting, & Balancing for HVAC.

E. Section 23 2113 - Hydronic Piping.

F. Section 23 2123 - Hydronic Pumps.

G. Section 23 6416 - Centrifugal Water Chillers.

H. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.

B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; 2014.

C. ASME PTC 23 - Atmospheric Water Cooling Equipment; 2003, Reaffirmed 2014.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

G. CTI ATC-105 - Acceptance Test Code; 2000.

H. FM Global Property Loss Prevention Data Sheet 1-6 Cooling Towers

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, dimensions, weights and point loadings, accessories, required clearances, electrical requirements and wiring diagrams, and location and size of field connections. Submit schematic indicating capacity controls.

C. Shop Drawings: Indicate suggested structural steel supports including dimensions, sizes, and locations for mounting bolt holes.

D. Manufacturer's Certificate: Certify that cooling tower performance, based on ASME PTC 23 meets or exceeds specified requirements and submit performance curve plotting leaving water temperature against wet bulb temperature.

E. Manufacturer's Certificate: Certify that cooling tower is approved by FM Gloabal, and meets all requirements of FM Global Property Loss Prevetion Data Sheet 1-6 Cooling Towers.

F. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.

G. Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories.

H. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Factory assemble entire unit. For shipping, disassemble into as large as practical sub-assemblies so that minimum amount of field work is required for re-assembly.

B. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide a five year warranty to include coverage for corrosion resistance of cooling tower structure labor only.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. SPX Cooling Technologies/Marley: www.spxcooling.com.

1. Marley is the basis of design; alternate manufacturers shall meet all of the requirements of this portion of the specification, the requirements of the equipment schedules on the drawings (including opeerating weight) and shall fit in the space allocated on the drawings.

B. EVAPCO, Inc: www.evapco.com

C. Baltimore Aircoil Company: www.baltimoreaircoil.com

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MANUFACTURED UNITS

A. Provide units for outdoor use, factory assembled, sectional, counterflow, vertical discharge, blow through design, with fan assemblies built into pan and casing.

2.03 COMPONENTS

A. Casing: Galvanized steel, 12 gage, 0.1046 inch for casing and 8 gage, 0.1644 inch for reinforcing angles and channels with access doors at both ends of tower to air plenum.

B. Collection Basin: Welded, 301L stainless steel.

C. Fans: Multi blade, cast aluminum, axial type, with a right angle, industrial duty, oil lubricated gersedspeed reducer,that requires no oil change for the first five years of operation, bearings with ABMA STD 9 or ABMA STD 11 L-10A life at 100,000 hours. Provide any required modifications to enable operation at 10% of full speed.

D. Motor: Single speed 1800 rpm, 460 V, 3 Ph, 20HP maximum, NEMA Premium Efficiency, TEFC, 1.15 service factor, inverter duty, variable torque, specifically insulated for cooling tower duty (Class F). Motoer shall operate in the shaft-horizontal position. Refer to Section 23 0513.

E. The motor to gearbox close coupling shall be a tire-type, single piece, flexible element design to accommodate frequency speed changes inherent with VFD operation.

F. Fan Guard: Welded steel rod and wire guard, hot dipped galvanized after fabrication.

G. Safety: Safety railings, and ladder with safety cage from grade to fan deck, and maintenance platforms.

H. Distribution Section: Polyvinyl chloride piping header and branches with ABS plastic spray nozzles.

I. Fill:

1. Fill type, thermoformed of polyvinyl chloride plastic with flame spread index of 5 or less, when tested in accordance with ASTM E84.
2. Suspended from hot dip galvanized structural tubing supported from the tower structure, elevated above floor of cold water basin..
3. Fungal Resistance: No growth when tested according to ASTM G21.

J. Drift Eliminators: Triple pass PVC, , drift loss limited to 0.005% or less of the design water flow rate.

K. Float Valves: Brass or bronze balanced piston type make-up valve with plastic or copper float.

L. Hardware: Galvanized steel nuts, bolts, washers, and nails; assembled with phenolic epoxy coated, corrosion resistant washer head fasteners.

M. Galvanized Steel Sheet Components: Hot-dipped galvanized, ASTM A653/A653M, with G-235 coating.

N. Tower structure, anchorage, and all of its components shall be designed to withstand a wind load of 30 psf, as well as a 0.3g seismic load. Fan deck, hot water basin covers, and maintenance platforms shall be designed for a 60psf live load, or a 200 lb concentrated load. Guardrails shall be capable of withstanding a 200 lb concentrated live load in any direction, and shall be designed i accordance with OSHA guidellines.

2.04 PERFORMANCE REQUIREMENTS

A. For performance requirements see equipment schedules on the drawings.

2.05 ACCESSORIES

A. Electric Immersion Heaters: In pan suitable to maintain temperature of water in pan at 42 degrees F when outside temperature is 0 degrees F and wind velocity is 15 mph; immersion thermostat and float control operate heaters on low temperature when the pan is filled.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide the services of the manufacturer's field representative to supervise rigging, hoisting, and installation, allowing for minimum of one eight hour day per tower.

C. Install tower on structural steel beams as instructed by manufacturer.

D. Install tower on vibration isolators. Refer to Section 23 0548.

E. Connect condenser water piping with flanged connections to tower. Pitch condenser water supply to tower and condenser water suction away from tower. Refer to Section 23 2113.

F. Connect make-up water piping with flanged or union connections to tower. Pitch to tower. Refer to Section 22 1005.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Provide the services of the manufacturer's field representative to inspect tower after installation and submit report prior to start-up, verifying installation is in accordance with specifications and manufacturer's recommendations.

C. Test for capacity under actual operating conditions in accordance with CTI ATC-105 and verify specified performance.

1. Refer to Section 23 0593.

3.03 SYSTEM STARTUP

A. Start-up tower in presence of and instruct Owner's operating personnel.

END OF SECTION

SECTION 23 73 13 - MODULAR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Casing construction.

B. Fan section.

C. Coil section.

D. Filter and air cleaner section.

E. Damper section.

F. Multizone section (MZ-1).

G. Access section.

H. Turning and discharge plenum section (MZ-1).

I. Controls.

J. Roof mounting curb (MZ-1).

1.02 RELATED REQUIREMENTS

A. Section 23 0513 - Common Motor Requirements.

B. Section 23 0548 - Vibration Controls for Piping & Equipment.

C. Section 23 0593 - Testing, Adjusting, & Balancing for HVAC.

D. Section 23 0719 - HVAC Piping Insulation.

E. Section 23 3300 - Air Duct Accessories: Flexible duct connections.

F. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.

B. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001 (R2011).

C. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; http://www.amca.org/certified/search/company.aspx.

D. AMCA 99 - Standards Handbook; 2010.

E. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2007.

F. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

G. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

H. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2012.

I. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2012.

J. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; 2016.

K. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013, Including All Amendments and Errata.

L. ASTM B177/B177M - Standard Guide for Engineering Chromium Electroplating; 2011.

M. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

N. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).

O. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

P. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other trades for installation of roof mounted air handling units on roof curbs.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data:

1. Published Literature: Indicate dimensions, weights, capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.
2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

C. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

D. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

E. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

F. Manufacturer's Instructions: Include installation instructions.

G. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.07 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier Corporation: www.carrier.com.

B. Daikin Applied: www.daikinapplied.com.

C. Trane Inc: www.trane.com.

D. York International Corporation / Johnson Controls Inc: www.york.com.

2.02 CASING CONSTRUCTION

A. Full Perimeter Base Rail:

1. Construct of galvanized steel.
2. Provide base rail of sufficient height to raise unit for external trapping of condensate drain pans.

B. Casing:

1. Casing for multi-zone unit (MZ-1) will be constructed of one piece, insulated double panels. Casing for single zone unit (AHU-1) will be multiple sections, each constructed of insulated double panels, suitable for assembly at consturction site. See drawings for additional information
2. Provide mid-span, no through metal, internal thermal break.
3. Construct outer panels of galvanized steel and inner panels of galvanized steel.
4. Casing Air Pressure Performance Requirements:
    a. Able to withstand up to 8 inches w.g. positive or negative static pressure.
    b. Not to exceed 0.0042 inches per inch deflection at 1.5 times design static pressure up to a maximum of plus 8 inches w.g. in positive pressure sections and minus 8 inches w.g. in negative pressure sections.

C. Access Doors:

1. Construction, thermal and air pressure performance same as casing.
2. Provide surface mounted handles on hinged, swing doors.

D. Outdoor Unit Roof (MZ-1):

1. Factory install single layer outer roof above inner roof.
2. Slope at a minimum of 0.125 inches per foot from one side of unit to the other side, or from center to sides of unit.
3. Roof assembly to overhang each unit wall or base rail to overhang curb to facilitate water runoff and prevent water intrusion into roof curb to base connection.

E. Outside Air and Exhaust Air Weather Hood (MZ-1):

1. Fabricate from same material as casing outer panel.
2. Extend hood past perimeter of unit casing opening so as not to instruct airflow path.
3. Paint hoods with same finish as external surface of outdoor units.
4. Provide inlet hood for each fresh air damper with a sine wave moisture eliminator to prevent entrainment of water into the unit from outside air.
5. Provide exhaust hoods for each exhaust air opening.
6. Size each hood for 100 percent of nominal fresh air damper capacities.
7. Protect each hood with bird screen to prevent nesting at intake or exhaust air flow paths.

F. Unit Flooring: Construct with sufficient strength to support expected people and equipment loads associated with maintenance activities.

G. Casing Leakage: Seal joints and provide airtight access doors so that air leakage does not exceed one percent of design flow at the specified casing pressure.

H. Insulation:

1. Provide minimum thermal thickness of 12 R throughout.
2. Completely fill panel cavities in each direction to prevent voids and settling.
3. Comply with NFPA 90A.

I. Drain Pan Construction:

1. Provide cooling coil sections with an insulated, double wall, stainless steel drain pan complying with ASHRAE Std 62.1 for indoor air quality and sufficiently sized to collect all condensate.
2. Slope in two planes to promote positive drainage and eliminate stagnate water conditions.

3. Locate outlet of sufficient diameter at lowest point of pan to prevent overflow at normal operating conditions.

4. Provide threaded drain connections constructed of drain pan material, extended sufficient distance beyond the base to accommodate field installed, condensate drain trapping.

J. Louvers: Stationary, of galvanized steel, 4 inch deep with plenum, nylon bearings, 1/2 inch mesh, 0.04 inch galvanized wire bird screen in aluminum frame, and bearing AMCA Certified Ratings Seal in accordance with AMCA 500-L. Furnish adjustable louvers with hollow vinyl bulb edging on blades and foam side stops to limit leakage to maximum 2 percent at 4 inch wg differential pressure when sized for 2000 fpm face velocity.

K. Finish:

1. Outdoor Units (MZ-1):

a. Coat external surface of unit casing with primer and minimum 1.5 mil, enamel paint finish.

b. Comply with salt spray test in accordance with ASTM B177/B177M.

c. Color: Manufacturer's standard color.

2. Indoor Units (AHU-1):

a. Provide exterior, galvanized steel panels with painted surface complying with ASTM B177/B177M.

b. Color: Manufacturer's standard color.

2.03 FAN SECTION

A. Type: (MZ-1): Centrifugal double width, double inlet, Class 2.

B. Type: (AHU-1): Multi-fan, centifugal plenum fan, Class 2.

C. Type: Forward curved, single width, single inlet, centrifugal plug type fan, conforming to AMCA 99.

D. Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.

E. Sound Ratings: AMCA 301; tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.

F. Bearings: Self-aligning, grease lubricated, with lubrication fittings extended to exterior of casing with plastic tube and grease fitting rigidly attached to casing.

G. Mounting:

1. Locate fan and motor internally on welded steel base coated with corrosion resistant paint.
2. Factory mount motor on slide rails.
3. Provide access to motor, drive, and bearings through removable casing panels or hinged access doors.
4. Mount base on vibration isolators.

H. External Motor Junction Box: Factory mount NEMA 4 external junction box and connect to extended motor leads from internally mounted motors.

I. Motor Wiring Conduit: Factory wire fan motor wiring to the unit mounted external motor junction box.

J. Flexible Duct Connections:

1. For separating air handling unit from supply and return ductwork.
2. Refer to Section 23 3300.

K. Drives:

1. Conform to AMCA 99.
2. Bearings: Heavy duty pillow block type, ball bearings, with ABMA STD 9, L-10 life at 50,000 hours.
3. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.
4. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts, and keyed. Variable and adjustable pitch sheaves for motors 15 hp and under selected so required rpm is obtained with sheaves set at mid-position; fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
5. Belt Guard: Fabricate to SMACNA (DCS); 0.106 inch thick, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

2.04 COIL SECTION

A. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends exposed outside casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.

B. Drain Pans: 24 inch downstream of coil and down spouts for cooling coil banks more than one coil high.

C. Eliminators: Three break of galvanized steel, mounted over drain pan.

D. Air Coils:

1. Certify capacities, pressure drops, and selection procedures in accordance with AHRI 410.

E. Fabrication:

1. Tubes: 5/8 inch OD seamless copper expanded into fins, brazed joints.
2. Fins: Aluminum.
3. Casing: Die formed channel frame of galvanized steel.

F. Water Heating Coils:

1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
2. Configuration: Drainable, with threaded plugs for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.

G. Water Cooling Coils:

1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
2. Configuration: Drainable, with threaded plugs for drain and vent; threaded plugs in return bends and in headers opposite each tube.

2.05 FILTER AND AIR CLEANER SECTION

A. General: Provide filter sections with filter racks, minimum of one access door for filter removal, and filter block-offs to prevent air bypass.

B. See equipment schedules for filter requirements

C. Differential Pressure Gage:

1. Provide factory installed dial type differential pressure gage, flush mounted with casing outer wall, and fully piped to both sides of each filter to indicate status.
2. Maintain plus/minus 5 percent accuracy within operating limits of 20 degrees F to 120 degrees F.

2.06 DAMPER SECTION

A. Mixing Section: (MZ-1 only)Provide a functional section to support the damper assembly for modulating the volume of outdoor and return air.

B. Damper Blades:

1. Double-skin airfoil design with metal, compressible jamb seals and extruded-vinyl blade-edge seals on each blade.
2. Self-lubricating stainless steel or synthetic sleeve bearings.
3. Comply with ASHRAE Std 90.1 I-P for rated maximum leakage rate.
4. Provide leakage testing and pressure ratings in compliance with AMCA 500-D test methods.
5. Arrange in parallel or opposed-blade configuration.

2.07 MULTIZONE SECTION (MZ-1)

A. Two-Deck Multizone:

1. Provide cooling coil in the lower deck and heating coil in the upper deck.
2. Pressure drop equalization baffles balance air pressure drop through each deck.
3. Multizone Damper Construction:
   a. Double-skin airfoil design.
   b. Metal, compressible jamb seals.
   c. Extruded vinyl edge seals on each blade.
   d. Stainless steel ball bearings.
   e. Maximum Damper Leakage: 11 cfm per sq ft at 1.0 inch w.g..

2.08 ACCESS SECTION

A. Provide as required to allow for inspection, cleaning, and maintenance of field installed components.

B. Construct access doors same as previously specified within this Section.

2.09 TURNING AND DISCHARGE PLENUM SECTION (MZ-1)

A. Provide plenum to efficiently turn and discharge air.

1. Scale plenum vertical height to accommodate discharge duct height.
2. Scale plenum horizontal length to accommodate required dimensional constraints.

B. Acoustical Liner:

1. Fabricate from corrosion-proof, perforated stainless steel with completely encapsulated fiberglass insulation.
2. Prevent breakaway, flake off, or delamination when tested at 9000 fpm in accordance with UL 181.

2.10 CONTROLS

A. All controls to be provided by BMS contractor.

B. Combination Starter-Disconnects:

1. Provide combination starter-disconnect for each fan motor.

2. Factory mount in full metal enclosure and wire to fan motor.

3. Mount starter-disconnect on fan section externally in a NEMA 1 enclosure within a dedicated controls section or housed fan section.

a. Internal Enclosure Construction Characteristics:
1) Integral part of unit casing to allow for thermal venting to casing interior.
2) Accessible from unit exterior via access door.
3) Construction of access doors same throughout unit.

4. Include circuit breaker disconnect with through-the-door interlocking handle for externally mounted starters, spring loaded, and designed to rest only in the full and lockable ON or OFF state.

2.11 ROOF MOUNTING CURB (MZ-1)

A. Roof Mounting Curb: 14 inches high galvanized steel, channel frame with gaskets and nailer strips.

B. Include roof curb accessories for each roof mounted unit.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Bolt sections together with gaskets (AHU-1).

C. Isolate air handling unit from ductwork with flexible duct connections.

D. Install assembled unit on vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads. Install restraining snubbers as indicated. Refer to Section 23 0548. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

E. Provide fixed sheaves required for final air balance.

F. Make connections to coils with unions or flanges.

G. Hydronic Coils:

1. Hydronic Coils: Connect water supply to leaving air side of coil (counterflow arrangement).
2. Provide shut-off valve on supply line and lockshield balancing valve with memory stop on return line.
3. Locate water supply at bottom of supply header and return water connection at top.
4. Provide manual air vents at high points complete with stop valve.
5. Ensure water coils are drainable and provide drain connection at low points.

H. Cooling Coils:

1. Pipe drain and overflow to nearest floor drain.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Final Acceptance Requirements:

1. Use dial indicator gages to demonstrate fan and motor are aligned.
2. Verify conformance to specifications using vibration analysis.
3. Maximum Vibration Levels:
   a. 0.075 inch per second at 1 times run speed and at fan/blade frequency.
   b. 0.04 inch per second at other multiples of run speed.

3.03 SYSTEM STARTUP

A. Provide manufacturer's field representative to perform systems startup.

B. Prepare and start equipment and systems in accordance with manufacturers' instructions and recommendations.

C. Adjust for proper operation within manufacturer's published tolerances.

3.04 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation of equipment to Owner's designated representative.

D. Demonstration: Demonstrate operation of system to Owner's personnel.

1. Use operation and maintenance data as reference during demonstration.

2. Conduct walking tour of project.

3. Briefly describe function, operation, and maintenance of each component.

E. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

2. Provide minimum of two hours of training.

3. Instructor: Manufacturer's training personnel.

4. Location: At project site.

3.05 SCHEDULES

A. See equipment schedules on drawings for capacity requirements and electrical characteristics.

END OF SECTION

SECTION 26 05 01 - MINOR ELECTRICAL DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

PART 3 EXECUTION

2.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Owner before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

2.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
2. Make temporary connections to maintain service in areas adjacent to work area.

2.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in

accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Repair adjacent construction and finishes damaged during demolition and extension work.

H. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

I. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

2.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Wiring connectors.

C. Electrical tape.

D. Wire pulling lubricant.

E. Cable ties.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0501 - Minor Electrical Demolition: Disconnection, removal, and/or extension of existing electrical conductors and cables.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

G. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2009.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

K. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

L. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

M. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

N. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductor Material:

1. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.

2. Tinned Copper Conductors: Comply with ASTM B33.

H. Minimum Conductor Size:

1. Branch Circuits: 12 AWG.

a. Exceptions:
1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.

3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.

2. Control Circuits: 14 AWG.

I. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

J. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.

2. Color Coding Method: Integrally colored insulation.

3. Color Code:

a. 480Y/277 V, 3 Phase, 4 Wire System:
1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral/Grounded: Gray.

b. 208Y/120 V, 3 Phase, 4 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.

c. Equipment Ground, All Systems: Green.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:

1. Copper Building Wire:

a. Cerro Wire LLC: www.cerrowire.com.

b. Encore Wire Corporation: www.encorewire.com.

c. Southwire Company: www.southwire.com.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:

1. Feeders and Branch Circuits:

a. Size 10 AWG and Smaller: Solid.

b. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:

1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

2.04 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

2.05 WIRING ACCESSORIES

A. Electrical Tape:

1. Manufacturers:

a. 3M: www.3m.com.

b. Plymouth Rubber Europa: www.plymouthrubber.com.

2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.

B. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

C. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
7. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

G. Install conductors with a minimum of 12 inches of slack at each outlet.

H. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

I. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

J. Make wiring connections using specified wiring connectors.

1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.

2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.

3. Do not remove conductor strands to facilitate insertion into connector.

4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.

K. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

L. Insulate ends of spare conductors using vinyl insulating electrical tape.

M. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

N. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

C. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal air ducts.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:

1. Use insulated copper conductors unless otherwise indicated.

a. Exceptions:
1) Use bare copper conductors where installed underground in direct contact with earth.
2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.

3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.

2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.

3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.

4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Identify grounding and bonding system components in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.13.

C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 0534 - Conduit: Additional support and attachment requirements for conduits.

C. Section 26 0537 - Boxes: Additional support and attachment requirements for boxes.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.

4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.

2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.

3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.

4. Do not use products for applications other than as permitted by NFPA 70 and product listing.

5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.

a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.

b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.

1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.

2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

1. Comply with MFMA-4.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: Also comply with Section 26 0534.

I. Box Support and Attachment: Also comply with Section 26 0537.

J. Secure fasteners according to manufacturer's recommended torque settings.

K. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 05 34 - CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Flexible metal conduit (FMC).

C. Liquidtight flexible metal conduit (LFMC).

D. Electrical metallic tubing (EMT).

E. Conduit fittings.

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems.

D. Section 26 0529 - Hangers and Supports for Electrical Systems.

E. Section 26 0537 - Boxes.

F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2015.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2015.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.

E. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

H. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

I. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

J. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

K. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).

D. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.

E. Exposed, Exterior: Use galvanized steel rigid metal conduit.

F. Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit.
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
3. Maximum Length: 6 feet unless otherwise indicated.

2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Minimum Conduit Size, Unless Otherwise Indicated:

1. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.

E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Allied Tube & Conduit: www.alliedeg.com.
2. Republic Conduit: www.republic-conduit.com.
3. Wheatland Tube Company: www.wheatland.com.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:

1. Manufacturers:
   a. Bridgeport Fittings Inc: www.bptfittings.com.
   b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
   c. Thomas & Betts Corporation: www.tnb.com.
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:

1. AFC Cable Systems, Inc; _____: www.afcweb.com.
2. Electri-Flex Company; _____: www.electriflex.com.
3. International Metal Hose; _____: www.metalhose.com.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:

1. AFC Cable Systems, Inc; _____: www.afcweb.com.

2. Electri-Flex Company; _____: www.electriflex.com.
3. International Metal Hose; _____: www.metalhose.com.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:

1. Manufacturers:
   a. Bridgeport Fittings Inc: www.bptfittings.com.
   b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
   c. Thomas & Betts Corporation: www.tnb.com.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.

2.06 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube & Conduit; _____: www.alliedeg.com.
2. Republic Conduit: www.republic-conduit.com.
3. Wheatland Tube Company; _____: www.wheatland.com.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:

1. Manufacturers:
   a. Bridgeport Fittings Inc: www.bptfittings.com.
   b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
   c. Thomas & Betts Corporation: www.tnb.com.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use compression (gland) or set-screw type.
   a. Do not use indenter type connectors and couplings.

2.07 ACCESSORIES

A. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
   3. Arrange conduit to maintain adequate headroom, clearances, and access.
   4. Arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.
   5. Arrange conduit to provide no more than 150 feet between pull points.
   6. Route conduits above water and drain piping where possible.
   7. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   8. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
   9. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
      a. Heaters.

b. Hot water piping.

c. Flues.

10. Group parallel conduits in the same area together on a common rack.

E. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.

2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

F. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.

2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.

3. Use suitable adapters where required to transition from one type of conduit to another.

4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.

5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.

6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.

7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

G. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.

2. Make penetrations perpendicular to surfaces unless otherwise indicated.

3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.

4. Conceal bends for conduit risers emerging above ground.

5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.

6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.

7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations.

Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.

8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

H. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.

2. Where conduits are subject to earth movement by settlement or frost.

I. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:

1. Where conduits pass from outdoors into conditioned interior spaces.

2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

J. Provide grounding and bonding in accordance with Section 26 0526.

3.03 FIELD QUALITY CONTROL

A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

B. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 05 37 - BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0534 - Conduit:

1. Conduit bodies and other fittings.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 2726 - Wiring Devices:

1. Wall plates.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
4. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
5. Minimum Box Size, Unless Otherwise Indicated:
6. Wall Plates: Comply with Section 26 2726.
7. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation; _____: www.cooperindustries.com.
    b. Hubbell Incorporated; Bell Products; _____: www.hubbell-rtb.com.
    c. Hubbell Incorporated; RACO Products; _____: www.hubbell-rtb.com.
    d. O-Z/Gedney, a brand of Emerson Industrial Automation; _____: www.emersonindustrial.com.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:

1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:

3. Junction and Pull Boxes Larger Than 100 cubic inches:

   a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Box Locations:

1. Unless dimensioned, box locations indicated are approximate.
2. Locate boxes as required for devices installed under other sections or by others.

E. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

F. Install boxes plumb and level.

G. Install boxes as required to preserve insulation integrity.

H. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

I. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

J. Close unused box openings.

K. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

L. Provide grounding and bonding in accordance with Section 26 0526.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 26 0573 - Power System Studies: Arc flash hazard warning labels.

C. Section 26 2726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:

1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.

2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.07 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

    a. Enclosed switches, circuit breakers, and motor controllers:
        1) Identify voltage and phase.
        2) Identify power source and circuit number. Include location when not within sight of equipment.
        3) Identify load(s) served. Include location when not within sight of equipment.

2. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.

3. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.

    a. Service equipment.

    b. Industrial control panels.

    c. Motor control centers.

    d. Elevator control panels.

e. Industrial machinery.

4. Arc Flash Hazard Warning Labels: Comply with Section 26 0573.

B. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.

2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Manufacturers:

a. Brimar Industries, Inc: www.brimar.com.

b. Kolbi Pipe Marker Co; _____: www.kolbipipemarkers.com.

c. Seton Identification Products; _____: www.seton.com.

2. Materials:

a. Indoor Clean, Dry Locations: Use plastic nameplates.

b. Outdoor Locations: Use stainless steel nameplates suitable for exterior use.

3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.

4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.

5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Manufacturers:

a. Brady Corporation; _____: www.bradyid.com.

b. Brother International Corporation: www.brother-usa.com.

c. Panduit Corp: www.panduit.com.

2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.

3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:

1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
    a. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
    a. Equipment Designation: 1/2 inch.
5. Color:
    a. Normal Power System: White text on black background.

2.03 WIRE AND CABLE MARKERS

A. Manufacturers:

1. Brady Corporation; _____: www.bradyid.com.
2. HellermannTyton; _____: www.hellermanntyton.com.
3. Panduit Corp: www.panduit.com.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A. Manufacturers:

1. Brady Corporation; _____: www.bradyid.com.
2. Brimar Industries, Inc: www.brimar.com.
3. Seton Identification Products; _____: www.seton.com.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:

1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.

E. Legend:

1. Markers for Voltage Identification: Highest voltage present.

F. Color: Black text on orange background unless otherwise indicated.

2.05 WARNING SIGNS AND LABELS

A. Manufacturers:

1. Brimar Industries, Inc: www.brimar.com.
2. Clarion Safety Systems, LLC; _____: www.clarionsafety.com.
3. Seton Identification Products; _____: www.seton.com.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:

1. Materials:
   a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic signs.
   b. Outdoor Locations: Use factory pre-printed STAINLESS STEEL signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Interior Components: Legible from the point of access.
6. Conductors and Cables: Legible from the point of access.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Secure rigid signs using stainless steel screws.

END OF SECTION

SECTION 26 05 73 - POWER SYSTEM STUDIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.

1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS

A. Section 26 0553 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

B. Section 26 2818 - Enclosed Switches.

1.03 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.

B. IEEE 141 - IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants; 1993 (Reaff 1999).

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata, 2003.

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.

F. IEEE 1584 - IEEE Guide for Performing Arc Flash Hazard Calculations; 2002, including 1584a (2004) and 1584b (2011) amendments.

G. NEMA MG 1 - Motors and Generators; 2016.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2015.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.

2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.

3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Submit study reports prior to or concurrent with product submittals.

2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.

C. Scheduling:

1. Arrange access to existing facility for data collection with Owner.

2. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Study preparer's qualifications.

C. Study reports, stamped or sealed and signed by study preparer.

D. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.

1. Include characteristic time-current trip curves for protective devices.

2. Identify modifications made in accordance with studies that:

a. Can be made at no additional cost to Owner.

b. As submitted will involve a change to the contract sum.

E. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.

F. Site-specific arc flash hazard warning labels.

G. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

1.06 POWER SYSTEM STUDIES

A. Scope of Studies:

1. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).

2. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.

a. Known Operating Modes:
1) Utility as source.
2) Generator as source.

B. General Study Requirements:

1. Comply with NFPA 70.

2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:

1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.

a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
1) Obtain up-to-date information from Owner.
2) Utility Company: EVERSOURCE.

b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.

c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.

d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.

e. Protective Devices:
   1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
   2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).

f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.

g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

2. Existing Installations:

   a. Provide the services of field testing agency or equipment manufacturer's representative to perform field data collection.

   b. Collect data on existing electrical distribution system necessary for completion of studies, including field verification of available existing data (e.g. construction documents, previous studies). Include actual settings for field-adjustable devices.

D. Short-Circuit Study:

1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.

2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:

   a. Maximum utility fault currents.

   b. Maximum motor contribution.

   c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Protective Device Coordination Study:

1. Comply with applicable portions of IEEE 242 and IEEE 399.

2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

3. Analyze protective devices and associated settings for suitable margins between time-current curves to achieve full selective coordination while providing adequate protection for equipment and conductors.

F. Arc Flash and Shock Risk Assessment:

1. Comply with NFPA 70E.

2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.

a. To clarify IEEE 1584 statement that "equipment below 240 V need not be considered unless it involves at least one 125 kVA or larger low-impedance transformer in its immediate power supply" for purposes of studies, study preparer to include equipment rated less than 240 V fed by transformers less than 125 kVA in calculations.

b. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.

3. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:

a. Maximum and minimum utility fault currents.

b. Maximum and minimum motor contribution.

c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

G. Study Reports:

1. General Requirements:

a. Identify date of study and study preparer.

b. Identify study methodology and software product(s) used.

c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.

d. Identify base used for per unit values.

e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.

f. Include conclusions and recommendations.

2. Short-Circuit Study:

a. For each scenario, identify at each bus location:
1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
2) Fault point X/R ratio.

3) Associated equipment short circuit current ratings.

b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.

3. Protective Device Coordination Study:

a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.

b. For each graph include (where applicable):
1) Partial single-line diagram identifying the portion of the system illustrated.
2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
3) Conductors: Damage curves.
4) Transformers: Inrush points and damage curves.
5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
6) Motors: Full load current, starting curves, and damage curves.
7) Capacitors: Full load current and damage curves.

c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
2) Include ground fault pickup and delay.
3) Include fuse ratings.
4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.

d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.

4. Arc Flash and Shock Risk Assessment:

a. For each scenario, identify at each bus location:
1) Calculated incident energy and associated working distance.
2) Calculated arc flash boundary.
3) Bolted fault current.
4) Arcing fault current.
5) Clearing time.
6) Arc gap distance.

b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

c. Identify locations where the calculated maximum incident energy exceeds 40 calories per sq cm.

1.07 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in the preparation of studies of similar type and complexity using specified computer software.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

PART 2 PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.

1. Materials: Comply with Section 26 0553.
2. Minimum Size: 4 by 6 inches.
3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
    a. Include the following information:
        1) Arc flash boundary.
        2) Available incident energy and corresponding working distance.
        3) Nominal system voltage.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install arc flash warning labels in accordance with Section 26 0553.

3.02 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Adjust equipment and protective devices for compliance with studies and recommended settings.

C. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.

3.03 CLOSEOUT ACTIVITIES

A. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.

1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.

END OF SECTION

SECTION 26 27 17 - EQUIPMENT WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 26 0534 - Conduit.

C. Section 26 0537 - Boxes.

D. Section 26 2726 - Wiring Devices.

E. Section 26 2818 - Enclosed Switches.

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R2015).

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
2. Determine connection locations and requirements.

B. Sequencing:

1. Install rough-in of electrical connections before installation of equipment is required.
2. Make electrical connections before required start-up of equipment.

1.05 SUBMITTALS

A. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 3 EXECUTION

2.01 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Receptacles.

B. Wall plates.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0537 - Boxes.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 2717 - Equipment Wiring: Cords and plugs for equipment.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Revision H, 2014.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

D. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R2015).

E. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2016.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

H. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

I. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.

2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.

3. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.

4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

2.02 RECEPTACLES

A. Manufacturers:

1. Hubbell Incorporated; _____: www.hubbell-wiring.com.

2. Leviton Manufacturing Company, Inc; _____: www.leviton.com.

3. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.

2. NEMA configurations specified are according to NEMA WD 6.

C. GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.

2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.

2.03 WALL PLATES

A. Manufacturers:

1. Hubbell Incorporated; _____: www.hubbell-wiring.com.

2. Leviton Manufacturing Company, Inc; _____: www.leviton.com.

3. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us

B. Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.

2. Size: Standard; _____.

3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of wiring devices provided under this section.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Install wiring devices plumb and level with mounting yoke held rigidly in place.

I. Install wall switches with OFF position down.

J. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

K. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed

outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

L. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

3.03 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Test each receptacle to verify operation and proper polarity.

C. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

D. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.04 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.05 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 28 18 - ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

B. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; _____: www.eaton.com.

B. General Electric Company; _____: www.geindustrial.com.

C. Schneider Electric; Square D Products; _____: www.schneider-electric.us.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.

2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:

1. Minimum Ratings:

a. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.

G. Provide with switch blade contact position that is visible when the cover is open.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

L. Heavy Duty Switches:

1. Comply with NEMA KS 1.

2. Conductor Terminations:

a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

B. Verify that mounting surfaces are ready to receive enclosed safety switches.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

C. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION