

1 **ADDENDUM NO. #1 (Rev 1/2023)**
2 **ISSUE DATE: June 5, 2024**

3
4
5 **RE: GOLDA MEIR LIBRARY**
6 **LUBAR CONFERENCE ROOM RENOVATION**
7 **UNIVERSITY OF WISCONSIN - MILWAUKEE**
8 **MILWAUKEE, WISCONSIN**
9 **UWM Project No. GML B1970 / UWSA Project No. B-23-001**

10
11 **BID SUBMISSION DUE by 1:00 PM, BID OPENING for AAC BIDDERS: 2:00 P.M., June 27, 2024**

12
13 **FROM: Indoor Air Quality Diagnostics**
14 **11611 W North Avenue, Suite 203**
15 **Wauwatosa, WI 53226**

16
17 **TO: Prospective Bidders**

18
19 This addendum forms a part of the Contract Documents and modifies the original Contract Documents dated **May**
20 **9, 2024**, as noted below. Acknowledge receipt of this Addendum by inserting the number and issue date of this
21 addendum in the blank space provided on the Bid Form. Failure to do so may subject the Bidder to
22 disqualification.

23
24 This Addendum consists of **four hundred twenty (420)** and the attached documents:
25 **Technical Specifications Division 4 thru 10, 22, 23, 26 thru 28**

26
27 **CHANGES TO BIDDING REQUIREMENTS:**

28
29 **1. Invitation to Bid Page A-2: Delete line 9 and replace with "Passcode 820674Dial In 1-507-473-4847"**

30
31 **CHANGES TO CONDITIONS OF THE CONTRACT:**

32
33 **2. None**

34
35 **CHANGES TO SPECIFICATIONS (DIVISIONS 2 THRU 34):**

36
37 **3. Insert Technical Specifications Division 4 thru 10, 22, 23, 26 thru 28**

38
39 **CHANGES TO DRAWINGS: Sheet G000 Remove "(FOR REFERENCE ONLY)" from Abatement Sheet H102**

40
41 **4. Sheet G000 Remove "(FOR REFERENCE ONLY)" from Abatement Sheet H102**

42 **5. Sheet G000 Remove "(FOR REFERENCE ONLY)" from Abatement Sheet H103**

43
44
45 **END OF ADDENDUM**

46
47 **Indoor Air Quality Diagnostics**
48 **11611 W North Avenue, Suite 203**
49 **Wauwatosa, WI 53226**

The Board of Regents Of The
University of Wisconsin System
C/O UWSA - Capital Planning &
Budget
780 Regent Street, Suite 239
Madison, Wisconsin 53715

UW-MILWAUKEE GOLDA MEIR LIBRARY LUBAR CONFERENCE ROOM RENOVATION

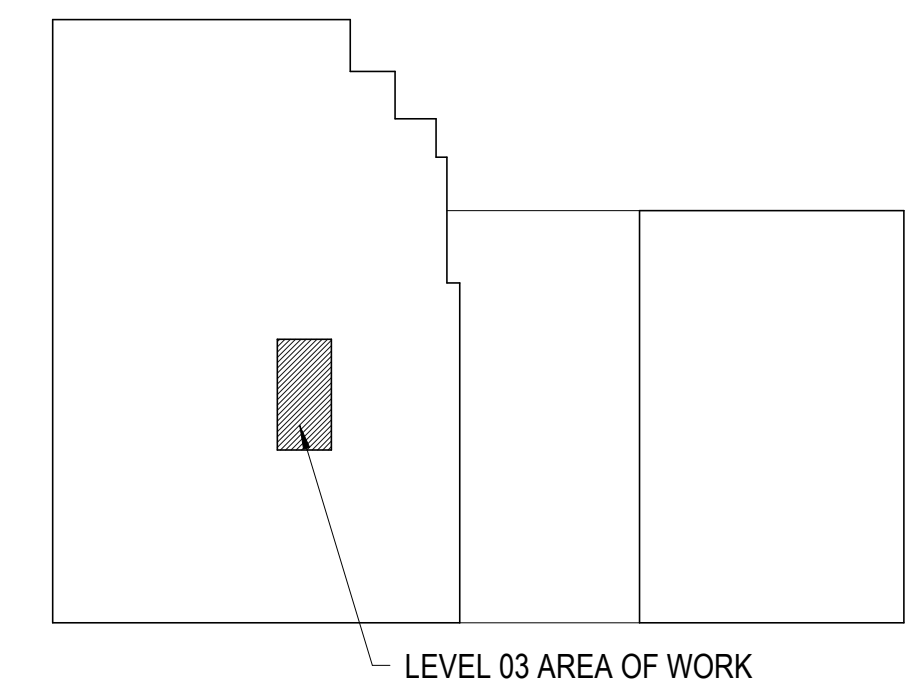
2311 E HARTFORD AVE.
MILWAUKEE, WI 53211



HGA

333 EAST ERIE STREET
MILWAUKEE, WISCONSIN 53202
TELEPHONE: 414.278.8200

KEY PLAN:



HGA COMMISSION NUMBER: 4200-026-00

MAY 24, 2024

MAP: 2311 E HARTFORD AVE. MILWAUKEE, WI 53211

BID SET

UWSA: B-23-001

GML B1970

NOTE: RENDERING NOT FOR CONSTRUCTION USE

PROJECT INFORMATION

PROJECT NAME: UW-MILWAUKEE - GOLDA MEIR LIBRARY - LUBAR CONFERENCE ROOM

PROJECT DESCRIPTION:
LEVEL 2 ALTERATION
CONFERENCE ROOM RENOVATION AND TOILET ROOM RELOCATION

OCCUPANCY:
A-3, LIBRARY

PROPOSED USE:
LIBRARY

PROJECT ADDRESS:
2311 E HARTFORD AVE.
MILWAUKEE, WI 53211

REQUIRED FIRE SEPARATION: _____ **TYPE OF CONSTRUCTION:** IA

HEIGHT OF BUILDING:
55' GROUND LEVEL TO 4TH FLOOR ROOF

PROJECT FLOOR AREA:
800 SF

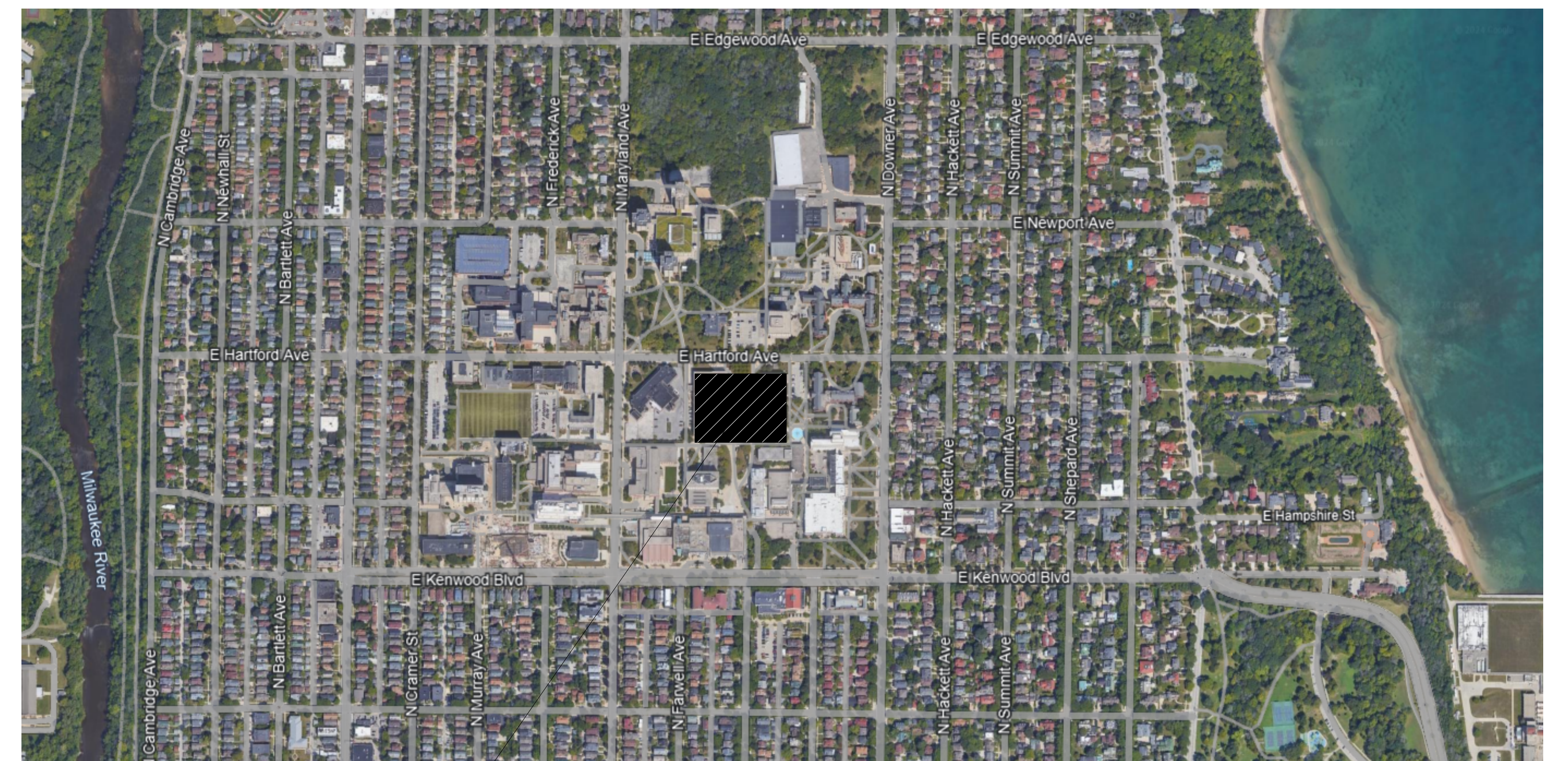
CONTACT INFORMATION

ARCHITECT: HAMMEL, GREEN AND ABRAHAMSON
CONTACT: KEVIN ALLEBACH

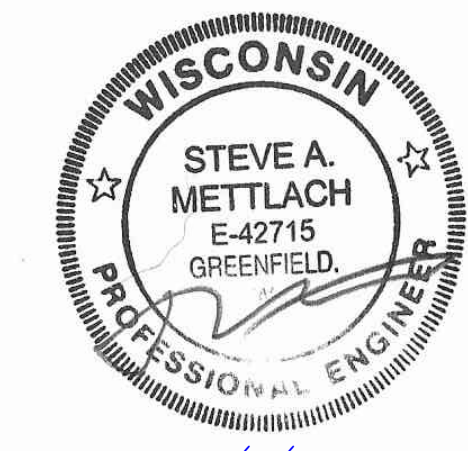
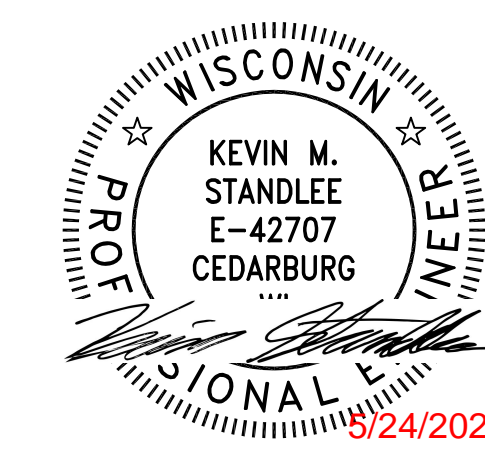
PHONE: (414) 278-3442
EMAIL: KALLEGACH@HGA.COM

DRAWING INDEX

REV #	NUMBER	SHEET NAME
1-GENERAL		
G000		COVERSHEET
G033		LIFE SAFETY PLAN LEVEL 03
8-ARCHITECTURAL		
A010		GENERAL NOTES AND SYMBOLS
A030		CONSTRUCTION LOGISTICS PLAN
A103		DEMOLITION PLAN - LEVEL 03
A202		CEILING PLAN - LEVEL 02
A203		FLOOR PLAN - LEVEL 03
A263		FLOOR FINISH PLAN - LEVEL 03
A600		TYPICAL MOUNTING HEIGHTS
A620		INTERIOR ELEVATIONS AND DETAILS
A660		TYPICAL INTERIOR PARTITION TYPES
A661		TYPICAL PARTITION DETAILS
A664		INTERIOR METAL STUD FRAMING DETAILS
A700		DOOR SCHEDULE
12-PLUMBING		
P001		PLUMBING GENERAL NOTES AND SYMBOLS
P202		PLUMBING FLOOR PLAN - LEVEL 2
P203		PLUMBING FLOOR PLAN - LEVEL 3
14-MECHANICAL		
M001		MECHANICAL ABBREVIATIONS, SYMBOLS, AND DETAILS
M203		HVAC FLOOR PLAN - LEVEL 3
16-ELECTRICAL		
E000		ELECTRICAL GENERAL NOTES AND SYMBOLS
E103		DEMOLITION PLAN - LEVEL 03
E203		LIGHTING PLAN - LEVEL 03
E303		ELECTRICAL PLANS
E600		ELECTRICAL DETAILS
E601		ELECTRICAL DETAILS
18-ABATEMENT		
H102		ASBESTOS ABATEMENT PLAN - LEVEL 02 (FOR REFERENCE ONLY)
H103		ASBESTOS ABATEMENT PLAN - LEVEL 03 (FOR REFERENCE ONLY)
Grand total: 27		



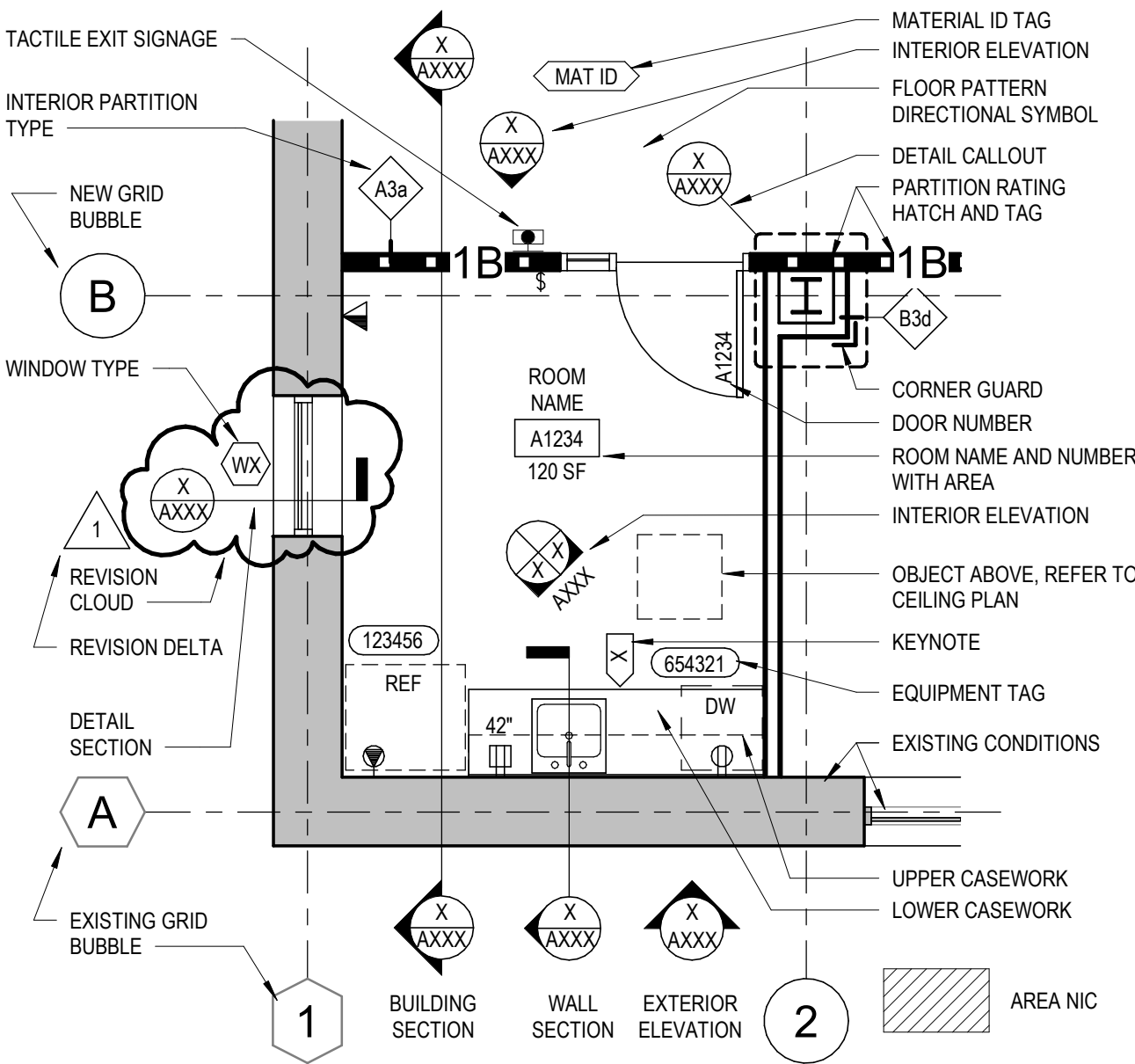
PROJECT LOCATION:



G000

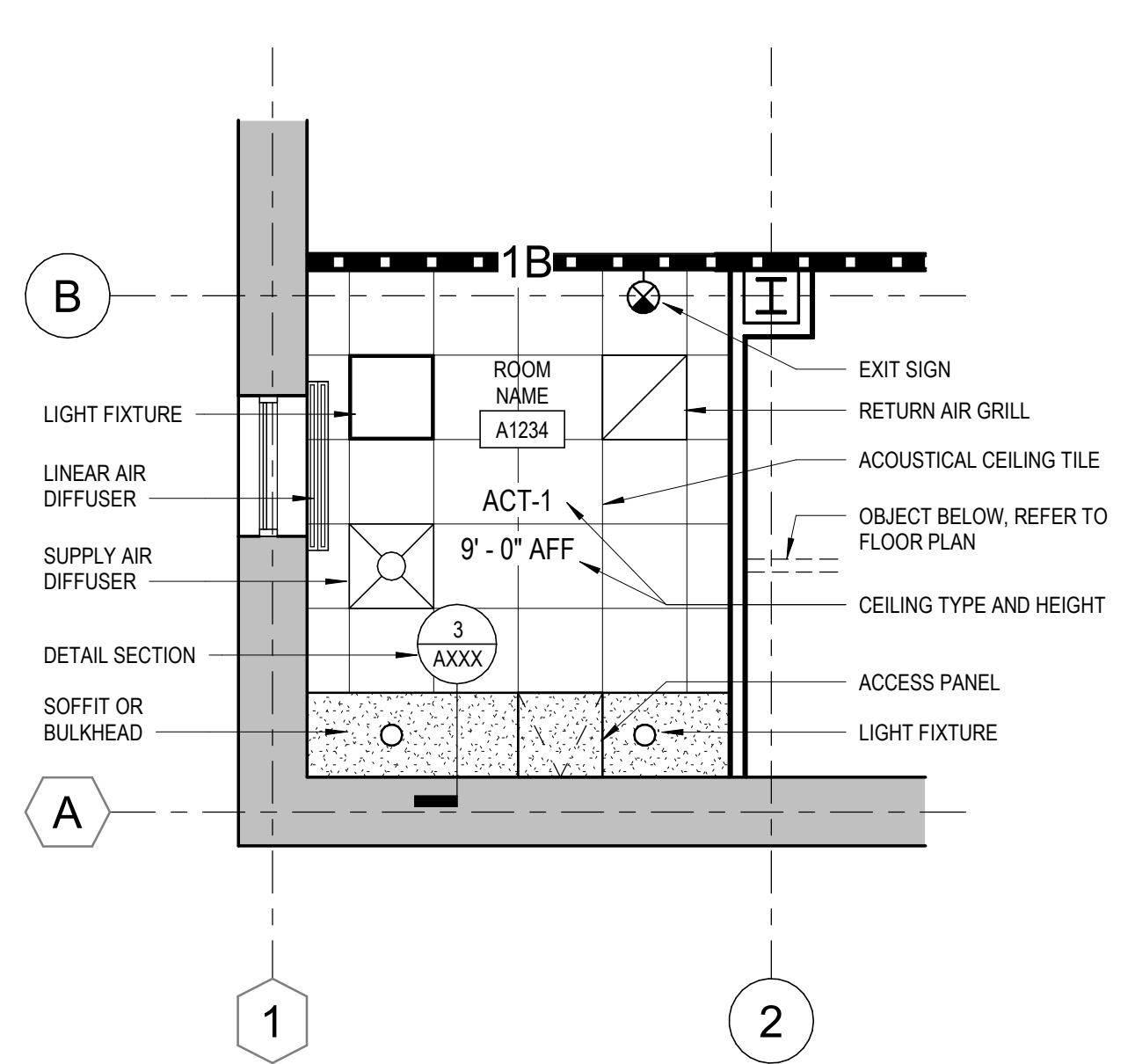
A	ARCHITECT/ENGINEER	FW	FACE OF WALL	PL	PLATE
AE	ARCHITECTURAL	FP	FILLER PANEL	PLAM	PLASTIC LAMINATE
ACOUS	ACOUSTICAL	FSTR	FASTENED (ER)	PLBG	PLUMBING
AD	ACCESS DOOR	FT	FOOT, FEET	PLYWD	PLYWOOD
ADA	THE AMERICANS WITH DISABILITIES ACT	FTG	FOOTING	PNEU	PNEUMATIC
ADD	ADDENDUM	F	FLOOR	PNL	PANEL
ADDL	ADDITIONAL	G	GAS	FR	PAIR
ADJ	ADJUSTABLE	GA	GAUGE	FRCAST	PRECAST
ADJC	ADJACENT	GALV	GALVANIZED	PREFAB	PREFABRICATED
AED	DEFIBRILATOR	GB	GRAB BAR	PTD	PAINTED
AF	ACCESS FLOOR	GC	GENERAL CONTRACTOR	PTN	PARTITION
AFF	ABOVE FINISH FLOOR	GEN	GENERATOR	PTS	PNEUMATIC TUBE STATION
AL	ALUMINUM	GL	GLASS	Q	QUANTITY
ALT	ALTERNATE	GR	GRADE	QTY	QUANTITY
AP	ACCESS PANEL	GWB	GYP/SLUM WALL BOARD	R	RADIUS; RADII; RISER (STAIR)
APPROX	APPROXIMATELY	H	HIGH, HEIGHT	RCP	REFLECTED CEILING PLAN
ARCH	ARCHITECTURAL	HB	HOSE BIB	RD	ROOF DRAIN
ASC	ABOVE SUSPENDED CEILING	HD	HEAD	REC	RECESSED
ASPH	ASPHALT	HDW	HARDWARE	RECP	RECEPTACLE
B	BOARD	HWD	HARDWOOD	REF	REFERENCE
BLDG	BUILDING	HGT	HEIGHT	REFR	REFRIGERATOR
BLKG	BLOCKING	HM	HOLLOW METAL	REIN	REINFORCE (ED) (ING) (EMENT)
BM	BEAM	HMD	HOLLOW METAL DOOR	REQD	REQUIRED
BO	BOTTOM OF	HO	HOLD OPEN	RESIL	RESILIENT
BOTT	BOTTLE	HORIZ	HORIZONTAL	REV	REVERSE (ED) (ION)
BRKT	BRACKET	HP	HIGH POINT	RHR	RIGHT HAND REVERSE
BS	BACKSPLASH	HR	HANDRAIL(S)	RM	ROOM
BSMT	BASEMENT	HT	HEIGHT	RO	ROUGH OPENING
BTW	BETWEEN	HVAC	HEATING, VENTILATION, AIR CONDITIONING	S	SCHEDULE
BYND	BEYOND	HYDR	HYDRAULIC	SECT	SECTION
C	C	I	INSIDE DIAMETER/DIMENSION	IN	INCHES
CAB	CABINET	INCL	INCLUDE (DED) (DING) (SIVE)	SFT	SQUARE FOOT/FEET
CEN	CENTER (TRAL)	INSUL	INSULATION (ED)	SHT	SHEETING
CFCI	CONTRACTOR FURNISHED, CONTRACTOR INSTALLED	INT	INTERIOR	SHTG	SHEATHING
CGR	CORNER GUARD	INTR	INTERIOR	SIM	SIMILAR
CIP	CAST IN PLACE	J	JANITOR	SKLT	SKYLIGHT(S)
CJ	CONTROL/CONSTRUCTION JOINT	JAN	JANITOR	SPEC(S)	SPECIFICATION(S)
CL	CENTER LINE	JKT	JOINT	SPK	SPEAKER
CLG	CEILING	JS	JOIST	SS	STAINLESS STEEL
CLR	CLEARANCE	JT	JOINT	ST	STREET
CLR	CLEAR	K	KNOCKOUT PANEL	STAG	STAGGER
CMPT	COMPOSITE	KOP	KNOCKOUT PANEL	STD	STANDARD
CMU	CONCRETE MASONRY UNIT	KPL	KICK PLATE	STL	STEEL
ONTFG	CENTRIFUGE	KNS	KNEE SPACE	STOR	STORAGE
CNTR	COUNTER	L	ANGLE (STRUC SHAPE)	STRUC	STRUCTURE (AL)
CO	CASED OPENING, CLEAN OUT	LAB	LABORATORY	SUSP	SUSPENDED
COL	COLUMN	LAV	LAVATORY	SYM	SYMMETRY (ICAL)
CONC	CONCRETE	LB	POUND	T	TREAD
CONN	CONNECTION	LB	POUND	T&G	TONGUE AND GROOVE
CONST	CONSTRUCTION	LGTH	LONG, LENGTH	TID	TELEPHONE DATA OUTLET
CONT	CONTINUOUS	LF	LINEAR FOOT	TEL	TELEPHONE
CONT	CONTINUOUS	LFFET	LINEAL FOOT, FEET	TEMP	TEMPORARY
CORR	CORRIDOR	LH	LEFT HAND	TER	TERRAZZO
CR	CARD READER	LHR	LEFT HAND REVERSE	THK	THICKNESS
CYL	CYLINDER	LKR	LOCKER	TME	TO MATCH EXISTING
D	D	LNTL	LINTEL	TO	TOP OF
DBL	DOUBLE	LT	LIGHT	TOB	TOP OF BEAM
DED	DEDICATED	LTG	LIGHTING	TOC	TOP OF CONCRETE
DEG	DEGREE	LTMW	LIGHTWEIGHT	TOS	TOP OF STEEL
DEMO	DEMOLISH (LITON)	LVL	LEVEL	TV	TELEVISION
DEPT	DEPARTMENT	LVR	LOUVER	TYP	TYPICAL
DET	DETAIL	M	MACHINE	U	UNDER CABINET
DF	DRINKING FOUNTAIN	MANT	MAINTENANCE	UCL	UNDER CABINET LIGHTING
DIA	DIAMETER	MAS	MASONRY	UNEX	UNEXCAVATED
DIM	DIMENSION	MATL	MATERIAL	UNFN	UNFINISHED
DISP	DISPENSER	MB	MARKERBOARD	UNO	UNLESS NOTED OTHERWISE
DN	DOWN	MECH	MECHANICALLY	UPS	UNINTERRUPTIBLE POWER SUPPLY
DO	DATA OUTLET	MED	MEDIUM	UR	ULTRAVIOLET
DR	DOOR	MEMB	MEMBRANE	V	METAL
DWG(S)	DRAWING(S)	MET	METAL	VAC	VACUUM
E	E	MEZZ	MEZZANINE	VAR	VARY (IES) (ATION)
(E), EXIST	EXISTING	MFR	MANUFACTURER	VCT	VINYL COMPOSITION TILE
E	ELEVATOR	MH	MANHOLE	VEN	VENEER
EA	EACH	MIN	MINIMUM	VERT	VERTICAL
EFS	EXTERIOR INSULATION FINISH SYSTEM	MIR	MIRROR	VERT	VERTICAL
EJ	EXPANSION JOINT	MISC	MISCELLANEOUS	VEST	VESTIBULE
EL	ELEVATION	NO	MASONRY OPENING	VIF	VERIFY IN FIELD
ELEC	ELECTRICAL	MT(D)	MOUNTED	W	WIDE, WIDTH
ELY	ELEVATOR	MTL	METAL	W	WITH
EMER	EMERGENCY	MUL	MULLION	WIO	WITHOUT
EMI	ELECTROMAGNETIC INTERFERENCE	MVBL	MOVABLE	WC	WATER CLOSET
ENCL	ENCLOSURE	N	NORTH, NITROGEN	WD	WOOD
EO	ELECTRICAL OUTLET	N/A	NOT APPLICABLE	WP	WATERPROOFING
EOS	EDGE OF SLAB	NEC	NECESSARY	WSCT	WAINSCOT
EP	ELECTRICAL PANEL	NIC	NOT IN CONTRACT	WT	WEIGHT
EPDM	ETHYLENE PROPYLENE DIENE MONOMER	NOG	NITROGEN OXIDE	X	DIAMETER
EPRF	EXPLOSION PROOF	NOM	NOMINAL	XP(D)	EXPOSE(D)
EQU	EQUAL	NTS	NOT TO SCALE		
EQUIP	EQUIPMENT	O	OXYGEN		
ETR	EXISTING TO REMAIN	OC	ON CENTER		
EXCL	EXCLUDE (ED) (ING)	OD	OUTSIDE DIAMETER/DIMENSION		
EXG	EXISTING	OF	OUTSIDE FACE		
EXH	EXHAUST	OFI	OWNER FURNISHED, CONTRACTOR INSTALLED		
EXP	EXPAND (SION)	OFF	OFFICE		
EXT	EXTERIOR	OFI	OWNER FURNISHED, OWNER INSTALLED		
EXTR	EXTERIOR	OFVI	OWNER FURNISHED, VENDOR INSTALLED		
F	F	OH	OVERHEAD		
FA	FACE TO FACE	OH	OPPOSITE HAND		
FACFP	FIRE ALARM PANEL	OHSC	OVERHEAD SERVICE CARRIER		
FAS	FASTENED (ER)	OPG	OPENING		
FB	FLAT BAR	OPP	OPPOSITE		
FDC	FLOOR CLEAN OUT	OPT	OPTIONAL		
FD	FLOOR DRAIN	PA	POWER ASSIST		
FDD	FIRE DEPARTMENT CONNECTION	PAR	PARALLEL		
FDN	FOUNDATION	PART	PARTICLE, PARTIAL		
FE	FIRE EXTINGUISHER	PB	PANIC BAR		
FEC	FIRE EXTINGUISHER CABINET	PC	PRECAST		
FF	FLOOR FINISH	PLN	PERFORATED		
FHC	FIRE HOSE CABINET	PERM	PERIMETER		
FHP	FULL HEIGHT PARTITION	PGBD	PEG BOARD		
FIN	FINISH				
FL	FLASHING				
FLN	FLOORING(S)				
FO	FACE OF				
FOC	FACE OF CONCRETE				

SPECIAL SYMBOLS			
&	AND	#	NUMBER
<	ANGLE(STRUC SHAPE)	/	PER
@	AT	⊥	PERPENDICULAR
⊕	CENTERLINE	±	PLUS/MINUS
φ	DIAMETER		



OTHER FLOOR PLAN SYMBOL DESIGNATIONS	
[Symbol]	EXISTING DOOR TO REMAIN
[Symbol]	EXISTING DOOR TO DEMO
[Symbol]	EXISTING WALL TO REMAIN
[Symbol]	EXISTING WALL TO DEMO
[Symbol]	NEW WALL
[Symbol]	TEMPORARY BARRIER
[Symbol]	NEW RATED WALL

1 SYMBOL DESIGNATIONS - FLOOR PLAN (REFERENCE)
1/4" = 1'-0"



OTHER CEILING PLAN SYMBOL DESIGNATIONS	
[Symbol]	RECESSED DOWNLIGHT
[Symbol]	RECESSED WALL WASHER
[Symbol]	PENDANT MOUNTED LIGHT FIXTURE
[Symbol]	CEILING MOUNTED EXIT LIGHT (SEE ELECTRICAL DRAWINGS)
[Symbol]	WALL MOUNTED EXT LIGHT (SEE ELECTRICAL DRAWINGS)
[Symbol]	SMOKE DETECTOR (SEE ELECTRICAL DRAWINGS)
[Symbol]	TV CONNECTION (SEE ELECTRICAL DRAWINGS)
[Symbol]	HORN (SEE ELECTRICAL DRAWINGS)
[Symbol]	TRACK LIGHT FIXTURE (SEE ELECTRICAL DRAWINGS)
[Symbol]	EQUIPMENT MOUNTING TRACKS
[Symbol]	SPRINKLER HEAD
[Symbol]	SPEAKER (SEE ELECTRICAL DRAWINGS)

2 SYMBOL DESIGNATIONS - CEILING PLAN (REFERENCE)
1/4" = 1'-0"

GENERAL NOTES

A. THESE GENERAL NOTES APPLY TO THE CONSTRUCTION DOCUMENTS AND SHALL GOVERN UNLESS NOTED OTHERWISE BY GENERAL NOTES OR KEYNOTES ON SPECIFIC SHEETS.

B. COORDINATE ALL PROJECT PHASING WITH OWNER OR AS SPECIFIED AND/OR SHOWN ON THE DRAWINGS.

C. PROVIDE A SAFE MEANS OF EGRESS THROUGH AND/OR AROUND THE BUILDING AND SITE PER APPLICABLE CODES AT ALL TIMES DURING THE CONSTRUCTION PROCESS. MINIMIZE DISRUPTION TO ADJACENT AREAS/FLOORS AS MUCH AS POSSIBLE.

D. MINIMIZE NOISE TO LEVEL ACCEPTABLE WITH THE OWNER. SCHEDULE TASKS CREATING EXCESSIVE NOISE OR NEAR SENSITIVE AREAS WITH THE OWNER.

E. PROVIDE DUST CONTROL BETWEEN CONSTRUCTION AREAS AND OCCUPIED AREAS AT ALL TIMES AS SPECIFIED.

F. NOTIFY ARCHITECT PROMPTLY IF INFORMATION SHOWN IN ONE CONSTRUCTION DOCUMENT CONFLICTS WITH INFORMATION SHOWN ON ANOTHER.

G. NOTIFY ARCHITECT PROMPTLY IF CONSTRUCTION DOCUMENTS ARE INCONSISTENT WITH THE CURRENT APPLICABLE CODES AND REGULATIONS.

H. NOTIFY ARCHITECT PROMPTLY IF ANY EXISTING CONDITIONS CONFLICT WITH THE CONSTRUCTION DOCUMENTS.

I. STRUCTURAL STEEL MEMBER PROFILES AS INDICATED ON ARCHITECTURAL DRAWINGS MAY VARY FROM ACTUAL PROFILES AND SIZES INDICATED ON THE STRUCTURAL DRAWINGS WHICH SHALL GOVERN.

J. COORDINATE EXACT LOCATIONS OF LIGHT FIXTURES, SPEAKERS, SMOKE DETECTORS, EXIT LIGHTS, ACCESS PANELS, SPRINKLER HEADS, HVAC DUCTS, DIFFUSERS, REGISTERS, AND OTHER CEILING ITEMS WITH MECHANICAL, ELECTRICAL AND OTHER TRADES. NOTIFY ARCHITECT PROMPTLY IF ANY LOCATIONS CONFLICT WITH ARCHITECTURAL REFLECTED CEILING PLANS.

K. REFER TO ARCHITECTURAL, STRUCTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS FOR FLOOR, WALL AND CEILING OPENINGS. ALL OPENINGS SHALL BE CUT AND PATCHED AS REQUIRED BY EACH DISCIPLINE OR TRADE REQUIRING THE OPENING UNLESS NOTED OTHERWISE IN THE CONSTRUCTION DOCUMENTS. PATCHING IS TO BE IN CONFORMANCE WITH APPLICABLE CODES.

L. WOOD BLOCKING WITHIN THE WALL SYSTEM SHALL BE FIRE RETARDANT TREATED. ALL EXTERIOR WOOD BLOCKING SHALL BE MOISTURE TREATED. WOOD MAY NOT BE USED IN AN EXPOSED LOCATION UNLESS IT IS A FINISH MATERIAL IN A NON-COMBUSTIBLE ASSEMBLY OR AS SPECIFIED.

333 East Erie Street
Milwaukee, Wisconsin 53202
Telephone 414.278.8200

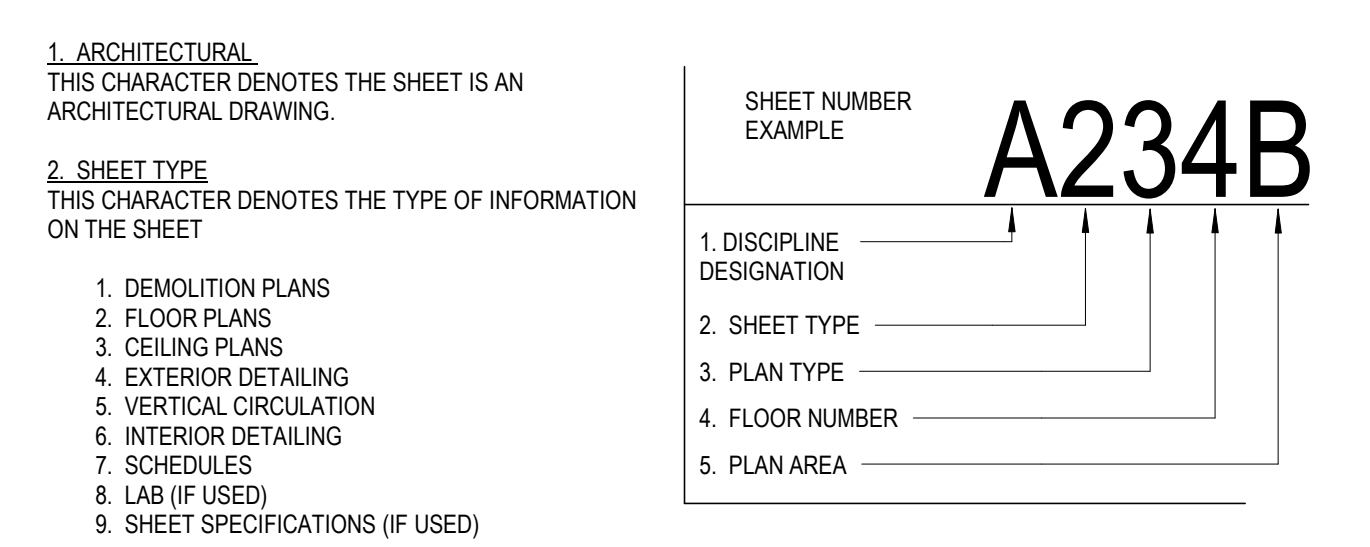
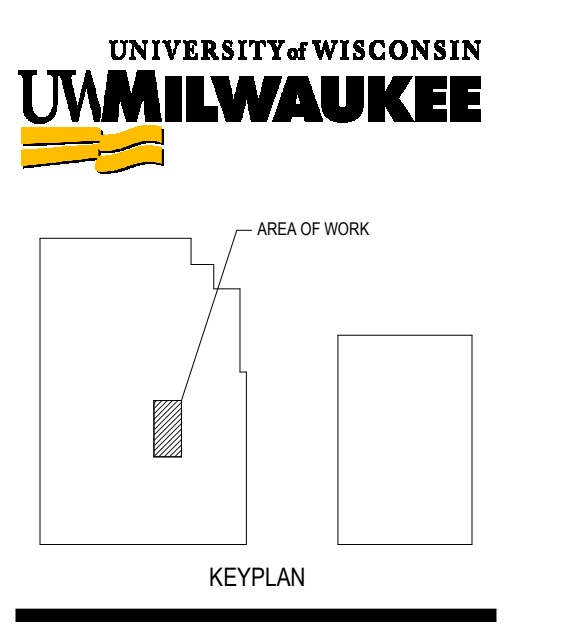
MECHANICAL/PLUMBING ENGINEER
ELECTRICAL ENGINEER

INTERIOR ARCHITECT
HGA ARCHITECTS AND ENGINEERS
333 E. ERIE ST
MILWAUKEE, WI 53202
414.278.8200

**UW-MILWAUKEE
GOLDA MEIR LIBRARY
LUBAR CONFERENCE
ROOM RENOVATION**

UWSA: B-23-001
GML B1970

2311 E HARTFORD
AVE.
MILWAUKEE, WI 53211



3 ARCHITECTURAL SHEET NUMBER DESIGNATIONS

- 1. ARCHITECTURAL**
THIS CHARACTER DENOTES THE SHEET IS AN ARCHITECTURAL DRAWING.
- 2. SHEET TYPE**
THIS CHARACTER DENOTES THE TYPE OF INFORMATION ON THE SHEET
 - DEMOLITION PLANS
 - FLOOR PLANS
 - CEILING PLANS
 - EXTERIOR DETAILING
 - VERTICAL CIRCULATION
 - INTERIOR DETAILING
 - SCHEDULES
 - LAB (IF USED)
 - SHEET SPECIFICATIONS (IF USED)
- 3. PLAN TYPE**
THESE CHARACTERS DENOTE THE SUB CATEGORY OF THE SHEET TYPE
- 4. FLOOR NUMBER**
THESE CHARACTERS DENOTE THE FLOOR SHOWN ON THE SHEET
- 5. PLAN AREA**
THESE CHARACTERS DENOTE THE AREA PLAN SHOWN ON THE SHEET (IF USED)

NO	DESCRIPTION	DATE

ISSUANCE HISTORY - THIS SHEET

HGA NO: 4200-026-00

**GENERAL NOTES
AND SYMBOLS**

DATE: MAY 24, 2024

BID SET

SEE SPECIFICATIONS FOR CONSTRUCTION SCHEDULE AND MILESTONES

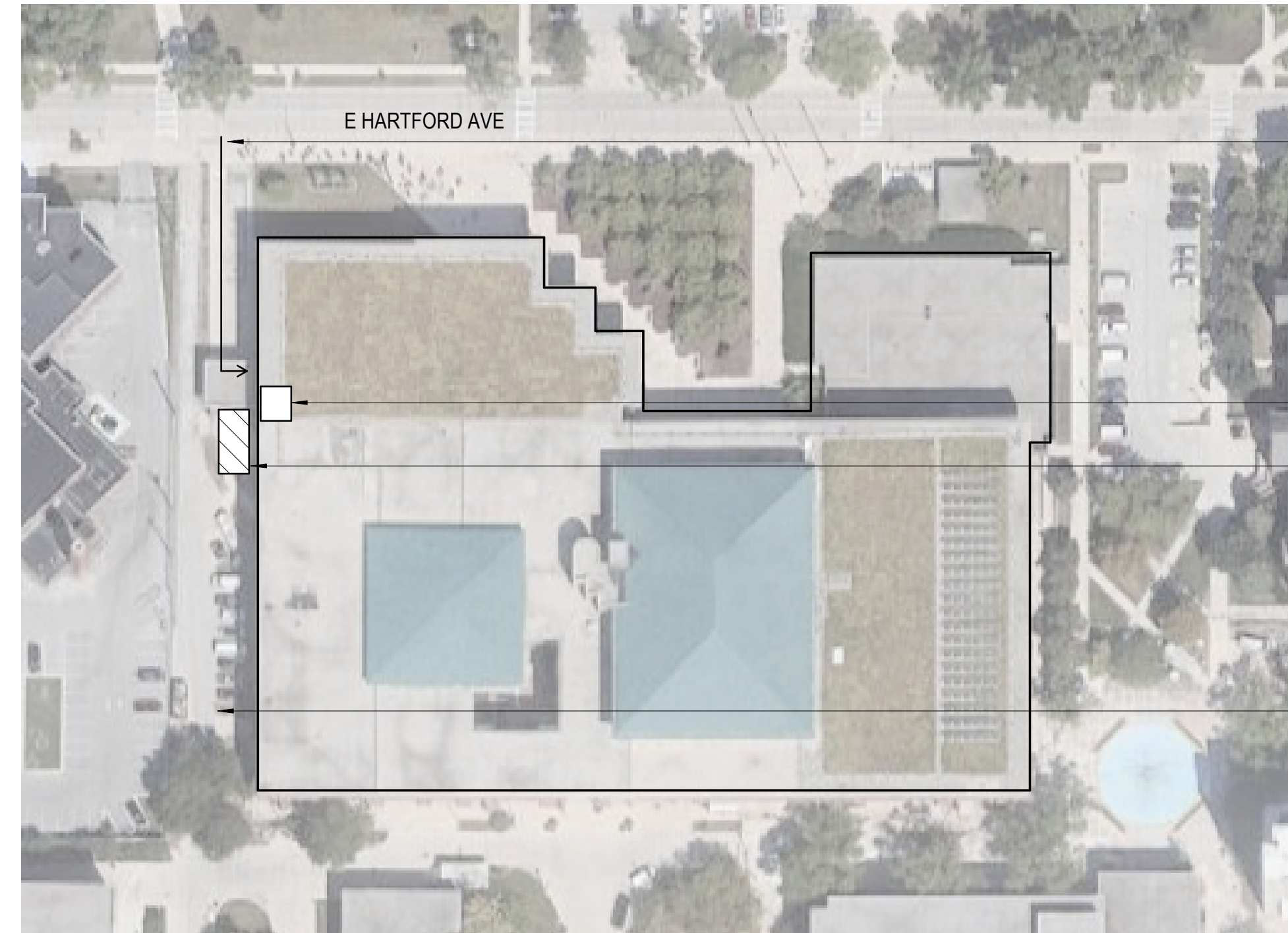
SEE SPEC

UW-MILWAUKEE 2024 SUMMER ACADEMIC CALENDAR

Summer Session Calendar 2024	
Graduation	May 19
Steam/Heat Shutdown	May 20-24
First Day of Summer Instruction	May 28
Last day of Summer Instruction	August 17
First Day of Fall Instruction	September 3

GENERAL NOTES:

- BUILDING WILL REMAIN OCCUPIED THROUGHOUT THE CONSTRUCTION DURATION.
- ALL CONTRACTORS TO WEAR HARD HATS, EYE PROTECTION & SAFETY VESTS AT ALL TIMES WHILE ON SITE.
- CONTRACTORS, TO THE EXTENT POSSIBLE, TO COORDINATE THEIR TASKS SO THAT NOISIEST ACTIVITIES OCCUR BETWEEN THE HOURS OF 6:30AM -9AM.
- CONTRACTORS ACCESS TO THE BUILDING IS LIMITED TO WORK AREAS, STAGING AREAS AND DIRECT TRAVEL TO AND FROM WORK AREAS.
- NO WORK (OTHER THAN NON-NOISE GENERATED ACTIVITIES, I.E. PAINTING, GROUTING, CLEANING) ON STUDY DAYS AND EXAM DAYS (SEE CALENDAR).
- CONSTRUCTION DELIVERIES SHALL HAPPEN IN THE MORNING DURING OFF-PEAK HOURS (6AM -10AM).
- CONTRACTOR TO MAXIMIZE WORK EFFORTS DURING STUDENT BREAKS / RECESSES. REFER TO ACADEMIC CALENDAR FOR OPPORTUNITIES FOR UNRESTRICTED CONSTRUCTION ACTIVITIES. CONTRACTOR TO COORDINATE WITH OWNER.
- THERE IS NO CONTRACTOR PARKING PROVIDED; CONTRACTORS ARE RESPONSIBLE FOR THEIR PARKING. CITY PARKING STRUCTURES ARE AVAILABLE NEARBY. CONTRACTORS MAY BE ABLE TO PURCHASE PARKING FROM TRANSPORTATION SERVICES.
- CONTRACTORS ARE RESPONSIBLE FOR PROVIDING DUST/DEBRIS CONTROL MEASURES TO ASSURE THE DUST/DEBRIS IS NOT TRACKED THROUGH CORRIDORS/OTHER AREAS OF THE BUILDING. CONTRACTORS ARE RESPONSIBLE FOR CLEANING UP ANY VISIBLE DUST/DEBRIS OUTSIDE OF THEIR WORK AREAS ON A DAILY BASIS.
- CONTRACTOR CONVERSATIONS WITH STUDENTS IS TO BE MINIMIZED.
- THE DESIGNATED WORK AREA IS THE ONLY AREA IN THE BUILDING THAT IS AVAILABLE AS A STAGING AREA OR AREA FOR MATERIAL LAY DOWN.
- CONTRACTOR IS TO PROVIDE A FULL TEMPORARY ENCLOSURE TO SEPARATE THE WORK AREA FROM THE CORRIDOR.
- NO CONTRACTOR PARKING; UNIVERSITY LOTS MUST BE OPEN AND AVAILABLE FOR UEM AT ALL TIMES. CONTRACTOR TO PROVIDE THEIR OWN PARKING ARRANGEMENT AND/OR UTILIZE CITY REGULATED STREET PARKING SERVICES.

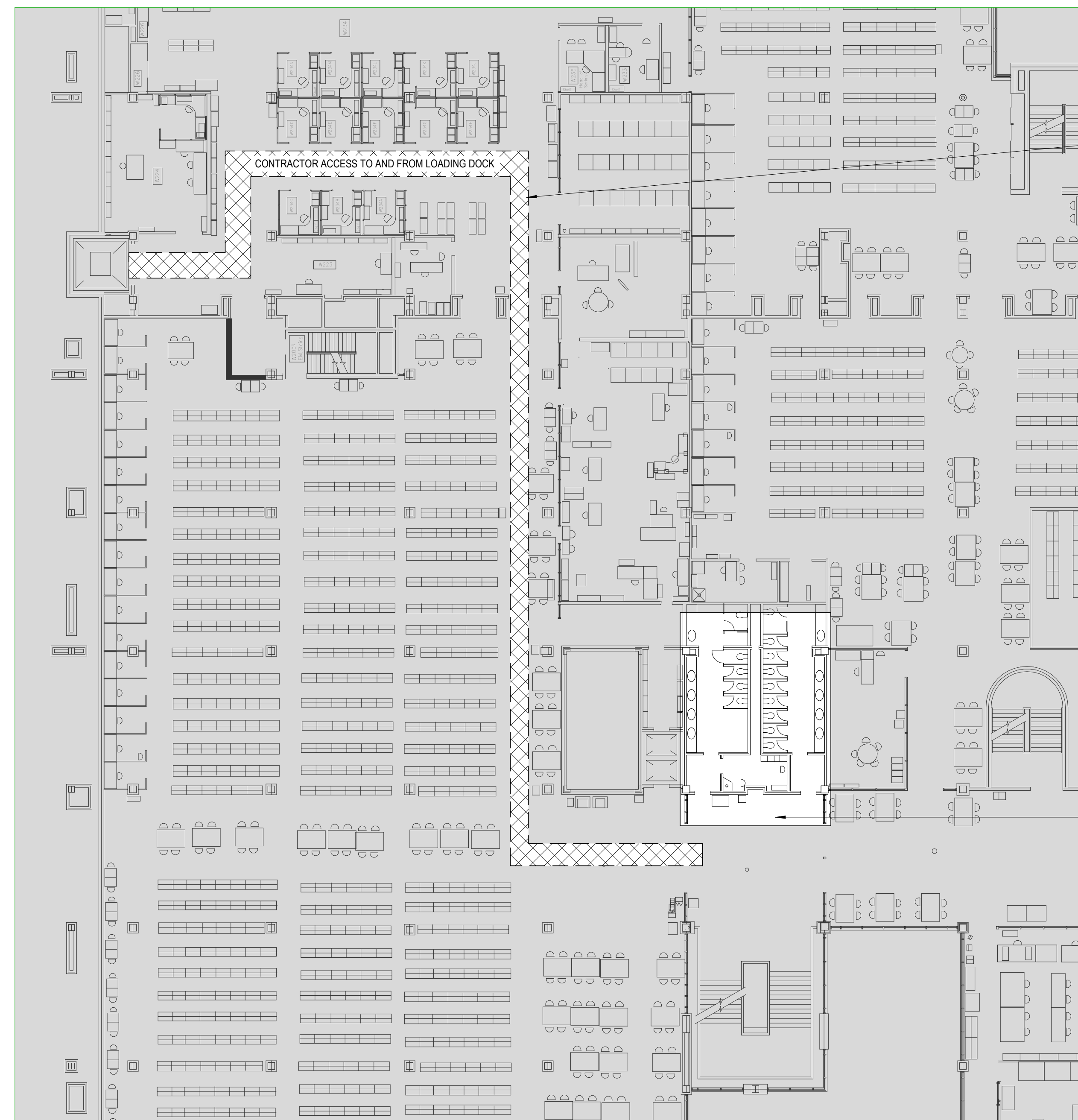


- CONSTRUCTION DELIVERIES
- FREIGHT ELEVATOR
- DUMPSTER LOCATION, CONTRACTOR TO PROTECT SIDEWALK AND REPAIR ANY DAMAGES
- DRIVEWAY FREQUENTLY USED AS STUDENT WALKWAY; USE CAUTION

1 SITE LOGISTICS
1/2" = 1'-0"

INDICATES EXISTING SPACE THAT IS EXCLUDED FROM THE SCOPE OF THIS PROJECT REFER TO DRAWINGS AND DETAILS FOR MORE INFORMATION

CONTRACTOR PATH TO WORK AREA

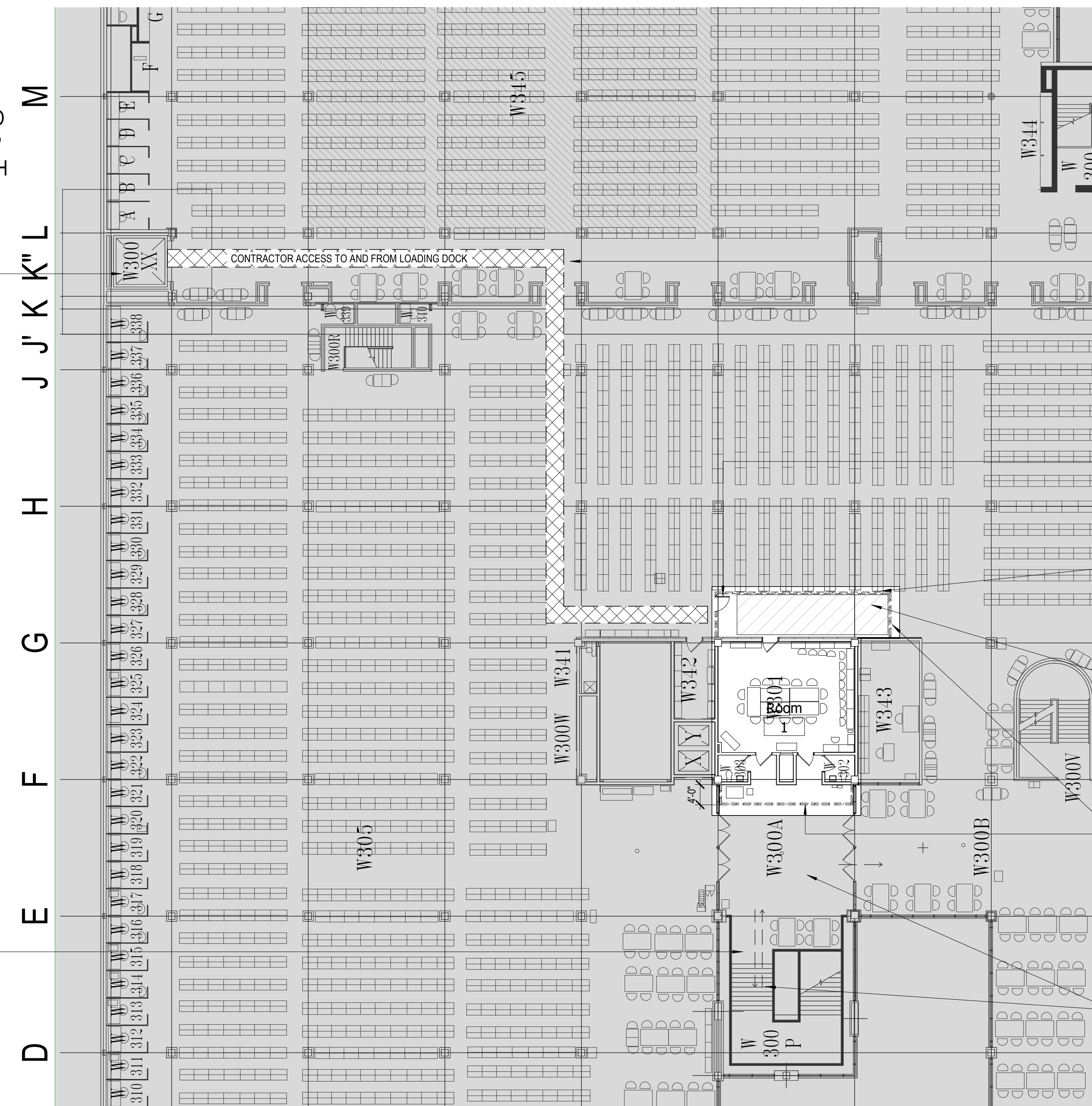


CONTRACTOR TO LAY DOWN HARD SURFACE MATERIAL TO PROTECT CARPET. CLEAN UP ANY DEBRIS ALONG THE PATH DAILY

FREIGHT ELEVATOR LIVE LOAD CAPACITY IS 5,000 LBS

NO TEMPORARY BARRIER ON THIS FLOOR. COORDINATE WITH UWM WHEN TO SHUT DOWN BATHROOMS FOR NECESSARY WORK.

CONTRACTOR IS RESPONSIBLE FOR CLEANING ANY DUST OR DEBRIS AROUND THE WORK AREA AND STAIRS DAILY.



CONTRACTOR TO LAY DOWN HARD SURFACE MATERIAL TO PROTECT CARPET. CLEAN UP ANY DEBRIS ALONG THE PATH DAILY

CONSTRUCTION DOOR INTO LAYDOWN AND WORK AREA
ALIGN TEMPORARY BARRIER WITH THE EDGE OF THE STACKS. TEMPORARY BARRIER CAN NOT DISTURB THE CEILING.

STAGING / MATERIAL LAYDOWN AREA

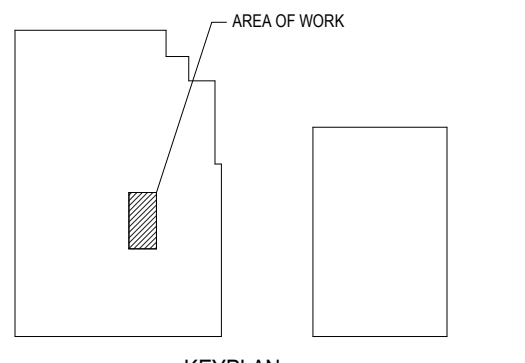
TEMPORARY CONSTRUCTION PARTITION CONSISTING OF 3/8" METAL STUDS, SOUND BATT INSULATION, AND 5/8" GYPSUM BOARD. TEMPORARY BARRIER CAN NOT DISTURB THE CEILING.

MAINTAIN A CLEAR ENTRANCE / EGRESS PATH FOR OCCUPANTS. MAINTAIN A SAFE UNOBSTRUCTED ACCESS TO ADJACENT SPACES. THESE AREAS WILL REMAIN OCCUPIED THROUGHOUT CONSTRUCTION

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NO	DESCRIPTION	DATE

ISSUANCE HISTORY - THIS SHEET

HGA NO: 4200-026-00

CONSTRUCTION LOGISTICS PLAN

DATE: MAY 24, 2024

BID SET

A030

GENERAL NOTES - DEMOLITION PLAN

- A. GPC TO COORDINATE DEMOLITION SCHEDULE WITH THE ABATEMENT CONTRACTOR.
- B. REMOVE EXISTING CONSTRUCTION INCLUDING, BUT NOT LIMITED TO, FLOOR FINISHES, WALLS, CEILING, WALL BASE, AND OTHER EXISTING CONSTRUCTION AS INDICATED OR REQUIRED FOR NEW WORK, UNLESS NOTED OTHERWISE.
- C. REMOVE WALLS INCLUDING WALL MATERIALS INCLUDING INTEGRAL BASES, DOORS, DOOR FRAMES AND ASSOCIATED HARDWARE AND THRESHOLDS, UNLESS OTHERWISE INDICATED.
- D. REMOVE PARTITIONS COMPLETELY TO UNDERSIDE OF STRUCTURAL COMPONENTS ABOVE AND TO TOP OF FLOOR STRUCTURAL COMPONENTS AT BASE. DO NOT LEAVE SECTIONS OR MATERIALS OF WALL ASSEMBLIES IN PLACE.
- E. AT SIDES OF WALLS THAT ABUT WALLS TO REMAIN, CUT BACK AT LEAST 1 INCH (25 MM) BEYOND FACE OF FINISH OF WALL TO REMAIN TO FACILITATE SUBSEQUENT PATCHING AND NEW CONSTRUCTION.
- F. COMPLETELY REMOVE FINISHES, SUBBASE MATERIALS AND STRUCTURAL FRAMING MATERIALS TO LINES INDICATED OR REQUIRED FOR NEW WORK.
- G. EXISTING ITEMS TO BE SALVAGED FOR REUSE IN NEW WORK BY GPC:
 - A. WOOD DOORS IN CONFERENCE ROOM
 - B. BRICKS
 - C. LEVEL 2 CEILING ACCESSORIES
 - D. FIRE ALARM DEVICES
- H. EXISTING ITEMS TO BE SALVAGED FOR DELIVERY TO OWNER:
 - A. WOOD DOORS IN CONFERENCE ROOM
 - B.
- I. EXISTING UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS ARE TO REMAIN, UNLESS INDICATED OTHERWISE. - SEE MECHANICAL, ELECTRICAL, AND PLUMBING DRAWINGS FOR ADDITIONAL DEMOLITION SCOPE.
- J. RELOCATE EXISTING WORK SERVING OCCUPIED PORTIONS OF THE BUILDING AS REQUIRED TO MAINTAIN SERVICE TO OCCUPIED AREAS AND TO ACCOMMODATE NEW WORK.
- K. REMOVE AND CAP PORTIONS OF EXISTING UTILITIES INDICATED TO BE DEMOLISHED AS REQUIRED TO ACCOMMODATE NEW WORK, INCLUDING SURFACE-MOUNTED ELECTRICAL CONDUIT, DEVICES AND LIGHT FIXTURES, RADIATORS, RADIATOR COVERS, PLUMBING FIXTURES AND ASSOCIATED PIPING.
- L. REMOVE CEILING INDICATED TO BE DEMOLISHED INCLUDING INTEGRAL HANGERS, SUPPORTS, ANCHORS AND MATERIALS OR ASSEMBLIES ATTACHED TO CEILING CONSTRUCTION.
- M. REMOVE SUSPENDED CEILING TO UNDERSIDE OF STRUCTURE OR ORIGINAL PLASTER OR GYPSUM BOARD CEILING SURFACES.
- N. MAINTAIN EGRESS FROM EXISTING OCCUPIED SPACES AND SURROUNDING BUILDING AREAS AS INDICATED AND AS REQUIRED BY AUTHORITIES HAVING JURISDICTION. MAINTAIN EGRESS FROM EXISTING OCCUPIED SPACES AND SURROUNDING BUILDING AREAS AS INDICATED AND AS REQUIRED BY AUTHORITIES HAVING JURISDICTION.
- O. PROVIDE AND MAINTAIN FIRE EXTINGUISHERS IN AREA OF WORK, IN ACCORDANCE WITH REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.
- P. COORDINATE UTILITY INTERRUPTIONS WITH OWNER. PROVIDE AT LEAST 48 HOURS WRITTEN NOTICE TO OWNER BEFORE UTILITY INTERRUPTIONS OBTAIN OWNER'S WRITTEN APPROVAL OF INTERRUPTIONS BEFORE PROCEEDING.
- Q. COORDINATE OPERATIONS THAT MAY RESULT IN HIGH LEVELS OF NOISE AND VIBRATION, ODORS, OR OTHER DISRUPTIONS TO OCCUPANCY WITH OWNER. OBTAIN OWNER'S WRITTEN PERMISSION BEFORE PROCEEDING.
- R. PROVIDE TEMPORARY BARRIERS AND ENCLOSURES AS REQUIRED TO PROTECT MATERIALS AND PEOPLE. PREVENT DUST, FUMES, AND ODORS FROM ENTERING OCCUPIED AREAS. MAINTAIN AND RELOCATE TEMPORARY BARRIERS AND ENCLOSURES AS REQUIRED BY THE PROGRESS OF THE WORK. REMOVE TEMPORARY BARRIERS AND ENCLOSURES AT COMPLETION OF WORK.
- S. PRIOR TO STARTING DEMOLITION, VERIFY EXISTING CONDITIONS AND DIMENSIONS. COORDINATE EXTENT OF DEMOLITION WORK AND EXISTING CONSTRUCTION TO REMAIN WITH NEW WORK. NOTIFY ARCHITECT OF CONFLICTS OR DISCREPANCIES.
- T. REFER TO DISCIPLINE-SPECIFIC DRAWINGS FOR RELATED FIRE SUPPRESSION, PLUMBING, HEATING VENTILATION AND AIR CONDITIONING, ELECTRICAL, COMMUNICATIONS, AND ELECTRONIC SAFETY AND SECURITY SYSTEM DEMOLITION WORK.

DEMOLITION PLAN LEGEND

SEE A101 FOR ALL GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS

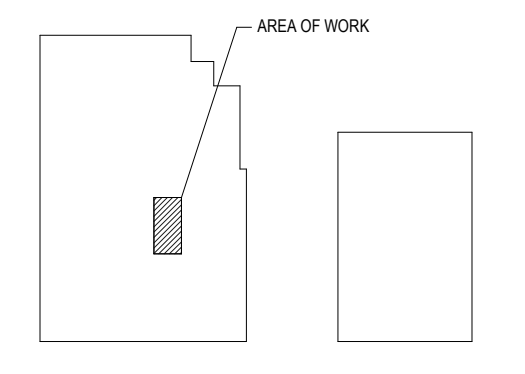
(E) CONSTRUCTION TO REMAIN	
(E) CONSTRUCTION TO BE REMOVED	
TEMPORARY BARRIER	

DEMOLITION RCP LEGEND

	DEMOLISHED PLASTER CEILING
	2X4 LIGHT FIXTURE
	1X4 LIGHT FIXTURE
	2X2 LIGHT FIXTURE
	RECESSED LIGHT
	ACCESS PANEL
	DIFFUSER
	SMOKE DETECTOR



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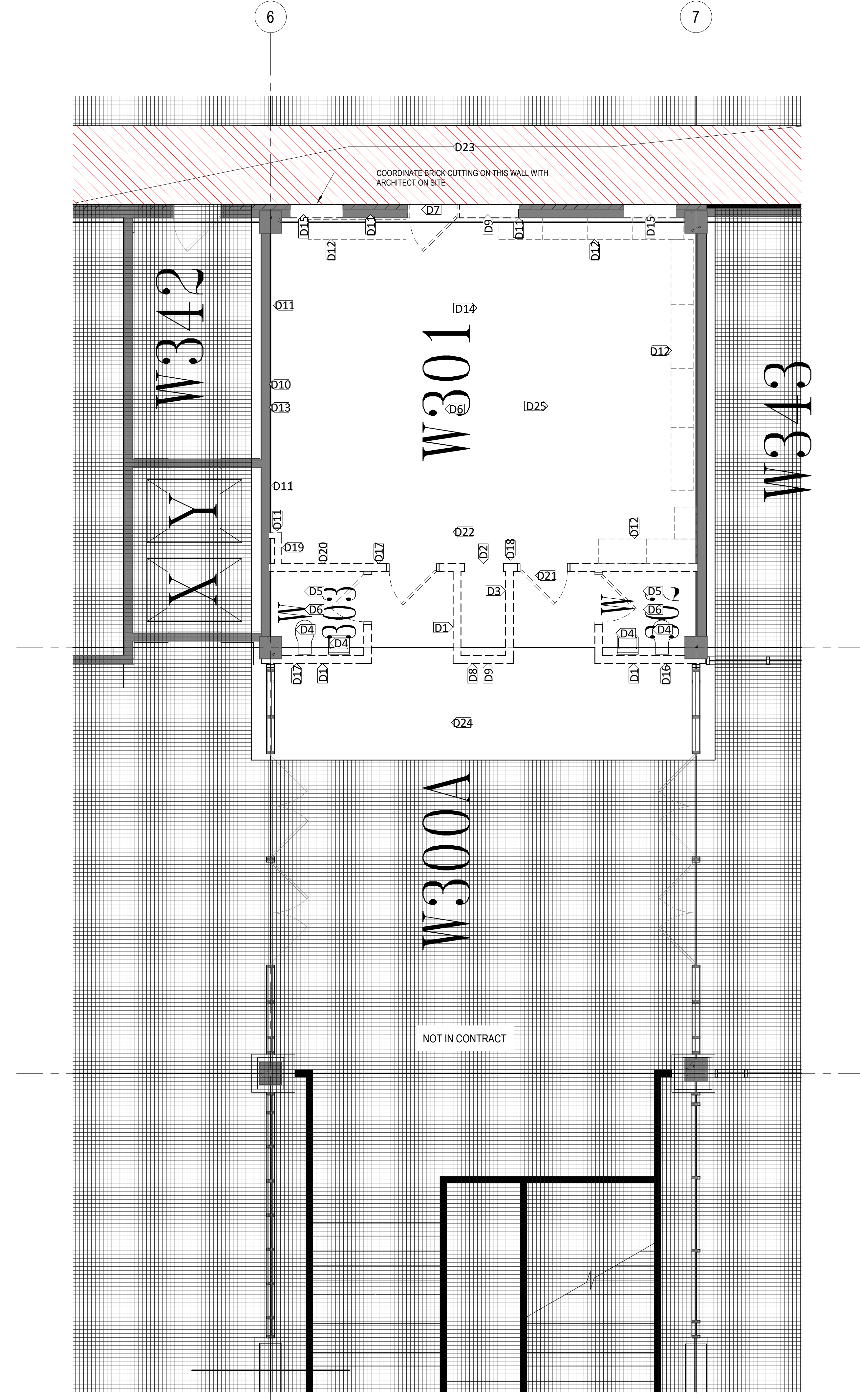
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DEMOLITION PLAN - LEVEL 03

DATE: MAY 24, 2024

BID SET

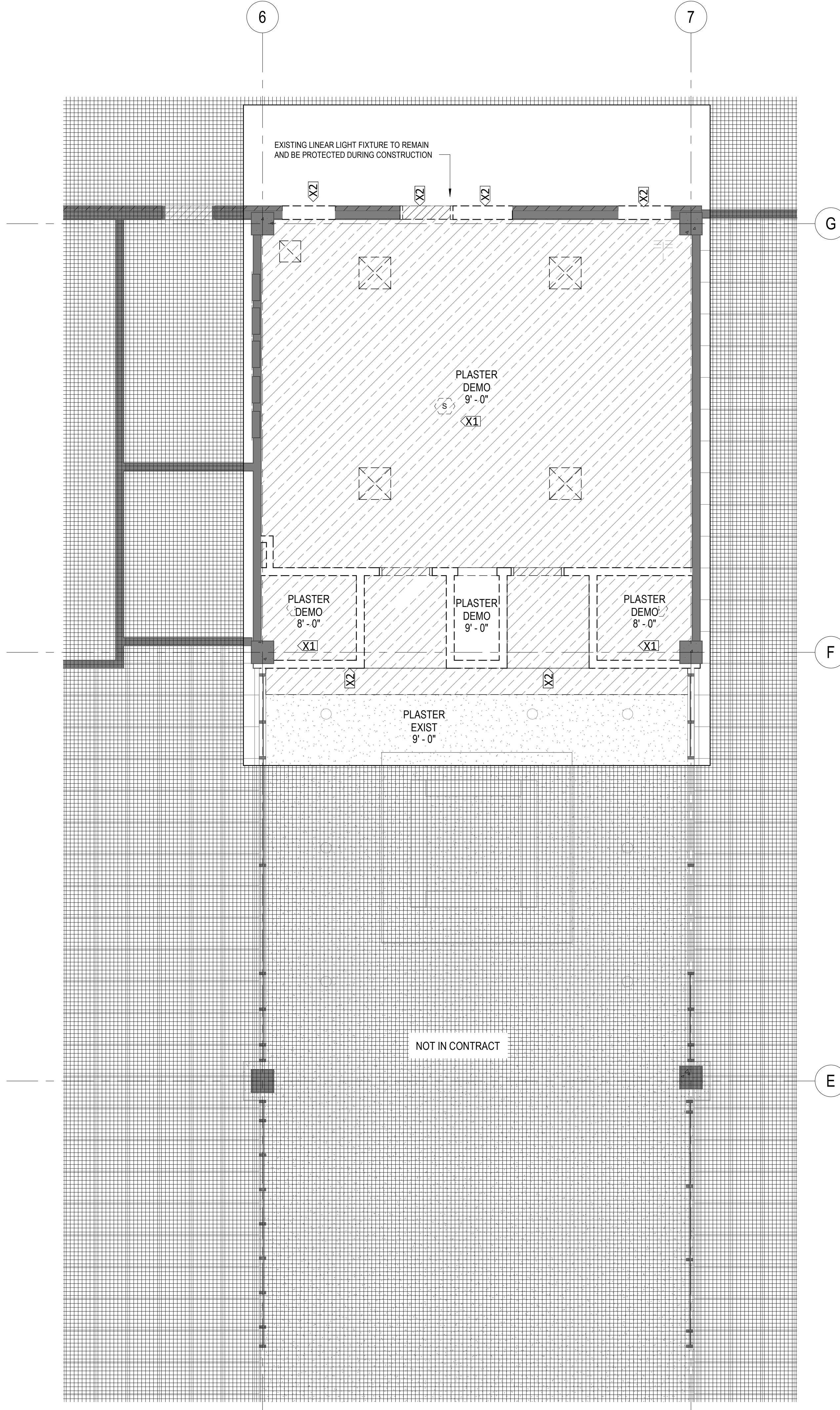


1 OVERALL DEMOLITION PLAN - LEVEL 03
1/4" = 1'-0"

ALL DEMO TO BE DONE BY ABATEMENT CONTRACTOR U.N.O.

DEMOLITION KEYNOTES

Keynote Number	Keynote Text
D1	REMOVE EXISTING MASONRY WALL - GPC TO PATCH, GRIND, AND FILL FLOOR IN PREPERATION FOR NEW FLOOR, PATCH TERRAZZO WHERE NEEDED
D2	REMOVE FOLDING PARTITION AND ALL ASSOCIATED HARDWARE
D3	REMOVE AND RE-LOCATE EXISTING ELECTRICAL PANEL - SEE ELEC DRAWING
D4	EXISTING PLUMBING FIXTURES AND ASSOCIATED HARDWARE TO BE REMOVED, ALL PLUMBING LINES TO BE TERMINATED
D5	ALL BATHROOM ACCESSORIES TO BE REMOVED AND DISCONNECTED (SOAP DISPENSER, HAND DRYER, MIRROR TP HOLDER, GRAB BARS) - DEMO AND CAP ALL ELECTRICAL
D6	REMOVE FLOOR AND ASSOCIATED BASE - GPC TO PREP FOR NEW FLOORING
D7	WOOD DOOR TO BE SALVAGED AND RE-USED IN NEW CONSTRUCTION FOR DOOR W317A. BY GPC
D8	REMOVE DRINKING FOUNTAIN - CAP ALL PLUMBING LINES
D9	REMOVE AND DISCONNECT CLOCK - CAP ELECTRICAL
D10	REMOVE PROJECTOR SCREEN AND ALL ASSOCIATED HARDWARE
D11	REMOVE ALL WIRE MOLD AND CAP ALL ASSOCIATED ELECTRICAL AND DATA
D12	REMOVE ALL GLASS AND WOOD CASEWORK
D13	REMOVE WARNER BOARD AND ALL ASSOCIATED HARDWARE
D14	REMOVE OVERHEAD TRACK FOR FOLDING PARTITION
D15	REMOVE PORTION OF BRICK WALL FOR NEW DOOR OPENING COORDINATE WITH ARCH NOTE FROM ABOVE. SALVAGE BRICK FOR RE-USE AT INFILL LOCATION. PATCH EDGES AS NEEDED FOR CLEAN FINISH. BY GPC
D16	REMOVE AND RE-LOCATE EXISTING FIRE ALARM BY GPC
D17	REMOVE AND RE-LOCATE EXISTING THERMOSTAT. BY GPC
D18	REMOVE AND DISCONNECT OCCUPANCY SENSOR - CAP ELECTRICAL
D19	REMOVE WALL BUMP OUT.
D20	REMOVE SHELF.
D21	WOOD DOOR TO BE SALVAGED AND RE-USED IN NEW CONSTRUCTION FOR DOOR W317A. BY GPC
D22	PATCH GRIND AND FILL FLOOR TO CREATE SMOOTH FLOOR TRANSITION AT WALL DEMO LOCATIONS. BY GPC
D23	REMOVE CAPERT AS NEEDED - REPLACE EXISTING CARPET - INDICATED BY HATCH. SEE A263 FOR FULL EXTENTS OF CARPET REMOVAL BY GPC
D24	PATCH ANY TERRAZZO DAMAGED THROUGHOUT THE COURSE OF DEMOLITION. BY GPC
D25	GPC TO CORE DRILL HOLE FOR NEW FLOOR BOX - SEE ELECTRICAL



2 OVERALL DEMOLITION REFLECTED CEILING PLAN - LEVEL 03
1/4" = 1'-0"

ALL DEMO TO BE DONE BY ABATEMENT CONTRACTOR U.N.O.

DEMOLITION CEILING KEYNOTES

Keynote Number	Keynote Text
X1	REMOVE CEILING AND ALL ASSOCIATED FIXTURE, DIFFUSERS, GRILLES, LIGHT FIXTURES, WAP, SMOKE DETECTORS
X2	DEMO PLASTER TO EXISTING WALL LOCATION - WHERE NEW STOREFRONT WILL BE INSTALLED. GPC TO PATCH AND REPAIR PLASTER CEILING IN STAIR WELL TO MEET NEW STOREFRONT.

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MILWAUKEE, WISCONSIN**

(Rev 4/2024)

TECHNICAL SPECIFICATIONS BID DOCUMENTS
Invitation to Bid

UW- Milwaukee Project No. **GML B1970** / UWSA Project No. **B-23-001**

May 24, 2024

FOR
THE BOARD OF REGENTS OF THE
UNIVERSITY OF WISCONSIN SYSTEM
C/O UWSA - CAPITAL PLANNING AND BUDGET, 780 REGENT STREET, SUITE 239
MADISON, WISCONSIN 53715

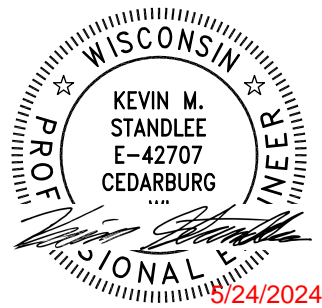
Volume 2 of 2



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SECTION 02 05 00
COMMON WORK RESULTS FOR EXISTING CONDITIONS
BASED ON DFD MASTER SPECIFICATION DATED 10/01/2012

PART 1 - GENERAL

SCOPE

This section provides information common to two or more technical site work specification sections or items that are of a general nature, and not included in other sections. This section applies to ALL site work, as applicable. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Referenced Organizations
- Referenced Documents
- Quality Assurance
- Safety
- Permits
- Construction Limits
- Submittals
- Off Site Storage
- Codes
- Certificates and Inspections

PART 2 - MATERIALS

- Barricades, Signs, and Warning Devices

PART 3 - EXECUTION

- Maintenance of Site and Building Access/Egress
- Continuity of Existing Traffic/Parking and Traffic Control
- Protection and Continuity of Existing Utilities
- Protection of Existing Work and Facilities

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

REFERENCED ORGANIZATIONS

Applicable provisions of Division 1 shall govern all work under this section.

Abbreviations of organizations referenced in these specifications are as follows:

AASHTO	American Association of State Highway and Transportation Officials
ACPA	American Concrete Pipe Association
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWS	American Welding Society
FHA	Federal Highway Administration
EPA	Environmental Protection Agency
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration

1	STI	Steel Tank Institute
2	UL	Underwriters Laboratories Inc.
3	WDNR	State of Wisconsin Department of Natural Resources
4	WISDOT	State of Wisconsin Department of Transportation

5

6 **REFERENCED DOCUMENTS**

7 Where reference is made to the "SSHSC", it shall mean the pertinent sections of the State of Wisconsin,
8 Department of Transportation, Standard Specifications for Highway and Structure Construction, current
9 edition, and all supplemental and interim supplemental specifications. Where reference is made to the
10 "SSSWC", it shall mean pertinent sections of the Standard Specifications for Sewer and Water Construction
11 in Wisconsin, current edition. Where reference is made to the "BMPH", it shall mean the Wisconsin
12 Construction Site Best Management Practice Handbook, current edition as published by the WDNR. Method
13 of measurement and basis of payment sections in referenced documents shall not apply.

14

15 **QUALITY ASSURANCE**

16 Provide materials and products as required by individual specification sections. Refer to Section GC -
17 General Conditions of the Contract regarding substitutions.

18

19 Provide quality assurance testing and reporting as required by individual specification sections.

20

21 **SAFETY**

22 Contractor is solely responsible for worksite safety.

23

24 Perform all work in accordance with applicable OSHA, state and local safety standards.

25

26 **PERMITS**

27 Unless otherwise noted in the Contract Documents, Contractor shall be responsible for obtaining and
28 paying for all permits necessary to complete the work.

29

30 **CONSTRUCTION LIMITS**

31 Construction Limits are indicated on the drawings. In the absence of such a designation on the drawings,
32 confine work to the minimum area reasonably necessary to undertake the work as determined by the UW
33 Construction Representative. In no case shall construction activities extend beyond state property lines or
34 construction easements.

35

36 The Contractor shall restore all disturbed areas in accordance with the drawings and specifications. If plans
37 and specifications do not address restoration of specific areas, these areas will be restored to pre-construction
38 conditions as approved by the UW Construction Representative.

39

40

41 **SUBMITTALS**

42 Refer also to Section GC - General Conditions of the Contract and Division 1.

43

44 Submit manufacturer's shop drawings, product data, samples, substitutions and operation and maintenance
45 (O&M) data for approval as required by individual specification sections.

46

47 Unless otherwise noted, provide 6 copies of each submittal. Submit to project architect/engineer (A/E)
48 unless otherwise directed by the UW Construction Representative at the Pre-Construction Meeting.

49

50 **OFF SITE STORAGE**

51 Refer to Division 1.

52

1 In general, the payments for materials stored off site will only be considered in instances where there is
2 limited space available for storage on the site. Prior approval by the UW Construction Representative,
3 together with the execution of a Storage Agreement will be required.

4
5 **CODES**

6 Comply with the requirements of all applicable, local, state and federal codes.

7
8 **CERTIFICATIONS AND INSPECTIONS**

9 Refer to Section GC - General Conditions.

10
11 Obtain and pay for all required sampling, testing, inspections, and certifications except those expressly
12 listed as provided by the A/E or other third party in the Contract Documents. Deliver originals of
13 certificates and documents to the UW Construction Representative w/I 3 days; provide copies to the A/E.
14 Include copies of the certifications and documents in the O&M Manual.

15
16
17
18 **PART 2 - MATERIALS**

19
20 **BARRICADES, SIGNS, AND WARNING DEVICES**

21 Traffic barricades, traffic signs, and warning devices shall meet the requirements of applicable OSHA
22 standards and the FHA Manual of Uniform Traffic Control Devices (MUTCD).

23
24 **PART 3 - EXECUTION**

25
26
27 **MAINTENANCE OF SITE AND BUILDING ACCESS/EGRESS**

28 Unless otherwise shown or directed, maintain existing access and egress to the facility throughout
29 construction. Maintain ANSI A117 compliant access for disabled persons, delivery access, emergency
30 vehicle access, and emergency egress. Do not interrupt access and egress without prior written approval
31 from the UW Construction Representative.

32
33 **CONTINUITY OF EXISTING TRAFFIC/PARKING AND TRAFFIC CONTROL**

34 Refer also to Section GR - General Requirements.

35
36 Do not interrupt or change existing traffic, delivery, or parking without prior written approval from the UW
37 Construction Representative. When interruption is required, coordinate schedule with the Owner agency to
38 minimize disruptions. When working in public right-of-way, obtain all necessary approvals and permits
39 from applicable municipalities and WISDOT.

40
41 When Contractor's activities impede or obstruct traffic flow, Contractor shall provide traffic control
42 devices, signs and flaggers in accordance with other Contract Documents and the current version of the
43 MUTCD, or as shown on the Drawings.

44
45 **PROTECTION AND CONTINUITY OF EXISTING UTILITIES**

46 Verify the locations of any water, drainage, gas, sewer, electric, drainage, gas, sewer, electric,
47 telephone/communication, fuel, steam lines or other utilities and site features which may be encountered in
48 any excavations or other sitework. All lines shall be properly underpinned and supported to avoid disruption
49 of service.

50
51 Do not interrupt or change existing utilities without prior written approval from the UW Construction
52 Representative, affected utilities and users. Notify all users impacted by outages a minimum of 48 hours in
53 advance of outage. Notification shall be provided in writing and describe the nature and duration of outages
54 and provide the name and number of Contractor's foreman or other contact.

1
2 Any service connections encountered which are to be removed shall be cut off at the limits of the excavation
3 and capped in accordance with the requirements of applicable codes and any specifications governing such
4 removals.

5
6 **PROTECTION OF EXISTING WORK AND FACILITIES**
7 Verify the locations of, and protect, any signs, paved surfaces, buildings, structures, landscaping, streetlights,
8 utilities, and all other such facilities that may be encountered or interfered with during the progress of the
9 work. Take measures necessary to safeguard all existing work and facilities that are outside the limits of the
10 work or items that are within the construction limits but are intended to remain. Report any damage to
11 existing facilities to the UW Construction Representative immediately. Correct and pay for all damages.

12
13 **END OF SECTION**

1 **SECTION 02 41 30**
2 **INTERIOR SELECTIVE DEMOLITION**

3 PART 1 - GENERAL

4 1.1 SUMMARY

- 5 A. Section Includes: Demolition and removal of selected portions of building or structure.
6 1. Demolition and removal of selected site elements.
7 2. Salvage of existing items to be reused or recycled.
8 3. Repair procedures for selective demolition operations.

9 1.2 INFORMATIONAL SUBMITTALS

- 10 A. Schedule of Selective Demolition Activities: Indicate the following:
11 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each
12 activity. Ensure building manager's and other tenants on-site operations are uninterrupted.
13 2. Interruption of utility services. Indicate how long utility services will be interrupted.
14 3. Coordination for shutoff, capping, and continuation of utility services.
15 4. Use of elevator and stairs.
16 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's
17 partial occupancy of completed Work.

18 1.3 QUALITY ASSURANCE

- 19 A. Skilled Mechanics: Accomplish all work of cutting, removal, demolition, relocation, patching and other
20 restoration by using only mechanics skilled in the trade. If necessary, sublet the work to skilled contractors
21 or subcontractors.

22 1.4 FIELD CONDITIONS

- 23 A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct
24 selective demolition such that Owner's operations will not be disrupted.
25 B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with
26 selective demolition.

27 PART 2 - PRODUCTS

28 NOT USED

1 PART 3 - EXECUTION

2 3.1 SELECTIVE DEMOLITION

- 3 A. General: Demolish and remove existing construction only to the extent required by new construction and
4 as indicated. Use methods required to complete the Work within limitations of governing regulations.
- 5 1. Regulatory Requirements: Comply with governing EPA notification regulations before beginning
6 selective demolition. Comply with hauling and disposal regulations of authorities having
7 jurisdiction.
- 8 2. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.
- 9 3. Hazardous Materials: Hazardous materials are present in construction to be selectively demolished.
10 A report on the presence of hazardous materials is on file for review and use. Examine report to
11 become aware of locations where hazardous materials are present.
- 12 a. Do not disturb hazardous materials or items suspected of containing hazardous materials.
- 13 4. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged
14 during selective demolition, by methods and with materials so as not to void existing warranties.
- 15 B. Pre-Demolition Conference: Conduct conference at Project site.
- 16 1. Inspect and discuss condition of construction to be selectively demolished.
- 17 2. Review structural load limitations of existing structure.
- 18 3. Review and finalize selective demolition schedule and verify availability of materials, demolition
19 personnel, equipment, and facilities needed to make progress and avoid delays.
- 20 4. Review requirements of work performed by other trades that rely on substrates exposed by selective
21 demolition operations.
- 22 5. Review areas where existing construction is to remain and requires protection.
- 23 C. Examination: Survey existing conditions and correlate with requirements indicated to determine extent of
24 selective demolition required.
- 25 1. Review record documents of existing construction provided by Owner. Owner does not guarantee
26 that existing conditions are same as those indicated in record documents.
- 27 2. Survey existing conditions and correlate with requirements indicated to determine extent of selective
28 demolition required.
- 29 3. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with
30 selective demolition.
- 31 4. Engage a professional engineer to perform an engineering survey of condition of building to
32 determine whether removing any element might result in structural deficiency or unplanned collapse
33 of any portion of structure or adjacent structures during selective building demolition operations.
- 34 a. Perform surveys as the Work progresses to detect hazards resulting from selective demolition
35 activities.
- 36 D. Preparation:
- 37 1. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury
38 to people and damage to adjacent buildings and facilities to remain.
- 39 2. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to
40 preserve stability and prevent movement, settlement, or collapse of construction and finishes to
41 remain, and to prevent unexpected or uncontrolled movement or collapse of construction being
42 demolished.
- 43 3. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect,
44 and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be
45 selectively demolished.
- 46 E. Removed and Salvaged Items:
- 47 1. Clean salvaged items.

1
2
3 **SECTION 02 82 13**
4 **ASBESTOS ABATEMENT**
5 **BASED ON DFDM MASTER SPECIFICATION DATED 7/15/05 (Rev5/2/2019)**

6 **PART 1 - GENERAL**

7
8
9 **SCOPE**

10 Perform all operations in connection with asbestos abatement, encapsulation, removal and related
11 work as shown on drawings and/or specified herein.

12 **PART 1 - GENERAL**

13 Related work
14 Description of Work
15 References
16 Qualifications
17 Definitions
18 Submittals and Notices
19 Site Security
20 Emergency Planning
21 Preconstruction Meeting
22 Delivery, Storage and Handling

23 **PART 2- PRODUCTS**

24 Materials
25 Equipment

26 **PART 3 - EXECUTION**

27 General Compliance Measures
28 Preparations of Regulated Area
29 Decontamination Enclosure System
30 Temporary Isolation Partitions
31 Maintenance of Enclosure System
32 Workplace Entry and Exit Procedures
33 Waste Container Pass-Out Procedure
34 Water Collection and disposal
35 Wet Removal Procedure
36 Ceiling System Removal
37 Pipe Tunnel or Crawl Space Removal Work
38 Flooring Removal
39 Small Scale - Short Duration Removal Procedure
40 Encapsulation Procedures
41 Enclosure Procedure
42 Air Monitoring
43 Cleanup Procedure
44 Disposal Procedures
45 Reestablishment of Regulated Area

46
47
48 **RELATED WORK**

49 Applicable provisions of Division 1 govern work under this Section.

50
51 None

52
53 **DESCRIPTION OF WORK;**

54
55 Golda Meir Library is a four (4) story academic building with a basement. The original building
56 was constructed in 1967 with subsequent additions (additions 1 & 2). This project renovates Room
57 W301, W302 and W303 to create a conference and study room with a display of the artifacts of
58 Sheldon Lubar. The majority of the project is in the original building. A very small portion is in
59 addition 2.
60

1 The work will also involve the following impacts to the mechanical, electrical, and plumbing
2 (MEP) systems in the spaces beneath the project areas:

3
4 • Plumbing: Some work within (including above plaster ceilings) and below Room
5 W301, W302 & W303 to either demolish or extend the existing services.

6
7 • HVAC: Some work within (including above plaster ceilings) and below Room
8 W301, W302 & W303 to either demolish or extend the existing services.

9
10 All existing sealants/caulks, miscellaneous adhesives and glazing compounds are assumed to
11 contain asbestos. Unless otherwise noted, the removal or disturbance of these materials as required
12 for the project shall be conducted in accordance with DHS 159, "Certification and Training Course
13 Requirements for Asbestos Activities".

14
15 Roofing materials are assumed to contain asbestos. Unless otherwise noted, the removal or
16 disturbance of these materials as required for the project shall be conducted in accordance with
17 DHS 159, "Certification and Training Course Requirements for Asbestos Activities".

18
19
20 Removal;

21
22 The asbestos abatement contractor (AAC) shall remove and dispose of up to four hundred
23 fifty (450) square feet of asbestos containing textured plaster from the ceiling in Room
24 W301. Additional abatement of the textured plaster from the ceiling may need to be
25 removed in Corridor W300A in support of the project (i.e. if it is necessary to construct a
26 hard construction barrier in Corridor W300A)

27
28 The AAC shall also remove and dispose of up to seventy-five (75) ACM fittings hidden in
29 walls or above ceilings associated with Rooms W301, W302, W303, W201 & W203 as
30 part of this renovation. This would include at least the partial demolition of the ceilings
31 and walls in Rooms W301, W302 & W303 to locate and abate these materials.

32
33 The AAC shall remove and dispose of up fifteen (15) square feet of 6" ceramic base with
34 grey/white mortar set from Rooms W302 & W303.

35
36 Additional information regarding the asbestos abatement and the AAC scope of work are
37 found in Sheets H 102 & H103.

38
39 Encapsulation;

40
41 None

42
43 Enclosure;

44
45 None

46
47 The following materials associated with the Golda Meir Library are confirmed as non-ACMs (those
48 materials in **BOLD** are in the project areas):

49
50

Material Code	Material Description
• MTZOWN (both)	White/Brown Terrazo
• SPI (both)	Plaster (Both Skim and Base Coats)

51
52

1	•	INOSF1 (original)	Partition Wall
2	•	INOSF2 (original)	4" Grey Vinyl Base + Adhesive
3	•	INOSF3 (original)	Carpet Adhesive
4	•	INOSF4 (original)	2" x 2" Ceramic Floor Tile/grout/mortar - Tan
5	•	MCM (both)	Carpet Mastic
6	•	MDC (both)	Brown Door Caulk
7	•	MDC2 (original)	White Door Caulk
8	•	MDC2 (addition)	Grey Door Caulk
9	•	MDJC (both)	Duct Joint Caulk
10	•	MDWC (both)	Drywall w/Joint Compound
11	•	MEC (original)	Brown Exposed Caulk
12	•	MEC (addition)	Exposed Caulk
13	•	MEC2 (addition)	Beige Exterior Exposed Caulk
14	•	MEC4 (addition)	Grey Exterior Exposed Caulk
15	•	MPCR (original)	Red Pipe Caulk
16	•	MPG2 (original)	Black, Sticky Exterior Windowpane Glazing
17	•	MRF (addition)	Roof Flashing
18	•	MRM (addition)	Roof Field (Built-Up)
19	•	MSCT1 (addition)	1' x 1' Suspended Ceiling Tiles with Pinholes
20	•	MSCT1 (original)	2'x4' Drywall Ceiling Tile
21	•	MSCT2 (both)	2'x4' Susp. Ceil. Tile w/Pinholes, Fissures, 4" SQ
22	•	MSCT3 (original)	1'x1' Suspended Ceiling Tile w/Pinholes & Fissures
23	•	MSCT3 (addition)	2'x4' Suspended Ceiling Tile w/Pinholes & Fissures
24	•	MSCT4 (original)	2'x4' Suspended Ceiling Tile w/Pinholes & Fissures
25	•	MTP (original)	Transite Panel
26	•	MTZON (both)	Brown Terrazo
27	•	MV4K (original)	4" Black Vinyl Wallbase & Assoc. Mastic
28	•	MV4N (both)	4" Brown Vinyl Wallbase & Assoc. Mastic
29	•	MV6N (addition)	6" Brown Vinyl Wallbase & Assoc. Mastic
30	•	MVFN (original)	Brown Vinyl Flooring & Associated Mastic
31	•	MVFNE (both)	Brown/Beige Vinyl Flooring & Associated Mastic
32	•	MVFR (original)	Red Vinyl Flooring & Associated Mastic
33	•	MWC (original)	Brown Window Caulk
34	•	MWC (addition)	Wall Caulk
35	•	MWC2 (original)	White Window Caulk
36	•	MWC2 (addition)	Brown Exterior Window Caulk
37	•	MWC3 (original)	Brown Exterior Window Caulk
38	•	SSF (addition)	White Sprayed on Fireproofing
39	•	SSF2 (addition)	Grey Sprayed on Fireproofing

The following materials associated with the Golda Meir Library are assumed or confirmed ACMs (those materials in **BOLD** are in the project areas):

Material Code	Material Description
• SP2 (both)	Textured Plaster
• TF5-20F (both)	1"-20+" O.D. Fittings On Fiberglass
• TM5-20 (both)	1"-20" O.D. Magnesia Pipe
• INOSF5 (original)	Mortar Associated with Ceramic Base
• MCDCW (addition)	White Cloth Duct Connector
• MCTG (addition)	Ceramic Tile Grout (assumed)
• MCTM (addition)	Ceramic Tile Mastic (assumed)
• MDC3 (original)	Brown Exterior Door Caulk
• MF12W (both)	12"x12" White Floor Tile & Assoc. Mastic
• MF12Y (original)	12"x12" Gray Floor Tile & Assoc. Mastic
• MF12WY (addition)	12"x12" White/Gray Floor Tile & Assoc. Mastic
• MFB (addition)	Fiberboard with Suspect Layer
• MFD (both)	Fire Door
• MPG (both)	Black Sticky Windowpane Glazing
• MPG (addition)	Windowpane Glazing
• MRB (original)	Roof: Built-Up
• MRF (original)	Roof Flashing
• MSLK (original)	Black Sink Lining
• MSLP (both)	Pink Sink Lining

- 1 • MSLY (original) Gray Sink Lining
- 2 • MWC4 (original) Gray Exterior Window Caulk
- 3 • MVFW (addition) White Vinyl Flooring & Associated Mastic
- 4 • MVFY (addition) Gray Vinyl Flooring & Associated Mastic
- 5 • TDP (original) Duct Patch
- 6 • TTIE (ordinal) Tank Insulation Caps

7
8
9 **Special Precautions:**

10
11 Coordinate with the Owner’s Project Representative for the shutdown and isolation of all
12 electrical circuits and air movement systems within the regulated area from that of the rest
13 of the facility to prevent any inconvenience to building occupants and contamination
14 outside of the regulated area. Refer to Article entitled: "Preparation of Regulated Area,"
15 of this section relative to shutdown of mechanical and electrical systems.

16
17 Equipment that must remain in operation while abatement work is in progress consists of
18 the following:

19
20 None

21 **Special Circumstances:**

22
23 None

24 **Restoration:** Contractor is responsible for restoring all existing finish surfaces to their original
25 state, which were damaged as a result of abatement activities.

26
27
28 **REFERENCES**

29 **General Reference:**

30
31 All work under this contract shall be done in strict accordance with all applicable General
32 and State regulations, standards and codes governing asbestos abatement and any other
33 trade work done in conjunction with the abatement.

34
35 The most recent edition of any relevant regulation in force at the time of bid opening shall
36 be in effect. Where conflict among the laws, rules, and regulations or with these
37 specifications exists the most stringent requirements shall be utilized.

38
39 The Contractor shall make available, in the clean change area of the worker
40 decontamination system, copies of this specification and all standards, regulations, and
41 codes listed hereinafter.

42
43 **Specific Reference:**

44
45 Occupational Safety and Health Administration (OSHA):

46
47 Title 29 Code of Federal Regulations, Section 1910.134(d) -

48
49 Title 29 Code of Federal Regulations, Section 1926.1101- Construction Industry,
50 including the mandatory appendices;

51
52 Appendix A - OSHA Reference Method.

53
54 Appendix C - Qualitative and Quantitative Fit Testing Procedures.

55
56 Appendix D - Medical Questionnaires.

1 Appendix E - Interpretation and Classification of Chest Roentgenograms.

2
3 Nonmandatory appendices:

4
5 Appendix B - Detailed Procedures for Asbestos, Tremolite, Anthrophyllite,
6 and Actinolite Sampling and Analysis.

7
8 Appendix F - Work Practices and Engineering Controls for Major Asbestos
9 Removal, Renovation, and Demolition Operations.

10
11 Appendix G - Work Practices and Engineering Controls for Small Scale, Short
12 Duration Asbestos Renovation and Maintenance Activities.

13
14 Appendix H - Substance Technical Information for Asbestos.

15
16 Appendix I - Medical Surveillance Guidelines for Asbestos, Tremolite,
17 Anthrophyllite, and Actinolite.

18
19 Title 29 Code of Federal Regulations, Section 1926.59 - Hazard Communication
20 Standard. Requires employers to inform their workers of the hazards of any
21 chemicals used on the project and to train their employees in proper safeguards.

22
23 Environmental Protection Agency (EPA): Title 40 Code of Federal Regulations (CFR)
24 Part 763 Subpart G - Asbestos Abatement Projects; worker Protection (effective March 27,
25 1987).

26
27 Environmental Protection Agency (EPA) Title 40 Code of Federal Regulations (CFR) Part
28 61 - National Emission Standards for Hazardous Air Pollutants; Asbestos NESHAP
29 Revision; Final Rule effective November 20, 1990.

30
31 Department of Health Services (DHS) State of Wisconsin Administrative Rule, Chapter
32 DHS 159, Asbestos Certification and Training.

33
34 Department of Natural Resources (DNR) State of Wisconsin Administrative Rule, Chapter
35 NR 447, Control of Asbestos Emissions.

36
37 Compressed Gas Association, Inc., New York, Pamphlet G-7, "Compressed Air for Human
38 Respiration", and Specification G-7.1 "Commodity Specification for Air".

39
40 Department of Natural Resources (DNR) State of Wisconsin Administrative Rule Chapter
41 NR 506, Landfill Operations Criteria for Disposal of Asbestos Containing Material.

42
43 **QUALIFICATIONS**

44 The prospective Contractor who is proposed to actually perform the asbestos abatement work, shall
45 submit to the Architect/Engineer the data hereinafter requested within ten (10) days after Bid
46 Opening. The proposed asbestos abatement Contractor will be awarded a Contract, only if data
47 submitted is determined to be favorable in all instances, by the Architect/Engineer, and the
48 prospective Contractor further meets the qualifications requirements specified in the Instructions
49 to Bidders.

50
51 The proposed asbestos abatement Contractor shall, if requested:

52
53 Demonstrate prior experience on asbestos abatement projects of similar nature and scope
54 of that being bid, through the submission of letters of reference from building owners
55 including the name, address, and telephone numbers of the contact persons who are
56 specifically familiar with the referenced projects. At least three previous users of this
57 service shall be submitted. Include descriptions of projects and records of all air
58 monitoring data that was generated during the projects.

1
2 Submit a description of all major Asbestos Abatement Equipment owned by the
3 prospective Contractor which is available for use on this project such as:

4
5 Respiratory protection equipment.

6
7 HEPA vacuum equipment.

8
9 Negative air pressure equipment.

10
11 Spray equipment for amended water.

12
13 Equipment used for shower facilities in decontamination enclosure system.

14
15 Submit a list of names, work responsibilities and evidence of certification for all employees
16 that will be assigned to this project:

17
18 At least one firm principal, the firm's "competent person" and any other personnel
19 performing supervisory duties must be certified by the Wisconsin Department of
20 Health Services as having successfully completed a comprehensive 5-day course
21 for Asbestos Abatement Contractors and Supervisors in conformance with
22 Wisconsin Administrative Code DHS 159.

23
24 Contractor's employees who perform asbestos abatement activities must be
25 certified by the Wisconsin Department of Health Services as having successfully
26 completed a comprehensive 4-day course for Asbestos Abatement Workers in
27 conformance with Wisconsin Administrative Code DHS 159.

28
29 **DEFINITIONS**

30 ACGIH: American Conference of Governmental Industrial Hygienists

31
32 AIHA: American Industrial Hygiene Association

33
34 Air Monitoring: The process of measuring the fiber content of a known volume of air collected
35 during a specific period of time shall conform with Appendix A to OSHA 29 CFR 1926.1101. The
36 procedure normally utilized for asbestos follows the NIOSH Standard Analytical Method 7400 for
37 Asbestos in Air. For clearance air monitoring, electron microscopy methods may be utilized for
38 lower detectability limit and specific fiber identification.

39
40 Air Sampling Professional: The Professional contracted or employed by UWS to supervise and
41 conduct air monitoring and analysis schemes. This individual shall not be affiliated in any way
42 other than through this contact with the Contractor performing the abatement work.

43
44 ANSI: American National Standards Institute

45
46 Asbestos: Means the asbestiform varieties of chrysotile (serpentine); crocidolite (riebeckite);
47 amosite (cummingtonite-grunerite); tremolite; anthrophyllite, and actinolite.

48
49 Asbestos Containing Material (ACM): Material composed of asbestos of any type and in an amount
50 greater than 1%, either alone or mixed with other fibrous or nonfibrous materials.

51
52 Asbestos Containing Waste Material: Asbestos containing material or asbestos contaminated
53 objects requiring disposal.

54
55 ASTM: American Society for Testing and Materials

1 Authorized Visitor: The Building Owner (and designated representatives) and any representative
2 of a regulatory agency having jurisdiction over the project.
3

4 Certified Industrial Hygienist (CIH): An industrial hygienist certified in Comprehensive Practice
5 by the American Board of Industrial Hygiene.
6

7 Competent Person: Means an employee of the asbestos abatement contractor who is capable of
8 identifying existing asbestos hazards in the workplace and who has the authority to take prompt
9 corrective measures to eliminate them pursuant to OSHA 1926.1101(b).
10

11 Decontamination Enclosure: A decontamination system consisting of a clean room, a shower room,
12 and an equipment room separated from each other and from the regulated area by airlocks. This
13 system is used for all workers to enter and exit the regulated area and may also serve as equipment
14 and waste pass out on small jobs.
15

16 Department of Natural Resources (DNR): A Wisconsin state agency that is responsible for
17 enforcement of Chapter NR 447.
18

19 Encapsulation: The application of a bridging or penetrating liquid material to asbestos containing
20 materials to control the release of asbestos fibers into the air. The bridging liquid material creates
21 a membrane over the surface and the penetrating liquid material seeps through the surface and binds
22 all components together.
23

24 Enclosure: The construction of an airtight, impermeable, permanent barrier around asbestos
25 containing material to control the release of asbestos fibers into the air.
26

27 EPA: U. S. Environmental Protection Agency
28

29 Glovebag Technique: A method with limited applications for removing small amounts of friable
30 asbestos-containing material from ducts, short piping runs, valves, joints, elbows, and other
31 nonplanar surfaces in a noncontained (plasticized) regulated area. The glovebag is constructed and
32 installed in such a manner that it surrounds the object or material to be removed and contains all
33 asbestos fibers released during the process.
34

35 HEPA Filter: A high efficiency particulate air filter capable of removing particles 0.3 microns in
36 diameter with 99.97% efficiency.
37

38 HEPA Vacuum: A vacuum system equipped with HEPA filtration.
39

40 NESHAPS: National Emission Standards for Hazardous Air Pollutants
41

42 NIOSH National Institute for Occupational Safety and Health
43

44 OSHA: Occupational Safety and Health Administration
45

46 Permissible Exposure Limits (PEL): No personnel associated with asbestos abatement work shall
47 be exposed to an airborne concentration of asbestos in excess of the following limits, as determined
48 by the method prescribed in Appendix A to OSHA 29 CFR 1926.1101, or by an equivalent method:
49

50 P.E.L. is 0.1 fiber per cubic centimeter of air as an eight (8) - hour time-weighted average.
51

52 Excursion Limit (EL) is 1.0 fiber per cubic centimeter of air as averaged over a sampling
53 period of thirty (30) minutes.
54

55 Regulated Area: An area identified by specific boundaries where airborne concentrations of
56 asbestos exceed, or can reasonably be expected to exceed the P.E.L. and/or Excursion Limit. The
57 regulated area may take the form of:
58

59 A temporary negative-pressure enclosure, or
60

1 An area specifically identified and segregated in any manner that minimizes the number of
2 employees exposed to asbestos.

3
4 Surfactant: A chemical wetting agent added to water to improve penetration.

5
6 Visible Emissions: Any emissions containing particulate asbestos material that is visually
7 detectable without the aid of instruments. This does not include condensed uncombined water
8 vapor.

9
10 Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and
11 objects by using cloths, mops, or other cleaning utensils which have been dampened with water
12 and afterwards thoroughly decontaminated or disposed of as asbestos contaminated waste.

13
14 **SUBMITTALS AND NOTICES**

15
16 The Contractor shall submit a completed Asbestos/Lead Abatement Certification (Form #DOA-
17 4509) no later than the end of the seventh calendar day after the bid opening date.

18
19 Prior to Commencement of Work, Contractor shall:

20
21 File a "Notification of Demolition and/or Renovation Form 4500-113" with the parties
22 named hereinafter, when required, at least 10 working days prior to commencement of
23 demolition or renovation project involving any asbestos-containing material.

24
25 Air Management Asbestos Coordinator
26 Department of Natural Resources
27 P.O. Box 7921
28 Madison WI 53707-7921
29

30 File an "Asbestos Project Notification Form 00041" with the parties named hereinafter,
31 when required, at least 2 working days prior to commencement of renovation project
32 involving any asbestos-containing material.

33
34 Department of Health Services
35 Asbestos/Lead Section, Room 137
36 P.O. Box 2659
37 Madison, WI 53701-2659

38 Submit the following documentation attached to completed form DOA-4523 prior to commencing
39 work:

40
41 Manufacturer's information and MSDS or SDS for the mastic remover that the Contractor
42 intends to use for floor tile mastic removal. Mastic remover shall be low odor and shall
43 not contain known carcinogens.

44
45 A copy of the asbestos training certification card issued by Wisconsin Department of
46 Health and Family Services pursuant to DHS 159 for all Contractor employees that will be
47 working on the project.

48
49 Submit the following documentation at completion of the work:

50
51 Copies of all completed "Transportation and Disposal Manifest" forms for all asbestos
52 waste materials removed from the regulated area during the abatement process.

53
54 Project Log per DHS 159.21(2)

55
56 Occupant Protection Plan per DHS 159.21(3).
57

1 During Abatement Activities, Contractor shall submit to the Owner's Project Representative, if
2 requested:

3
4 Shop drawings for layout and construction of decontamination enclosure systems and
5 barriers for isolation of the regulated area as detailed in this specification and required by
6 applicable regulations. If work is to be phased, a phasing schedule shall also be submitted.

7
8 Weekly (or as required) job progress reports detailing abatement activities. Include review
9 of major problems and action taken, injury reports, equipment breakdown.

10
11 Logs documenting filter changes on respirators, HEPA vacuums, negative pressure
12 ventilation units, local exhaust ventilation systems, and other engineering controls.

13
14 Results of bulk material analysis and air sampling data collected during the course of the
15 abatement including OSHA compliance air monitoring results.

16
17 Results of materials testing conducted during the abatement for purposes of utilization
18 during abatement activities (e. g., testing of encapsulant for depth of penetration, testing of
19 materials for adherence to encapsulated surfaces).

20
21 Contractor shall post at the entrance to the regulated area a list containing the names,
22 addresses, and telephone numbers of the Contractor, Fire Department and any other
23 personnel who may be required to be contracted during abatement activities.

24
25 **SITE SECURITY**

26 Contractor shall be responsible for the security of the regulated area(s) during abatement operations
27 in order to protect work efforts and equipment.

28
29 The regulated area shall be restricted to only authorized, trained, and protected personnel. These
30 may include the Contractor's employees, employees of subcontractors, state representatives, and
31 any other designated individuals. A list of authorized personnel shall be established prior to job
32 start and posted in the clean room of the decontamination facility.

33
34 Contractor shall immediately decontaminate (if required) and evict any unauthorized individual
35 entering the regulated area and notify the Construction Representative of action taken and identity
36 of the unauthorized individual.

37
38 A log book shall be maintained in the clean room area of the decontamination system. Anyone
39 who enters the regulated area must record name, affiliation, time in, and time out for each entry.

40
41 Access to the regulated area shall be through a single decontamination system located where shown
42 on approved Shop Drawings. All other means of access (doors, windows, hallways, etc.) shall be
43 blocked or locked so as to prevent entry to or exit from the regulated area. The only exceptions to
44 this rule are the waste pass-out air lock which shall be sealed except during the removal of
45 containerized asbestos waste from the regulated area, and emergency exits in case of fire or
46 accident. Emergency exits shall not be locked from the inside; however, they shall be sealed with
47 polyethylene sheeting and tape until needed.

48
49 **EMERGENCY PLANNING**

50 Written emergency plan shall be submitted through the Owner's Project Representative and
51 approved by the Architect/Engineer prior to the initiation of abatement activities.

52
53 Emergency procedures shall be in written form and prominently posted in the clean change area
54 and equipment room of the worker decontamination area. Everyone prior to entering the regulated
55 area must read and sign these procedures to acknowledge receipt and understanding of work site
56 layout, location of emergency exits and emergency procedures.

57

1 Emergency planning shall include notification of police, fire and emergency medical personnel of
2 planned abatement activities, work schedule and layout of regulated area, particularly barriers that
3 may affect response capabilities.

4
5 Emergency planning shall include considerations of fire, explosion, toxic atmospheres, electrical
6 hazards, slips, trips and falls, confined spaces and heat related injury. Written procedures shall be
7 developed and employee training in procedures shall be provided.

8
9 Employees shall be trained in evacuation procedures in the event of workplace emergencies under
10 the following conditions:

11
12 For non-life-threatening situations, employees injured or otherwise incapacitated shall
13 decontaminate following normal procedures with assistance from fellow workers, if
14 necessary, before exiting the workplace to obtain proper medical treatment.

15
16 For life-threatening injury or illness, worker decontamination shall take least priority.
17 After measures to stabilize the injured worker, remove the worker from the workplace and
18 secure proper medical treatment.

19
20 Telephone numbers of all emergency response personnel shall be prominently posted in the clean
21 change area and equipment room, along with the location of the nearest telephone.

22 23 **PRECONSTRUCTION MEETING**

24 The Contractor shall attend a preconstruction meeting to be conducted at a time and place
25 designated by the Owner's Project Representative. All parties having an active role in asbestos
26 abatement shall be in attendance.

27
28 The Contractor, Contractor's competent person and other supervisory personnel who shall provide
29 on-site direction of the abatement activities must attend.

30
31 At this meeting the Contractor shall provide all documentation as required by Article entitled:
32 "Submittals and Notices," herein. In addition, the Contractor shall be prepared to provide detailed
33 information concerning:

- 34
35
- 36 • Preparation of regulated area.
 - 37 • Personal protective equipment including respiratory protection and protective clothing.
 - 38 • Employees who will participate in the project, including delineation of experience, training, certification, and assigned responsibilities during the project.
 - 39 • Decontamination procedures for personnel, regulated area and equipment.
 - 40 • Abatement methods and procedures to be utilized.
 - 41 • Required air monitoring procedures.
 - 42 • Procedures for handling and disposing of waste materials.
 - 43 • Procedures for final decontamination and cleanup.
 - 44 • A sequence of work and performance schedule.
 - 45 • Procedures for dealing with heat stress.
 - 46 • Emergency procedures.
 - 47 • Methods of adhering plastic sheeting to the surfaces to be covered.
- 48
49

50 **DELIVERY, STORAGE AND HANDLING**

51 Deliver all materials in the original packages, containers or bundles bearing the name of the
52 manufacturer and the brand name.

53

1 Damaged, deteriorating or previously used materials shall not be used and shall be removed from
2 the work site and disposed of properly.

3 4 5 **PART 2 - PRODUCTS**

6 7 **MATERIALS**

8 Polyethylene sheeting for walls and stationary objects shall be a minimum of four (4) mil thick.
9 For floors and all other uses, sheeting of at least six (6) mil thickness shall be used in widths selected
10 to minimize the frequency of joints.

11
12 Polyethylene sheeting utilized for decontamination enclosure shall be opaque white or black in
13 color.

14
15 Flame retardant polyethylene sheeting shall be utilized.

16
17 Hardboard or plywood, minimum 1/4 inch thick, shall be furnished to protect finished floor
18 surfaces, such as carpet or hardwood floors, to prevent damage from scaffolds or falling objects.
19 Such protection shall also be provided for polyethylene sheeting under the scaffold area if the
20 material being removed has sharp projections which could readily puncture the enclosure material.

21
22 Disposal bags shall be of six (6) mil polyethylene, preprinted with labels as required by OSHA
23 Requirement 29 CFR 1926.1101 (k) (8).

24
25 Disposal drums for transporting disposal bags shall be metal or fiberboard with locking ring tops.

26
27 Stick-on labels as per EPA, OSHA or DNR requirements shall be present on disposal containers.

28
29 Surfactant (Wetting Agent):

30
31 For use with materials containing asbestos identified as "Amosite", shall be a 50/50 mixture
32 of polyoxyethylene ether and polyoxyethylene ester, mixed in a proportion of one (1) fluid
33 ounce to five (5) gallons of water or as specified by manufacturer.

34
35 For all materials containing asbestos identified as "chrysotile", "crocidolite", or types other
36 than Amosite, shall consist of soapy water mixed in a proportion of two (2) fluid ounces of
37 liquid soap to five (5) gallons of water.

38
39 Asbestos Removal Encapsulant (substitute for surfactant): In lieu of using a wetting agent in water
40 to control airborne fibers, an asbestos removal encapsulant may be used.

41
42 Encapsulating Material:

43
44 Bridging type encapsulant (for sealing masonry and concrete walls, barrier surfaces during
45 cleanup phase and asbestos containing surfaces to remain in place) shall be capable of
46 being applied with airless spray equipment, able to withstand light impact or abrasion
47 without releasing fibers, water insoluble when cured, and must retain sufficient integrity
48 after six (6) years to allow recoating.

49
50 Penetrating type encapsulant (for sealing scratch coat plaster, wood grounds and wood
51 blocking which have been in contact with asbestos containing material and also exposed
52 ends of pipe insulation) shall not be noxious or toxic to applicator or subsequent occupants,
53 shall have high flame retardance and low toxic fume and smoke emission ratings, and shall
54 have some permeability to water vapor to prevent condensation accumulation.

55 56 **EQUIPMENT**

57 Negative Pressure Ventilation Units:

58
59 A sufficient quantity of negative pressure ventilation units equipped with HEPA filtration
60 and operated in accordance with ANSI Z9.2-79 (local exhaust ventilation requirements)

1 and EPA guidance document EPA 560/5-83-002 Guidance for Controlling Friable
2 Asbestos-Containing Material in Buildings Appendix F: Recommended Specifications
3 and Operating Procedures for the Use of Negative Pressure Systems for Asbestos
4 Abatement shall be utilized so as to provide one workplace air change every 15 minutes.

5
6 To calculate total air flow requirement:

7
8
$$\text{Total Ft}^3/\text{Min.} = \frac{\text{Volume of Regulated area (in Ft}^3\text{)}}{15 \text{ Min.}}$$

9

10
11 To calculate the number of units needed for the abatement:

12
13
$$\text{Number of Units Needed} = \frac{\text{Total Ft}^3/\text{Min.}}{0.75 \text{ (Capacity of Unit in Ft}^3/\text{Min.)}}$$

14
15

16 The air filtering equipment shall be capable of filtering asbestos fibers at 0.3 um at 99.9
17 percent efficiency. Prefilters, which protect the final filter by removing the larger particles,
18 are required to prolong the operating life of the HEPA filter. Two stages of prefiltration
19 are required. The first-stage prefilter shall be a low efficiency type (e.g., for particles 10
20 um and larger). The second-stage (or intermediate) filter shall have a medium efficiency
21 (e.g., effective for particles down to 5 um). Prefilters and intermediate filters shall be
22 installed either on or in the intake grid of the unit and held in place with special housings
23 or clamps.

24
25 Exhaust air from the regulated area shall maintain a negative pressure of 0.02 inches of
26 water (head). The ventilation shall operate on a 24 hours basis throughout the abatement
27 process until final clearance has been approved.

28
29 **Air Purifying Respirators:**

30
31 Respirator bodies shall be of half face or full face type with removable cartridges. Single
32 use, disposable or quarter face respirators shall not be used. Full face respirators shall be
33 equipped with a nose cup or other anti fogging devices as would be appropriate for use in
34 air temperatures less than 32 degrees F.

35
36 Filter cartridges shall, at a minimum, be HEPA type filters certified by NIOSH under 30
37 CFR Part 11 or with filters certified for particulates under 42 CFR Part 84.

38
39 Full body disposable protective clothing, including head, body and foot coverings consisting of
40 material impenetrable by asbestos fibers (Tyvek^R or equivalent) shall be provided to all workers
41 and authorized visitors in sizes adequate to accommodate movement without tearing.

42
43 Additional safety equipment, such as hard hats, eye protection, safety shoes, disposable PVC
44 gloves, as necessary, shall be provided to all workers and authorized visitors. Safety Equipment
45 shall meet latest ANSI Standards.

46
47 Nonskid footwear shall be provided to all abatement workers. Disposable clothing shall be
48 adequately sealed to the footwear to prevent body contamination.

49
50 Provide sufficient supply of disposable mops, rags and sponges for work area decontamination.

51
52 Provide scaffolds, ladders, lifts and hand tools such as scrapers, wire cutters, brushes, utility knives,
53 wire saws, as the work requires.

54
55 Sprayers with pumps capable of providing 14-15 pounds per square inch (psi) at the nozzle tip at a
56 flow rate of 2 gallons per minute for spraying amended water.

57
58 Rubber dust pans and rubber squeegees shall be provided for cleanup.

1
2 Brushes utilized for removing loose asbestos containing material shall have nylon or fiber bristles,
3 not metal.

4
5 A sufficient supply of HEPA filtered vacuum systems shall be available during cleanup.

6
7 Airless spray equipment with an adjustable low pressure nozzle shall be provided for spraying
8 encapsulants. Nozzle tip size and pressure adjustment shall conform to encapsulant manufacturers
9 written recommendations.

10
11 Heavy duty power cables for temporary electrical service and a portable electric generator for
12 maintaining negative pressure in the work area shall be present in case of power failure.

13
14 Warning Signs and Labels: As required by OSHA Regulation 29 CFR 1926.1101(k).

15
16 Other equipment the Contractor deems necessary for asbestos abatement work shall be submitted
17 to the Architect/Engineer for approval prior to its use.

18
19 **PART 3 - EXECUTION**

20
21 **GENERAL COMPLIANCE MEASURES**

22 Mandatory Protection Conditions: Contractor's employees shall wear appropriate respiratory
23 protection and protective clothing under the following conditions:

24
25 During installation or implementation of engineering work practices and control measures.

26
27 During maintenance and repair activities for which control measures, hereinafter described,
28 are not feasible.

29
30 Whenever the control measures are not yet sufficient to reduce exposure below the
31 Permissible Exposure Limits (TWA and/or Excursion Limits).

32
33 Whenever emergency conditions exist.

34
35 Control Measures: The Contractor shall use one or any combination of the following control
36 methods to achieve compliance with the "Permissible Exposure Limits" defined hereinbefore:

37
38 Local exhaust ventilation equipped with HEPA filter dust collection systems.

39
40 General dilution ventilation equipped with HEPA filtration systems on both exhaust and
41 return air.

42
43 Vacuum cleaners equipped with HEPA filters.

44
45 Enclosure or isolation of processes producing airborne asbestos fibers and dust.

46
47 Use of wet methods, wetting agents or removal encapsulants to control employee exposures
48 during their performance of asbestos abatement activities. Where wet methods would
49 result in equipment damage or a safety hazard, dry removal is allowed with written
50 approval from WDNR pursuant to NR447.08(3)(b).

51
52 Prompt disposal of wastes contaminated with asbestos in leak-tight containers.

53

1 Supplement to Control Measures: Whenever the control measures described above are not
2 sufficient to reduce the employee exposure to or below the "Permissible Exposure Limits" (TWA
3 and/or Excursion Limit), the Contractor shall continue to use the control measures to maintain the
4 employee exposure to the lowest levels attainable and supplement them with the use of appropriate
5 respiratory protection and protective clothing.

6
7 Negative-Pressure Enclosure: A negative-pressure enclosure shall be employed whenever feasible,
8 prior to commencing removal, demolition and renovation operations involving asbestos containing
9 materials.

10
11 Types of Respiratory Protection: The following Table represents the minimum respiratory
12 protection required for given airborne concentrations of asbestos:
13

<u>Airborne Concentration of Asbestos, Tremolite, Anthophyllite, Actinolite, or a Combination of These Minerals</u>	<u>Required Respirator</u>
Not in excess of 1 f/cc (10 X PEL)	1. Half-mask air purifying respirator equipped with high-efficiency filters.
Not in excess of 5 f/cc (50 X PEL)	1. Full faceplate air purifying respirator equipped with high-efficiency filters.
Not in excess of 10 f/cc (100 X PEL)	1. Any powered air purifying respirator equipped with high efficiency filters. 2. Any supplied air respirator operated in continuous flow mode.
Not in excess of 100 f/cc (1000 X PEL)	1. Full face piece supplied air respirator operated in pressure demand mode.
Greater than 100 f/cc (1,000 X PEL) or unknown concentration	1. Full face piece supplied air respirator operated in pressure demand mode equipped with an auxiliary positive pressure self-contained breathing apparatus.

14 NOTE: Respirators assigned for higher environmental concentrations may be used at lower
15 concentrations.

16
17 A high-efficiency filter means a filter that is at least 99.97 percent efficient against mono-
18 dispersed particles of 0.3 micrometers in diameter or larger.

19
20 Employee Rotation: The Contractor shall not use employee rotation as a means of compliance with
21 Permissible Exposure Limits (TWA and/or Excursion Limit).

22
23 Supervision: The Contractor shall have a project supervisor on site at all times that only supervises
24 the project and is responsible to assure contract and regulatory compliance.

25 26 **PREPARATION OF REGULATED AREA**

27 Post the following warning signs at all approaches to a regulated area per OSHA 1926.110(k)(7).
28 Signs shall be posted at a distance sufficiently far enough away from the regulated area to permit
29 any person to read the sign and take the necessary protective measures before entering the area
30 marked by the signs.

31
32 **DANGER**

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ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

Post the Occupant Protection Plan at the entrance to the regulated area per DHS 159.21(3).

Post at the entrance to the regulated area a list containing the names, addresses and telephone numbers of the Contractor, Fire Department and any other personnel who may be required to be contacted during abatement activities.

Maintain Project Log per DHS 159.21(2).

Shutdown and lock out all heating, cooling and air conditioning system (HVAC) components that are in, supply or pass through the regulated area. Appropriate equipment and control measures shall be utilized to prevent contamination of building spaces. Seal all intake and exhaust vents in the work area with tape and two layers of 6 mil polyethylene. Also seal any seams in system components that pass through the regulated area.

All electrical circuits to the area in which asbestos abatement work is to take place must be disconnected. The regulated area and other uncontaminated areas that were dependent on the disconnected electrical circuits shall be serviced by a temporary electrical service provided by owner. In accordance with the latest issue of the National Electrical Code, temporary electrical service shall be equipped with combination ground fault interrupter and circuit breakers meeting the requirements of UL for Class A, Group 1 devices. The ground fault interrupter portion shall be solid state type, insulated and isolated from the breaker mechanism. A test mechanism shall provide overload and short circuit protection and shall be operated by a toggle switch with over-center switching mechanism so that contact cannot be held closed.

Preclean all movable objects within the regulated area using a HEPA filtered vacuum or wet cleaning methods as appropriate. After cleaning, these objects shall be removed from the regulated area and carefully stored in an uncontaminated location.

Preclean all fixed objects in the regulated area using HEPA filtered vacuums or wet cleaning techniques as appropriate, if contamination is visibly covering them. Careful attention must be paid to machinery and behind grills or gratings where access may be difficult but contamination significant. Also pay particular attention to wall, floor and ceiling penetrations behind fixed items. After precleaning, enclose fixed objects in four (4) mil polyethylene sheeting and seal securely in place with tape.

Preclean all surfaces in the regulated area using HEPA filtered vacuums and/or wet cleaning methods as appropriate. Do not use any methods that would raise dust such as dry sweeping or vacuuming with equipment not equipped with HEPA filters. Do not disturb asbestos containing materials during the precleaning phase.

Seal off all windows, doorways, elevator openings, corridors, tunnels, entrances, drains, ducts, grills, grates, diffusers, skylights and any other openings between the regulated area and uncontaminated areas outside of the regulated area (including the outside of the building, tunnels and crawl spaces) with four (4) mil polyethylene sheeting and tape.

Wall Covering:

1
2 Where surfacing materials are being removed from overhead, walls shall be covered with two (2)
3 layers of four (4) mil polyethylene sheeting, starting at top of wall and extending down and across
4 the floor area until it meets in the center of the floor. Here the covering sheets shall be taped
5 together to form a monolithic covering which completely encases the regulated area.

6
7 Polyethylene sheets shall be sized to minimize seams. Seams shall be staggered and separated by
8 a distance of at least six (6) feet.

9
10 Wall sheeting shall be secured adequately to prevent it from falling away from the walls. This may
11 require additional support/attachment when negative pressure ventilation systems are utilized.

12 13 Floor Covering:

14
15 The floor area, which has previously been covered with sheeting extended from the walls, shall be
16 covered with one additional layer of six (6) mil (minimum) sheeting. Provide additional protection
17 such as plywood, canvas, or extra plastic sheeting for floors requiring special protection such as
18 carpeting, hardwood flooring and tile floors which may be damaged by water leakage, ladder feet
19 or scaffold wheels. Additional layers of sheeting may be utilized as drop cloths to aid in cleanup
20 of bulk materials.

21
22 Polyethylene sheets shall be sized to minimize seams. If the floor area necessitates seams, those
23 on successive layers of sheeting shall be staggered to reduce the potential for water to penetrate to
24 the flooring material. A distance of at least six (6) feet between seams is sufficient. Do not locate
25 any parallel seams at wall/floor joints.

26
27 Floor sheeting shall extend at least 24" up the side walls of the work area.

28 29 **DECONTAMINATION ENCLOSURE SYSTEM**

30 A decontamination enclosure system shall be provided at each location where workers will enter
31 or exit a regulated area.

32
33 Plans for construction, including materials and layout, shall be submitted as shop drawings and
34 approved by the Architect/Engineer prior to work initiation. Decontamination enclosure systems
35 constructed at the work site shall utilize six (6) mil opaque black or white polyethylene sheeting or
36 other acceptable materials for privacy. Detailed descriptions of portable, prefabricated units, if
37 used, must be submitted for the Architect/Engineer's approval. Plans must include floor plan with
38 dimensions, materials, size, thickness, plumbing and electrical utilities.

39
40 The decontamination enclosure system shall consist of at least a clean room, a shower room, and
41 an equipment room, each separated from each other and from the regulated area by air locks.

42
43 Entry to and exit from all airlocks and decontamination enclosure system chambers shall be through
44 curtained doorways consisting of two sheets of overlapping six (6) mil polyethylene sheeting. The
45 curtain doorway sheets shall be secured at the top and one side opposite each other. All curtains
46 shall have weights attached to the bottom to ensure that they hang straight and maintain a seal over
47 the doorway when not in use. Doorway designs, providing equivalent protection and acceptable to
48 the Architect/Engineer may be utilized.

49
50 Access between any two rooms in the decontamination enclosure system shall be through an airlock
51 with at least three (3) feet separating each curtained doorway. Pathways into (from clean to
52 contaminated) and out from (contaminated to clean) the regulated area shall be clearly designated.

1 The clean room shall be sized to adequately accommodate the work crew. Clean, disposable
2 clothing, replacement filters for respirators, disposable towels and other necessary items shall be
3 provided in adequate supply in the clean room. A location for postings shall also be provided in
4 this area. Whenever possible, a lockable door shall be used to permit access into the clean room
5 from outside the regulated area.

6
7 The shower room shall contain one or more shower heads as necessary to adequately accommodate
8 workers. Each shower head shall be supplied with hot and cold water adjustable at the tap. The
9 shower enclosure shall be constructed to insure against leakage of any kind. An adequate supply
10 of soap and disposable towels shall be supplied by the Contractor and available at all times. Shower
11 water shall be drained, collected and filtered as specified in the Article entitled: "Water Collection
12 and Disposal," herein.

13
14 The equipment room shall be used for storage of equipment and tools at the end of a shift after
15 workers have been decontaminated using a HEPA filtered vacuum and/or wet cleaning techniques
16 as appropriate. Replacement filters (in sealed containers until used) for HEPA vacuums and
17 negative pressure ventilation equipment, extra tools, containers or surfactant and other materials
18 and equipment that may be required during the abatement, may also be stored here as needed. A
19 walk-off pan (a small children's swimming pool or equivalent filled with water) shall be located in
20 the regulated area just outside the equipment room for workers to clean off foot coverings after
21 leaving the regulated area and prevent excessive contamination of the worker decontamination
22 enclosure system. A drum lined with a labeled six (6) mil polyethylene bag for collection of
23 disposable clothing shall be located in this room. Contaminated rubber boots or other reusable
24 footwear shall be stored in this area for reuse the following workday.

25
26 **Waste Container Pass-Out Airlock:**

27
28 The waste container pass-out airlock shall be constructed at some location away from the worker
29 decontamination enclosure system. Wherever possible, this shall be located where there is direct
30 access from the regulated area to the outside of the building.

31
32 This airlock system shall consist of an airlock, a container staging area, and another airlock with
33 access to outside the regulated area.

34
35 The waste container pass-out airlock shall be constructed in similar fashion to the worker
36 decontamination enclosure system using similar materials and airlock and curtain doorway designs.

37
38 This airlock system shall not be used to enter or exit the regulated area. The airlock system shall
39 be tightly sealed when not in use.

40
41 Emergency exits shall be established and clearly marked with duct tape arrows or other effective
42 designations to permit easy location from anywhere within the regulated area. They shall be
43 secured to prevent access from uncontaminated areas, but still permit emergency exiting. These
44 exits shall be properly sealed with polyethylene sheeting which can be cut to permit egress if
45 needed. These exits may be through the decontamination enclosure, the waste pass-out airlock, or
46 other alternative exits satisfactory to fire officials.

47
48 **TEMPORARY ISOLATION PARTITIONS**

49 Large rooms or open areas that require temporary air tight barriers to separate a contaminated
50 regulated area from an uncontaminated area shall be provided with temporary partitions,
51 constructed in the following manner:

52
53 Walls shall be constructed of wood or metal framing to support barriers in all openings larger than
54 4' x 8'.

1
2 A sheathing material (plywood, drywall) of at least 3/8" thickness shall be applied to work side of
3 barrier.

4
5 Cover the work side of partition with a double layer of four (4) mil polyethylene sheeting with
6 staggered joints and seal in place.

7
8 Provide at least one (12" x 12") window in the barrier system, where feasible, for the purpose of
9 viewing into the regulated area. The window shall consist of heavy gauge plastic or clear safety
10 glass. Panes shall be framed into the barrier system and completely sealed to prevent any leakage
11 of air through the unit.

12 13 **MAINTENANCE OF ENCLOSURE SYSTEM**

14 Following completion of the construction of all polyethylene barriers and decontamination system
15 enclosures, initiate negative pressure system and allow overnight settling to ensure that barriers
16 will remain intact and secured to walls and fixtures before beginning actual abatement activities.

17
18 All polyethylene barriers and decontamination enclosure systems shall be inspected at least twice
19 daily by the Contractor's competent person prior to the start of each day's abatement activities and
20 following the completion of the day's abatement activities. Document inspections and observations
21 in the daily project log.

22
23 Damage and defects in the enclosure system are to be repaired immediately upon discovery.

24
25 Use smoke tubes to test the effectiveness of the barrier system when directed by Owners Project
26 Representative.

27
28 Anytime during the abatement activities, if visible construction related dust or debris is observed
29 outside of the regulated area or if damage occurs to barriers, work shall immediately stop, repairs
30 shall be made to barriers, and debris/residue cleaned up using appropriate HEPA vacuuming and
31 wet mopping procedures.

32
33 Openings made in the enclosure system to accommodate negative air pressure system shall be made
34 airtight with tape and caulking as needed. If more than one unit is installed, they should be turned
35 on one at a time, checking the integrity of wall barriers for secure attachment and need for additional
36 reinforcement. Insure that adequate power supply is available to satisfy the requirements of the
37 ventilating and exhaust units. Negative pressure units shall be exhausted to the outside of the
38 building. They shall not be exhausted into occupied areas of the building. Careful installation and
39 daily inspections shall be done to ensure that the ducting does not release fibers into
40 uncontaminated building areas.

41
42 Use of enclosure system shall not commence until the following has been accomplished:

43
44 Enclosure systems have been constructed, inspected, and tested.

45
46 Negative pressure systems are functioning adequately.

47
48 All preabatement submissions, notifications, postings and permits have been provided and
49 approved by the Architect/Engineer, or Construction Representative, as applicable.

50
51 All equipment for abatement, cleanup and disposal are on hand.

52
53 All worker training is completed.

54

1 Contractor has received written notice to commence abatement work from the UWS, based on
2 recommendation of the Owners Project Representative.

3
4 **WORKPLACE ENTRY AND EXIT PROCEDURES**

5 All workers and authorized personnel shall enter the regulated area through the decontamination
6 enclosure system.

7
8 All personnel who enter the regulated area must sign the registration log, located in the clean room,
9 both upon entry and exiting the area.

10
11 All personnel shall proceed first to the clean room, remove all street clothes, and appropriately don
12 respiratory protection (as approved for the job conditions) and disposable coveralls, head covering
13 and foot covering. Hard hats, eye protection and gloves shall also be utilized if required. Clean
14 respirators and protective clothing shall be provided and utilized by each person for each separate
15 entry into the regulated area.

16
17 Personnel wearing designated personal protective equipment shall proceed from the clean room
18 through the decontamination enclosure system to the regulated area.

19
20 Before leaving the regulated area all personnel shall remove gross contamination from the outside
21 of respirators and protective clothing by brushing or wet wiping procedures. (Small HEPA
22 vacuums with brush attachments may be utilized for this purpose.) Each person shall clean bottoms
23 of protective footwear in the walk-off pan just prior to entering the equipment room.

24
25 Personnel shall proceed to equipment room where they remove all protective equipment except
26 respirators. Deposit disposable clothing into appropriately labeled containers for disposal.

27
28 Reusable, contaminated footwear shall be stored in the equipment room when not in use in the
29 regulated area. Upon completion of abatement it shall be disposed of as asbestos contaminated
30 waste. Rubber boots may be decontaminated at the completion of the abatement for reuse.

31
32 Still wearing respirators, personnel shall proceed to the shower area, clean the outside of the
33 respirators and the exposed face area under running water prior to removal of respirator and shower
34 and shampoo to remove residual asbestos contamination. Various types of respirators will require
35 slight modification of these procedures. An airline respirator with HEPA filtered disconnect
36 protection may be disconnected in the equipment room and worn into the shower. A powered air
37 purifying respirator face piece will have to be disconnected from the filter/power pack assembly
38 which is not waterproof, upon entering the shower. Cartridges must be in place for each new entry
39 into the regulated area.

40
41 After showering and drying off, proceed to the clean room and don street clothing, even though
42 there will be later reentry into the regulated area or street clothes, if it is the end of the work shift.

43
44 Workers shall NOT eat, drink, smoke, chew gum or tobacco in the regulated area. To eat, drink or
45 smoke, workers shall follow the procedure described above, then dress in street clothes before
46 entering the nonregulated areas of the building.

47
48 These procedures shall be posted in the clean room and equipment room.

49
50 **WASTE CONTAINER PASS-OUT PROCEDURE**

51 Asbestos contaminated waste that has been containerized shall be transported out of the regulated
52 area through the waste container pass-out airlock (or through the decontamination enclosure if a
53 separate airlock has not been constructed).

1 The inside team wearing protective clothing and respirators appropriate for the contaminated
2 regulated area shall clean the entire surface, including bottoms, of properly labeled bags, using
3 HEPA vacuums and wet wiping techniques and transport them into the waste container pass-out
4 airlock where they will be placed into another properly labeled bag. No worker from the inside
5 team shall further exit the regulated area through this airlock.

6
7 Workers from outside the regulated area wearing appropriately assigned respirators, shall enter the
8 airlock from outside the regulated area. No worker from the outside team shall further enter the
9 regulated area through this airlock.

10
11 The exit from this airlock shall be secured to prevent unauthorized entry.

12 13 **WATER COLLECTION AND DISPOSAL**

14 All water resulting from precleaning operation, excess from floor of regulated area and the final
15 cleaning operation shall be collected and placed in sealed containers for disposal as contaminated
16 material.

17
18 Water from the decontamination shower shall be collected in a holding tank and filtered to remove
19 particles of 0.5 microns or larger size before draining water into sanitary sewer system. The
20 drainage and filtering system shall consist of the following:

21
22 A centrifugal pump capable of pumping at least 25 gallons/minute.

23
24 Two filter cartridge housings, one serving as a prefilter, utilizing at least 6 cylindrical 100 micron
25 filters (reusable type) and the other serving as final filter with 6 cylindrical 0.5 micron filters.

26
27 Maintain two sets (6 cylinders per set) of 100 micron filters, to allow one set to be cleaned while
28 the other set is in use.

29
30 A common garden hose may be connected to final filter housing to drain water to sanitary sewer
31 system.

32 33 **WET REMOVAL PROCEDURE**

34 Wet all asbestos containing material with an amended water solution, or removal encapsulant, using
35 equipment capable of providing a fine spray mist, in order to reduce airborne fiber concentrations
36 when the material is disturbed. Saturate the material to the substrate. Keep all removed material
37 wet to prevent fiber release until it can be containerized for disposal. If regulated area temperatures
38 are below 32°F and amended water is subject to freezing, modify as specified for surfactant in
39 Article entitled: "Materials," herein. Maintain a high humidity in the regulated area by misting or
40 spraying to assist in fiber settling and reduce airborne concentrations.

41
42 Saturated asbestos containing material shall be removed in manageable sections. Removed
43 material should be containerized before moving to a new location for continuance of work.
44 Surrounding areas shall be periodically sprayed and maintained in a wet condition until visible
45 material is cleaned up.

46
47 Material removed from building structures or components shall not be dropped or thrown to the
48 floor. Material should be removed as intact sections or components whenever possible and
49 carefully lowered to the floor. If this cannot be done for materials greater than 50 feet above the
50 floor, a dust-tight chute shall be constructed to transport the material to containers on the floor or
51 the material may be containerized at elevated levels (e.g. on scaffolds) and carefully lowered to the
52 ground by mechanical means. For materials between 15 and 50 feet above the ground they may be
53 containerized at elevated levels or dropped onto inclined chutes or scaffolding for subsequent
54 collection and containerization.

1
2 Bags shall be considered full when half their capacity have been filled. They should be securely
3 sealed to prevent accidental opening and leakage by tying tops of bags in an overhand knot or by
4 taping in gooseneck fashion. Do not seal bags with wire or cord.

5
6 Large components removed intact may be wrapped in two (2) layers of six (6) mil polyethylene
7 sheeting secured with tape for transport to the approved disposal site.

8
9 Asbestos containing waste with sharp edged components (e.g., nails, screws, metal lath, tin
10 sheeting) shall be placed into drums for disposal in lieu of polyethylene bags. Drums shall be
11 marked to differentiate contents from those drums containing bagged material.

12
13 After completion of all stripping work, surfaces from which asbestos containing materials have
14 been removed, such as plaster base coat or metal deck, etc., shall be wet brushed and sponged to
15 remove all visible residue.

16 17 **CEILING SYSTEM REMOVAL**

18 Remove, clean and enclose in polyethylene the ceiling mounted objects such as lights and other
19 items that may interfere with the abatement process and were not previously cleaned and sealed
20 off. Utilize localized spraying of amended water, or HEPA vacuums, to reduce fiber dispersal
21 during the removal of these fixtures.

22
23 Remove ceiling (tiles) (panels) within the regulated area carefully. If panels are to be reused,
24 vacuum them with a HEPA filtered vacuum cleaner and carefully damp sponge and wrap cleaned
25 (tiles) (panels) in four (4) mil polyethylene sheeting and seal with tape. Store as designated by
26 Owner's Project Representative (preferably outside of the regulated area). If (tiles) (panels) are to
27 be discarded it is not necessary to clean them, but wrap in a similar fashion and stage for disposal
28 in the waste container pass-out airlock.

29
30 Where suspended ceiling T-grid components must be removed to perform the abatement, HEPA
31 vacuum and wet sponge each piece after removal from hangers. Wrap clean grid pieces in four (4)
32 mil polyethylene sheeting and seal with tape. Store as designated by Owner's Project
33 Representative or in waste staging area if designated for disposal.

34
35 When removal of ceiling grid suspension system is not necessary for accessibility to the asbestos
36 containing materials, leave the system in place and clean properly following completion of
37 abatement, as specified in the Article of this section entitled: "Cleanup Procedure."

38
39 Remove plaster/drywall ceilings including lath, furring channel system, wire mesh, ties, clips,
40 screws, nails and other accessory items as necessary and dispose of them as asbestos contaminated
41 waste material. As work progresses, spray ceiling materials and debris with amended water to keep
42 wet until containerized for disposal.

43 44 **PIPE TUNNEL OR CRAWL SPACE REMOVAL WORK**

45 A decontamination enclosure shall be provided at the entrance to the pipe tunnel or crawl space.
46 All requirements for regulated area entry and exit procedures and waste container pass-out
47 procedures, as hereinbefore specified, shall apply to this work.

48
49 All openings within the pipe tunnel or crawl space shall be sealed with four (4) mil polyethylene
50 and tape. The existing surfaces within the space will not be required to be covered with
51 polyethylene sheeting.

52
53 A negative pressure system shall be required to maintain the security of the workspace and the
54 integrated decontamination enclosure.

1
2 All loose and fallen asbestos-containing material shall be very carefully cleaned up with an
3 industrial vacuum equipped with HEPA filter.
4

5 After asbestos abatement work has been completed in the crawl space or pipe tunnel, all ceiling,
6 wall and floor surfaces shall be cleaned with the HEPA equipped vacuum. All cleaned surfaces
7 shall be sealed with an approved encapsulant.
8

9 **FLOORING REMOVAL**

10 Where flooring removal is specified with the use of solvents to remove flooring adhesive, the
11 substrate shall have no adhesive residue or debris remaining. Contractor shall wash the substrate
12 with soap and water to remove all solvent. Contractor shall be responsible for the cost of repair or
13 replacement of any building components damaged by excessive use of solvents.
14

15 Where flooring removal is specified without the use of solvents to remove flooring adhesive, the
16 contractor shall diligently remove adhesive by scraping process so that all trowel marks are
17 removed and a uniform substrate, smooth to the touch, is attained. Contractor shall coordinate with
18 the flooring installer to ensure that the remaining substrate is suitable for replacement flooring
19 installation.
20

21 **SMALL SCALE - SHORT DURATION REMOVAL PROCEDURE**

22 Glovebag Method:
23

24 All workers who are permitted to use the glovebag technique must be trained, experienced and
25 skilled in this method.
26

27 All tools and materials that will be required during the removal procedure shall be placed into the
28 tool pouch.
29

30 Glovebag shall be installed so that it completely encompasses the surface where removal work will
31 take place. The side seams of the glovebag shall be cut the appropriate length to accommodate a
32 size that will fit over the removal area. The bag shall be placed in position, the edges of the bag
33 shall be folded together and sealed with tape. All openings in the bag shall be sealed with duct tape
34 (or equivalent material). The bottom seam of the bag must also be sealed with tape to prevent
35 leakage.
36

37 Workers performing asbestos removal with glovebag shall wear (at a minimum) half mask dual-
38 cartridge HEPA-equipped respirator, and full protective clothing to protect against the possibility
39 of accidental leakage.
40

41 All material removed within the glovebag shall be thoroughly wetted with wetting agent, or
42 removal encapsulant, applied with airless sprayer through the side port provided in the bag. After
43 asbestos containing material has been removed, the exposed base surface must be thoroughly
44 cleaned and wet wiped until all traces of asbestos-containing material is removed.
45

46 Create constant negative pressure by running a HEPA vacuum hose into bag.
47

48 Any exposed edges of asbestos-containing that will remain after bag is removed shall be
49 encapsulated with a bridging encapsulant to seal the material from releasing fibers to the
50 atmosphere. Provide neatly beveled and coated terminations, where insulation terminates, suitable
51 for a butt joint with new insulation.
52

53 In all glovebag removal settings, all doors, windows and other openings to the functional space
54 must be sealed with a minimum of four (4) mil polyethylene sheeting. The HVAC system must be

1 shut down. Once the area is completely sealed off, negative air pressure must be introduced to the
2 entire functional space.

3
4 In glovebag settings which involve small scale short duration removal the immediate area shall be
5 prepared using the following techniques: polyethylene drop cloths (minimum 6 mil) on floor and
6 walls in a 12 foot perimeter of the removal area with a negative air machine present and running in
7 the immediate area. Glovebag must be placed under variable negative pressure during removal
8 stages. A centralized three stage decontamination system must be established in the building for
9 this method of glovebag removal.

10 11 Mini-Enclosure Method:

12
13 A mini-enclosure may be built around an area which is too large for glovebag method, but is of
14 small-scale and short duration work and would not warrant large enclosure.

15
16 The mini-enclosure can be small enough to restrict the space to use by one worker. A small change
17 room shall be contiguous to the mini-enclosure. The change room shall be a minimum of 3' x 3'

18
19 The mini-enclosure shall be constructed by affixing plastic sheeting to existing walls and covering
20 the floor with plastic sheeting, which shall extend up walls at least 24 inches and sealed with tape.
21 If existing walls are not available, frame shall be constructed and two (2) layers of six (6) mil
22 polyethylene sheeting applied to the interior side of frame to allow clean "take-down" at
23 completion. Sheeting shall be sealed with tape.

24
25 The change room shall be constructed of framing to which shall be applied two (2) layers of six (6)
26 mil polyethylene sheeting to interior side of frame and sealed with tape. The change room shall be
27 provided with double six (6) mil polyethylene curtains at the exit and the entrance to the mini work
28 enclosure. Both curtains in each opening shall be secured at the top and one side opposite from the
29 other.

30
31 A hose from a HEPA vacuum shall be extended through the wall of the mini-enclosure and the
32 opening around the hose shall be sealed with tape. The HEPA vacuum shall run continuously
33 during the time asbestos abatement work is taking place.

34
35 All abatement work shall be conducted using the wet removal method and all debris from such
36 work shall be bagged and disposed of as contaminated material. Upon completion, the interior
37 surfaces of the regulated area shall be cleaned and sprayed with an encapsulant.

38
39 Worker using the mini-enclosure method shall wear two (2) Tyvek^R or equivalent disposable work
40 suits and the appropriate HEPA filtered dual cartridge respiratory protection. Upon completion of
41 the work and before leaving the change area, worker shall remove outer work suit and then proceed
42 to a shower that is not contiguous with the work area.

43
44 The polyethylene enclosure, comprising the regulated area and the change room, shall be collapsed
45 inwardly, bagged and disposed of as contaminated material.

46 47 **ENCAPSULATION PROCEDURES**

48 Clean and isolate the regulated area as specified in Article entitled: "Preparation of Regulated
49 Area", hereinbefore.

50
51 Repair damaged and missing areas of existing materials with nonasbestos-containing substitutes.
52 Material must adhere adequately to existing surfaces and provide an adequate base for application
53 of encapsulating agents. Filler material shall be applied in accordance with manufacturer's
54 recommended specifications.

1
2 Spray apply using airless equipment with low nozzle pressure to all surfaces where asbestos is
3 removed or surfaces containing asbestos that are to remain in place. Spray must completely
4 encapsulate any remaining asbestos, permanently locking it in place.

5
6 Apply a minimum of one (1) coat with coverage in strict accordance with manufacturer's
7 recommendations. Surfaces must be dry and free of dirt, oil and dust.

8 9 **ENCLOSURE PROCEDURE**

10 Clean and isolate the regulated area as specified in Article entitled: "Preparation of Regulated
11 Area" hereinbefore.

12
13 Spray areas that will be disturbed during the installation of hangers or other support/framing
14 materials for the enclosure with water containing the specified surfactant. Keep these areas damp
15 to reduce airborne fiber concentrations.

16
17 Remove loose or hanging asbestos containing materials.

18
19 After installation of hangers and other fixing devices and before installation of enclosure, repair
20 damaged areas of fireproofing/thermal insulation materials as required using a nonasbestos-
21 containing replacement material. Prepare surfaces and apply replacement material in accordance
22 with manufacturer's recommendations.

23 24 **AIR MONITORING**

25 Daily Personal Air Monitoring (OSHA Compliance):

26
27 Daily determination of employee exposure shall be made by collecting one or more
28 breathing zone samples that are representative of the 8-hour TWA, full-shift exposure for
29 each employee in each regulated area; and one or more breathing zone air samples that are
30 representative of 30-minute exposures associated with operations that are most likely to
31 produce exposures above the excursion limit for employees in each regulated area.

32
33 OSHA P.E.L. As required by 29CFR 1926.1101(c). Within the breathing zone of each
34 worker category (i.e., wetter, receiver, bagger) 25% of the crew or one per job category.

35
36 All samples collected shall be analyzed by a laboratory accredited by the American Industrial
37 Hygiene Association or in accordance with 1926.1101 – Appendix A.

38
39 The Owners Project Representative has the authority to stop the abatement work under the
40 provisions of the General Conditions of this contract at anytime the Representative determines
41 either personally or through the services of an air sampling professional that conditions are not in
42 compliance with the specifications and applicable regulations. The stoppage of work shall continue
43 until conditions have been corrected and corrective steps have been taken to the satisfaction of the
44 Construction Representative. Standby time required to resolve violations shall be at the
45 Contractor's expense.

46 47 **CLEANUP PROCEDURE**

48 Remove and containerize all visible accumulations of asbestos containing material and asbestos
49 contaminated debris utilizing rubber dust pans and rubber squeegees to move material around. Do
50 not use metal shovels to pick up or move accumulated waste. Special care shall be taken to
51 minimize damage to floor sheeting.

52
53 Wet clean all surfaces in the regulated area using rags, mops and sponges as appropriate. (Note:
54 Some HEPA vacuums might not be wet-dry vacuums.)

1
2 Prior to removing the inner layer of plastic sheeting, the sheeting shall be sprayed with an
3 encapsulant, so that any residue remaining will be adhered to the plastic sheeting.

4
5 Remove the cleaned inner layer of plastic sheeting from walls and floors. Windows, doors, HVAC
6 system vents and all other openings shall remain sealed. The negative pressure ventilation units
7 shall remain in continuous operation. Decontamination enclosure systems shall remain in place
8 and be utilized.

9
10 Remove all containerized waste from the regulated area and waste container pass-out airlock.

11
12 The DFDM's Project Representative, DNR Representative and the Contractor shall inspect the
13 regulated area for visible residue. If any accumulation of residue is observed, it will be assumed to
14 be asbestos and the cleaning cycle shall be repeated.

15
16 After cleaning the regulated area the Contractor may either spray the remaining barrier material
17 with encapsulant, or wait at least 24 hours to allow fibers to settle and HEPA vacuum and wet clean
18 all objects and surfaces in the regulated area again.

19
20 Decontaminate all tools and equipment and remove at the appropriate time in the cleaning
21 sequence.

22
23 **DISPOSAL PROCEDURES**

24 As the work progresses to prevent exceeding available storage capacity onsite, sealed and labelled
25 containers of asbestos-containing waste shall be removed and transported directly to the
26 prearranged disposal location, which must be an authorized site in accordance with regulatory
27 requirements of NESHAP and Wisconsin Administrative Rule NR 447.13 and NR 506.10. Use of
28 intermediate storage locations is not an accepted disposal procedure. Mark vehicles used to
29 transport asbestos-containing waste in accordance with NR 447.12(4)(a)1 to 3. Comply with US
30 DOT Hazardous Material regulations, 49 CFR 171-180.

31
32 The Contractor shall provide documentation in the form of a transportation and disposal manifest
33 that will provide a chain-of-custody record of all asbestos-containing waste from project site to the
34 disposal site. All asbestos-containing waste generated must be accounted for by these records and
35 copies of all such records shall be delivered to the Construction Representative.

36
37 Transportation to the Landfill:

38
39 Contractor shall provide an enclosed lockable waste container, consisting of a truck, trailer
40 or dumpster, for storage and transportation of waste. The waste container shall be locked
41 while unattended and during transportation of waste. Once bags have been removed from
42 the regulated area, they shall be loaded directly into the waste container for transportation.

43
44 The waste container shall be free of debris and lined with six (6) mil polyethylene sheeting
45 to prevent contamination from leaking or spilled containers. Floor sheeting shall be
46 installed first and extend up the side walls. Wall sheeting shall be overlapped and taped
47 into place.

48
49 Drums shall be placed on level surfaces in the waste container and packed tightly together
50 to prevent shifting and tipping. Large components shall be secured to prevent shifting and
51 bags placed on top. Do not throw containers into waste container.

52

1 Personnel loading asbestos containing waste shall be protected by disposable clothing
2 including head, body and foot protection and at a minimum, half-face piece, air-purifying,
3 dual cartridge respirators equipped with HEPA filters.

4
5 Any debris or residue observed on containers or surfaces outside of the regulated area
6 resulting from cleanup or disposal activities shall be immediately cleaned up using HEPA
7 filtered vacuum equipment and/or wet methods.

8
9 Disposal at the Landfill:

10
11 Upon reaching the landfill, trucks are to approach the dump location as closely as possible
12 for unloading of the asbestos containing waste.

13
14 Bags, drums and components shall be inspected as they are off-loaded at the disposal site.
15 Damaged containers shall be very carefully taped shut and repacked into drums or bags as
16 applicable.

17
18 Waste containers shall be placed on the ground at the disposal site, not pushed or thrown
19 out of trucks (weight of wet material could rupture bags).

20
21 Personnel off-loading containers at the disposal site shall wear protective equipment
22 consisting of disposable head, body and foot protection and, at a minimum, half-face piece,
23 air-purifying, dual cartridge respirators equipped with HEPA filters.

24
25 Following the removal of all containerized waste, the truck cargo area shall be
26 decontaminated using HEPA vacuums and wet methods to meet the no visible residue
27 criteria. Polyethylene sheeting shall be removed and discarded along with contaminated
28 cleaning materials and protective clothing in bags or drums at the disposal site.

29
30 **REESTABLISHMENT OF REGULATED AREA**

31 Reestablishment of the regulated area shall occur only after completion of cleanup procedures and
32 documentation has been performed to the satisfaction of the Owner's Representative.

33
34 Resecure mounted objects removed from their former positions during area preparation activities.

35
36 Resecure and relocate objects that were removed to temporary locations back to their original
37 positions.

38
39 Reestablish HVAC, mechanical and electrical systems in proper working order. Remove
40 potentially contaminated HVAC system filters and dispose of as asbestos contaminated waste.
41 Decontaminate filter assembly using HEPA vacuums and wet cleaning techniques.

42
43 END OF SECTION
44
45

1 **SECTION 04 03 22**
2 **HISTORIC BRICK UNIT MASONRY REPAIR**

3 PART 1 - GENERAL

4 1.1 SUMMARY

- 5 A. Section includes historic treatment work consisting of repairing historic clay brick masonry as follows:
6 1. Infilling in and patching existing unit masonry.

7 1.2 DELIVERY, STORAGE, AND HANDLING

- 8 A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use
9 cementitious materials that have become damp.
- 10 B. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have
11 been damaged or have been opened for more than two days.

12 PART 2 - PRODUCTS

13 2.1 MASONRY MATERIALS

- 14 A. Salvaged Brick: Obtain salvaged brick from location indicated on Drawings. Clean off residual mortar.

15 2.2 MORTAR MATERIALS

- 16 A. Portland Cement: ASTM C150, Type I or Type II; white or gray as where required for color matching of
17 mortar.
- 18 B. Hydrated Lime: ASTM C207, Type S.
- 19 C. Mortar Sand: ASTM C144 unless otherwise indicated.
20 1. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several
21 sands if necessary to achieve suitable match.
22 2. Colored Mortar: Natural sand or ground marble, granite, or other sound stone of color necessary to
23 produce required mortar color.
- 24 D. Mortar Pigments: ASTM C979M, compounded for use in mortar mixes, and having a record of
25 satisfactory performance in masonry mortars.
- 26 E. Water: ASTM C270, potable.

1 2.3 ACCESSORY MATERIALS

- 2 A. Anchors and Ties, General: Provide ties and anchors specifically designed to be used together; sized to
3 extend at least halfway, but not less than 1-1/2 inches, through masonry unit and with at least 5/8-inch
4 mortar cover on outside face; and made of materials that comply with the following, unless otherwise
5 indicated:
- 6 1. Steel Sheet: ASTM A 1008, Commercial Steel; 0.074-inch minimum thickness; with
7 ASTM A 153, Class B coating applied after fabrication.
 - 8 2. Steel Wire: ASTM A 82; 0.187-inch minimum diameter; with ASTM A 153, hot-dip galvanized
9 Class B-2 coating applied after fabrication.
- 10 B. Setting Buttons and Shims: Resilient plastic, nonstaining to masonry, sized to suit joint thicknesses and
11 bed depths of bricks, less the required depth of pointing materials unless removed before pointing.

12 2.4 MORTAR MIXES

- 13 A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or
14 equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical
15 batch mixer.
- 16 B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified
17 proportions without Architect's approval.
- 18 1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent
19 by weight of the cementitious or binder materials, except for carbon black which is limited to 2
20 percent, unless otherwise demonstrated by a satisfactory history of performance.
- 21 C. Do not use admixtures in mortar unless otherwise indicated.
- 22 D. Mixes: Mix mortar materials in the following proportions:
- 23 1. Rebuilding (Setting) Mortar by Type: ASTM C270, Proportion Specification, Type N with
24 cementitious material limited to portland cement and lime.
 - 25 2. Colored Mortar: Add mortar pigments to produce exposed, setting (rebuilding) mortar of colors
26 required.

27 PART 3 - EXECUTION

28 3.1 PROTECTION

- 29 A. Prevent mortar from staining face of surrounding masonry and other surfaces.

30 3.2 BRICK REMOVAL AND REPLACEMENT

- 31 A. At locations indicated, remove entire units from joint to joint, without damaging surrounding masonry, in
32 a manner that permits replacement with full-size units.
- 33 B. Support and protect remaining masonry that surrounds removal area.
- 34 C. Remove in an undamaged condition as many whole bricks as possible.
- 35 1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and
36 water.

1 **SECTION 055000**
2 **METAL FABRICATIONS**

3 PART 1 - GENERAL

4 1.1 SUMMARY

- 5 A. Section Includes: Loose lintels.

6 1.2 ACTION SUBMITTALS

- 7 A. Shop Drawings: Indicate dimensions, description of materials and finishes.

8 PART 2 - PRODUCTS

9 2.1 MATERIALS

- 10 A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components
11 exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade
12 names, or blemishes.

- 13 B. Steel Plates, Shapes and Bars: ASTM A36.

14 2.2 FRAMING, SUPPORTS AND PLATES

- 15 A. (MET FAB-1) Loose Steel Lintels: Fabricate loose steel lintels from steel angles and shapes of size
16 indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in
17 single lengths for each opening unless otherwise indicated.
18 1. Finish: Shop-prime for field-applied paint.

19 2.3 FINISHING

- 20 A. Comply with NAAMMS "Metal Finishes Manual for Architectural and Metal Products" for
21 recommendations for applying and designating finishes.
22 1. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary
23 protective covering before shipment.

- 24 B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum
25 requirements indicated below for SSPC surface-preparation specifications and environmental exposure
26 conditions of installed products:
27 1. Interior (SSPC Zone 1A): SSPC SP 3, "Power Tool Cleaning."

- 28 C. Shop-Applied Primer and Field-Applied Paint (PT): Coordinate with Section 09 90 00 - Painting.

1 PART 3 - EXECUTION

2 3.1 EXAMINATION

3 A. Examine areas and conditions under which miscellaneous metal items are to be installed. Do not proceed
4 with work until unsatisfactory conditions have been corrected.

5 3.2 INSTALLATION

6 A. Provide anchorage devices and fasteners where necessary for securing miscellaneous metal items to in-
7 place construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through-
8 bolts, lag bolts, wood screws and other connectors as required.

9 B. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint
10 exposed areas with same material as used for shop painting. Apply by brush or spray to provide minimum
11 dry film thickness of 2 mils.

12 C. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal
13 fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces
14 level, plumb, true, and free of rack; and measured from established lines and levels.

15 D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are
16 required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and
17 masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

18 **END OF SECTION**

- 1 C. Plywood Standard: Comply with U. S. Product Standard PS 1-74/ANSI A199.1; and Grades and
2 Specifications, Performance-Rated Panels and Specifications by APA – The Engineered Wood Association
3 local code standard. Each construction and industrial panel shall bear APA trademark and appropriate
4 identification.
- 5 D. Not Allowed: Products containing following materials will not be permitted:
6 1. Urea Formaldehyde.
7 2. Chromium in wood pressure treatment products.
8 3. Arsenic.

9 2.2 LUMBER

- 10 A. (WD BLKG-1) Miscellaneous Lumber: Lumber for support or attachment of other construction, including
11 rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping
12 and similar members.
13 1. Grade: No. 3 or standard grade.
14 2. Moisture content of 19 percent maximum for lumber items not specified to have wood preservative
15 treatment.

16 2.3 WOOD SHEATHING

- 17 A. Specified sheathing thicknesses are minimums. Provide sheathing in other thicknesses as shown on
18 Drawings.
- 19 B. (WD SHTG-1) Concealed Sheathing: APA, C-D touch-sanded plugged, Exposure 1, square edge, fire-
20 resistive treated, Douglas Fir.
21 1. Thickness: 1/2-inch.
- 22 C. (WD SHTG-8) Exposed Sheathing: APA Douglas Fir, with medium density overlay (MDO) for painted
23 finish, 3/8 inch, square edge.

24 2.4 FIRE-RETARDANT TREATMENT AND TREATED MATERIALS

- 25 A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of
26 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive
27 combustion when the test is extended an additional 20 minutes, and with the flame front not extending more
28 than 10.5 feet beyond the centerline of the burners at any time during the test.
29 1. Complete fabrication prior to treatment to minimize cutting and jointing after treatment.
30 2. Coat surfaces cut after treatment with heavy brush coat of same fire-retardant chemical.
31 3. After treatment: Material shall be dried to an average moisture content of 15 percent or less for
32 plywood and 19 percent or less for other lumber.
33 4. Do not use twisted, warped, bowed or otherwise damaged or defective pieces.
- 34 B. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
35 Each piece to bear:
36 1. UL FR-S rating (flame spread and smoke developed less than 25),
37 2. Complying with extended 30-minute tunnel test, ASTM E84 or UL 723
38 3. Meet interior Type A requirements in AWPA Standard C-20 for lumber and C-27 for plywood.
39 4. And shall be registered for use as a wood preservative by the U.S. Environmental Protection
40 Agency.

- 1 2.5 ROUGH HARDWARE, FASTENERS AND ANCHORAGE DEVICES
- 2 A. General: Provide rough hardware required, including nails, screws, bolts, lag screws, cinch anchors, toggle
3 bolts, shot anchors and similar items . Provide proper size and type for use intended and for materials to be
4 fastened.
- 5 1. Install adequate hardware to insure substantial and positive anchorage.
- 6 B. Nails: Conform to materials standards established under FS FF-N-105.
- 7 1. Refer to IBC Nailing Schedule for quality and size.
- 8 C. Adhesive: As recommended by manufacturer of product to be applied for surface material to give
9 permanent adhesion, with material remaining flat to back surface. Comply with local code standards.
- 10 1. Comply with APA AFG-01 for adhesive for use with type of construction panel indicated.
- 11 2. Interior: Water-resistant casein and other adhesives suited for particular use.

12 PART 3 - EXECUTION

13 3.1 BLOCKING AND BACKING

- 14 A. Install plumb, level, true and square to dimensions shown and required. Allow for finishes and proper
15 clearances where necessary.
- 16 B. Provide sound bearing, square cuts, and full bearing surfaces. Set crown up for horizontal members. Shim
17 and block where required.
- 18 C. Eliminate crooked, twisted, cupped or bowed framing where required.
- 19 D. Anchorage: Adequately anchor, fasten and support members to form secure, substantial and accurate
20 anchorage and to hold required dimensions and prevent twist.
- 21 1. Use bolts and screws to eliminate loosening up of joints, sagging or similar movement.
- 22 E. Secure WD SHTG-2 to substrate with adhesive. Exposed fasteners are not acceptable.

23 **END OF SECTION**

24

1 PART 2 - PRODUCTS

2 2.1 ARCHITECTURAL WOODWORK, GENERAL

- 3 A. Quality Standards: Provide custom-fabricated architectural woodwork, casework, millwork and other
4 assemblies that are fabricated and installed in accordance with the *North American Architectural Woodwork*
5 *Standards, Adopted and Published jointly by Architectural Woodwork Institute, Architectural Woodwork*
6 *Manufacturer's Association of Canada and Woodwork Institute - Current Edition* (NAAWS).
7 1. Comply with requirements of specified NAAWS Grade except where more stringent requirements
8 are indicated in the Contract Documents.

9 2.2 WOOD MATERIALS, GENERAL

- 10 A. General: Provide specified wood materials and other materials recommended by woodwork fabricator, and
11 in compliance with specified NAAWS Grade.
12 1. Wood Moisture Content: 5 to 10 percent.
13 2. Provide wood products made with binder containing no urea formaldehyde,
14 3. Dimensions: As indicated on Drawings.
- 15 B. Miscellaneous Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by
16 ALSC's Board of Review.
- 17 C. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber .

18 2.3 LAMINATE-FACED FABRICATIONS

- 19 A. Minimum Quality Standard: Unless otherwise indicated, comply with the *North American Architectural*
20 *Woodwork Standards* (NAAWS) for grades of architectural plastic-laminate cabinets indicated for
21 construction, finishes, installation, and other requirements.
22 1. Contract Documents contain selections chosen from options in the quality standard and additional
23 requirements beyond those of the quality standard. Comply with those selections and requirements in
24 addition to the quality standard.
- 25 B. Plastic-Laminate-Faced Cabinets:
26 1. Minimum Quality Standard: NAAWS Custom Grade.
27 2. (PLAM-1) Basis of Design: Wilsonart River Cherry.
28 3. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required
29 by woodwork quality standard.

30 2.4 SOLID SURFACE FABRICATIONS

- 31 A. Solid Surface Countertops and Fabrications: Comply with NAAWS Premium Grade for architectural
32 countertops on base cabinets, wall-mounted countertops and shelves, and other assemblies as shown on
33 Drawings.
34 1. Dimensions and Configurations: As shown on Drawings.
35 2. Countertops: Fabricate tops in one piece with shop-applied eased edges unless otherwise indicated.
36 a. Backsplash: Standard single length solid surface pieces; longest length possible to minimize
37 joints. Where indicated provide countertop with coved backsplash.
38 b. Inside Corners: Fabricate countertops with square inside corners.
39 c. Sinks: Install integral sink bowls in countertops in the shop.

- 1 B. (SSF-1) Cast Polymer: Homogeneous non-porous high density product; core structure is composed of
2 paper, impregnated with thermosetting resins; outer surface is metal structure substrate treated with acrylic
3 resins applied as multilayer coating, cured via an electron beam process. Comply with Manufacturer's
4 written instructions for adhesives, sealers, fabrication, and finishing.
- 5 1. Basis of Design: HI-Macs; Color: Ghost white ST907.
 - 6 2. Integral Sinks: Install integral sink bowls in countertops in the shop.
 - 7 a. Basis of Design: Architect will select a single basin bowl from manufacturer's standards.
- 8 C. Adhesives and Sealants for Solid Surfacing: Comply with manufacturer's written instructions for adhesives,
9 sealers, fabrication, and sealing. Do not use adhesives that contain urea formaldehyde.
- 10 1. Sealant: Silicone sealant as recommended by panel manufacturer for application to substrate.
 - 11 2. VOC Limits for Installation Adhesives and Glues, and for Primers and Sealers: Use installation
12 adhesives with VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D
13 (EPA Method 24).

14 2.5 INSTALLATION ACCESSORIES

- 15 A. Installation Accessories: Provide assembly hardware as shown on Drawings, or as recommended by
16 Fabricator and approved by Architect.
- 17 B. Mechanical Fasteners and Anchors: Use material, type, size and finish required for each substrate for
18 secure anchorage and as recommended by architectural woodwork fabricator and installer.
- 19 1. Provide concealed anchors unless otherwise indicated.
 - 20 2. Provide metal expansion sleeves or expansion bolts for post-installed anchors.

21 2.6 FABRICATION

- 22 A. General: Fabricate Work of this Section using materials, methods and quality control procedures in
23 accordance with NAAWS, and in accordance with reviewed Shop Drawings.
- 24 1. Complete fabrication in shop, including assembly, finishing, and hardware application, to maximum
25 extent possible before shipment to Project site.
 - 26 2. Join and assemble work to provide durable, strong, rigid units that will not warp or rack, including
27 during shipping and installation.
- 28 B. Shop cut openings, to maximum extent possible, to receive plumbing fixtures and similar items. Locate
29 openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped
30 openings. Sand edges of cutouts to remove splinters and burrs.

31 PART 3 - EXECUTION

32 3.1 EXAMINATION AND PREPARATION

- 33 A. Examination and Acceptance of Conditions: Before proceeding with installation, take field measurements,
34 examine substrates and verify temperature and relative humidity and other conditions.
- 35 1. Verify that mechanical and electrical items affecting this section are properly placed and complete.
 - 36 2. Proceed with installation only after unsatisfactory conditions have been corrected and after building
37 temperature and relative humidity are within specified range. Proceeding with the Work indicates
38 acceptance of surfaces and site conditions.

- 1 B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck
2 measurements before installing each product.
3 1. Where portions of the Work are indicated to fit to other construction, verify dimensions of other
4 construction by field measurements before fabrication.
5 2. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
6 3. Verify space requirements and dimensions of items shown diagrammatically on Drawings.

7 3.2 INSTALLATION

- 8 A. General: Install architectural woodwork in accordance with *North American Architectural Woodwork*
9 *Standards* (NAAWS) and in accordance with reviewed shop drawings and manufacturer instructions.
10 B. Anchorage: Adequately anchor, fasten and support members to form secure, substantial and accurate work
11 and to hold required dimensions and prevent twist.
12 C. Solid Surfacing: Install solid surfacing in accordance with reviewed shop drawings and manufacturer's
13 instructions.

14 3.3 INSTALLED WORK

- 15 A. Damaged or Non-Compliant Woodwork: Remove and replace materials that are damaged or do not comply
16 with requirements.
17 B. Cleaning: Clean and provide maintenance on completed construction as frequently as necessary through
18 the remainder of the construction period.
19 C. Protection: Provide final protection and maintain conditions that ensure installed Work is without damage
20 or deterioration at time of Substantial Completion.

21 **END OF SECTION**

1 **SECTION 07 92 00**
2 **JOINT SEALANTS**

3 PART 1 - GENERAL

4 1.1 SUMMARY

- 5 A. Section Includes: Interior sealants (SLNT).

6 1.2 ACTION SUBMITTALS

- 7 A. Product Data: For each joint-sealant product.

- 8 B. Color Samples:

- 9 1. Samples for Initial Selection: Manufacturer's color charts consisting of actual strips of cured
10 sealants showing the full range of colors available for each product exposed to view.

11 1.3 DELIVERY, STORAGE, AND HANDLING

- 12 A. Deliver materials to project site in original unopened containers or bundles with labels informing about
13 manufacturer, product name and designation, color, expiration period for use, pot life, curing time and
14 mixing instructions for multi component materials.

- 15 B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes,
16 contaminants, or other causes.

17 1.4 PROJECT CONDITIONS

- 18 A. Joint Width Conditions: Do not proceed with installation of joint sealers when joint widths are less than
19 allowed by joint sealer manufacturer for application indicated.

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

- 22 C. Compatibility and Adhesion Testing: Ascertain sealant compatibility and adhesion with adjacent materials
23 using laboratory testing procedures.

24 PART 2 - PRODUCTS

25 2.1 SEALANT, GENERAL

- 26 A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one
27 another and with joint substrates under conditions of service and application, as demonstrated by joint-
28 sealant manufacturer, based on testing and field experience.

- 29 B. Sealant Colors: In accordance with approved sealant color schedule.

1 1. Colors as selected by Architect from manufacturer's standard colors. Acceptance of sealant will
2 depend on range of standard colors available for selection.

3 2.2 SILICONE SEALANT

4 A. Silicone Sealant, Mildew-Resistant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as
5 applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing
6 interior nonporous substrates that are subject to in-service exposures of high humidity and extreme
7 temperatures.

8 1. Products and Manufacturers:

- 9 a. Dow Corning Corporation; Dow Corning 786.
- 10 b. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
- 11 c. Laticrete International, Inc.; Latacil Tile & Stone Sealant.
- 12 d. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
- 13 e. Tremco Incorporated; Tremsil 200 White.

14 2. Applications: Interior joints as follows:

- 15 a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
- 16 b. Tile control and expansion joints where indicated.
- 17 c. Joints subject to water and high moisture areas.

18 2.3 ACRYLIC SEALANT

19 A. Acrylic Sealants: General purpose, paintable acrylic-emulsion sealant. Caulk with approximately 12-1/2
20 percent elongation complying with ASTM C834.

21 1. Products and Manufacturers:

- 22 a. Tremco Incorporated: Acrylic Latex 834.
- 23 b. Pecora Corporation: AC-20.

24 2. Location/Use:

- 25 a. Joints in vertical surfaces and in horizontal surfaces not subject to traffic.
- 26 b. Vertical joints on exposed surfaces of interior partitions.
- 27 c. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
- 28 d. Other joints as indicated.

29 B. Acoustic Joint Sealant: Refer to Section 09 29 00 for acoustic sealant in gypsum board assemblies.

30 2.4 JOINT SEALANT BACKING

31 A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates,
32 sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer
33 based on field experience and laboratory testing.

34 2.5 PREPARATORY MATERIALS

35 A. Joint Primer: Non-staining type recommended by sealant manufacturer to suit application.

36 B. Joint Cleaner: Non-corrosive type recommended by sealant manufacturer; compatible with joint forming
37 materials.

38 C. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to
39 joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

- 1 D. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant
2 backing materials, free of oily residues or other substances capable of staining or harming joint substrates
3 and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to
4 joint substrates.

5 PART 3 - EXECUTION

6 3.1 EXAMINATION

- 7 A. Examine joint surfaces, backing, and anchorage of units forming sealant rabbet, and conditions under which
8 sealant work is to be performed. Do not proceed with sealant work until unsatisfactory conditions have
9 been corrected.

10 3.2 JOINT SURFACE PREPARATION

- 11 A. Preparation: Clean out joints immediately before installing joint sealants to comply with joint-sealant
12 manufacturer's written instructions.
- 13 B. Clean joint surfaces immediately before installation of sealant. Remove dirt, insecure coatings, moisture
14 and other substances which would interfere with bond of sealant.
- 15 C. Examine joint dimensions and size materials to achieve required width/depth ratios. Use joint filler to
16 achieve required joint depths, to allow sealants to perform properly.

17 3.3 SEALANT APPLICATION

- 18 A. Installation:
- 19 1. Comply with joint-sealant manufacturer's written installation instructions for products and
20 applications indicated, unless more stringent requirements apply.
- 21 2. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint
22 sealants as applicable to materials, applications, and conditions indicated.
- 23 3. Install sealant backings of kind indicated to support sealants during application and at position
24 required to produce cross-sectional shapes and depths of installed sealants relative to joint widths
25 that allow optimum sealant movement capability.
- 26 4. Install sealants using proven techniques that comply with the following and at the same time
27 backings are installed:
- 28 5. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing
29 begins, tool sealants according to requirements specified in subparagraphs below to form smooth,
30 uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and
31 adhesion of sealant with sides of joint.
- 32 B. Apply sealant in accordance with manufacturer's printed instructions. Perform work in accordance with
33 ASTM C804.
- 34 C. Prime or seal joint surfaces. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.
- 35 D. Install sealant backer rod for liquid elastomeric sealant, except where recommended to be omitted by
36 sealant manufacturer for application shown.

- 1 E. Install bond breaker tape wherever required by manufacturer's recommendations to ensure that elastomeric
2 sealant will perform properly.
- 3 F. Employ only proven installation techniques, which will ensure that sealant will be deposited in uniform,
4 continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on
5 opposite sides.
- 6 G. Install sealant to depth as shown or, if not shown, as recommended by sealant manufacturer but within
7 following general limitations, measured at center (thin) section of bead:
- 8 H. Remove excess and spillage of sealant promptly as work progresses. Clean adjoining surfaces by whatever
9 means may be necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes.

10 3.4 PROTECTION AND CLEANING

- 11 A. Protect joint sealers during and after curing period from contact with contaminating operations or other
12 causes so that they are without deterioration or damage at time of Substantial Completion.
 - 13 1. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or
14 deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer
15 installations with repaired areas indistinguishable from original work.
- 16 B. Clean off excess sealant or sealant smears adjacent to joints as work progresses by methods and with
17 cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

18 **END OF SECTION**

1 PART 2 - PRODUCTS

2 2.1 MANUFACTURERS

- 3 A. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.
- 4 B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 5 1. Ceco Door Products; an Assa Abloy Group company.
- 6 2. Curries Company; an Assa Abloy Group company.
- 7 3. Republic Doors and Frames.
- 8 4. Steelcraft; an Ingersoll-Rand company.

9 2.2 MATERIALS AND COMPONENTS

- 10 A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled
11 content not less than 25 percent.
- 12 B. Steel Sheets:
- 13 1. Cold-Rolled Steel Sheet: ASTM A1008, Commercial Steel (CS), Type B; suitable for exposed
14 applications.
- 15 2. Hot-Rolled Steel Sheet: ASTM A1011, Commercial Steel (CS), Type B; free of scale, pitting, or
16 surface defects; pickled and oiled.
- 17 C. Fastenings: Provide fastenings, anchors and clips as required to secure hollow metal work in place. Provide
18 Jackson head screws, or flatter. Dimple metal work to receive screw heads. Set stops and other non-
19 structural fastenings with #8 FHSMS.
- 20 D. Steel Reinforcing: ASTM A36.

21 2.3 FABRICATION, GENERAL

- 22 A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to
23 required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble
24 units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot
25 be permanently factory assembled before shipment.
- 26 B. Construct doors and frames to comply with the standards indicated for materials, fabrication, hardware
27 locations, hardware reinforcement, tolerances, and clearances, and as specified.
- 28 1. Refer to Openings Schedule on Drawings for openings and locations.
- 29 C. Interior Frames: Provide Extra-Heavy-Duty Frames, ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4,
30 Level A; 0.053 inch (18 ga.) minimum steel thickness, typical.

31 2.4 HOLLOW METAL FRAMES

- 32 A. General: Provide frames as full profile welded unless otherwise indicated. Where necessary, alternate
33 details will be considered provided design intent is maintained. Consider and provide for erection methods.
- 34 B. Jamb Anchors:

- 1 1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
2 2. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- diameter bolts
3 with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement
4 plate, welded to frame at each anchor location.
- 5 C. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
6 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
- 7 D. Fasteners:
8 1. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153.
9 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated,
10 fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching
11 hollow-metal frames of type indicated.

12 2.5 FINISHES

- 13 A. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with
14 ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and
15 field-applied coatings despite prolonged exposure.

16 PART 3 - EXECUTION

17 3.1 EXAMINATION

- 18 A. Examine supporting structure and conditions under which hollow metal is to be installed. Do not proceed
19 with installation until unsatisfactory conditions have been corrected.

20 3.2 INSTALLATION

- 21 A. Install hollow metal in accordance with reviewed shop drawings and manufacturer's printed instructions.
22 Securely fasten and anchor work in place without twists, warps, bulges or other unsatisfactory or defacing
23 workmanship. Set hollow metal plumb, level, square to proper elevations, true to line and eye. Set clips and
24 other anchors with Ramset "shot" anchors or drill in anchors as approved.
- 25 B. Placing Frames: Set frames accurately in position, plumbed, aligned, and braced securely until permanent
26 anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving
27 surfaces smooth and undamaged.
- 28 1. At acoustic rated metal stud and gypsum board partitions, install insulation within frames.
29 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure
30 with post-installed expansion anchors.
- 31 3. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural
32 supports or substrates above frame unless frame is anchored to masonry or to other structural support
33 at each jamb. Bend top of struts to provide flush contact for securing to supporting construction.
34 Provide adjustable wedged or bolted anchorage to frame jamb members.
- 35 4. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and
36 plumb to the following tolerances:
37 a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from
38 jamb perpendicular to frame head.
39 b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane
40 of wall.

- 1 c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines,
2 and perpendicular to plane of wall.
- 3 d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

4 3.3 INSTALLED WORK

- 5 A. Touchup: Sand and clean rusted or abraded surfaces and apply compatible touchup finish:
 - 6 1. Primer: Apply air-drying, rust-inhibitive primer.
 - 7 2. Metallic-Coated Surface: Repair with galvanizing repair paint according to manufacturer's written
8 instructions.
 - 9 3. Painting: As specified in Section 09 90 00 - Painting.
- 10 B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and
11 frames.
- 12 C. Final Adjustments: Check and readjust operating hardware items immediately before final inspection.
13 Leave work in complete and proper operating condition. Remove and replace defective work, including
14 hollow-metal work that is warped, bowed, or otherwise unacceptable.

15 **END OF SECTION**

16

1 **SECTION 08 41 10**
2 **ALUMINUM STOREFRONTS & ENTRANCES**

3 PART 1 - GENERAL

4 1.1 SUMMARY

5 A. Section Includes:

- 6 1. Non-thermally-broken interior aluminum storefront framing systems and entrances.
7 2. Non-thermally-broken interior aluminum stile and rail doors.
8 3. Installation accessories.

9 1.2 ACTION SUBMITTALS

10 A. Product Data: Include construction details, material descriptions, glazing and fabrication methods,
11 dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

12 B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational
13 clearances, and details of installation, including anchor, flashing, and sealant installation.

14 C. Samples: For each exposed product and for each color specified, **2 by 4 inches** in size.

15 1.3 CLOSEOUT SUBMITTALS

16 A. Maintenance Data: For weather stripping, operable panels, and operating hardware to include in
17 maintenance manuals.

18 1.4 PROJECT CONDITIONS

19 A. Field Measurements: Verify aluminum storefront, window and door openings by field measurements
20 before fabrication and indicate measurements on Shop Drawings.

21 1.5 WARRANTY

22 A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace
23 aluminum windows and doors that fail in materials or workmanship within specified warranty period.

- 24 1. Warranty Period: Three years from date of Substantial Completion.

25 PART 2 - PRODUCTS

26 2.1 PRODUCTS AND MANUFACTURERS

27 A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including
28 framing, doors, and accessories, from single manufacturer.

- 1 B. Subject to requirements, provide Basis of Design or equivalent as approved by Architect, by one of the
2 following Manufacturers:
3 1. EFCO Corporation
4 2. Kawneer Company
5 3. Tubelite Incorporated,
6 4. Oldcastle/VistaWall.
7 5. YKK AP America Inc..

8 2.2 GLAZED ALUMINUM FRAMING SYSTEMS

- 9 A. (AFS-2) Interior Storefront Framing Systems: Non-thermally-broken storefront framing.
10 1. Basis of Design: Kawneer; Trifab VersaGlaze 450.
11 a. Mullion Profile: 1-3/4 inches by 4-1/2 inches.
12 2. Glazing Set: Center.

13 2.3 ENTRANCES

- 14 A. (AL DR-1) Entrance Doors: Framing system manufacturer's non-thermally-broken extruded aluminum
15 tubular stile and rail doors for swing operation; with square profile, snap-on, extruded-aluminum stops and
16 preformed glazing gaskets; Mechanically-fastened corners with reinforcing brackets that are deeply
17 penetrated and fillet welded or that incorporate concealed tie rods.
18 1. Interior, Non-Thermally-Broken Basis of Design:
19 a. Kawneer; 350 Standard Entrances.
20 1) Door Thickness: 1-3/4 inches.
21 2) Stile and Top Rail Width: 3-1/2 inches.
22 3) Bottom Rail Height: 12 inches unless otherwise indicated on Drawings.
23 4) Tube Wall Thickness: 0.125 inch, minimum.
24 B. Door Hardware: In accordance with Section 08 71 00 - Door Hardware.

25 2.4 COMPONENTS & MATERIALS

- 26 A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
27 1. Sheet and Plate: **ASTM B 209**.
28 2. Extruded Bars, Rods, Shapes, and Tubes: **ASTM B 221**.
29 3. Extruded Structural Pipe and Tubes: ASTM B 429.
30 4. Structural Profiles: ASTM B 308.
31 B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-
32 PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface
33 preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to
34 applicable SSPC standard.
35 1. Structural Shapes, Plates, and Bars: ASTM A 36.
36 2. Cold-Rolled Sheet and Strip: ASTM A 611.
37 3. Hot-Rolled Sheet and Strip: ASTM A 570.
38 C. Fasteners:
39 1. Concealed Fasteners: ASTM A449, SAE Grade 5 carbon steel with cadmium and yellow chromate
40 finish, type and size recommended by storefront manufacturer.
41 D. Accessories

- 1 1. Setting Blocks: Black EPDM 85±5 durometer, Shore-A per ASTM D 2000.
- 2 2. Gaskets: Glazing gaskets shall be extruded EPDM rubber.
- 3 3. Perimeter Anchors: Aluminum. When steel anchors are used, provide insulation between steel
- 4 material and aluminum material to prevent galvanic action.

5 E. Glass and Glazing: Refer to Section 08 80 00 – Glazing.

6 2.5 FABRICATION

7 A. Fabrication, General:

- 8 1. Conceal fasteners wherever possible.
- 9 2. Reinforce work as necessary for performance requirements, and for support to structure.
- 10 3. Separate dissimilar metals and aluminum in contact with concrete utilizing protective coating or
- 11 preformed separators, which will prevent contact and corrosion.
- 12 4. Comply with Section 08 80 00 for glazing requirements.
- 13 5. Welding: Comply with recommendations of the American Welding Society.
 - 14 a. Use recommended electrodes and methods to avoid distortion and discoloration.
 - 15 b. Weld in concealed locations to greatest extent possible to minimize distortion or
 - 16 discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by
 - 17 descaling or grinding.
 - 18 c. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.

19 B. Prefabrication: To greatest extent possible, complete fabrication, assembly, finishing and other work before

20 shipment to project site. Disassemble components only as necessary for shipment and installation.

- 21 1. Do not drill and tap for surface-mounted hardware items until time of installation at project site.
- 22 2. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal
- 23 work in manner which prevents damage to exposed finish surfaces.
 - 24 a. For hardware, perform these operations prior to application of finishes.

25 C. Coordination of Fabrication:

- 26 1. Check actual frame or door openings required in construction work by accurate field measurements
- 27 before fabrication.
- 28 2. Fabricate units to withstand loads that will be applied when system is in place.

29 D. Framing:

- 30 1. Sealant Back Stop Containment: At perimeter, provide not less than 1-1/2 inch continuous flush
- 31 metal to permit sealant back-stop containment.
- 32 2. Provide inside-outside matched resilient flush-glazed system with provisions for glass replacement.
- 33 3. Provide members of size, shape and profile indicated.
- 34 4. Fabricate frame assemblies with joints straight and tight fitting.
- 35 5. Reinforce internally with structural members as necessary to support design loads.
- 36 6. Maintain accurate relation of planes and angles, with hairline fit of contacting members.

37 E. Entrances:

- 38 1. Door Frames: Fabricate tubular and channel frame assemblies, as indicated, with either welded or
- 39 mechanical joints in accordance with manufacturer's standards, reinforced as necessary to support
- 40 required loads Reinforce as required to support loads imposed by door operation and for installing
- 41 entrance door hardware.
 - 42 a. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three
 - 43 silencers on strike jamb of single-door frames and two silencers on head of frames for pairs
 - 44 of doors.

- 1 2. Stile-and-Rail Doors: Provide tubular frame members, fabricated with mechanical joints using
- 2 heavy inserted reinforcing plates and concealed tie-rods or j-bolts, or fabricate with structurally
- 3 welded joints, at manufacturer's option. Reinforce doors as required for installing entrance door
- 4 hardware.
- 5 3. Glazing: Fabricate doors to facilitate replacement of glass or panels, without disassembly of door
- 6 stiles and rails. Provide snap-on extruded aluminum glazing stops, with exterior stops anchored for
- 7 non-removal.
- 8 4. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent
- 9 possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- 10 F. (SMF-1) Flashings: Form from sheet aluminum with same finish as extruded sections. Apply finish after
- 11 fabrication. Material thickness as required to suit condition without deflection or "oil-canning".

12 2.6 FINISHES

- 13 A. General: Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and
- 14 designating finishes.
- 15 1. Form or extrude aluminum shapes before finishing.
- 16 2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary
- 17 protective covering before shipping.
- 18 B. Color-Anodized Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
- 19 1. Color: Champagne to match existing.
- 20 C. Other Finishes:
- 21 1. Concealed Steel Items: Galvanized in accordance with ANSI/ASTM A653 to 2.0 oz/sq ft primed
- 22 with iron oxide paint.
- 23 2. Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with
- 24 cementitious or dissimilar materials.
- 25 3. Primer: FS TT-P-31; for shop application and field touch-up.
- 26 4. Touch-Up Primer for Galvanized Surfaces: FS TT-P-641; TT-P-645.

27 PART 3 - EXECUTION

28 3.1 EXAMINATION AND PREPARATION

- 29 A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for
- 30 compliance with requirements for installation tolerances and other conditions affecting performance of
- 31 work. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- 32 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- 33 B. Field Measurement: Wherever possible, take field measurements prior to preparation of shop drawings and
- 34 fabrication, to ensure proper fitting of work.

35 3.2 INSTALLATION

- 36 A. Comply with manufacturer's instructions and recommendations for installation of aluminum entrances and
- 37 storefronts, windows, doors, hardware, accessories, and other components.
- 38 B. Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels.

1 1.5 ACTION SUBMITTALS

2 A. Hardware Schedule: Submit hardware schedule per Section 01 33 00 in vertical format as illustrated by the
3 Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute.
4 Schedules, which do not comply, will be returned for correction before review. Hardware schedule shall
5 clearly indicate architect's hardware group and manufacturer of each item proposed. The schedule shall be
6 reviewed prior to submission by a certified Architectural Hardware Consultant, who shall affix his or her
7 seal attesting to the completeness and correctness of the schedule.

- 8 1. Provide illustrations from manufacturers' catalogs and data in brochure form.
- 9 2. Check specified hardware for suitability and adaptability to details and surrounding conditions.
10 Indicate unsuitable or incompatible items and proposed substitutions in the hardware schedule
11 submittal.
- 12 3. When requested, provide listing of manufacturers' template numbers for each item of hardware in
13 the hardware schedule submittal.
- 14 4. Furnish associated Contractors and Subcontractors with copies of final approved hardware schedule.
15 Submit necessary templates and schedules as soon as possible to hollow metal, wood, aluminum,
16 and other door and frame fabricators in accordance with schedule they require for fabrication.
- 17 5. Samples; if requested by Architect, provide for each exposed product in each finish specified, in
18 manufacturer's standard size
19 a. Tag Samples with full product description to coordinate Samples with door hardware
20 schedule.
- 21 6. List of related door devices specified in other Sections for each door and frame.

22 B. Closer Mounting: Indicate mounting description for each closer included in the submittal's hardware
23 groups.

24 C. Existing Hardware Conditions: Refer to Part 1 - Coordination.
25 1. Advise Hardware Supplier and Architect of any existing conditions which would prevent utilization
26 of specified hardware.

27 D. Provide keying schedule, prepared by or under the supervision of Installer's Architectural Hardware
28 Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and
29 index each key set to unique door designations that are coordinated with the Contract Documents. Keying
30 schedule to be coordinated with and approved by Owner.

31 E. Electrified Hardware Coordination:
32 1. List all hardware specified in groups and identify items not in your scope as -inches by Others-
33 inches or other means of identification.
34 2. Provide operational descriptions for each electrified hardware group including operation for exit,
35 entry, and fire alarm conditions.
36 a. Refer to operational descriptions in electrified hardware groups. Part 3 - Hardware Groups.
37 3. Wiring Diagrams: When requested after final approval of the hardware schedule submittal, provide
38 wiring diagrams for each opening that requires electrified hardware.
39 a. Exception: groups where only magnetic hold-opens or door position switches are specified.
40 b. Approved diagrams to be sent with hardware delivery to the jobsite.

41 F. Installation Instructions: Provide manufacturer's written installation and adjustment instructions for finish
42 hardware. Send installation instructions to site with hardware.

43 1.6 INFORMATIONAL SUBMITTALS

44 A. Contract Closeout Submittals: Comply with Section 01 78 00 including specific requirements indicated.
45 1. Operating and maintenance manuals containing the following:

- 1 a. Complete information in care, maintenance, and adjustment, and data on repair and
2 replacement parts, and information on preservation of finishes.
- 3 b. Catalog pages for each product.
- 4 c. Name, address, and phone number of local representative for each manufacturer.
- 5 d. Parts list for each product.
- 6 2. Copy of final approved hardware schedule, edited to reflect As installed.
- 7 3. Copy of final keying schedule.
- 8 4. As installed Wiring Diagrams for each opening connected to power, both low voltage and 110 volts.
- 9 5. One complete set of special tools required for maintenance and adjustment of hardware, including
10 changing of cylinders.

11 1.7 QUALITY ASSURANCE

- 12 A. Manufacturer: Obtain each type of hardware, i.e. latch and locksets, hinges, closers from single
13 manufacturer, although several may be indicated as offering products complying with requirements.
- 14 B. Supplier: Recognized architectural finish hardware supplier, with warehousing facilities, who has been
15 providing hardware for period of not less than 3 years. The supplier shall be, or employ, a certified
16 Architectural Hardware Consultant AHC, who is registered in the continuing education program as
17 administered by the Door and Hardware Institute. The hardware schedule shall be prepared and signed by
18 a certified AHC.
- 19 C. Installer: Firm with three years experience in installation of similar hardware to that required for this
20 project, including specific requirements indicated.
- 21 D. Regulatory Label Requirements: Provide nationally recognized testing agency label or stamp on hardware
22 for labeled openings. Where UL requirements conflict with drawings or specifications, hardware
23 conforming to UL requirements shall be provided. Conflicts and proposed substitutions shall be clearly
24 indicated in hardware schedule.
- 25 E. All electric locking system units that control egress shall be listed in accordance with UL 294.
- 26 F. Accessibility Requirements: Doors to stairs, other than exit stairs, loading platforms, boiler rooms, stages
27 and doors serving other hazardous locations shall have knurled or other similar approved marking of door
28 lever handles or cross bars, if required by local building codes.
- 29 G. Pre-Installation Conference: Prior to the installation of hardware, manufacturers' representatives for
30 locksets, closers, and exit devices shall arrange and conduct a jobsite meeting to instruct the installing
31 contractor's personnel on the proper installation of their respective products. A letter of compliance,
32 indicating when this meeting is held and who is in attendance, shall be sent to the Architect and Owner.
33 Refer to Keying article for keying conference requirements.

34 1.8 DELIVERY, STORAGE AND HANDLING

- 35 A. Deliver hardware to jobsite in manufacturer's original packaging, marked to correspond with the approved
36 hardware schedule. Do not deliver hardware until suitable locked storage space is available. Check
37 hardware against reviewed hardware schedule. Store hardware to protect against loss, theft, or damage.
- 38 B. Deliver hardware required to be installed during fabrication of hollow metal, aluminum, wood, or stainless-
39 steel doors prepaid to the respective manufacturer.

1 1.9 WARRANTY

- 2 A. Guarantee workmanship and material provided against defective manufacture. Repair or replace defective
3 workmanship and material appearing within period of one year after Substantial Completion.
- 4 B. Provide a minimum ten-year factory warranty on door closer body against defects in material and
5 workmanship from date of occupancy of Project.
- 6 C. Replace shortages and incorrect items with correct material at no additional cost to Owner.
- 7 D. At completion of project, qualified factory representative shall inspect closer installations. After this
8 inspection, letter shall be sent to Architect reporting on conditions, verifying that closers have been properly
9 installed and adjusted.

10 1.10 ATTIC STOCK

- 11 A. Coordinate with Owner for products and quantities desired for attic stock.

12 PART 2 - PRODUCTS

13 2.1 GENERAL

- 14 A. Confirm acceptable manufacturers and models of all hardware products with Owner. Specified products
15 are listed only to establish function and a level of quality.
- 16 B. Specified manufacturers and models are based on the best information available at the time of this printing
17 to establish function and level of quality but are subject to change as additional information becomes
18 available. Changes will be advised in future documentation.
- 19 C. Acceptable manufacturers and models of particular products will be determined by hardware
20 distributor/supplier who has been contracted and directed by the Owner. Specified products are listed only
21 to establish function and a level of quality.

22 2.2 BUTTS AND HINGES

- 23 A. Acceptable Manufacturers:
- 24 1. Bommer
- 25 2. Hager listed below for design intent only
- 26 3. Ives
- 27 4. McKinney
- 28 5. PBB
- 29 6. Stanley/Best
- 30 B. Types per Application:
- 31 1. Interior doors with closers: BB1279/BB1168
- 32 2. Interior doors over 36 inches wide: BB1168
- 33 3. Interior doors 36 inches or less without closer: BB1279
- 34 4. Provide NRP, non-removable pins, at out-swinging doors that are lockable or locked and at other
35 doors when specifically indicated.

- 1 C. Size:
2 1. 1-3/4 inch Doors 4-1/2 inch by 4-1/2 inch
3 D. Quantity:
4 1. 2 – hinges per leaf for openings through 60 inches in height.
5 2. 1 – additional hinge per leaf for each additional 30 inches in height or fraction thereof.
6 3. 1 – additional hinge per leaf for openings 40 inches wide and wider.
7 a. For mineral core doors Refer to Part 2 - Continuous Stainless-Steel Hinges
8 E. Drill 5/32 inch hole and use No. 12, 1-1/4 inch steel threaded to the head wood screws for hinges on wood
9 doors.

10 2.3 ELECTRIC POWER TRANSFERS

- 11 A. Acceptable Manufacturers:
12 1. ABH: PT Series
13 2. Pemko: EL-CEPT
14 3. Securitron EPT/EPTL
15 4. Von Duprin EPT-2/EPT-10
16 B. Provide electric power transfer devices as specified in hardware groups or as required by electrified
17 hardware voltage requirements.
18 C. When specifically indicated, provide surface-mounted armored power transfer loops with length to
19 accommodate door opening conditions.
20 D. UL 10C fire tested and listed for labeled doors up to and including Class A.

21 2.4 CONTINUOUS GEARED HINGES

- 22 A. Acceptable Manufacturers:
23 1. ABH A110HD, A240HD
24 2. Hager/Roton: 780-112HD, 780-224HD
25 3. Ives: 112HD, 224HD
26 4. McKinney: MCK-12HD, MCK-25HD
27 5. Pemko: FM_SLFHD, FM_HD
28 6. Select: SL-11HD, SL-24HD
29 7. Stanley/Best: 661HD, 662HD
30 B. Provide model of continuous hinges as appropriate for the type, inset, and thickness of door where specified.
31 Coordinate hinge types with the door supplier.
32 C. Specialty hinges for special mounting conditions, example: swing-clear, wide-throw, etc. are indicated in
33 assigned hardware groups for particular openings.

34 2.5 BOLT LOCKS

- 35 A. Acceptable Manufacturers:
36 1. ABH
37 2. Burns
38 3. Door Controls International

- 1 4. Hager
- 2 5. Ives listed below for design intent only
- 3 6. Rockwood
- 4 7. Trimco

- 5 B. Automatic Flushbolt: FP31/FP41 Series

- 6 C. Dust Proof Strike: Ives DP2

- 7 D. Provide flush bolts meeting the requirements of ANSI A156.3, Grade 1, Type 25, conforms to positive
- 8 pressure standards of UL10C and UBC 7-2 -1997, and is UL listed at fire rated openings.

- 9 E. Provide flush bolts for inactive door of pairs as indicated in the hardware groups, as required for metal or
- 10 wood doors, and per the following conditions, unless indicated otherwise:
- 11 1. At all exterior openings and locking interior openings, provide top and bottom bolt configuration
- 12 for inactive door of pair, unless indicated otherwise.
- 13 2. At non-locking interior openings, provide top bolt only.
- 14 3. At fire-rated openings utilizing top bolt only configurations, provide appropriate auxiliary fire latch,
- 15 as required by the door manufacturer to attain the specified fire-rating/label.
- 16 4. Include appropriate strike to receive bolt/pin when projected.
- 17 5. Where bottom bolts are utilized, provide dustproof strike, as required for sill conditions.
- 18 6. Locate centerline of top bolt not more than 78 inches above finished floor – provide rod extensions
- 19 as necessary.
- 20 7. Only provide manual flushbolts or surface bolts when specifically indicated in the assigned
- 21 hardware group.

22 2.6 LOCKSETS – MORTISE

- 23 A. Acceptable Manufacturer and Series: Lever design: **MATCH LEVER TO EXISTING DOORS ON**
- 24 **FLOOR**
- 25 1. Corbin ML2000 Series – citation - bronze
- 26 2.

- 27 B. Provide mortise locks, unless indicated otherwise, with functions specified in Hardware Groups and with
- 28 following provisions:
- 29 1. Cylinders: Provide cylinders, as required, to accomplish specified lock function. Refer to Part 2 –
- 30 KEYING.
- 31 2. Locksets shall meet the requirements of ANSI/BHMA A156.13-1994, Operational Grade 1, and
- 32 Security Grade 1.
- 33 3. Backsets: 2-3/4 inches.
- 34 4. Strikes: Provide wrought boxes and strikes with proper lip length to protect trim but not to project
- 35 more than 1/8 inch beyond trim, frame or inactive leaf. Where required, provide open back strike
- 36 and protected to allow practical and secure operation.
- 37 5. Where electrified locksets are specified, provide wiring harness and connections from electric lock
- 38 to electric power transfer.
- 39 6. Provide escutcheons to match existing conditions, where applicable.

40 2.7 LOCKSETS – HEAVY-DUTY CYLINDRICAL

- 41 A. Acceptable Manufacturer and Series. **MATCH LEVER TO EXISTING DOORS ON FLOOR**
- 42 B.

1. Best: 9K
 2. Sargent: 10-Line
 3. Schlage: ND
- C. Provide heavy-duty cylindrical locks unless indicated otherwise with functions specified in Hardware Groups and with the following provisions:
1. Cylinders: Provide cylinders, as required, to accomplish specified lock function. Refer to Part 2 – KEYING.
 2. Backsets: 2-3/4 inches.
 3. Strikes: Provide wrought boxes and strikes with proper lip length to protect trim but not to project more than 1/8 inch beyond trim, frame or inactive leaf. Where required, provide open back strike and protected to allow practical and secure operation.
 4. Where electrified locksets are specified, provide wiring harness and connections from electric lock to electric power transfer.
 5. Where required by codes, doors which open onto stairways, mechanical rooms, or other spaces where caution is required, shall have levers with tactile markings to alert a visually impaired person of such conditions.

2.8 KEYING

- A. **All locks, cylinders, and keying will be provided by UWM lock shop.**
- B. Contractor shall provide construction masterkeying and keys for the construction period.
- C. Authorized local distribution/service shall be available for purchase of additional keys and cylinders to allow for system revisions, expansion, and service, as required.
- D. Keying Conference: Conduct conference.
1. Conference participants shall include Installer's Architectural Hardware Supplier/Consultant, Architect and Owner's security consultant.
 2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:
 - a. Flow of traffic and degree of security required.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.
- E. If requested, submit proposed keying schedule to Architect and meet with Owner and Architect to review schedule.
- F. Provide construction masterkeying. Permanent cylinders/cores shall be installed/activated upon completion of the project.
- G. Provide 6 masterkeys for each masterkey set. Provide 3 change keys for each lock. Stamp keys Do Not Duplicate. When interchangeable core cylinders are specified, provide 2 control keys for core removal.
- H. All keys shall be delivered to the designated Owner's representative via method determined and agreed upon by the Owner at the keying meeting.

- 1 2.9 DOOR TRIM
- 2 A. Acceptable Manufacturers and Types:
- 3 1. Burns
- 4 2. Hiawatha listed below for design intent only
- 5 3. Rockwood
- 6 4. Trimco.
- 7 B. Door Protection Plates and Edge Guards: Minimum of 0.050 inch thick, stainless-steel, beveled 4 edges.
- 8 1. Kick Plates:
- 9 a. At single doors provide width 1-1/2 inches less than door width on push side.
- 10 b. At pairs of doors provide width 1 inch less than door width on both doors.
- 11 c. Height: 10 inches unless otherwise detailed in Architectural drawings or indicated in
- 12 hardware groups.
- 13 2. When door protection plates and edge guards are specified for fire-rated openings, they must be
- 14 installed in accordance with the listing of the door. Field-installed products must be labeled and
- 15 installed in accordance with manufacturers' listings.
- 16 3. Do not provide protection plates, or edge guards for impact-resistant doors. Refer to Door Panel
- 17 type in Opening Schedule or MAT-ID list.

18 2.10 COORDINATORS

- 19 A. Acceptable Manufacturers:
- 20 1. Door Controls International
- 21 2. Hager
- 22 3. Ives.
- 23 4. Trimco, listed below for design intent only
- 24 5. Ives
- 25 B. Provide stop-mounted coordinator for labeled pairs of doors equipped with automatic flush bolts and those
- 26 with vertical rod/mortise lock fire exit device combinations with astragals, unless indicated otherwise.
- 27 1. Trimco 3094 series, or approved equivalent
- 28 C. Provide filler bars for total opening width, closer mounting brackets, carry bars, and special preparation for
- 29 top latches where applicable.

30 2.11 DOOR CLOSERS

- 31 A. Acceptable Manufacturers and Types of Exposed Closers:
- 32 1. Heavy-Duty - cast aluminum bodies:
- 33 a. LCN 4050
- 34 b. Norton 7500/PR7500
- 35 c. SARGENT 351/351 P-10
- 36 d. Stanley D-4550
- 37 B. Provide heavy-duty drop plates, brackets, or adapters for arms as required to suit details.
- 38 C. Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors,
- 39 unless indicated otherwise.
- 40 D. Provide back-check for closers.

1 E. Provide closers for doors as noted in Hardware Groups and, in addition, provide closers for labeled doors
2 whether or not specifically noted in group.

3 F. Provide closers meeting the requirements of UBC 7-2 and UL 10C positive pressure tests.

4 G. No through bolting of closers will be accepted.

5 2.12 AUTOMATIC OPERATORS

6 A. Acceptable low-energy standard-duty manufacturers/models:

7 1. Besam: SW100

8 2. LCN Senior-Swing

9 3. Horton: 4000LE Series

10 4. Stanley: Magic-Force-LE

11 5. Best/Stanley: D-4990. Provide low energy automatic swing door operators complying with ANSI
12 A156.19 and as indicated in the hardware groups. Provide complete with drop plates, brackets, or
13 adapters for arms as required to suit details. Must function as compliant manual closer if power
14 fails.

15 C. Provide a terminal strip in an enclosed box near or above door that indicates connections for security and
16 fire alarm equipment and for electrified hardware items associated with proper door operation, as indicated
17 by hardware group operational description.

18 D. Provide wall-mounted actuator switches by the same manufacturer as the operator. Actuators shall be
19 weather-resistant type at exterior applications.

20 E. Provide connections and integration with other specified electronic hardware to achieve the operational
21 description, as specified.

22 F. Provide fire-alarm connection, or smoke detectors, as required by local codes, to de-activate operator to
23 close door during fire-alarm event.

24 G. Install automatic operators in compliance with manufacturer's installation procedures. Adjust automatic
25 operators for smooth and quiet operation.

26 2.13 STOPS AND HOLDERS

27 A. Acceptable Manufacturers:

28 1. Burns

29 2. Hager

30 3. Ives listed below for design intent only

31 4. Trimco

32 B. Wall Bumper: WS406/407CVX; WS406/407CCV

33 C. Wall Mounted Stops: WS11/WS11X

34 D. Provide wall bumper for each door leaf except where wall mounted stops are specified in the Hardware
35 Groups, or where opening conditions require the use of an overhead stop. Refer to Part 2 – Overhead Stops

36 1. Provide an overhead stop for doors in which the door face or operating trim on the leading/latch
37 edge does not open against wall or opens against equipment or furniture.

- 1 E. Provide base mounted stops at toilet rooms, unless alternate stop is specified: WS11/WS11X.
- 2 F. Floor or base stops must be used only where specified or absolutely unavoidable.

3 2.14 DOOR POSITION SWITCHES

- 4 A. Acceptable Manufacturers and Types:
 - 5 1. Ademco ADI 800-233-6261: 944SP-WH 3/4-in recessed white
 - 6 2. Detex: MS-2049F
 - 7 3. SARGENT: 3287
 - 8 4. Sentrol: 1078
- 9 B. Provide model to accommodate door and frame materials and mounting conditions.
- 10 C. Coordinate door and frame preparations with door and frame suppliers.
- 11 D. Switches shall be installed in frame head approximately 4-inches from latching edge of door, unless detailed
- 12 otherwise.

13 2.15 FASTENERS

- 14 A. Including, but not limited to; wood or machine screws, special screws, bolts, special bolts, nuts, expansion
- 15 shields, anchors, and other accessory items of proper type, material, and finish required for complete
- 16 operational installation of hardware.
- 17 B. Use phillips head for exposed screws. Do not use aluminum screws to attach hardware.
- 18 C. Provide self-tapping, TEC, screws for attachment of sweeps and stop-applied weatherstripping.

19 2.16 TYPICAL FINISHES AND MATERIALS

- 20 A. Finishes, unless otherwise specified: Satin Brass **OR MATCH EXISTING FINISH OF DOORS**
- 21 **NEARBY ON FLOOR**
 - 22 1. Hinges: Interior Doors: US4/BHMA 633 Dull Brass, clear coated on Steel.
 - 23 2. Continuous Hinges: Gold Anodized, or custom painted, if indicated.
 - 24 3. Flush Bolts: US4/BHMA 606 Dull Brass, clear coated on Brass.
 - 25 4. .
 - 26 5. Locks and Latches: US4/BHMA 606 Dull Brass, clear coated on Brass.
 - 27 6. Door Trim: US4/BHMA 606 Dull Brass, clear coated on Brass.
 - 28 7. Coordinators: USP/BHMA 600 Primed on Steel.
 - 29 8. Protection Plates and Edge Guards: US4/BHMA 606 Dull Brass, clear coated on Brass.
 - 30 9. Closers - Surface mounted, Sprayed Lacquer to Match.
 - 31 10. Wall Stops: US4/BHMA 606 Dull Brass, clear coated on Brass.
 - 32 11. Floor Stops: US4/BHMA 606 Dull Brass, clear coated on Brass.
 - 33 12. Miscellaneous Hardware: US4/BHMA 606 Dull Brass, clear coated on Brass.

1 PART 3 - EXECUTION

2 3.1 EXAMINATION

- 3 A. Examine doors, frames, and related items for conditions that would prevent the proper application of finish
4 hardware. Do not proceed until defects are corrected.

5 3.2 INSTALLATION

- 6 A. Install finish hardware in accordance with reviewed hardware schedule and manufacturer's printed
7 instructions. Prefit hardware before finish is applied, remove and reinstall after finish is completed. Install
8 hardware so that parts operate smoothly, close tightly and do not rattle.

- 9 B. Installation of hardware shall comply with the current NFPA 80 and NFPA 101 requirements or as amended
10 by state and local building codes.

- 11 C. Set units level, plumb and true to line and location. Adjust and reinforce attachment to substrate as
12 necessary for proper installation and operation.

- 13 D. Screws for hinges and lock fronts in wood doors shall have pilot holes pre-drilled to avoid splitting doors.
14 Do not over-drill pilot holes or over-torque installation of screws.

- 15 E. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and
16 anchors in accordance with industry standards.

17 3.3 FIELD QUALITY CONTROL

- 18 A. After installation has been completed, provide services of qualified hardware consultant to check Project
19 to determine proper application of finish hardware according to schedule. Also check operation and
20 adjustment of hardware items.

- 21 B. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

22 3.4 ADJUSTING AND CLEANING

- 23 A. At final completion, hardware shall be left clean and free from disfigurement. Make final adjustment to
24 door closers and other items of hardware. Where hardware is found defective repair or replace or otherwise
25 correct as directed.

- 26 B. Adjust door closers to meet opening force requirements of Uniform Federal Accessibility Standards.
27 1. Force Requirements:
28 a. Interior hinged doors and gates: 5 pounds maximum.
29 b. Sliding or folding doors: 5 pounds maximum.

- 30 C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or
31 occupancy of space or area, return to work during week prior to acceptance or occupancy, and make final
32 check and adjustment of hardware items in such space or area. Clean operating items as necessary to restore
33 proper function and finish of hardware and doors.

1 D. Instruct Owner's personnel in proper adjustment and maintenance of door hardware and hardware finishes.

2 E. Clean adjacent surfaces soiled by hardware installation.

3 3.5 PROTECTION

4 A. Provide for proper protection of hardware items until the Owner accepts Project as complete.

5 3.6 HARDWARE GROUPS

6 A. Provide all required door hardware for each specified opening to comply with requirements of this section
7 in its entirety. Included are desired/intended functions, acceptable manufacturers and models, systems
8 coordination, etc. for a complete installed opening.

9 B. Refer to the openings schedule for hardware group and modifiers assigned to each door opening. Ignore
10 hardware groups and modifiers not assigned on the openings schedule.

11 C. All electrified hardware groups listed below, assigned to doors in the project, provide free egress at all
12 times, complying with code requirements for door operations, sensor release of electrically locked egress
13 doors and door hardware release of electrically locked egress doors.

14 **GROUP 31.92 – Existing single door/frame/hardware assembly with closer, replace existing lock/latch**
15 **with Privacy (mortise) function with occupancy indicator**

16 Existing hardware (hinges, closer, stop, etc.) to remain, except as noted below.

17 1 each Mortise Lockset Privacy function with OCC/VAC indicator

18 Function: Latchbolt is retracted by lever on either side, unless inside thumb turn lever locks outside lever.

19 Operating inside lever or closing door unlocks outside lever. Outside indicator indicates occupancy when
20 door is locked. Outside emergency release unlocks outside lever.

21 Patch/refinish door & frame, as required, for “like new” appearance.

1
2 **GROUP 510.24 – Aluminum active/inactive pair with automatic flushbolts, coordinator, and closers –**
3 **narrow backset electric lever lock (fail-secure entry with inside lever signal switch) via electronic**
4 **access control system/devices**
5 2 each Continuous Hinges
6 1 each Electric Power Transfer Device
7 1 each Latchset (narrow backset) Accurate No.8525 (confirm backset req'd)
8 1 set Electrified Lever Trim SECURITECH - GG (fail-secure outside, request-to-exit inside)
9 Function: Latchbolt is retracted by lever inside, key outside, and lever outside when unlocked electronically.
10 Power off locks outside lever. (fail-secure entry) Rotating inside lever connects/contacts signal switch.
11 1 each Cylinder
12 1 each Coordinator
13 1 set Flushbolts (automatic)
14 2 each Closers w/stop arms
15 2 each Stops, as required by opening conditions
16 2 each Door Position Switches/Contacts
17 Astragal provided by Door Manufacturer/Supplier (unless indicated otherwise).
18 Electronic access control system/devices, power supply (for electric lock), and monitoring/alarms are
19 provided by Security Contractor. Refer to security documents for locations and types of controls.
20 Connection by Electrical.
21 **Operational Description:** Manual exit (from overlook to floor) is possible at all times by rotating inside
22 (pull-side) lever to retract latchbolt, though monitor signal will be sent. Entry to overlook (from floor to
23 overlook) is controlled via electronic access control system (card reader, etc.) which locks and unlocks
24 outside (push-side) lever for predetermined periods of time. When locked, presenting authorization
25 temporarily unlocks outside (push-side) lever to allow entry. Manual entry is possible by outside (push-side)
26 key at all times, but monitoring/alarm system will be alerted when door is opened.

27 **END OF SECTION**

1 PART 2 - PRODUCTS

2 2.1 PERFORMANCE REQUIREMENTS

- 3 A. General: Provide glazing systems capable of withstanding normal lateral and impact loads (where
4 applicable) without failure, including loss or glass breakage attributable to the following: defective
5 manufacture, fabrication, and installation; or other defects in construction.
- 6 B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201,
7 Category II.
- 8 1. Safety Glazing Labeling: Where safety glazing is indicated and/or required, permanently mark
9 glazing with certification label of the SGCC or another certification agency acceptable to authorities
10 having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety
11 glazing standard with which glass complies.

12 2.2 GLASS PRODUCTS

- 13 A. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened). Provide heat-strengthened as
14 required for wind pressure or thermal stress.
- 15 B. Fully-Tempered Float Glass: ASTM C1048, Kind FT (fully tempered). Provide as required to comply with
16 safety code requirements and as indicated with "T" in the Material Identification Abbreviation. Provide
17 safety glazing labeling, as applicable.
- 18 C. Clear Float Glass: ASTM C1036, Type I (transparent glass, flat), Class 1 (clear), Quality Q3 (glazing
19 select).

20 2.3 GLAZING SCHEDULE

- 21 A. Glazing type locations as indicated on Drawings. Provide full-tempered glass where specified and where
22 indicated with 'T' at the end of the material designation.
- 23 B. (GL-1) Clear Float Glass, Fully-Tempered: 1/4-inch (6 mm) minimum thickness.
- 24 C. (GL-2) Clear Float Glass, Fully-Tempered: 1/2-inch (12 mm) minimum thickness.

25 2.4 GLAZING ACCESSORIES

- 26 A. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants
27 suitable for applications indicated and for conditions existing at time of installation.
- 28 B. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class
29 50, for Use NT, G, A, and O; SWRI validation.
- 30 1. Basis of Design: Dow Corning Corporation, 795 Silicone Building Sealant
- 31 C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape;
32 nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as
33 recommended in writing by tape and glass manufacturers for application indicated; and complying with
34 ASTM C 1281 and AAMA 800 for products indicated below:

- 1 1. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- 2 D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both
3 surfaces; and complying with AAMA 800 for the following types:
- 4 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
- 5 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead
6 of liquid sealant.
- 7 E. Setting Blocks: Neoprene, 80 to 90 shore "A" durometer hardness, chemically compatible with glazing
8 sealant or compound, length as recommended by glass manufacturer.
- 9 F. Spacers and Shims: Neoprene, 40 to 50 shore "A" durometer hardness, chemically compatible with glazing
10 sealant or compound, length as recommended by glass manufacturer.

11 PART 3 - EXECUTION

12 3.1 EXAMINATION

- 13 A. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify
14 conditions detrimental to proper or timely completion.
- 15 1. Verify glazing channels are free of burrs, irregularities, and debris.
- 16 2. Verify glass is free of edge damage or face imperfections.
- 17 3. Inspect door and frames to determine that frames, sash, and stops are set true and straight. Sash
18 rabbets and stops shall be clean and dry at time of glazing.
- 19 4. Do not proceed until unsatisfactory conditions have been corrected.
- 20 B. Beginning of installation means acceptance of substrate.

21 3.2 PREPARATION

- 22 A. Provide glass manufacturer's recommended edge clearances when sizing glass.
- 23 B. Remove protective coatings from surfaces to be glazed.
- 24 C. Clean glass and glazing surfaces to remove dust, oil, and contaminants, and wipe dry.
- 25 D. Verify measurements of sash and openings at Project.
- 26 1. Dimensions shown or indicated are given only as a guide for estimating purposes, and actual size
27 shall be determined by measurement of the actual openings. Accurately cut glass to fit openings
28 with proper clearances and setting block height.
- 29 E. Coordinate with and check Shop Drawings furnished by other suppliers of Work affecting this Section to
30 avoid field installation problems.
- 31 F. Before glazing metal sash, remove oil, lacquer, or other material to which the compound will not readily
32 adhere or which will tend to delaminate from metal and cause a leak through the glazing seal.

- 1 3.3 INSTALLATION
- 2 A. Comply with glass fabricators recommendations.
- 3 B. Except where curtain wall, window, entrance or glass manufacturer recommends otherwise, comply with
4 Flat Glass Marketing Association (FGMA) Sealant Manual and FGMA Glazing Manual.
- 5 C. Glaze insulated units as recommended by glass and frame manufacturers.
- 6 D. Set glass using neoprene setting blocks and spacers to insure proper edge clearance and uniform beads of
7 compound. Clearances shall conform to FGMA Glazing Manual requirements. Center glass in glazing
8 rabbets.
- 9 E. Check openings to confirm proper clearance at perimeters and between glass and stops.
- 10 1. Clean surfaces of rabbet (including stops) and surface of glass which will come into contact with
11 sealant. Use solvents and methods which insure clean, dry surfaces without film or foreign material
12 when sealant is placed.
- 13 F. Remove and replace glazing beads carefully to avoid marking or defacing any portion of frame, sash, or
14 fastenings.
- 15 1. Set glass in full bed of glazing tape or sealant. Clean glazing material after stops are installed. Clean
16 excess compound, etc. from glass after setting in conformance with glass manufacturer's
17 recommendations.
- 18 2. If recommended prime surfaces prior to glazing.
- 19 G. Set glass with reams (waves) running horizontally. Set glass with factory attached labels in place.
- 20 H. Setting Blocks: Place setting blocks at locations recommended by glass manufacturer, generally between
21 1/4 points and 6 inches from corner, except at glazed doors.
- 22 1. At glazed doors, provide one block at sill, located 3 inches up from edge of glass at hinge side; one
23 block at hinge side jamb, located 3 inches up from lower edge of glass; one block at head, located 3
24 inches from edge of glass at latch side of door; and, one block at jamb at lock side of door, located
25 3 inches down from edge of glass at top corner.
- 26 2. Use blocks of length required to properly support glass. Offset approximately 1 inch from shims.
- 27 I. Glass Installation in Aluminum Frames:
- 28 1. Glaze aluminum frames using preformed EPDM elastomeric glazing extrusion separately or in
29 combination with sealant and pre-shimmed glazing tape in compliance with aluminum frame
30 supplier's recommendations.
- 31 2. Set glass on setting blocks as recommended by manufacturer.
- 32 3. Apply tape and/or sealant to produce uniform sight line even with frame.
- 33 4. Set glass in gaskets with corners sealed.
- 34 J. Glazing Sealant: Along entire bottom edge of light, and up at least 6 inches at each jamb, gun in continuous
35 full bed of sealant to fill voids.
- 36 1. Fill entire space, full width of pane, full depth of glass, with sufficient sealant to form heel along
37 inside face and edge of glass.
- 38 2. At other edges (top and sides) gun in continuous heel bead of sealant along edges of glass perimeter
39 to set stop against and into, acting as fill between glass and stop.
- 40 3. Immediately after setting glass, at entire perimeter of glass, gun in sealant between stop and glass
41 so space above spacer is completely filled, without voids.
- 42 4. Place sealant flush with daylight edge of stops, with slight watershed at exterior. Provide straight,
43 smooth surface meeting at opening corners with sharp intersection.
- 44 5. Leave no sealant on exposed surfaces of stops and glass.

- 1 3.4 CLEANING
- 2 A. Remove surplus materials.
- 3 B. Final cleaning of glass by Contractor.

4 **END OF SECTION**

- 1 D. Furring and Bracing Members: Provide members with protective galvanized coating, in depths as
2 indicated.
3 1. (MET FURG-1) Hat-Shaped, Rigid Furring Channels: ASTM C645; with minimum base-metal
4 thickness of 0.033 inch
5 2. (MET FURG-3) Cold-Rolled Steel Channels: Channel bridging, furring channels, carrying
6 channels, steel channel stiffeners and braces; with minimum base-metal thickness of 0.054 inch.
- 7 E. Galvanized Flat Strap and Backing Plate at Interior Stud Walls: Steel sheet for blocking and bracing in
8 length and width indicated.
9 1. Minimum Base-Metal Thicknesses:
10 a. Typical: 0.054 inch.
11 b. For Heavy Equipment and Grab Bar Locations: 0.068 inch.
12 2. Where Wood Backing and Blocking is Indicated: Refer to Section 06 10 00 for wood requirements.
13 Provide fire-resistant treatment.
- 14 2.3 SUSPENSION SYSTEMS
- 15 A. General: Comply with ASTM C754 for conditions indicated.
- 16 B. Metal Studs and Furring Channels: As specified above.
- 17 C. Tie Wire: ASTM A641, Class 1 zinc coating, soft temper, 0.0625 inch diameter wire, or double strand of
18 0.0475 inch diameter wire.
- 19 D. Hanger Attachment to Anchors in Concrete: Fabricated from corrosion-resistant materials with holes or
20 loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that
21 imposed by construction as determined by testing according to ASTM E488 by a qualified independent
22 testing agency.
23 1. Postinstalled, chemical anchor.
24 2. Postinstalled, expansion anchor.
- 25 E. Wire Hangers: ASTM A641, Class 1 zinc coating, soft temper, 0.162 inch diameter.
- 26 F. Manufactured Suspension Grid System for Ceilings and Soffits: ASTM C 645, direct-hung system
27 composed of main beams and cross-furring members that interlock.
28 1. Products and Manufacturers:
29 a. Drywall Grid Systems by Armstrong World Industries, Inc..
30 b. Drywall Grid Systems by Chicago Metallic Corporation.
31 c. Drywall Suspension System by USG Corporation.

32 2.4 AUXILIARY MATERIALS

- 33 A. Fasteners: Galvanized steel fasteners of type, size, corrosion resistance, holding power, and other properties
34 required to fasten steel members to substrates; and of length suitable for adequate penetration of substrate
- 35 B. Acoustic Sealant: In accordance with Section 09 29 00 - Gypsum Board.

1 PART 3 - EXECUTION

2 3.1 EXAMINATION

- 3 A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in
4 anchors, and structural framing, for compliance with requirements and other conditions affecting
5 performance of the Work.
- 6 B. Proceed with installation only after unsatisfactory conditions have been corrected.

7 3.2 INSTALLATION, GENERAL

- 8 A. Installation Standards: ASTM C 754.
9 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing
10 installation.
- 11 B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars,
12 toilet accessories, furnishings, or similar construction. Install bracing at terminations in assemblies.
- 13 C. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame
14 both sides of joints independently.
- 15 D. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more
16 than 1/8 inch from plane formed by faces of adjacent framing.

17 3.3 FRAMING INSTALLATION

- 18 A. Framing Installation, General:
19 1. Partition Heights: Extend partition stud system through suspended ceilings to structural support
20 above, except where indicated to terminate at ceiling.
21 a. Provide additional bracing for partitions extending above ceiling where indicated.
22 b. Continue framing around ducts penetrating partitions above ceiling.
23 2. Coordinate erection of studs with installation of service utilities. Align stud web openings.
24 Coordinate installation of bucks, anchors, blocking, electrical and mechanical work which is to be
25 placed in or behind partition framing. Allow such items to be installed after framing is complete.
26 3. Isolate stud system from transfer of structural loading to system, both horizontally and vertically.
27 Provide slip or cushioned joints to attain lateral support and avoid axial loading.
28 4. Reinforce stud partitions and provide additional metal studs as indicated and required for installation
29 of wall cabinets, wall mounted equipment, wall mounted mechanical and electrical fixtures,
30 accessories, shelves and shelf standards. Provide thick steel plate to span minimum of 3 studs for
31 installation of mirrors, toilet accessories or grab bars.
32 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated on
33 Drawings. Do not fasten or bridge inner and outer tracks at nested track construction. Verify that
34 tracks are free of all bridging elements.
- 35 B. Runners and Tracks: Secure runner tracks to floor and ceiling construction, and to structure above ceilings
36 as recommended by manufacturer, with fastener spacing not to exceed 24 inches o.c.
37 1. Runner Tracks: Provide continuous track sized to match studs. Align runner tracks accurately to
38 partition layout at both floor and ceiling. Provide fasteners at corners and ends of runner tracks.
39 2. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce
40 joints at tops of framing systems that prevent axial loading of finished assemblies.

- 1 3. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly
2 indicated.
3 4. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner
4 track section (for cripple studs) at head and secure to jamb studs.
- 5 C. Metal Studs: Install studs vertically at 16 inches o.c., unless otherwise indicated, and not more than 2 inches
6 from abutting construction, each side of openings, and at corners.
7 1. Install metal studs in floor and ceiling runner tracks. Secure studs to runners. Anchor light gauge
8 screw-type partition studs to runner tracks by screwing opposite flanges top and bottom, except
9 screw end studs to both tracks at both flanges.
10 2. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior
11 walls, install isolation strip between studs and exterior wall.
12 3. Provide additional studs at exterior corners and 2 inches from inside corners, terminations of
13 partitions, and both sides of control joints.
14 4. Where partitions abut other construction, provide vertical runner track securely attached to
15 construction.
16 5. Use full length studs between runner tracks.
17 6. Stud Splicing: Not permitted.
- 18 D. Door Openings:
19 1. Frame door openings with vertical studs attached to each jamb of door frame.
20 2. Provide additional studs 2 inches from jamb studs.
21 3. Frame head of door with horizontal section of runner track attached to jamb studs and provide
22 vertical studs cut to fit between head and ceiling tracks and attach to tracks.
23 4. Provide 3/4 inch cold-rolled steel channel stiffener at 6 inches above door head extending at least 2
24 stud spaces beyond jamb studs, and attach to studs.
25 5. Fit runners under and above openings, secure intermediate studs at spacing of wall studs. Brace stud
26 framing system and make rigid.
- 27 E. Other Framed Openings: Frame openings other than door openings the same as required for door openings,
28 unless otherwise indicated. Install framing below sills of openings to match framing required above door
29 heads.

30 3.4 SUSPENSION SYSTEM INSTALLATION

- 31 A. Suspended Assemblies, General: ASTM C 754.
32 1. Install ceiling framing independent of walls, columns, and above ceiling work.
33 2. Do not bridge building expansion joints with support system.
34 3. Installation Tolerances: Install steel framing components for suspended ceilings so members for
35 panel attachment are level to within 1/8 inch in 12 feet measured lengthwise on each member
36 transversely between parallel members.
- 37 B. Hangers: Install hangers plumb and free from contact with insulation or other objects within ceiling plenum
38 that are not part of supporting structural or suspension system. Splay hangers only where required to miss
39 obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective
40 means.
41 1. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye
42 screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner
43 that will not cause hangers to deteriorate or otherwise fail.
44 a. Space hanger wires 48 inches o.c. along carrying channels and within 6 inches of ends of
45 channel run. Anchor hanger wires to supporting structure. Do not attach hangers to metal
46 deck tabs.
47 2. Coordinate location of hangers with other work.

1 **SECTION 09 29 00**
2 **GYPSUM BOARD**

3 PART 1 - GENERAL

4 1.1 SUMMARY

- 5 A. Section Includes:
6 1. Interior gypsum board.
7 2. Acoustic insulation and sealant.
8 3. Gypsum assembly accessories.

9 1.2 DEFINITIONS

- 10 A. Gypsum Board Terminology: Refer to ASTM C11 for definitions of terms for gypsum board assemblies
11 not defined in this Section or in other referenced standards.

12 1.3 ACTION SUBMITTALS

- 13 A. Product Data: For each type of product.

14 1.4 DELIVERY, STORAGE, AND HANDLING

- 15 A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct
16 sunlight, construction traffic, and other potential causes of damage.
17 1. Stack panels flat and supported on risers on a flat platform to prevent sagging.

18 1.5 PROJECT CONDITIONS

- 19 A. Environmental Limitations: Comply with ASTM C 840 requirements and recommendations of gypsum
20 board manufacturer, for environmental conditions before, during and after application of gypsum board.
- 21 B. Damaged Materials: Do not install panels that are wet, moisture damaged, and mold damaged.
22 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration,
23 sagging, or irregular shape.
24 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface
25 contamination and discoloration.

26 PART 2 - PRODUCTS

27 2.1 PERFORMANCE REQUIREMENTS

- 28 A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those
29 tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an
30 independent testing agency.

1 1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design
2 Manual."

3 2.2 GYPSUM PANEL PRODUCTS

4 A. Manufacturers:

- 5 1. United States Gypsum.
6 2. National Gypsum Company.
7 3. Georgia-Pacific.
8 4. CertainTeed Corporation.

9 B. Gypsum Board Products, General: In accordance with ASTM C 1396, and other specified requirements,
10 and as follows:

- 11 1. Provide products that do not contain asbestos.
12 2. Provide products in accordance with recommendations of GA 216 - Application and Finishing of
13 Gypsum Panel Products.
14 3. Provide products in maximum lengths and widths available to minimize joints and to correspond
15 with support system indicated.

16 C. (GYP BD-1) Fire-Rated Board: Type X, 5/8 inch thick.

17 D. (GYP BD-2) Moisture- and Mold-Resistant Board, Type X: With moisture- and mold-resistant paper
18 surfaces and core. Provide mold and water-resistant gypsum board as required by local building code and
19 as indicated

- 20 1. Thickness: 5/8 inch.
21 2. Mold Resistance: ASTM D 3273, score of 10.
22 3. Basis of Design: Sheetrock Mold Tough Firecode by United States Gypsum (USG).

23 2.3 JOINT TREATMENT MATERIALS

24 A. General: Comply with ASTM C 475.

25 B. Joint Tape:

- 26 1. Interior Gypsum Wallboard: Paper.
27 2. Tile Backing Panels: As recommended by panel manufacturer.

28 C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with
29 other compounds applied on previous or for successive coats.

- 30 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-
31 type taping compound.
32 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges,
33 use setting-type taping compound.
34 a. Use setting-type compound for installing paper-faced metal trim accessories.
35 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
36 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
37 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound, or high-
38 build interior coating product designed for application by airless sprayer and to be used instead of
39 skim coat compound to produce Level 5 finish.

- 1 2.4 ACCESSORIES
- 2 A. General: Provide auxiliary materials and accessories that comply with referenced installation standards and
3 manufacturer's written instructions.
- 4 B. Trim Accessories: ASTM C 1047; galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-
5 faced galvanized steel sheet; in the following shapes as required:
- 6 1. Cornerbead.
7 2. Bullnose bead.
8 3. LC-Bead: J-shaped; exposed long flange receives joint compound.
9 4. L-Bead: L-shaped; exposed long flange receives joint compound.
10 5. U-Bead: J-shaped; exposed short flange does not receive joint compound.
11 6. Expansion (control) joint.
- 12 C. Fasteners and Anchorages: GA 216, type and size as recommended by board manufacturer.
- 13 D. Fasteners: Use self-tapping or appropriate threaded fastener, compatible with all materials fasteners will
14 contact with and not causing galvanic corrosion.
- 15 E. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
- 16 F. Joint Sealant (Non-Acoustic): As specified in Section 07 92 00 - Joint Sealants.

17 2.5 ACOUSTICAL INSULATION

- 18 A. Acoustic Insulation, General:
- 19 1. Insulation is required to be formaldehyde-free or GreenGuard Indoor Air Quality Certified.
20 2. Flamespread: Maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per
21 ASTM E 84; passing ASTM E 136 for combustion characteristics.
- 22 B. (INSUL-40) Glass-Fiber Acoustic Insulation: ASTM C 665, Type I; unfaced fiberglass batts or blankets,
23 free of formaldehyde and GreenGuard Indoor Air Quality Certified.
- 24 1. Basis of Design:
25 a. CertainTeed; NoiseReducer (FF)
26 b. Johns Manville: Formaldehyde-Free and Unfaced Sound Control Batt.

27 2.6 ACOUSTICAL SEALANT

- 28 A. (SLNT) Provide acoustical joint-sealant products that effectively reduce airborne sound transmission
29 through perimeter joints and openings in building construction, as demonstrated by testing representative
30 assemblies according to ASTM E 90.
- 31 1. Provide permanently resilient, non-hardening, non-bleeding silicone or polyurethane caulking
32 material. Use polyurethanes for joints that will be painted and silicone or polyurethane for unpainted
33 joints. Do not use latex, siliconized latex, or siliconized acrylic sealants for acoustic purposes, unless
34 the product is specifically listed below.
- 35 2. Product Requirements:
36 a. Elongation: 100 percent, minimum.
37 b. Shore "A" Hardness: 45, maximum.
38 c. Movement Capability: 30% or higher.
39 d. Class: 35 or higher per ASTM C920.

- 1 B. Acoustical Sealant for Exposed Joints: Manufacturer's standard nonsag, non-hardening, non-skinning,
2 paintable, nonstaining latex acoustical sealant complying with ASTM C 834.
- 3 C. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening,
4 nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.

5 PART 3 - EXECUTION

6 3.1 GYPSUM BOARD INSTALLATION

- 7 A. Install and finish gypsum board and accessories in accordance with manufacturer's printed instructions and
8 comply with recommendations of GA 216 and ASTM C840, including appendixes.
- 9 B. Minimize butt joints by using gypsum board of maximum length possible. If cut butt joints are unavoidable,
10 locate end butt joints as far from center of walls or ceilings as possible and stagger not less than 12 inches
11 in alternate courses of board.
- 12 C. Do not install imperfect, damaged, damp or wet gypsum board.
- 13 D. Abut boards together for light contact at edges or ends with not more than 1/16 inch open space between
14 boards. Do not force into place.
- 15 E. Locate edges and joints over supports or back-blocking except in horizontal applications. Position gypsum
16 board so that both tapered edge joints and cut edges abut. Do not place tapered edges against cut edges or
17 ends. Stagger vertical joints over different studs on opposite sides of partition/walls.
18 1. Hold gypsum board 1/4 inch above floor at each type of partition.
- 19 F. Isolate gypsum surfaces with control joints or other stress relief where:
20 1. Partition or furring abuts structural element (except floor) or dissimilar wall or ceiling.
21 2. Ceiling abuts structural element, dissimilar wall or partition or other vertical penetration.
22 3. Construction changes within plane of partition or ceiling.
23 4. Wings of "L", "U" and "T" shaped ceiling areas are joined.
24 5. Expansion joints occur in exterior wall if expansion joints are not used.
25 6. Where control joint is near a door opening, locate and align control joint with edge of door frame.
26 a. Ceiling height door frames may be used as control joints.
27 b. Where door frames are less than ceiling height, extend control joints to ceiling from both
28 corners
29 7. Review location of joints with Architect.
- 30 G. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings,
31 etc.), except in chases braced internally.
32 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage
33 may be accomplished with scraps of not less than 8 sq. ft.in area.
34 2. Fit gypsum panels around ducts, pipes, and conduits.
35 3. Where partitions intersect open concrete coffers, concrete joists, and other structural members
36 projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by
37 coffers, joists, and other structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
- 38 H. Provide perimeter isolation where non-load-bearing partitions abut structural decks or ceilings, or vertical
39 structural elements. Allow not less than 1/4 inch, or more than 1/2 inch gap between gypsum and structure.
40 Finish edges of face layer with casing bead. Seal space between casing bead and structure with continuous
41 acoustical sealant bead. Do not attach board directly to tracks.

- 1 I. Cutting, Fitting and Trimming: Accurately measure and precut gypsum drywall units prior to installation.
2 Make cuts from face side by scoring and snapping away from face side or by sawing. Completely cut paper
3 on back face; do not break paper by tearing. Maintain close tolerances for accurate fit at joints between
4 sheets and at framed openings, and allow for covering of edges of cut-outs with plates and escutcheons.
5 Cut edges smooth as required for neat and accurate fit.
- 6 J. Begin fastening from center portion of sheet and work toward edges and ends. Ensure contact of drywall
7 with supports by applying pressure on surface adjacent to fastener being driven. Do not locate fasteners
8 closer than 3/8 inch from edges or ends of sheets. Drive with shank approximately perpendicular to drywall
9 surface.
- 10 K. Drive screws with power screwdriver recommended by drywall manufacturer. Do not hammer drive
11 screws. Set screw heads slightly below surface of drywall, but do not break or strip paper face around screw.
12 Stagger screws on edges and ends of adjacent sheets.
- 13 3.2 ACOUSTICALLY RATED PARTITIONS
- 14 A. Where acoustically rated partitions are shown, provide complete air tight, acoustical rated assembly
15 meeting or exceeding requirements of Sound Transmission Class (STC) ratings per manufacturer's
16 requirements and GA 600 for sound control requirements.
- 17 B. Stagger joints between layers of gypsum board and install gypsum board to be continuous between adjacent
18 rooms.
- 19 C. Fit gypsum board tightly around structural elements.
- 20 D. Install continuous acoustical sealant at:
21 1. Entire perimeter of wall on each side of top, bottom and side of walls.
22 2. Intersection at change of plane and change of material.
23 3. Gaps between service outlets and gypsum board
24 4. Each penetration.
25 5. Structural elements.
26 6. All penetrations of partition, wall, and floor construction by ductwork, conduit, piping, or structure.
27 7. All termination of partitions enclosing Noise Critical Spaces to abutting construction (e.g. partitions,
28 structure, etc.)
29 8. Both sides of door frames to abutting construction where doors are scheduled to have acoustical
30 seals.
31 9. Both sides of window frames to adjacent construction.
32 10. Perimeter of and penetrations through sound isolating ceilings, roof systems, and floor systems.
- 33 E. Seal entire back of service boxes.
- 34 F. Seal gaps around penetrations as follows:
35 1. One inch or less gap filled tightly with batt insulation and apply sealant.
36 2. One inch or greater gap fill with acoustical insulation and moldable putty.
- 37 G. Acoustical Sealant Installation: Provide acoustical sealant at the following locations:
38 1. At penetrations of partition, wall, and floor construction by ductwork, conduit, piping, or structure.
39 2. At both sides of door frames to abutting construction where doors are scheduled to have acoustical
40 seals.
41 3. At perimeter of and penetrations through sound isolating ceilings, roof systems, and floor systems.
42 4. Provide backer rod at all acoustical sealant joints..

1 3.3 ACCESSORIES INSTALLATION

- 2 A. Acoustical Insulation: Install blankets in accordance with manufacturer's printed instructions, with tight
3 joints in blanket units. Use tape, adhesive or staples to hold blankets in place.
4 1. Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around
5 electrical and mechanical items within or behind partitions and tight to items passing through
6 partitions.
- 7 B. Drywall Sealant: Seal perimeter of sound-rated partitions by filling open space between drywall and floor
8 or ceiling construction with continuous bead of sealant. Fill open spaces between drywall and fixtures,
9 cabinets and other flush or penetrating items with continuous bead of sealant. Seal sides and back of
10 electrical boxes to completely close up openings and joints. Seal perimeter of wallboard shaft wall where
11 it abuts other work.
12 1. Apply joint sealant in accordance with Section 07 92 00 - Joint Sealants.

13 3.4 FINISHING

- 14 A. Finish exposed drywall surfaces with joints, corners and exposed edges reinforced or trimmed and with
15 joints, fastener heads, trim accessory flanges and surface defects filled with joint compound in accordance
16 with drywall manufacturer's recommendations for smooth, flush surface. Form true, level or plumb lines,
17 without joints, fastener heads, flanges of trim accessories or defects visible after application of field-applied
18 decoration. Exposed metal trim (not filled) will not be acceptable.
- 19 B. Use joint tape to reinforce joints formed by tapered edges or butt ends of drywall units and at interior
20 corners and angles. Set tape in joint compound and apply skim coat over tape in one application. Do not
21 use topping or finishing compounds for setting of tapes.
- 22 C. Apply joint compound to joint. Apply joint compound to fill holes left from removal of screws at
23 intermediate studs. Finish gypsum drywall thereafter, including sanding of final coat, in accordance with
24 ASTM C840.
- 25 D. Where open spaces of more than 1/16 inch width occur between abutting drywall units, except at control
26 joints, prefill joints with joint compound and allow prefill to dry before application of joint tape.
- 27 E. Finish Levels of Joints in Interior Gypsum Board Work:
28 1. Level 0: No taping, finishing, or accessories required.
29 a. Use above suspended ceilings and within other concealed spaces, unless assembly is fire
30 rated, sound rated, sound or smoke controlled, or unless space serves as air plenum.
31 2. Level 1: At joints and interior angles embed tape in joint compound. Leave surface free of excess
32 joint compound. Tool marks and ridges are acceptable.
33 3. Level 2: At joints and interior angles embed tape in joint compound with one separate coat of joint
34 compound applied over joints, angles, fastener heads, and accessories.
35 a. Use for mold and water resistant gypsum board indicated for use as a substrate for ceramic
36 tile.
37 b. Use for gypsum board indicated for use as a substrate for wood paneling or acoustical panels.
38 c. Use above suspended ceilings and within other concealed spaces if gypsum board assembly
39 is fire rated, sound rated, sound or smoke controlled, or space serves as air plenum.
40 4. Level 3: At joints and interior angles embed tape in joint compound with 2 separate coats of joint
41 compound applied over joints, angles, fastener heads, and accessories. Apply joint compound
42 smooth and free of tool marks and ridges.
43 5. Level 4: At joints and interior angles embed tape in joint compound with 3 separate coats of joint
44 compound applied over joints, angles, fastener heads, and accessories. Apply joint compound
45 smooth and free of tool marks and ridges.

1 1.6 WARRANTY

2 A. Mortar and Grout Warranty: Provide 20-year materials and installation.

3 PART 2 - PRODUCTS

4 2.1 TILE MATERIALS

5 A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer, and
6 from same production run and of consistent quality in appearance and physical properties for each
7 contiguous area.

8 B. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and
9 other characteristics indicated.

10 1. Factory-Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as
11 standard with manufacturer unless otherwise indicated.

12 C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so
13 tile units taken from one package show same range in colors as those taken from other packages and match
14 approved Samples.

15 D. Acceptable Manufacturers: Subject to compliance with the requirements provide the basis of design product
16 or equivalent as approved by the Architect from one of the following:

- 17 1. Crossville, Inc.
- 18 2. Daltile
- 19 3. Anitolia Capital Corp.

20 E. (CT) Basis of Design Ceramic Tiles:

- 21 1. (CTF-1) Ceramic Floor Tile: Daltile
 - 22 a. Pattern: Dignitary
 - 23 b. Color: DR11 Governor Black
 - 24 c. Size:24"x24"
 - 25 d. Thickness: 5/16"; Finish: Matte
 - 26 e. Installation: Stack Bond
- 27 2. (CTW-1) Ceramic Floor Tile: Daltile
 - 28 a. Pattern: Dignitary
 - 29 b. Color: DR11 Governor Black
 - 30 c. Size:24"x24"
 - 31 d. Thickness: 5/16"; Finish: Matte
 - 32 e. Installation: Stack Bond
- 33 3. (CTB-1) Ceramic Floor Tile: Daltile
 - 34 a. Pattern: Dignitary;
 - 35 b. Shape: Bullnose Base P43F9;
 - 36 c. Color: DR11 Governor Black;
 - 37 d. Size:3"x24";
 - 38 e. Thickness: 5/16";
 - 39 f. Finish: Matte

1 2.2 SETTING MATERIALS

- 2 A. Tile-Setting System Manufacturer: Provide complete tile-setting system consisting of materials by a single
3 Manufacturer. Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from
4 one manufacturer and each aggregate from one source or producer. Provide tile setting system by one of
5 the following:
- 6 1. Custom Building Products.
 - 7 2. LATICRETE International Inc..
 - 8 3. MAPEI Corporation.
- 9 B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI
10 standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods
11 specified in tile installation schedules, and other requirements specified.
- 12 C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:
- 13 1. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which
14 only water must be added at Project site.
 - 15 2. Prepackaged dry-mortar mix combined with styrene-butadiene-rubber liquid-latex additive.
 - 16 a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in
17 addition to the other requirements in ANSI A118.4.
 - 18 3. Flexible Latex-Cement Mortar: Add flexible latex additive to dry mortar mix as recommended by
19 porcelain tile manufacturer.
- 20 D. Mortar for Large Format Floor Tile: Polymer modified portland cement mortar, designed for large format
21 tile for thin-bed or medium-bed applications, complying with ANSI A118.4 and ANSI A118.11, and "Extra
22 Heavy" rating using ASTM C-627 Robinson Floor Test.
- 23 1. Basis of Design:
 - 24 a. Laticrete International, Sure-Set.
 - 25 b. Mapei, comparable product.
 - 26 c. ProLite Tile and Stone Mortar by Custom Building Products.
- 27 E. Polymer-Modified Cement Grout: ANSI A118.7. Provide Either ethylene vinyl acetate, in dry,
28 redispersible form, prepackaged with other dry ingredients; or acrylic resin or styrene-butadiene rubber in
29 liquid-latex form for addition to prepackaged dry-grout mix. Color as indicated.
- 30 1. Color: As selected by Architect from manufacturer's full range to match tile.

31 2.3 ACCESSORIES

- 32 A. (CT TRIM) Ceramic Tile Trim and Transition Strips: Basis of Design as follows:
- 33 1. (CT TRIM-1): Schluter Jolly, finish: anodized aluminum.
- 34 B. Sealant: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following
35 requirements and with the applicable requirements in Section 07 92 00 - Joint Sealants.
- 36 1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59,
37 Subpart D (EPA Method 24).
 - 38 2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
 - 39 3. Provide sanded elastomeric joints to match sanded grout joints.
- 40 C. Sealant and Backer Rod: As specified in Section 07 92 00 - Joint Sealants.

1 2.4 MIXING MORTARS AND GROUT

- 2 A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written
3 instructions.
- 4 B. Add materials, water, and additives in accurate proportions.
- 5 C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other
6 procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for
7 installations indicated.

8 PART 3 - EXECUTION

9 3.1 EXAMINATION

- 10 A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance
11 with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 12 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with
13 tile-setting materials including curing compounds and other substances that contain soap, wax, oil,
14 or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations
15 indicated.
- 16 B. Proceed with installation only after unsatisfactory conditions have been corrected.

17 3.2 PREPARATION

- 18 A. Prepare surfaces to receive tile as recommended by mortar or adhesive manufacturer; and in compliance
19 with TCA's "Handbook for Ceramic Tile Installation".
 - 20 1. Roughen surfaces that are glossy or which have loose surface material by sanding or scarifying.
 - 21 2. Remove surface material that is not compatible with adhesive.
 - 22 3. Use primer when recommended by adhesive manufacturer.
 - 23 4. Clean thoroughly to remove oil, dirt and dust.

24 3.3 TILE INSTALLATION

- 25 A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in
26 tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of
27 Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and
28 apply to types of setting and grouting materials used.
 - 29 1. Achieve 100 percent bond in tile work. Back butter units 12 inch by 12 inch and larger.
- 30 B. Extend tile work into recesses and under equipment and fixtures, to form complete covering without
31 interruptions. Terminate work neatly at obstructions, edges and corners without disruption of pattern or
32 joint alignment.
- 33 C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible
34 surfaces. Grind cut edges of tile abutting trim, finish or built-in items for straight, aligned joints.
 - 35 1. Fit tile closely to electrical outlets, piping and fixtures so that plates, collars or covers overlap tile.
- 36 D. Perimeter: Provide for expansion at perimeter with non-grouted and non-sealed perimeter expansion joint.

- 1 E. Grout Jointing Pattern: Unless otherwise shown, lay ceramic tile in grid pattern. Align joints when adjoining
2 tiles on floor, base, walls and trim are same size. Layout tile work and center tile fields both directions in
3 each space or on each wall area.
 - 4 1. Adjust to minimize tile cutting. Provide uniform joint width.
 - 5 2. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 6 a. Ceramic Mosaic Tile: 1/8 inch.
- 7 F. Grout Sealer: Apply grout sealer as recommended by sealer and grout material manufacturers.
- 8 G. Tile Accessories: Install at locations indicated, in accordance with Manufacturer's recommendations.

9 3.4 **INSTALLED WORK**

- 10 A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of
11 foreign matter.
 - 12 1. Remove grout residue from tile as soon as possible.
 - 13 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions
14 but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout
15 manufacturers and only after determining that cleaners are safe to use by testing on samples of tile
16 and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of
17 cleaning. Flush surfaces with clean water before and after cleaning.
 - 18 3. Remove temporary protective coating by method recommended by coating manufacturer and that
19 is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
- 20 B. Protection: Protect installed tile work with heavy covering during construction period to prevent damage
21 and wear.
 - 22 1. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
 - 23 a. Setting materials for large format tile require longer curing time.
 - 24 2. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile
25 surfaces.

26 **END OF SECTION**

- 1 B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture
2 content.
- 3 C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

4 PART 2 - PRODUCTS

5 2.1 PRODUCTS AND MANUFACTURERS

6 A. Source Limitations for Ceiling Units and Suspension Systems: Obtain each acoustical ceiling panel and
7 suspension system from one source with resources to provide products of consistent quality in appearance
8 and physical properties without delaying Work.

9 B. Products and Manufacturers: Provide specified Basis of Design or approved equivalent products by one of
10 the following:

- 11 1. Armstrong World Industries, Inc.;
- 12 2. USG Interiors, Inc.;
- 13 3. Ecophon CertainTeed, Inc.;
- 14 4. Chicago Metallic Corporation.

15 C. (ACT) Acoustical Ceiling Systems, Basis of Design Assemblies:

16 1. (ACT-1) Toilet Room ACT:

- 17 a. Panels: Armstrong Ceiling Solutions; Ultima Tegular Fine Texture No. 1912.
 - 18 1) Size: 24" x 24" x 3/4" thick
 - 19 2) Edge: square; tegular
 - 20 3) Color: white
 - 21 4) Acoustics:
 - 22 (a) NRC: 0.75
 - 23 (b) CAC: 35

24 b. Suspension System: 9/16" Prelude XL suspension grid, white.

25 2. (ACT-2) Conference Room ACT:

- 26 a. Panels: Armstrong Ceiling Solutions Calla High CAC Tegular Fine Texture No. 2824
 - 27 1) Size: 24" x 24" x 1" thick
 - 28 2) Edge: square; tegular
 - 29 3) Color: white
 - 30 4) Acoustics:
 - 31 (a) NRC: 0.85
 - 32 (b) CAC: 35

33 b. Suspension System: 9/16" Prelude XL suspension grid, white.

34 2.2 ACOUSTICAL CEILING PANELS

35 A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply
36 with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance,
37 unless otherwise indicated.

- 38 1. Recycled Content: Provide acoustical panels with recycled content such that postconsumer recycled
39 content plus one-half of pre-consumer recycled content constitutes a minimum of 40 percent by
40 weight.
- 41 2. Surface-Burning Characteristics: Provide acoustical panels with surface-burning characteristics
42 complying with ASTM E 1264 for Class A materials with flame spread of 0-25, as determined by
43 testing identical products per ASTM E 84.

1 2.3 SUSPENSION SYSTEMS

- 2 A. Metal Suspension System: Provide manufacturer's standard direct-hung metal suspension systems of types,
3 structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
4 1. Double-Web, Exposed Steel Suspension System: Main and cross runners roll formed from cold-
5 rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to
6 ASTM A 653, not less than G30coating designation, with prefinished metal caps on flanges.
7 a. Structural Classification: Heavy-duty system.
8 b. Face Design: Flat, flush.
9 c. Cap Material: Steel cold-rolled sheet.
10 d. Face Width: As indicated.
11 2. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper, pre-stretched, with a
12 yield stress load of at least time three design load, but not less than 12 gauge.
- 13 B. Accessories: Provide stabilizer bars, furring clips, splices, edge moldings and hold down clips as required
14 to complete and complement suspended ceiling grid system.
15 1. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct
16 Hung unless otherwise indicated.
17 2. Edge Moldings and Trim: Provide Roll-formed sheet metal type in profile indicated or, if not
18 indicated, manufacturer's standard moldings for edges and penetrations, [formed from sheet metal
19 of same material, finish, and color as that used for exposed flanges of suspension system runners,
20 and complying with seismic design requirements.
21 3. Touch-up Paint: Manufacturer's touch-up paint for field cut tegular or other reveal edge tiles.
- 22 C. Carrying Channels and Hangers: Primed steel, size and type to suit application and to rigidly secure
23 complete acoustic unit ceiling system, with maximum deflection of 1/360.
- 24 D. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and
25 Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's
26 standard factory-applied finish for type of system indicated.

27 2.4 METAL EDGE MOLDINGS AND TRIM

- 28 A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated,
29 manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements;
30 formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-
31 system runners.
32 1. (ACTR-1) Basis of Design: Axiom by Armstrong, 4" high, color to match suspension system.
33 2. Provide manufacturer's edge moldings that fit acoustical panel edge details and suspension systems
34 indicated and that match width and configuration of exposed runners unless otherwise indicated.

35 PART 3 - EXECUTION

36 3.1 EXAMINATION

- 37 A. Examine substrates and structural framing to which ceiling system attaches or abuts, with Installer present,
38 for compliance with requirements specified in this and other sections that affect installation and anchorage
39 of ceiling system. Do not proceed with installation until unsatisfactory conditions have been corrected.

1 3.2 PREPARATION

- 2 A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite
3 edges of each ceiling. Avoid use of less-than-half-width units at borders, and comply with reflected ceiling
4 plans.

5 3.3 SUSPENSION GRID INSTALLATION

- 6 A. General: Install acoustical panel ceilings to comply with ASTM C636, per manufacturer's written
7 instructions and CISCA's "Ceiling Systems Handbook."

- 8 B. Suspend ceiling hangers from building's structural members and as follows:
9 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum
10 that are not part of supporting structure or of ceiling suspension system.
11 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by
12 bracing, countersplaying, or other equally effective means.
13 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that
14 interfere with location of hangers at spacings required to support standard suspension system
15 members, install supplemental suspension members and hangers in form of trapezes or equivalent
16 devices. Size supplemental suspension members and hangers to support ceiling loads within
17 performance limits established by referenced standards and publications.
18 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three
19 tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices
20 that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age,
21 corrosion, or elevated temperatures.
22 5. Space hangers not more than 48 inches o.c. along each member supported directly from hangers,
23 unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

- 24 C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary
25 to conceal edges of acoustical panels.
26 1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3
27 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter
28 corners accurately and connect securely.
29 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

- 30 D. Install suspension system runners so they are square and securely interlocked with one another. Remove
31 and replace dented, bent, or kinked members.

- 32 E. Tolerances: Erect ceiling system level within 1/8 inch in 12'-0" in any direction.

33 3.4 ACOUSTICAL PANEL INSTALLATION

- 34 A. Fit acoustic lay-in panels in place, free from damaged edges or other defects detrimental to appearance and
35 function. Lay directional patterned tile one way with pattern parallel to shortest room axis.
36 1. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
37 2. Field recess units with tegular or reveal edge at border or ceiling edge.
38 3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces
39 using coating recommended in writing for this purpose by acoustical panel manufacturer.

- 40 B. Install lay-in panels level, in uniform plane and free from twist, warp and dents with straight joints, edges
41 in alignment, and edges and corners flush.

- 1 3.5 INSTALLED WORK
- 2 A. Adjusting: Adjust sags or twists that develop in ceiling systems and replace part which is damaged or faulty.
- 3 B. Cleaning: Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension
- 4 members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage.
- 5 C. Replace: Remove and replace work that cannot be successfully cleaned and repaired to permanently
- 6 eliminate evidence of damage.

7 **END OF SECTION**

1 PART 3 - EXECUTION

2 3.1 INSTALLATION

3 A. Examination: Proceed with installation only after unsatisfactory conditions have been corrected.
4 Installation of resilient products indicates acceptance of surfaces and conditions.

5 B. Installation: Comply with manufacturer's written instructions and with the following requirements:

6 1. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient
7 products.

8 2. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent
9 pieces aligned.

10 3. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous
11 contact with horizontal and vertical substrates.

12 4. Cope inside corners and miter outside corners

13 3.2 INSTALLED WORK

14 A. Cleaning: Comply with manufacturer's written instructions for cleaning and protecting resilient products.
15 Remove adhesive and other blemishes from exposed surfaces.

16 B. Protection: Protect resilient products from mars, marks, indentations, and other damage from construction
17 operations and placement of equipment and fixtures during remainder of construction period.

18 **END OF SECTION**

1 C. Store materials on-site in original undamaged packages, inside well-ventilated area protected from weather,
2 moisture, soilage, extreme temperatures, and humidity. Lay flat, with continuous blocking off ground.

3 1.5 PROJECT CONDITIONS

4 A. Comply with CRI 104, Section 6: "Site Conditions."

5 PART 2 - PRODUCTS

6 2.1 CARPETING

7 A. Single-Source Responsibility: Obtain each type of carpet from one source and by single manufacturer.

8 B. Acceptable Manufacturers: Subject to compliance with the requirements provide the basis of design product
9 or equivalent as approved by the Architect from one of the following:

- 10 1. Interfac, Inc.
- 11 2. Milliken Contract Carpets.
- 12 3. Shaw Industries Group, Inc.

13 C. (CPT-1) Basis of Design Carpet Tile: Interface

- 14 1. Pattern: Ice Breaker;
- 15 2. Style: 1473002500;
- 16 3. Color: 105784 Warm Rock

17 2.2 INSTALLATION ACCESSORIES

18 A. Trowel-Applied Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation
19 provided or recommended by carpet manufacturer.

20 B. Concrete-Slab Primer: Non-staining type as recommended by carpet manufacturer.

21 C. Adhesive: Water-resistant, mildew-resistant, nonstaining type recommended and approved by flooring
22 manufacturer to suit products and subfloor conditions indicated and to comply with flammability
23 requirements for installed carpet as recommended by carpet manufacturer.

24 D. Metal Edge/Transition Strips: Extruded aluminum with finish, profile and width selected by Architect, of
25 height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

26 PART 3 - EXECUTION

27 3.1 EXAMINATION

28 A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for
29 maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet
30 performance.

- 1 3.2 PREPARATION
- 2 A. General: Comply with CRI's "CRI Carpet Installation Standard" and with carpet manufacturer's written
3 installation instructions for preparing substrates.
- 4 B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill
5 cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch
6 wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by
7 manufacturer's written instructions.
- 8 C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are
9 incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use
10 mechanical methods recommended in writing by adhesive and carpet manufacturers.

11 3.3 INSTALLATION

- 12 A. Comply with CRI's "CRI Carpet Installation Standard" and written installation instructions by carpet and
13 adhesive manufacturers.
- 14 1. Installation Method: Glue-down method as recommended in writing by carpet manufacturer
15 2. Maintain dye-lot integrity. Do not mix dye lots in same area.
16 3. Install pattern parallel to walls and borders.
- 17 B. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including
18 cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet
19 manufacturer.
- 20 C. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges,
21 alcoves, and similar openings.

22 3.4 INSTALLED WORK

- 23 A. Cleaning: Perform the following operations immediately after installing carpet:
- 24 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by
25 carpet manufacturer.
26 2. Remove yarns that protrude from carpet surface.
27 3. Vacuum carpet using commercial machine with face-beater element.
- 28 B. Protection: Protect installed carpet to comply with CRI's "CRI Carpet Installation Standard."

29 **END OF SECTION**

**SECTION 099000
PAINTING**

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PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Painting and finishing of new and existing materials
 - 2. Preparation of surfaces for painting and finishing.
 - 3. Repainting and refinishing of existing surfaces as indicated. Preparation of existing surfaces for repainting and refinishing.

1.2 ACTION SUBMITTALS

- A. Product Data: For each paint system specified, all coats, including primers.
- B. Samples: Submit three 4 inch by 6 inch samples of each specified finish to be reviewed for color and sheen. Architect reserves right to select color or finish from any manufacturer, herein specified, as necessary to achieve desired color or finish.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Materials (Attic Stock): Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
 - 1. Quantity: Furnish Owner with extra paint materials in quantities indicated below:
 - a. Interior, Paint: 1 gal.of each color applied.

1.4 QUALITY ASSURANCE

- A. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver paint materials in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, color designation and instructions for mixing or reducing.
- B. Provide adequate storage facilities. Store paint materials at minimum ambient temperature of 45 degrees F in well ventilated area. Restrict storage to paint materials and related equipment.
- C. Take precautionary measures to prevent fire hazards and spontaneous combustion. Comply with health and fire regulations.

1 1.6 PROJECT CONDITIONS

- 2 A. Environmental Requirements: Comply with manufacturer's recommendations as to environmental
3 conditions under which painting and finishing can be applied. Do not apply finish in areas where dust is
4 being generated.
- 5 B. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless
6 moisture contents of surfaces are below following maximums:
7 1. Gypsum Wallboard: 12 percent.
- 8 C. Provide adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 45
9 degrees F for 24 hours before, during and 48 hours after application of finishes.
- 10 D. Provide minimum 25 foot candles of lighting on surfaces to be finished.

11 PART 2 - PRODUCTS

12 2.1 PRODUCT REQUIREMENTS

- 13 A. Manufacturers:
14 1. Sherwin-Williams Company
15 2. Benjamin Moore & Co.
16 3. ICI Paints
17 4. PPG Industries
- 18 B. Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another
19 and with the substrates indicated under conditions of service and application, as demonstrated by
20 manufacturer based on testing and field experience.
- 21 C. Single-Source Responsibility: Provide primers and undercoat coating produced by same manufacturer as
22 finish coats. No Exceptions.
- 23 D. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified
24 that are factory formulated and recommended by manufacturer for application indicated. Paint-material
25 containers not displaying manufacturer's product identification will not be acceptable.
- 26 E. Painting and Finishing Schedules: Refer to Painting and Finishing Schedules in Part 3 of this Section.
27 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or
28 materials is not intended to imply that products named are required to be used to the exclusion of
29 equivalent products of other manufacturers. Furnish manufacturer's material data and certificates
30 of performance for proposed substitutions.
31 2. Sheen: When one of following terms is used to denote specific sheen for coating listed, following
32 index shall apply:
33 a. Flat: Less than 15 units based on 85 degrees of sheen.
34 b. Eggshell: 5 to 20 units based on 60 degrees of sheen.
35 c. Satin/Low Lustre: 15 to 35 units based on 60 degrees of sheen.
36 d. Semi-gloss: 30 to 65 units based on 60 degrees of sheen.
37 e. Gloss: Above 65 units based on 60 degrees of sheen.
- 38 F. PT Paint Colors: Provide specified color in paint type as scheduled in this Section
39 1. (PT-1): Sherwin Williams; Origami White SW7636.

- 1 2. (PT-2): Color to match existing door frames within surrounding brick walls as approved by
2 Architect.
3 3. Mixing and Tinting: Deliver paints ready-mixed to job site. Job mixing and job tinting is not
4 acceptable.
- 5 G. (PTE) Epoxy Paint Colors: Provide specified color in paint color that matches corresponding PT-#.

6 PART 3 - EXECUTION

7 3.1 EXAMINATION

- 8 A. Examine surfaces to receive paint finishes for conditions that would adversely affect execution, permanence
9 or quality of work and which cannot be put into acceptable condition through preparatory work. Do not
10 proceed with surface preparation or coating application until conditions are suitable.

11 3.2 PREPARATION OF SURFACES

- 12 A. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as
13 specified, for each particular substrate condition.
- 14 1. Remove mildew, by scrubbing with solution of detergent, bleach and warm water. Rinse with clean
15 water and allow surface to dry completely.
- 16 2. Provide barrier coats over incompatible primers or remove and reprime as required. Notify Architect
17 in writing of anticipated problems in using specified coating systems with substrate primed by
18 others.
- 19 B. Remove hardware, hardware accessories, plates, lighting fixtures, and similar items in-place and not to be
20 finish painted, or provide surface-applied protection prior to surface preparation and painting operations.
21 Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of
22 painting of each space or area, reinstall removed items by workmen skilled in trades involved.
- 23 C. Clean surfaces to be painted before applying paint or surface treatment. Remove oil and grease with clean
24 cloths and cleaning solvents prior to mechanical cleaning. Program cleaning and painting so that dust and
25 other contaminants from cleaning process will not fall in wet, newly painted surfaces.
- 26 1. Remove dirt, grease and oil from canvas and cotton insulated coverings.
- 27 D. Gypsum Wallboard: Remove contamination from gypsum wallboard surfaces and prime to show defects,
28 if any. Paint after defects have been remedied.
- 29 E. Ferrous Metals: Clean non-galvanized, ferrous surfaces that have not been shop-coated of oil, grease, dirt,
30 loose mill scale and other foreign substances by solvent or mechanical cleaning, complying with Steel
31 Structures Painting Council (SSPC)-SP3.
- 32 1. Touch-up shop-applied prime coats which have damaged or bare areas. Wire-brush, solvent-clean,
33 and touch-up with same primer as shop coat.
- 34 2. Clean unprimed steel surfaces by washing with solvent. Apply treatment of phosphoric acid
35 solution, ensuring weld joints, bolts and nuts are similarly cleaned. Prime surfaces to indicate
36 defects, if any. Paint after defects have been remedied.
- 37 3. Sand and scrape shop primed steel surfaces to remove loose primer and rust. Feather out edges to
38 make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime
39 steel including shop primed steels.

1 F. Existing Surfaces to be Repainted or Refinished: Wash surfaces to remove grease, oil, soil or other matter
2 which will interfere with proper bond of new materials. Scrape and wire brush loose or flaking paint. Fill
3 cracks, voids or other defects.

4 3.3 MATERIALS PREPARATION

5 A. Mix and prepare painting materials and transparent finish materials in accordance with manufacturer's
6 directions.

7 B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing,
8 and application of paint in clean condition, free of foreign materials and residue.

9 C. Stir materials before application to produce mixture of uniform density, and as required during application
10 of materials. Do not stir any film that may form on surface into material. Remove film and, if necessary,
11 strain material before using.

12 3.4 APPLICATION

13 A. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according
14 to manufacturer's written instructions.

15 1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for
16 surface or item being painted.

17 2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by
18 manufacturer for material and texture required.

19 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer
20 for material and texture required.

21 4. Apply each coat at proper consistency.

22 5. Each coat of paint shall be slightly darker than preceding coat unless otherwise approved by
23 Architect.

24 6. Provide finish coats which are compatible with prime paints used.

25 B. Do not apply succeeding coats until previous coat has completely dried. Sand between each enamel or
26 varnish coat application with fine sandpaper, or rub surfaces with pumice stone where required to produce
27 even, smooth surface in accordance with coating manufacturer's directions.

28 1. Allow each coat of finish to dry before following coat is applied, unless directed otherwise by
29 manufacturer.

30 C. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint, until
31 paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including
32 edges, corners, crevices, welds, and exposed fasteners receive film thickness equivalent to that of flat
33 surfaces.

34 D. Finish doors on tops, bottoms, and side edges same as exterior faces, unless otherwise indicated.

35 E. Film Thickness: Apply materials in accordance to paint manufacturer's recommendations and spreading
36 rates to provide total dry film thickness as recommended.

37 1. Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry
38 film thickness indicated

39 2. Use precision instruments designed for measuring and evaluation wet and dry films of paints and
40 coatings.

41 3. Results measuring less than recommended thickness will require additional material application.

- 1 4. Use of poor hiding colors may require application of additional coats in order to achieve proper
2 coverage and hiding.
- 3 F. Apply first-coat material to surfaces that have been cleaned, pre-treated or otherwise prepared for painting
4 as soon as practicable after preparation and before subsequent surface deterioration.
- 5 G. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has
6 dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application
7 of another coat of paint does not cause lifting or loss of adhesion of undercoat.
- 8 H. Prime Coats: Recoat primed and sealed walls and ceilings where there is evidence of suction spots or
9 unsealed areas in first coat, to assure finish coat with no burn-through or other defects due to insufficient
10 sealing.
- 11 I. Painting and Repainting of Existing Surfaces: Where repainting of existing surfaces is required, repaint
12 wall and ceiling surfaces in their entirety, patch or spot painting is not acceptable.
- 13 J. Paint surfaces behind movable equipment or furniture same as similar exposed surfaces. Paint surfaces
14 behind permanently-fixed equipment or furniture with prime coat only.
- 15 K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint
16 work not complying with requirements.
- 17 3.5 CLEANING
- 18 A. As work proceeds and upon completion, promptly remove paint where spilled, splashed or spattered. Touch
19 up and restore damaged or defaced painted areas.
- 20 B. During progress of work keep premises free from unnecessary accumulation of tools, equipment, surplus
21 materials and debris. Remove at end of each workday.
- 22 C. Upon completion of work clean window glass and other paint-spattered surfaces and leave premises neat
23 and clean, to satisfaction of Architect.
- 24 3.6 PROTECTION
- 25 A. Adequately cover or otherwise protect finished work of other trades and other surfaces from paint and
26 damage. Repair damage as result of inadequate or unsuitable protection as acceptable to Architect.
- 27 1. Furnish sufficient drop cloths, shields and protective equipment to prevent spray or droppings from
28 fouling surfaces not being painted and in particular, surfaces within storage and preparation area.
- 29 B. Place cotton waste, cloths and material which may constitute fire hazard in closed metal containers and
30 remove daily from site.
- 31 C. Remove electrical plates, surface hardware, fittings and fastenings, prior to painting operations. These items
32 shall be carefully stored, cleaned and replaced on completion of work in each area. Do not use solvent to
33 clean hardware that may remove permanent lacquer finish.
- 34 D. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective
35 wrappings provided by others for protection of their work after completion of painting operations.

1 3.7 INTERIOR PAINTING AND FINISHING SCHEDULE

2 A. Interior Ferrous and Non-Ferrous Metal Surfaces:

- 3 1. Surfaces Included: Hollow Metal
4 2. Waterborne Low VOC, Low-Odor System: Zero-VOC, Low-Odor Acrylic over Waterborne Metal
5 Primer:
6 a. VOC Content:<50g/L
7 b. Primer: Acrylic Concrete & Masonry Primer
8 1) 1 coat S-W Pro Industrial Pro-Cryl Universal Acrylic Primer, B66-1300 Series
9 c. Finish: Water-based, 100 percent acrylic.
10 1) 2 coats S-W Pro Industrial Acrylic Semi-Gloss, B66-650 Series.

11 B. Gypsum Wallboard, Gypsum Plaster and Gypsum Veneer Plaster Surfaces:

- 12 1. Surfaces Included:
13 a. Gypsum wallboard, including over skim coat of joint compound.
14 2. Sheens, General: Unless noted otherwise on Room Finish Schedule.
15 a. Walls: Eggshell
16 b. Ceilings and Soffits: Flat
17 3. Zero VOC Vinyl Acrylic System:
18 a. VOC Content: 0g/L
19 b. Primer: Water-based vinyl acrylic primer and sealer.
20 1) S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600
21 c. Finish: Water-based acrylic, not less than 35 percent solids, ammonia free.
22 1) 2 coats S-W ProMar 200 Zero VOC Interior Latex Flat, B30-2600 Series.
23 2) 2 coats S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-2600 Series.
24 4. Water Based Polyamine Epoxy System:
25 a. VOC Content: <50g/L
26 b. Primer:
27 1) 1 coat S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600
28 2) 2 coats S-W Pro Industrial Water Based Epoxy Eg-Shel, B73-300 Series.

29 3.8 SPECIAL SURFACES

30 A. Black Enamel Finish:

- 31 1. Surfaces Included: Duct throats for visible distance but not less than approximately 24 inches behind
32 supply or return air grilles, registers, louvers.
33 2. Water-Based Systems, Low-VOC: Acrylic Latex Finish.
34 a. Finish: 1 coat S-W ProMar 400 Latex Flat Black, B30W400 Series.

35 3.9 REPAINTING OF EXISTING SURFACES

36 A. Existing Surfaces:

- 37 1. Surfaces Included:
38 a. Existing surfaces where indicated to be repainted.
39 2. Low-VOC Latex System:
40 a. Primer/Finish: 2 coats paint similar to type listed above.

41 **END OF SECTION**

1 **SECTION 10 12 00**
2 **DISPLAY CASE DOORS**

3 PART 1 - GENERAL

4 1.1 SUMMARY

- 5 A. Section Includes: Display Case Glass Doors (DC-1).

6 1.2 ACTION SUBMITTALS

- 7 A. Product Data: Submit Manufacturer's product data for Display Case Door Systems including:
8 1. Manufacturer's standard details and fabrication method.

- 9 B. Shop drawings for each Display Case Door System are required, including:
10 1. Layout and installation details.
11 2. Elevations at 1/4-inch scale.
12 3. Anchorage and reinforcement.
13 4. Glazing details.

- 14 C. Samples: Submit pairs of samples of each specified metal color and finish on 9-inch long sections of
15 extrusions or formed shapes.

16 1.3 CLOSEOUT SUBMITTALS

- 17 A. Data on finishing, hardware and accessories.
18 B. Recommendations for maintenance and cleaning of finished surfaces.

19 1.4 QUALITY ASSURANCE

- 20 A. Installer qualifications: Engage an experienced installer who has completed installations of Display
21 Case Door Systems similar in design and extent to those required for the project and whose work has
22 resulted in construction with a record of success in service performance.
- 23 B. Manufacturer's qualifications: Provide Display Case Doors produced by a firm experienced in
24 manufacturing Display Case Door Systems that are similar to those indicated for this project and that have
25 a record of success in service performance.
- 26 C. Single Source Responsibility: Obtain Display Case Door Systems from a single manufacturer.
- 27 D. Design Intent: The drawings indicate the size, profile and dimensional requirements of the Display
28 Case Door System required and are based on the specific types and models indicated. Display Case Doors
29 by other manufacturers may be considered, provided deviations in dimensions and profiles are minor and
30 do not change the design concept as judged by the Architect.

1 1.5 DELIVERY, STORAGE, AND HANDLING

- 2 A. Deliver all Display Case Door Systems and related components in the manufacturer's original
3 protective packaging. Do not deliver door units until the work is ready for their installation.
4 1. Inspect components for damage upon delivery. Unless minor defects in metal components can
5 be made to meet the Architect's specifications and satisfaction, damaged parts should be removed
6 and replaced.

7 1.6 PROJECT CONDITIONS

- 8 A. Field Measurements: Check opening by accurate field measurement before fabrication. Show recorder
9 measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay
10 of the work and possible damage to the finished product.
11 1. Where necessary, proceed with fabrication without measurement and coordinate
12 fabrication tolerances to ensure proper fit.

13 PART 2 - PRODUCTS

14 2.1 ACCEPTABLE MANUFACTURERS

- 15 A. Basis of Design: Subject to compliance with requirements provide CRL Slender Profile Door system by
16 C.R. Laurence Co., Inc. or comparable product from Blumcraft or Dorma.

17 2.2 COMPONENTS

- 18 A. Glass: ½-inch tempered safety glass (GL-2T) as specified in Section 08 80 00 "Glazing."
19 B. Rail Configuration: Full Width at top and bottom of doors as indicated on drawings.
20 1. 1-inch square brushed stainless steel.
21 C. Center Pivots: CRL9040WBP at top; INT402 at bottom.
22 D. Lock: #7150 lever type cam lock in bottom rail.
23 E. Accessories: Provide all necessary materials and accessories for a complete installation.
24 F. Overhead door stop: Roller Catch/Stop to be #593 with strike plate in top rail.
25 G. Anchors and Fasteners: Manufacturer's standard concealed anchors and fasteners. Do not use exposed
26 fasteners.

27 2.3 FABRICATION

- 28 A. General: Fabricate Display Case Door components to designs and sizes indicated. Sizes of doors and profile
29 requirements of hardware are indicated on the drawings.
30 1. Do not permit cutting, drilling or other alterations to glass after tempering.
31 2. Fabricate work to accommodate required hardware, anchors, reinforcement, and accessory items.

1 B. Prefabrication: Complete fabrication, assembly, finishing, hardware application and other work to the
2 greatest extent possible before shipment to the project site. Disassemble components only as necessary
3 for shipment and installation.

4 C. Continuity: Maintain accurate relation of planes and angles with hairline fit of contracting members.

5 PART 3 - EXECUTION

6 3.1 EXAMINATION

7 A. Examine substrates and supports with the installer, present for compliance with requirements indicated,
8 installation tolerances and other conditions that affect the installation of Display Case Door Systems.
9 Correct unsatisfactory conditions before proceeding with the installation.

10 1. Do not proceed with installation until unsatisfactory conditions are corrected.

11 3.2 INSTALLATION

12 A. Install Display Case Door Systems and associated components in accordance with manufacturer's printed
13 instructions and recommendations.

14 1. Verify units level, plumb and true line.

15 2. Lubricate hardware and other moving parts as required.

16 3.3 INSTALLED WORK

17 A. Adjustment:

18 1. Adjust doors and hardware to provide an acceptable fit at meeting points and at weatherstripping
19 for smooth operation and dust tight closure.

20 2. Hardware: Adjust operating hardware to ensure proper operation.

21 B. Cleaning:

22 1. Clean door and frame surfaces after installation, exercising care to avoid damage to the finish.

23 2. Clean glass surfaces after installation, complying with requirements contained in the "Glass and
24 Glazing" section for cleaning and maintenance. Remove excess glazing sealant compounds, dirt or
25 other substances.

26 C. Protection: Institute protective measures required throughout the remainder of the construction period to
27 ensure that the Display Case Door Systems do not incur any damage or deterioration.

28 **END OF SECTION**

1 **SECTION 10 28 13**
2 **TOILET & BUILDING ACCESSORIES**

3 PART 1 - GENERAL

4 1.1 SUMMARY

- 5 A. Section Includes:
6 1. Washroom accessories.
7 2. Installation of Owner-furnished accessories (OFCl).

8 1.2 COORDINATION

- 9 A. Coordinate accessory locations with other work to prevent interference with clearances required for access
10 by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of
11 accessories.
12 B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the
13 Work.

14 1.3 ACTION SUBMITTALS

- 15 A. Product Data: For each type of product indicated.

16 1.4 CLOSEOUT SUBMITTALS

- 17 A. Maintenance Data: For toilet accessories to include in maintenance manuals.

18 1.5 DELIVERY, STORAGE AND HANDLING

- 19 A. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.
20 B. Pack accessories individually in manner to protect accessory and its finish.

21 1.6 WARRANTY

- 22 A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner
23 may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent
24 with, other warranties made by Contractor under requirements of the Contract Documents.
25 B. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors
26 that develop visible silver spoilage defects and that fail in materials or workmanship within specified
27 warranty period.
28 1. Warranty Period: 15 years from date of Substantial Completion.

1 PART 2 - PRODUCTS

2 2.1 PRODUCT REQUIREMENTS

- 3 A. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities,
4 and performance, are established by specified Basis of Design products.
- 5 1. Products of other manufacturers listed in Part 2 with equal characteristics, as judged solely by
6 Architect, may be provided.
- 7 2. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval.
8 Where modifications are proposed, submit comprehensive explanatory data to Architect for review.
- 9 B. Names and labels are not permitted on exposed faces of accessories. On interior surface not exposed to
10 view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate
11 indicating manufacturer's name and product model number.
- 12 C. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single
13 source from single manufacturer.
- 14 D. Products and Manufacturers: Subject to compliance with specified requirements, provide Basis of Design
15 products as indicated in Product Schedule, or approved equivalent products by one of the following
16 manufacturers:
- 17 1. Bobrick Washroom Equipment Inc.
18 2. American Specialties Inc.
19 3. Bradley Corporation

20 2.2 WASHROOM ACCESSORIES

- 21 A. (GB-1) Grab Bars: In accordance with requirements of ADA guidelines, capable of withstanding load of
22 250 lbf applied in any direction and at any point on the grab bar, fastener, mounting device or supporting
23 device; in accordance with ASTM F 446.
- 24 1. Basis of Design: Bobrick B-6806 Series.
25 2. Material and Finish: Type 304 stainless steel pipe, 18 ga., 1-1/2" outer diameter, with satin finish
26 on ends and slip-resistant texture in grip area.
27 3. Mounting: Flanges with concealed fasteners and gasketed stainless steel escutcheon.
28 4. Configurations: As indicated on Drawings. Refer to grab bar schedule in Drawings.
- 29 B. (CH-1) Single Hook: Stainless steel, satin finish.
30 1. Basis of Design: Bobrick B-76717.
- 31 C. (MIR-1) Framed Mirror No Shelf:
32 1. Basis of Design: Bobrick B-290 Series.
33 2. Size: 24-inches wide by 36-inches tall unless otherwise indicated on the Drawings
- 34 D. (PTC-1) Paper Towel Dispensers: Owner furnished contractor installed.
- 35 E. (SDISP-1) Soap Dispenser: Owner furnished contractor installed.
- 36 F. (SND-1) Sanitary Napkin Disposal: Surface-mounted, stainless steel.
37 1. Basis of Design: Bobrick B-254
- 38 G. (TPH-1) Toilet Tissue (Roll) Dispenser: Owner furnished contractor installed.

- 1 H. (US-1) Stainless Steel Shelf: surface-mounted.
2 1. Basis of Design: Bobrick B-295: 5” deep x length shown on Drawings.

3 2.3 MATERIALS

- 4 A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal
5 thickness, unless otherwise indicated..
- 6 B. Steel Sheet: ASTM A 1008, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal
7 thickness.
- 8 C. Steel Sheet: ASTM A 366, cold rolled, commercial quality, 0.0359-inch minimum nominal thickness;
9 surface preparation and metal pretreatment as required for applied finish.
- 10 D. Galvanized Steel Sheet: ASTM A 653, G60.
- 11 E. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- 12 F. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering,
13 electroplated copper coating, and protective organic coating complying with FS DD-M-411.
14 1. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- 15 G. Fasteners and Mounting Devices: Provide concealed fasteners where possible.
16 1. Where fasteners remain exposed to view, provide tamper-resistant and theft-resistant fasteners, of
17 material and finish to match accessory unit.
18 2. Screws, bolts, and other devices of same material as unit and tamper-and-theft resistant where
19 exposed, and of galvanized steel where concealed.
20 3. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication
- 21 H. Fasteners, Screws, and Bolts: Hot dip galvanized.
- 22 I. Expansion Shields: Fiber, lead or rubber as recommended by accessory manufacturer for component and
23 substrate. Provide exposed fasteners with finish to match accessories.
- 24 J. Adhesive: Epoxy type contact cement

25 2.4 FABRICATION

- 26 A. General:
27 1. Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels
28 with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-
29 resistant backing plates.
30 2. Shop assemble components and package complete with anchors and fittings.
31 3. Keys: Provide universal keys for internal access to accessories for servicing and resupplying.
- 32 B. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not
33 exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped
34 nameplate indicating manufacturer's name and product model number.
- 35 C. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and
36 joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge.
37 Provide concealed anchorage where possible.

- 1 D. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection
2 material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation
3 and prevents moisture accumulation.
- 4 E. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with non-absorptive
5 filler material. Corrugated cardboard is not an acceptable filler material.
- 6 F. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant
7 installation, as follows:
8 1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold
9 mirror unit in position with no exposed screws or bolts.
- 10 G. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide
11 minimum of six keys to Owner's representative.

12 PART 3 - EXECUTION

13 3.1 PREPARATION

- 14 A. Deliver inserts and rough-in frames to jobsite at appropriate time for building-in. Provide templates and
15 rough-in measurements as required.
- 16 B. Before starting work notify Architect in writing of conflicts detrimental to installation or operation of units.
- 17 C. Verify exact location of accessories with Architect. Verify blocking is in place prior to gypsum board
18 installation.
- 19 D. Accessory Locations: Coordinate accessory locations with other work to avoid interference and to assure
20 proper operation and servicing of accessory units.

21 3.2 INSTALLATION

- 22 A. Install fixtures, accessories, and items in accordance with manufacturer's printed instructions.
- 23 B. Install true, plumb and level, securely and rigidly anchored to substrate and sealed to protect structural
24 elements of wall from moisture.
- 25 C. Use tamper proof (security) type fasteners.

26 3.3 INSTALLED WORK

- 27 A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace
28 damaged or defective items.
- 29 B. Clean and polish exposed surfaces in accordance with manufacturer's recommendations after removing
30 labels and protective coatings.

31 **END OF SECTION**

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SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING
BASED ON DFD MASTER SPECIFICATION DATED 11/01/2019

PART 1 - GENERAL

SCOPE

This section includes information common to two or more technical plumbing specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference
- Reference Standards
- Lead Free Requirements
- Quality Assurance
- Continuity of Existing Services
- Protection of Finished Surfaces
- Sleeves and Openings
- Sealing and Fire Stopping
- Submittals
- Codes
- Certificates and Inspections
- Operating and Maintenance Data
- Record Drawings

PART 2 - PRODUCTS

- Access Panels and Doors
- Identification
- Sealing and Fire Stopping

PART 3 - EXECUTION

- Demolition
- Concrete Work
- Cutting and Patching
- Building Access
- Equipment Access
- Coordination
- Identification
- Sleeves and Openings
- Sealing and Fire Stopping

RELATED WORK

Section 01 91 01 or 01 91 02 – Commissioning Process
Section 07 84 00 – Fire Stopping

REFERENCE

Applicable provisions of Division 1 govern work under this section.

This section applies to all Division 22 00 00 sections of plumbing.

REFERENCE STANDARDS

Abbreviations of standards organizations referenced in this and other sections are as follows:

- 1
2 ABMA American Boiler Manufacturers Association
3 ACPA American Concrete Pipe Association
4 AGA American Gas Association
5 AMCA Air Movement and Control Association
6 ANSI American National Standards Institute
7 ARI Air Conditioning and Refrigeration Institute
8 ASME American Society of Mechanical Engineers
9 ASPE American society of Plumbing Engineers
10 ASSE American Society of Sanitary Engineering
11 ASTM American Society for Testing and Materials
12 AWWA American Water Works Association
13 AWS American Welding Society
14 CISPI Cast Iron Soil Pipe Institute
15 CGA Compressed Gas Association
16 CS Commercial Standards, Products Standards Sections, Office of Eng. Standards Service, NBS
17 DSPS State of Wisconsin Dept. of Safety and Professional Services, State Plumbing Code
18 EPA Environmental Protection Agency
19 FS Federal Specifications, Superintendent of Documents, U.S. Government Printing Office
20 GAMA Gas Appliance Manufacturers Association
21 IAPMO International Association of Plumbing & Mechanical Officials
22 IEEE Institute of Electrical and Electronics Engineers
23 ISA Instrument Society of America
24 MCA Mechanical Contractors Association
25 MICA Midwest Insulation Contractors Association
26 MSS Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
27 NBS National Bureau of Standards
28 NEC National Electric Code
29 NEMA National Electrical Manufacturers Association
30 NFPA National Fire Protection Association
31 NSF National Sanitation Foundation
32 PDI Plumbing and Drainage Institute
33 SMACNA Sheet Metal and Air Conditioning Contractors' National Association. Inc.
34 STI Steel Tank Institute
35 UL Underwriters Laboratories Inc.

36
37 Standards referenced in this section:

- 38 ACI 614 Recommended Practice for Measuring, Mixing and Placing of Concrete
39 ASTM D1557 Standard Test Method for Moisture-Density Relations of Soils
40 ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
41 ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
42 D.O.T. Standard Specifications for Road and Bridge Construction, State of Wisconsin, Dept. of
43 Transportation
44 UL1479 Fire Tests of Through-Penetration Firestops
45 UL723 Surface Burning Characteristics of Building Materials

46
47 **LEAD FREE REQUIREMENTS**

48 All materials that contact potable water shall be lead free. Lead free refers to the wetted surface of pipe,
49 fittings and fixtures in potable water systems that have a weighted average lead content $\leq 0.25\%$
50 per the Federal Safe Drinking Water Act as amended January 4th 2011 Section 1417.

51
52 This requirement applies to all the subsequent Plumbing Specification Sections and Plumbing Drawings and
53 supersedes any part or model number that may conflict with this requirement.

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QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the intended performance from the system into which these items are placed.

CONTINUITY OF EXISTING SERVICES

Do not interrupt or change existing services without prior written approval from the Owner's Project Representative. When interruption is required, coordinate scheduling of down-time with the Owner to minimize disruption to his activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

PROTECTION OF FINISHED SURFACES

Refer to Division 1, General Requirements, Protection of Finished Surfaces.

SLEEVES AND OPENINGS

Refer to Division 1, General Requirements, Sleeves and Openings.

SEALING AND FIRE STOPPING

Sealing and firestopping of sleeves/openings between piping, etc. and the sleeve or structural opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with section 07 84 00 Fire Stopping.

CODES

Comply with requirements of Wisconsin Administrative Code.

CERTIFICATES AND INSPECTIONS

Refer also to Division 1, General Conditions, Permits, Regulations, Utilities and Taxes.

Obtain and pay for all required State installation inspections except those provided by the Architect/Engineer. Deliver the originals of inspection certificates and test records to the Owner's Project Representative. Include copies of the certificates and test records in the Operating and Maintenance Instructions.

SUBMITTALS

Refer to Division 1, General Conditions, Submittals.

Shop drawing submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.

The specific items that will be required for submittals shall be coordinated with the UWM Project Representative, the A/E, and the General Prime Contractor for inclusion in the project submittal log.

1
2 Submit sufficient quantities of data sheets and shop drawings to allow the following distribution:

- 3 • Operating and Maintenance Manuals 2 copies
- 4 • Division of Facilities Development 1 copy
- 5 • Architect/Engineer 1 copy

6
7 **OPERATION AND MAINTENANCE DATA**

8 All operations and maintenance data shall comply with the submission and content requirements specified
9 under section GENERAL REQUIREMENTS.

10
11 In addition to the general content specified under GENERAL REQUIREMENTS supply the following
12 additional documentation:

- 13 1. Records of tests performed a to certify compliance with system requirements
- 14 2. Manufacturer's wiring diagrams for electrically powered equipment
- 15 3. Certificates of inspection by regulatory agencies
- 16 4. Valve schedules
- 17 5. Lubrication instructions, including list/frequency of lubrication
- 18 6. Parts lists for fixtures, equipment, valves and specialties.
- 19 7. Manufacturers installation, operation and maintenance recommendations for fixtures, equipment,
20 valves and specialties.
- 21 8. Additional information as indicated in the technical specification sections

22
23 **RECORD DRAWINGS**

24 Refer to Division 1, General Requirements, Record Drawings.

25
26 **PART 2 - PRODUCTS**

27
28 **ACCESS PANELS AND DOORS**

29
30 **LAY-IN CEILINGS:**

31 Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Section 09500 are
32 sufficient; no additional access provisions are required unless specifically indicated.

33
34 **CONCEALED SPLINE CEILINGS:**

35 Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system
36 used will be provided under Section 09500.

37
38 **METAL PAN CEILINGS:**

39 Removable sections of ceiling tile held in position by a pressure fit will be provided under Section 09500.

40
41 **MASONRY WALLS, GYPSUM BOARD AND PLASTER WALLS AND CEILINGS:**

42 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications,
43 stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam
44 latch for general applications, key lock for use in public or secured areas, UL listed for use in fire rated
45 partitions if required by the application. Use the largest size access opening possible, consistent with the
46 space and the item needing service; minimum size is 12" by 12".

47
48 **IDENTIFICATION**

49 **STENCILS:**

50 Not less than 1 inch high letters/numbers for marking pipe and equipment.

51
52 **ENGRAVED NAME PLATES:**

53 White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting,
54 Setonply Style 2060 by Seton Name Plate Company or Emedolite Style EIP by EMED Co., or equal by W.
55 H. Brady.

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ADHESIVE LABELS:

Pressure-sensitive, adhesive backed, vinyl pipe markers with applicable labeling, 3/4" min. size for lettering and surrounding tape on both ends. With flow arrows on piping. Conforming to ANSI, ANSI and NFPA standards. Seton Opti-Code, MSI, Brady or approved equal. Clean piping before application.

SNAP-AROUND PIPE MARKERS:

One-piece, preformed, vinyl construction, snap-around or strap-around pipe markers with applicable labeling and flow direction arrows, 3/4" min. size for lettering. Provide nylon ties on each end of pipe markers. Equal to Seton Setmark.

VALVE TAGS:

Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains, brass "S" hooks or one piece nylon ties around the valve stem, available from EMED Co., Seton Name Plate Company, or W. H. Brady.

UNDERGROUND WARNING TAPE:

Detectable underground warning tape, 5.0 mil overall thickness, 6" width, .0035" thick aluminum foil core with polyethylene jacket bonded to both sides. Color code tape and print caution along with name of buried service in bold letters on face of tape. Thor Enterprises Magnatec or equal by Carlton, MSI Marking Services, Seton.

UNDERGROUND TRACER WIRE:

All underground non-metallic sewers/mains and water services/mains shall be provided with tracer wire installations. Tracer wire installations shall conform with Section 182.0715(2r) of Wisconsin Statutes and prevailing DSPS Chapter 384 requirements. Tracer wire shall be continuous solid copper or steel plastic coated with split bolt or compression-type connectors.

SEALING AND FIRE STOPPING

FIRE AND/OR SMOKE RATED PENETRATIONS:

Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with section 07 84 00 "Fire Stopping".

NON-RATED PENETRATIONS:

In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the cored opening or a water-stop type wall sleeve. The operating bolts of the mechanical type seal shall be accessible from the interior of the building.

At pipe penetrations of non-rated interior partitions, floors and exterior walls, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material

PART 3 - EXECUTION

DEMOLITION

Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the Owner to minimize disruption to the existing building occupants.

1
2 All pipe, fixtures, equipment, wiring and associated conduit, insulation and similar items demolished,
3 abandoned, or deactivated are to be removed from the site by the Contractor except as specifically noted
4 otherwise. All designated equipment is to be turned over to the user agency for their use at a place and time
5 so designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to
6 that existing before work began.

7
8 **CONCRETE WORK**

9 Cast-in-place concrete within the building will be performed by the Division 3 Contractor unless otherwise
10 noted. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into
11 concrete or used to form concrete for support or installation of plumbing piping, fixtures, specialties and
12 equipment. Coordinate locations of equipment, pipe penetrations in wet areas, etc. with the Division 3
13 Contractor.

14
15 Plumbing related cast-in-place concrete on the exterior of the building to be provided by this Contractor in
16 conformance with requirements of Division 3. This includes piping thrust restraints, pipe supports, hydrant
17 supports, manholes, catch basins, grease traps, septic tanks, distribution boxes, valve pits, meter pits, cleanout
18 cover pads, yard hydrant pads, etc.

19
20 **CUTTING AND PATCHING**

21 Refer to Division 1, General Requirements, Cutting and Patching.

22
23 **BUILDING ACCESS**

24 Arrange for the necessary openings in the building to allow for admittance or removal of all apparatus. When
25 the building access was not previously arranged and must be provided by this contractor, restore any opening
26 to its original condition after the apparatus has been brought into the building.

27
28 **EQUIPMENT ACCESS**

29 Install all piping, conduit and accessories to permit access to equipment for maintenance and service.
30 Coordinate the exact location of wall and ceiling access panels and doors with the General Prime Contractor,
31 making sure that access is available for all equipment and specialties. Access doors in general construction
32 are to be furnished by the Plumbing Contractor and installed by the General Prime Contractor.

33
34
35 Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do
36 not require access panels.

37
38 **COORDINATION**

39 Coordinate all work with other contractors prior to installation. Any work that is not coordinated and that
40 interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

41
42 Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

43
44 **IDENTIFICATION**

45 Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one
46 coat of black enamel against a light background or white enamel against a dark background. Use a primer
47 where necessary for proper paint adhesion.

48
49 Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

50
51 Identify interior piping not less than once every 30 feet, not less than once in each room, adjacent to each
52 access door or panel, and on both side of the partition where accessible piping passes through walls or floors.
53 Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a
54 light background or white enamel against a dark background.

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Identify all exterior buried piping for entire length with underground warning tape except for sewer piping which is routed in straight lines between manholes or cleanouts. Place tape 6"-12" below finished grade along entire length of pipe. Extend tape to surface at building entrances, meters, hydrants and valves. Where existing underground warning tape is broken during excavation, replace with new tape identifying appropriate service and securely spliced to ends of existing tape.

Identify valves with brass tags bearing a system identification and a valve sequence number. Identify medical gas and vacuum valves with brass tags and wall or cabinet mounted color coded engraved nameplate with the following "(Type of Gas) Shutoff Valve for (Location or Zone)". Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device, located in another room or not visible from device. Provide a typewritten valve schedule and pipe identification schedule indicating the valve number and the equipment or areas supplied by each valve and the symbols used for pipe identification; locate schedules in mechanical room and in each Operating and Maintenance manual. Schedule in mechanical room to be framed under clear plastic.

SLEEVES AND OPENINGS

Pipe penetrations in existing concrete floors: Core drill openings.

SEALING AND FIRE STOPPING

FIRE AND/OR SMOKE RATED PENETRATIONS:

Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with section 07 84 00 Fire Stopping.

NON-RATED PARTITIONS:

At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

END OF SECTION

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SECTION 22 05 14
PLUMBING SPECIALTIES
BASED ON DFD MASTER SPECIFICATION DATED 10/1/12

PART 1 - GENERAL

SCOPE

This section includes specifications for floor drains, roof drains, cleanouts, backflow preventers, water hammer arrestors and other miscellaneous plumbing specialties.

PART 1 - GENERAL

- Scope
- Related Documents
- Reference
- Reference Standards
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data

PART 2 - PRODUCTS

- Cleanouts
- Water Hammer Arrestors

PART 3 - EXECUTION

- Installation
- Construction Verification Items
- Agency Training

RELATED DOCUMENTS

- Section 01 91 01 or 01 91 02 – Commissioning Process
- Section 22 08 00 – Commissioning of Plumbing
- Section 22 11 00 - Facility Water Distribution
- Section 22 13 00 - Facility Sanitary Sewerage
- Section 22 05 23 - General-Duty Valves for Plumbing Piping

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

REFERENCE STANDARDS

- ANSI A112.26.1/PDI WH-201 - Water Hammer Arrestors.
- ASSE 1010 - Water Hammer Arrestors.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions..

Plumbing products requiring approval by the State of Wisconsin Dept. of Safety and Professional Services must be approved or have pending approval at the time of shop drawing submission.

SHOP DRAWINGS

Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

CLEANOUTS

1 Manufacturer: Josam, Smith, Wade, Watts, Zurn.

2
3 INTERIOR HORIZONTAL LINES: Cast iron hub with tapped ferrule and tapered threaded ABS or PVC
4 closure plug, or no-hub coupling and blind plug.

5
6 **WATER HAMMER ARRESTORS**

7 Manufacturer: PPP Industries, Sioux Chief, Wade, Watts.

8
9 ANSI A112.26.1, ASSE 1010; sized in accordance with PDI WH-201, precharged piston type constructed
10 of hard drawn Type K copper, threaded brass adapter, brass piston with o-ring seals, FDA approved
11 silicone lubricant, suitable for operation in temperature range 35 to 150 degrees F, maximum 250 psig
12 working pressure, 1500 psig surge pressure. Watts series 15.

13
14
15 **PART 3 - EXECUTION**

16
17 **INSTALLATION**

18 Coordinate location and setting of plumbing specialties with adjacent construction. Install in accordance with
19 manufacturers recommendations.

20 Install water hammer arrestors where indicated and at quick closing valve installations.

21
22
23
24
25 **CONSTRUCTION VERIFICATION ITEMS**

26 Contractor is responsible for utilizing the construction verification checklists supplied under specification
27 Section 22 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01
28 or 01 91 02.

29
30 **AGENCY TRAINING**

31 All training provided for agency shall comply with the format, general content requirements and submission
32 guidelines specified under Section 01 91 01 or 01 91 02.

33
34 **END OF SECTION**
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SECTION 22 05 23
GENERAL DUTY VALVES FOR PLUMBING PIPING
BASED ON DFD MASTER SPECIFICATION DATED 01/31/2024

PART 1 - GENERAL

SCOPE

This section includes valve specifications for all Plumbing systems except where indicated under Related Work. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference
- Lead Free Requirements
- Quality Assurance
- Submittals
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS

- Water System Valves
 - Ball Valves
 - Swing Check Valves
 - Balance Valves

PART 3 - EXECUTION

- General
- Shut-off Valves
- Balancing Valves
- Swing Check Valves

RELATED WORK

- Section 01 91 01 or 01 91 02 – Commissioning Process
- Section 22 05 00 Common Work Results for Plumbing
- Section 22 05 14 - Plumbing Specialties

REFERENCE

Applicable provisions of Division 1 govern work under this section.

LEAD FREE REQUIREMENTS

All materials that contact potable water shall be lead free. Lead free refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content $\leq 0.25\%$ per the Federal Safe Drinking Water Act as amended January 4th 2011 Section 1417.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

SUBMITTALS

Schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on the project. Temperature ratings specified are for continuous operation.

1 **OPERATION AND MAINTENANCE DATA**

2 All operations and maintenance data shall comply with the submission and content requirements specified
3 under section GENERAL REQUIREMENTS.

4
5 **DESIGN CRITERIA**

6
7 Where valve types (ball, butterfly, etc.) are specified for individual plumbing services (i.e. domestic water,
8 gas, etc.), each valve type shall be of the same manufacturer unless prior written approval is obtained from
9 the Owner.

10
11 Valves to be line size unless specifically noted otherwise.

12
13 **PART 2 - PRODUCTS**

14
15 **WATER SYSTEM VALVES**

16 All water system valves to be rated at not less than 125 water working pressure at 240 degrees F unless noted
17 otherwise.

18
19 **BALL VALVES:**

20 3" and smaller: Two piece bronze body; sweat, threaded or ASTM F1960 joint connection ends, full port
21 stainless steel ball and stem; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof
22 stem; 600 psig WOG. Provide valve stem extensions for valves installed in all piping with insulation. Nibco
23 585-70-66 LF or equal by Apollo, Milwaukee, Watts.

24
25 **SWING CHECK VALVES:**

26 3" and smaller: Bronze body, sweat or threaded ends, Y-pattern, regrindable bronze seat, renewable bronze
27 disc, Class 125, suitable for installation in a horizontal or vertical line with flow upward. Hammond UP904,
28 Milwaukee UP509, Nibco S413-Y-LF, Watts LFCV, Apollo equal.

29
30 **BALANCE VALVES:**

31 2" and smaller: Brass body, 304 stainless steel ball, sweat or threaded ends, glass filled teflon seat, brass
32 readout valves with EPT checks, with adjustable memory stop position indicator and extended handle stem,
33 suitable for 300 psig water working pressure at 200 degrees F. B&G Xylem Circuit Setter Plus CB1SLF/CB-
34 1LF, or equal by Nibco, Red and White Valve or Watts.

35
36
37 **PART 3 - EXECUTION**

38
39 **GENERAL**

40 Properly align piping before installation of valves. Install and test valves in strict accordance with valve
41 manufacturer's installation recommendations. Do not support weight of piping system on valve ends.

42
43 Mount valves in locations which allow access for operation, servicing and replacement.

44
45 Provide valve handle extensions for all valves installed in insulated piping.

46
47 Install all valves with the stem in the upright or horizontal position. If possible, install butterfly valves with
48 the stem in the horizontal position. Valves installed with the stems down will not be accepted.

49
50 Prior to flushing of piping systems, place all valves in the full-open position.

51
52 **SHUT-OFF VALVES**

53 Install shut-off valves at each piece of equipment and plumbing fixture, at each branch take-off from mains
54 for isolation or repair and elsewhere as indicated.

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BALANCING VALVES

Install where indicated on the drawings and details for balancing of flow in pumped hot water recirculation piping systems.

Upon project completion, adjust each valve and set position stop. Balance system to minimum flow in return piping branches needed to maintain even supply water temperature throughout building.

SWING CHECK VALVES

Install swing check valves in recirculation branch lines and elsewhere as indicated. Provide weighted swing check valves at sanitary sump pump discharges.

END OF SECTION

1
2 **SECTION 22 05 29**
3 **HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**
4 **BASED ON DFD MASTER SPECIFICATION DATED 3/17/2023**

5 **PART 1 - GENERAL**

6
7
8 **SCOPE**

9 This section includes specifications for supports of all plumbing equipment and materials as well as piping
10 system anchors. Included are the following topics:

11 **PART 1 - GENERAL**

12 Scope

13 Related Work

14 Reference

15 Reference Standards

16 Quality Assurance

17 Description

18 Shop Drawings

19 Design Criteria

20 **PART 2 - PRODUCTS**

21 Manufacturers

22 Structural Supports

23 Pipe Hangers and Supports

24 Beam Clamps

25 Riser Clamps

26 Concrete Inserts

27 **PART 3 - EXECUTION**

28 Installation

29 Hanger and Support Spacing

30 Riser Clamps

31 Concrete Inserts

32
33 **RELATED WORK**

34 Section 01 91 01 – Commissioning Process

35 Section 22 07 00 - Plumbing Insulation for insulation protection at support devices.

36
37 **REFERENCE**

38 Applicable provisions of Division 1 shall govern work under this section.

39
40 **REFERENCE STANDARDS**

41 MSS SP-58

42 **REFERENCE**

43 Applicable provisions of Division 1 govern work under this section.

44
45 **QUALITY ASSURANCE**

46 Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

47
48 **DESCRIPTION**

49 Provide all supporting devices as required for the installation of mechanical equipment and materials. All
50 support and installation procedures are to conform to the latest requirements of the ANSI Code for building
51 piping.

52
53 Do not hang any mechanical item directly from a metal deck or run piping so its rests on the bottom chord
54 of any truss or joist.

1
2 Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

3
4 Support apparatus and material under all conditions of operation, variations in installed and operating
5 weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

6
7 Protect insulation at all hanger points; see Related Work above.

8 9 **SHOP DRAWINGS**

10 Schedule of all hanger and support devices indicating attachment methods and type of device for each pipe
11 size and type of service.

12
13 All submittals are to comply with submission and content requirements specified with in section [17 00 00].

14 15 **DESIGN CRITERIA**

16 Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice
17 SP-58 unless noted otherwise.

18 19 **PART 2 - PRODUCTS**

20 21 **MANUFACTURERS**

22 Anvil, B-Line, FNW, G-Strut, Pate, Piping Technology, Roof Products & Systems or approved equal.

23 24 **STRUCTURAL SUPPORTS**

25 Provide all supporting steel required for the installation of mechanical equipment and materials, including
26 angles, channels, beams, etc. to suspended or floor supported tanks and equipment. All of this steel may
27 not be specifically indicated on the drawings.

28 29 **PIPE HANGERS AND SUPPORTS**

30 **HANGERS FOR PIPE SIZES 1/2" THROUGH 2":**

31 Carbon steel, adjustable swivel ring. B-Line B3170NF, Anvil 69 or 70.

32 Carbon steel, adjustable clevis, standard. B-Line B3100, Anvil 260.

33
34 **HANGERS FOR PIPE SIZES 2" AND LARGER:**

35 Carbon steel, adjustable clevis, standard. B-Line B3100, Anvil 260.

36
37 **MULTIPLE OR TRAPEZE HANGERS:**

38 Steel channels with welded spacers and hanger rods.

39
40 **WALL SUPPORT:**

41 Carbon steel welded bracket with hanger. B-Line 3068 Series, Anvil 194 Series.

42
43 Perforated, epoxy painted finish, 16-12 gauge, min., steel channels securely anchored to wall structure,
44 with interlocking, split-type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-
45 2000 series clamps, Anvil type PS 200 H with PS 1200 clamps. When copper piping is being supported,
46 provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and
47 avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers
48 clamp and cushion assemblies, B-Line BVT series, Anvil PS 1400 series.

49
50 **VERTICAL SUPPORT:**

51 Carbon steel riser clamp. B-Line B3373, Anvil 261 for above floor use.

52
53 **FLOOR SUPPORT:**

54 Carbon steel pipe saddle, stand and bolted floor flange. B-Line B3088T/B3093.

1
 2 **COPPER PIPE SUPPORTS:**
 3 All supports, fasteners, clamps, etc. directly connected to copper piping shall be copper plated or
 4 polyvinylchloride coated. Where steel channels are used, provide isolation collar between
 5 supports/clamps/fasteners and copper piping.
 6
 7 **GLASS PIPE SUPPORTS:**
 8 All supports, clamps, etc. directly connected to glass piping shall be fully lined with 1/4" neoprene padding.
 9

10 **PIPE HANGER RODS**

11 **STEEL HANGER RODS:**
 12 Threaded both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.
 13
 14 Size rods for individual hangers and trapeze support as indicated in the following schedule.
 15

16 Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed
 17 the limits indicated.

18	Maximum Load (Lbs.)	Rod Diameter
19	<u>(650°F Maximum Temp.) (inches)</u>	
20	610	3/8
21	1130	1/2
22	1810	5/8
23	2710	3/4
24	3770	7/8
25	4960	1
26	8000	1-1/4

27
 28 **BEAM CLAMPS**

29 MSS SP-58 Types 19 & 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick
 30 with a retaining ring and threaded rod of 3/8, 1/2, and 5/8 inch diameter. Furnish with a hardened steel cup
 31 point set screw. B-Line B3036L/B3034, Anvil 86/92.
 32
 33 MSS SP-58 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable
 34 for rod sizes to 1-1/2 inch diameter. B-Line B3054, Anvil 228.
 35

36 **CONCRETE INSERTS**

37
 38 **DRILLED FASTENERS:**
 39 Carbon steel drop-in type expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill
 40 bit of same manufacturer as anchor. Hilti, Rawl, Redhead.
 41

42 **PART 3 - EXECUTION**

43
 44 **INSTALLATION**

45 Size, apply and install supports and anchors in compliance with manufacturers recommendations.
 46
 47 Install supports to provide for free expansion of the piping system. Support all piping from the structure
 48 using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and
 49 wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.
 50
 51 Coordinate hanger and support installation to properly group piping of all trades.
 52
 53 Trim steel hanger rods to within one inch of the final lock nut position. Hanger and support cutoff burrs
 54 shall be removed and sharp edges ground smooth.

1
2 Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural
3 shapes or continuous insert channels for the supporting steel. Where continuous insert channels are used,
4 pipe supporting devices made specifically for use with the channels may be substituted for the specified
5 supporting devices provided that similar types are used and all data is submitted for prior approval.
6

7 Size and install hangers and supports, except for riser clamps, for installation on the exterior of piping
8 insulation. Where a vapor barrier is not required, hangers may be installed either on the exterior of pipe
9 insulation or directly on piping.
10

11 Perform welding in accordance with standards of the American Welding Society.
12

13 HANGER AND SUPPORT SPACING

14 Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
15

16 Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.
17

18 Use hangers with 1-1/2 inch minimum vertical adjustment.
19

20 Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze
21 hangers.
22

23 Support riser piping independently of connected horizontal piping.
24

25 Adjust hangers to obtain the slope specified in the piping section of these specifications.
26

27 Space hangers for pipe as follows:

<u>Pipe Material</u>	<u>Pipe Size</u>	<u>Max. Horiz. Spacing</u>	<u>Max. Vert. Spacing</u>
29 Cast Iron	2" and larger	5'-0"	15'-0"
30 Copper	1/2" through 3/4"	5'-0"	10'-0"
31 Copper	1" through 1-1/4"	6'-0"	10'-0"
32 Copper	1-1/2" through 2-1/2"	8'-0"	10'-0"
33 Copper	3"	10'-0"	10'-0"
34 Copper	4" and larger	12'-0"	10'-0"
35 Ductile Iron	All	10'-0"	20'-0"
36 Glass	Per Pipe Mfr.	8'-0"	12'-0"
37 Steel	1/2" through 1-1/4"	7'-0"	15'-0"
38 Steel	1-1/2" through 6"	10'-0"	15'-0"
39 Steel	8" through 12"	14'-0"	20'-0"
40 Steel	14" and over	20'-0"	20'-0"
41 Plastic	Drain and Vent	4'-0"	10'-0"
42 PEXa*	Tubing* 1/2" through 3/4"	6'-0"	4'-0"
43 PEXa*	Tubing* 1" through 1-1/2"	8'-0"	4'-0"
44 Plastic	Pure Water 1-1/2" or less	Continuous	5'-0"

45
46
47 *PEXa Tubing shall have PEXa continuous pipe support with stainless steel strapping around insulated
48 pipe. PEXa tubing without continuous channel (at fittings) shall be supported no less than every 32".
49

50 RISER CLAMPS

51 Support vertical piping with clamps secured to the piping and resting on the building structure or secured to
52 the building structure below at each floor.
53

END OF SECTION

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SECTION 22 07 00
PLUMBING INSULATION
BASED ON DFD MASTER SPECIFICATION DATED 10/1/12

PART 1 - GENERAL

SCOPE

This section includes insulation specifications for plumbing piping and equipment. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference Standards
- Quality Assurance
- Description
- Definitions
- Shop Drawings
- Operation and Maintenance Data

PART 2 - PRODUCTS

- Materials
- Insulation & Jackets
- Accessories

PART 3 - EXECUTION

- Installation
- Piping, Valve and Fitting Insulation
- Equipment Insulation
- Construction Verification Items

RELATED WORK

- Section 01 91 01 or 01 91 02 – Commissioning Process
- Section 22 08 00 – Commissioning of Plumbing
- Section 22 05 00 - Common Work Results for Plumbing
- Section 22 11 00 - Facility Water Distribution
- Section 22 13 00 - Facility Sanitary Sewerage
- Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

- ASTM B209 Aluminum and Aluminum Alloy Sheet and Plate
- ASTM C165 Test Method for Compressive Properties of Thermal Insulations
- ASTM C177 Heat Flux and Thermal Transmission Properties
- ASTM C195 Mineral Fiber Thermal Insulation Cement
- ASTM C240 Cellular Glass Insulation Block
- ASTM C302 Density of Preformed Pipe Insulation
- ASTM C303 Density of Preformed Block Insulation
- ASTM C449 Mineral Fiber Hydraulic Setting Thermal Insulation Cement
- ASTM C518 Heat Flux and Thermal Transmission Properties
- ASTM C533 Calcium Silicate Block and Pipe Thermal Insulation
- ASTM C534 Preformed Flexible Elastomeric Thermal Insulation
- ASTM C547 Mineral Fiber Preformed Pipe Insulation
- ASTM C552 Cellular Glass Block and Pipe Thermal Insulation
- ASTM C553 Mineral Fiber Blanket and Felt Insulation

1	ASTM C578	Preformed, Block Type Cellular Polystyrene Thermal Insulation
2	ASTM C591	Preformed Rigid Cellular Polyurethane Thermal Insulation
3	ASTM C610	Expanded Perlite Block and Thermal Pipe Insulation
4	ASTM C612	Mineral Fiber Block and Board Thermal Insulation
5	ASTM C921	Properties of Jacketing Materials for Thermal Insulation
6	ASTM C1136	Flexible Low Permeance Vapor Retarders for Thermal Insulation
7	ASTM E84	Surface Burning Characteristics of Building Materials
8	MICA	National Commercial & Industrial Insulation Standards
9	NFPA 225	Surface Burning Characteristics of Building Materials
10	UL 723	Surface Burning Characteristics of Building Materials

11

12 **QUALITY ASSURANCE**

13 Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and
14 Substitutions.

15

16 Label all insulating products delivered to the construction site with the manufacturer's name and description
17 of materials.

18

19 **DESCRIPTION**

20 Furnish and install all insulating materials and accessories as specified or as required for a complete
21 installation. The following types of insulation are specified in this section:

- 22 • Pipe Insulation
- 23 • Equipment Insulation

24

25 Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors
26 Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only
27 be accepted where specifically modified in these specifications, or where prior written approval has been
28 obtained from the UWM Project Representative.

29

30 **DEFINITIONS**

31 Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other
32 areas, including walk-through tunnels, shall be considered as exposed.

33

34 **SHOP DRAWINGS**

35 Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening
36 methods, fitting materials along with material safety data sheets and intended use of each material. Include
37 manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and
38 manufacturer's installation instructions.

39

40 **OPERATION AND MAINTENANCE DATA**

41 All operations and maintenance data shall comply with the submission and content requirements specified
42 under section GENERAL REQUIREMENTS.

43

44

PART 2 - PRODUCTS

45

46 **MATERIALS**

47 Materials or accessories containing asbestos will not be accepted.

48

49 Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame
50 spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions:

51

52 Insulation which is not located in an air plenum may have a flame spread rating not over 25 and a
53 smoke developed rating no higher than 150.

54

1 **INSULATION AND JACKETS**

2 Manufacturers: Armstrong, Certainteed Manson, Childers, Dow, Extol, Halstead, H.B. Fuller, Imcoa, Knauf,
3 Owens-Corning, Pittsburgh Corning, Rubatex, Johns-Mansville, or approved equal.

4
5 Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall
6 be suitable to receive jackets, adhesives and coatings as indicated.

7
8 **RIGID FIBERGLASS INSULATION:**

9 Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees
10 F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.

11
12 White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a self-sealing
13 pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance
14 of 50 units.

15
16 **PVC FITTING COVERS AND JACKETS:**

17 White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade
18 GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet
19 radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be .02 inch (20 mil).

20
21 **INSULATION INSERTS AND PIPE SHIELDS**

22 Manufacturers: B-Line, Pipe Shields, Value Engineered Products

23
24 Construct inserts with calcium silicate, minimum 140 psi compressive strength. Piping 12" and larger,
25 supplement with high density 600 psi structural calcium silicate insert. Provide galvanized steel shield. Insert
26 and shield to be minimum 180 degree coverage on bottom of supported piping and full 360 degree coverage
27 on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load
28 distribution steel plate.

29
30 Where contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thicknesses,
31 gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered pre-manufactured
32 product described above. On low temperature systems, extruded polystyrene may be substituted for calcium
33 silicate provided insert and shield length and gauge are increased to compensate for lower insulation
34 compressive strength.

35
36 Precompressed 20# density molded fiberglass blocks, Hamfab or equal, of same thickness as adjacent
37 insulation may be substituted for calcium silicate inserts with one 1"x 6" block for piping through 2-1/2" and
38 three 1" x 6" blocks for piping through 4". Submit shield schedule to demonstrate equivalency to pre-
39 engineered/pre-manufactured product described above.

40
41 Wood blocks will not be accepted.

42
43 **ACCESSORIES**

44 All products shall be compatible with surfaces and materials on which they are applied, and be suitable for
45 use at operating temperatures of the systems to which they are applied.

46
47 Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for
48 applications specified.

49
50 Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be
51 .015 inch for aluminum and .010 inch for stainless steel.

52
53 Tack fasteners to be stainless steel ring grooved shank tacks.

54

1 Staples to be clinch style.
2
3 Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.
4
5 Finishing cement to be ASTM C449.
6
7 Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.
8
9 Bedding compounds to be non-shrinking and permanently flexible.
10
11 Vapor barrier coatings to be non-flammable, fire resistant, polymeric resin.
12
13 Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.
14
15

16 **PART 3 - EXECUTION**

17 **INSTALLATION**

18 Install insulation, jackets and accessories in accordance with manufacturers instructions and under ambient
19 temperatures and conditions recommended by manufacturer. Surfaces to be insulated must be clean and dry.
20
21

22 Do not insulate systems or equipment which are specified to be pressure tested or inspected, until testing,
23 inspection and any necessary repairs have been successfully completed.
24

25 Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be
26 accepted. Cover and seal exposed fiberglass insulation when insulation is terminated, no raw fiberglass
27 insulation is allowed. Provide neat and coated terminations at all nameplates, uninsulated fittings, or at other
28 locations where insulation terminates. Install with longitudinal joints facing wall or ceiling.
29

30 Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.
31

32 Use full-length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or
33 pieces cut undersize and stretched to fit will not be accepted.
34

35 Insulation shall be continuous through sleeves and openings. Vapor barriers shall be maintained continuous
36 through all penetrations.
37

38 Provide a complete vapor barrier for insulation on the following systems:

- 39 • Cold water (potable and non-potable)
 - 40 • Storm Water
 - 41 • Equipment piping with a surface temperature below 65 degrees F
- 42

43 **PIPING, VALVE, AND FITTING INSULATION**

44 **GENERAL:**

45 Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2" lap on jacket
46 seams and 2" tape on butt joints, firmly cemented with lap adhesive. Additionally secure with staples along
47 seams and butt joints. Coat staples with vapor barrier mastic on systems requiring vapor barrier.
48

49 Water supply piping insulation shall be continuous throughout the building and installed adjacent to and
50 within building walls to a point directly behind the fixture that is being supplied.
51

52 Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of
53 insulation. Where a vapor barrier is not required, hangers and supports may be attached directly to piping
54 with insulation completely covering hanger or support and jacket sealed at support rod penetration. Where

1 riser clamps are required to be attached directly to piping requiring vapor barrier, extend insulation and vapor
2 barrier jacketing/coating around riser clamp.

3
4 **INSULATION INSERTS AND PIPE SHIELDS:**

5 Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4"
6 and smaller copper piping provided 12" long 22 gauge pipe shields are used.

7
8 **FITTINGS AND VALVES:**

9 Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up
10 insulation of the same thickness as adjoining insulation. Cover insulation with fabric reinforcing and mastic
11 or where temperatures do not exceed 150 degrees, PVC fitting covers. Secure PVC fitting covers with tack
12 fasteners and 1-1/2" band of mastic over ends, throat, seams or penetrations. On systems requiring vapor
13 barrier, use vapor barrier mastic.

14
15 **PROTECTIVE JACKETS:**

16
17 Provide a protective metal jacket for the following insulated piping: _____
18 Lap seams a minimum of 2 inches. Secure with metal bands for end to end joints, and rivets or sheet metal
19 screws for longitudinal joints. Rivets, screws, and bands to be constructed of the same material as the
20 jacket. Locate seams on bottom for exterior applications.

21
22 **PIPE INSULATION SCHEDULE:**

23 Provide insulation on new and existing remodeled piping as indicated in the following schedule:

24

Service	Insulation Types	Insulation Thickness by Pipe Size				
		<1-1/4"	1-1/2" to 2"	2-1/2" to 4"	5" to 6"	8" and larger
Hot Water Supply	Rigid Fiberglass	1"	1.5"	1.5"	1.5"	1.5"
Hot Water Circulating	Rigid Fiberglass	1"	1.5"	1.5"		
Cold Water	Rigid Fiberglass	0.5"	1"	1"	1"	1"
All Horizontal Storm Piping and 4'-0" of vertical Piping thereafter, & Roof Drain bodies	Rigid Fiberglass	0.5"	0.5"	0.5"	0.5"	0.5"
Clearwater Waste	Rigid Fiberglass	0.5"	0.5"	0.5"	0.5"	0.5"

33
34
35
36
37
38
39
40

41 The following piping and fittings are not to be insulated:

- 42 • Chrome plated exposed supplies and stops (except where specifically noted).
 - 43 • Water hammer arrestors.
 - 44 • Piping unions and flanges for systems not requiring a vapor barrier.
- 45

46 **CONSTRUCTION VERIFICATION ITEMS**

47 Contractor is responsible for utilizing the construction verification checklists supplied under specification
48 Section 22 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01
49 or 01 91 02.

50
51

END OF SECTION

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SECTION 22 08 00
COMMISSIONING OF PLUMBING
BASED ON DFD MASTER SPECIFICATION DATED 12/1/16

PART 1 - GENERAL

SCOPE

This section includes commissioning forms for construction verification and functional performance testing. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference
- Submittals

PART 2 - PRODUCTS

(Not Used)

PART 3 – EXECUTION

- Commissioning Forms
- CV-22 07 00 Plumbing Insulation
- CV-22 11 00 Facility Water Distribution
- CV-22 13 00 Facility Sanitary Sewerage
- CV-22 14 00 Facility Storm Drainage
- CV-22 42 00 Commercial Plumbing Fixtures
- CV-22 42 00 Electric Water Coolers

RELATED WORK

Section 01 91 01– Commissioning Process

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

SUBMITTALS

Reference the General Conditions of the Contract for submittal requirements.

Reference Section 01 91 01 or 01 91 02 Commissioning Process for Construction Verification Checklist and Functional Performance Test submittal requirements.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

COMMISSIONING FORMS

Commissioning forms are to be filled in as work progresses by the individuals responsible for installation and shall be completed for each installation phase.

Provide a description of the work completed since the last entry, the percentage of the total work completed for the system for that area and the step of installation or finalization.

Circle Yes or No for each commissioning form item. If the information requested for an item does not apply to the given stage of installation for the system, list it as “N/A”. Explain all discrepancies, negative responses or N/A responses in the negative responses section.

Once the work is 100% complete and the responses to each item are complete and resolved for a given commissioning forms group, mark as complete, initial and date in the spaces provided.

- 1
- 2 Provide copies of the commissioning forms to the commissioning agent 2 days prior to construction progress
- 3 meetings.
- 4
- 5

Construction Verification Checklist
22 05 14 – Plumbing Specialties

Construction Verification Checklist
22 07 00 – Plumbing Insulation

CV-22 07 00 – Plumbing Insulation

Equipment Identification/Tag: _____

Location: _____

PIPING INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)										
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____				DATE: _____						

Question Details

- 1) Piping clean, dry, pressure tested and approved prior to application of insulation.
- 2) Type and thickness of insulation complies with listed specification requirements for given system and pipe size.
- 3) Insulation installed with smooth and even surfaces, without the use of filler in voids.
- 4) Butt joints and longitudinal seams closed tightly with a minimum of 2” lap on jacket seams and 2” tape on butt joints.
- 5) Staples along seams and butt joints provided with vapor barrier mastic provided for staples on systems requiring vapor barrier.
- 6) Full-length material used as possible, with no scrap piecing or stretching of insulation utilized.
- 7) Insulation continuous through sleeves and openings with vapor barriers continuous through all penetrations.
- 8) Complete vapor barrier provided for all cold water, storm water and piping systems with surface temperatures below 65°F.
- 9) Exposed fiberglass insulation covered and sealed at all permanent terminations and at end of work day.
- 10) Piping and direction of flow is labeled per specification requirements.

Construction Verification Checklist
22 07 00 – Plumbing Insulation

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
22 07 00 – Plumbing Insulation

B) VALVE, FITTING & EQUIPMENT INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)					
				1)	2)	3)	4)	5)	6)
				YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____		DATE: _____			

Question Details

- 1) Fittings, valves, unions, flanges, couplings and specialties insulated with factory molded or built up insulation of the same thickness as adjoining insulation.
- 2) Insulated fittings, valves, unions, flanges, couplings and specialties covered with fabric reinforcing and mastic or where temperatures do not exceed 150°F, PVC fitting covers.
- 3) PVC fitting covers secured with tack fasteners and 1-1/2" band of mastic over ends, throat, seams or penetrations or for systems requiring vapor barrier, vapor barrier mastic.
- 4) Equipment access manholes, fittings, nameplates or ASME stamps left uninsulated with insulation beveled and sealed at these locations.
- 5) Equipment insulation installed with smooth and even surfaces per specifications requirements.
- 6) No insulation provided at chrome plated exposed supplies and stops (except where specifically noted), water hammer arrestors, and piping unions and flanges for piping systems not requiring a vapor barrier.

Construction Verification Checklist
22 07 00 – Plumbing Insulation

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
22 11 00 – Facility Water Distribution

V-22 11 00 – Facility Water Distribution

Equipment Identification/Tag: _____

Location: _____

A) PRE-INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)		
				1)	2)	3)
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____	DATE: _____	

Question Details

- 1) All piping, valves, etc. are clean and free of damage prior to installation.
- 2) Temporary protective coating is provided on cast iron and steel valves during storage.
- 3) Temporary end caps are provided on piping and fittings until installation.

Construction Verification Checklist
22 11 00 – Facility Water Distribution

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
22 11 00 – Facility Water Distribution

B) GENERAL PIPING INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)										
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____				DATE: _____						

Question Details

- 1) Piping is free to expand and contract without noise or damage to hangers, joints, or the building.
- 2) Piping is installed in a manner to ensure that insulation will not contact adjacent surfaces.
- 3) Piping is installed with sufficient pitch and arranged in a manner to ensure drainage of entire system.
- 4) Changes in pipe sizes are made with the proper size reducing fittings, reducing elbow or reducing tees, and no bushings are utilized.
- 5) Connections between dissimilar pipe materials are made with dielectric fittings.
- 6) Pipe hanger spacing complies with specification requirements.
- 7) All equipment requiring maintenance is accessible (valves, strainers, etc.).
- 8) Piping allows access to equipment that is part of this system or another system.
- 9) Water piping not installed within exterior walls.
- 10) Open pipe ends capped at completion of work day.

Construction Verification Checklist
22 11 00 – Facility Water Distribution

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
22 11 00 – Facility Water Distribution

C) UNDERGROUND PIPING INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)						
				1)	2)	3)	4)	5)	6)	7)
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____			DATE: _____			

Question Details

- 1) Exterior water piping installed below predicted frost level in accordance with SPS Table 382.30-6, but in no case less than 6' bury depth to top of pipe.
- 2) Minimum of 8' horizontal distance maintained between 2-1/2" and larger water piping and sanitary sewer piping.
- 3) Minimum of 30" horizontal and 12" vertical distance, water on top, maintained between 2" and smaller water piping and sanitary sewer piping.
- 4) Where water piping crosses a sanitary sewer, minimum 18" vertical clearance add waterproof PVC water pipe sleeve (reference sanitary sewer materials) sealed at both ends for distance of 10' from sewer in both directions provided.
- 5) Thrust restraints provided for 3" and larger exterior water piping joints, hydrants, caps, plugs, fittings and bends of 22-1/2 degrees or more.
- 6) Excavation and backfill meet specification requirements.
- 7) Underground warning tape installed 6"-12" below finished grade above all exterior below ground piping.
- 8) Pipe and fittings encased in a polyethylene wrap per specification.

Construction Verification Checklist
22 11 00 – Facility Water Distribution

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
22 11 00 – Facility Water Distribution

D) VALVE & FITTING INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)						
				1)	2)	3)	4)	5)	6)	7)
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____			DATE: _____			

Question Details

- 1) All valves are in a horizontal or upright vertical position (not inverted) with handles in an accessible position.
- 2) Valve handle extensions are provided where needed per the specification.
- 3) Drainage valves provided at all low points and downstream of riser isolation valves.
- 4) Isolation valves provided at all equipment connections, main branches and sub-branches, “T” connections, and as necessary for repairing the system as specified in contract documents.
- 5) Riser shutoff valve and a capped hose thread drain valve at the bottom of each riser provided.
- 6) All strainers in piping system have ball valves installed at the tapped screen retainer.
- 7) Yard and wall hydrants installed with discharge above minimum grade clearance requirements noted in specifications.

Construction Verification Checklist
22 11 00 – Facility Water Distribution

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
22 11 00 – Facility Water Distribution

E) TESTING CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)								
				1)	2)	3)	4)	5)	6)	7)	8)	
				YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____				DATE: _____				

Question Details

- 1) Piping tested utilizing water at specified pressure and duration as per specification.
- 2) All leaks identified during testing have been repaired and test re-done until satisfactory conditions are accomplished.
- 3) Test conducted with all piping of tested system or section visible during testing.
- 4) Proceeding system chlorination, all outlets flushed for a minimum of 1 minute with clean water until water runs clear.
- 5) Following initial flush system filled with water and chlorine at 50 PPM and allowed to stand for 24 hours, or system filled and with a water solution containing at least 200 PPM of chlorine and allowed to stand for 3 hours.
- 6) Following specification prescribed stand times for chlorine treatment system flushed until chlorine levels are at source water levels.
- 7) 24 hours after final flushing, water samples of the number and location specified by the Engineer taken for lab testing and results show the absence of coliform bacteria.

Construction Verification Checklist
22 11 00 – Facility Water Distribution

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
22 11 00 – Facility Water Distribution

F) FINALIZATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)			
				1)	2)	3)	4)
				YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____		DATE: _____	

Question Details

- 1) All exposed piping which passes through a wall, ceiling or floor is provided with escutcheon plates.
- 2) Piping labels and direction of flow is provided per specification requirements.
- 3) All penetrations through fire rated wall assemblies have been sealed per specification requirements.
- 4) All penetrations through non-rated wall assemblies have been sealed per specification requirements for given space type.

Negative Responses

Group/Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
22 13 00 – Facility Sanitary Sewerage

CV-22 13 00 – Facility Sanitary Sewerage

Equipment Identification/Tag: _____

Location: _____

A) PRE-INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)		
				1)	2)	3)
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____		DATE: _____

Question Details

- 1) All piping meets ASTM standards and specifications.
- 2) All piping, etc. is clean and free of damage prior to installation.
- 3) Temporary protective covering is provided on pipe and fittings during storage.

Construction Verification Checklist
22 13 00 – Facility Sanitary Sewerage

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
22 13 00 – Facility Sanitary Sewerage

B) GENERAL PIPING INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials											
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:				DATE:						

Question Details

- 1) Piping is free to expand and contract without noise or damage to hangers, joints, or the building.
- 2) Piping is installed with sufficient pitch and arranged in a manner to ensure drainage of entire system.
- 3) Interior piping pitched to drain at minimum slope of 1/4" per foot where possible and in no case less than 1/8" per foot for piping 3" and larger.
- 4) Changes in pipe sizes are made with the proper size reducing fittings, reducing elbow or reducing tees, and no bushings are utilized.
- 5) Pipe hanger spacing complies with specification requirements.
- 6) All equipment requiring maintenance is accessible (valves, strainers, etc.).
- 7) Drains and cleanouts level and plumb to finished floor, roof or finished wall.
- 8) Minimum clearance of 18" provided for all cleanouts and backwater valves.
- 9) Open pipe ends capped at completion of work day.

Construction Verification Checklist
22 13 00 – Facility Sanitary Sewerage

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
22 13 00 – Facility Sanitary Sewerage

C) UNDERGROUND PIPING INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)					
				1)	2)	3)	4)	5)	6)
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____		DATE: _____			

Question Details

- 1) Exterior piping installed below predicted frost level, but in no case less than 5' bury depth to top of pipe.
- 2) Minimum of 8' horizontal distance maintained between 2-1/2" and larger water piping and sanitary sewer piping.
- 3) Minimum of 30" horizontal and 12" vertical distance, water on top, maintained between 2" and smaller water piping and sanitary sewer piping.
- 4) Where water piping crosses a sanitary sewer, minimum 18" vertical clearance and waterproof PVC water pipe sleeve (reference sanitary sewer materials) sealed at both ends for distance of 10' from sewer in both directions provided.
- 5) Excavation and backfill procedures meet specification requirements.
- 6) Piping bedding and backfill materials meet specification requirements.
- 7) Underground warning tape installed 6"-12" below finished grade above all exterior below ground piping.
- 8) Non-metallic piping has tracer wire installed per Wisconsin Administrative Plumbing Codes.

Construction Verification Checklist
22 13 00 – Facility Sanitary Sewerage

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
22 13 00 – Facility Sanitary Sewerage

D) TESTING & FINALIZATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)								
				1)	2)	3)	4)	5)	6)	7)	8)	
				YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____				DATE: _____				

Question Details

- 1) Piping tested utilizing water at specified pressure and duration as per specification for given piping system type.
- 2) All leaks identified during testing have been repaired and test re-done until satisfactory conditions are accomplished.
- 3) Test conducted with all piping of tested system or section visible during testing.
- 4) Entire testing procedure witnessed by UWM Representative per the specifications.
- 5) Piping inlets (floor drains, hub drains, mop basins, fixtures, etc.) flushed with high flow of water at completion of project to demonstrate full flow capacity.
- 6) Blockages removed and necessary repairs made where flow is found to be impeded during flushing test.
- 7) Piping identification and direction of flow is provided per specification requirements.
- 8) All penetrations through fire rated wall assemblies have been sealed per specification requirements.
- 9) All penetrations through non-rated wall assemblies have been sealed per specification requirements for given space type.

Construction Verification Checklist
22 13 00 – Facility Sanitary Sewerage

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
 22 14 00 – Facility Storm Drainage

CV-22 14 00 – Facility Storm Drainage

Equipment Identification/Tag: _____

Location: _____

A) PRE-INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)		
				1)	2)	3)
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____		DATE: _____

Question Details

- 1) Piping materials meet specified ASTM standards and the specifications.
- 2) All piping, etc. is clean and free of damage prior to installation.
- 3) Temporary protective covering is provided on pipe and fittings during storage.

Construction Verification Checklist
22 14 00 – Facility Storm Drainage

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
22 14 00 – Facility Storm Drainage

B) GENERAL PIPING INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)										
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____				DATE: _____						

Question Details

- 1) Piping is free to expand and contract without noise or damage to hangers, joints, or the building.
- 2) Piping is installed in a manner to ensure that insulation will not contact adjacent surfaces.
- 3) Piping is installed with sufficient pitch and arranged in a manner to ensure drainage of entire system.
- 4) Changes in pipe sizes are made with the proper size reducing fittings, reducing elbow or reducing tees, and no bushings are utilized.
- 5) Connections between dissimilar pipe materials are made with approved fittings.
- 6) Pipe hanger spacing complies with specification requirements.
- 7) All equipment requiring maintenance is accessible.
- 8) Piping allows access to equipment that is part of this system or another system.
- 9) Minimum clearance of 18” provided for all cleanouts.
- 10) Open pipe ends capped at completion of work day.

Construction Verification Checklist
22 14 00 – Facility Storm Drainage

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
22 14 00 – Facility Storm Drainage

C) UNDERGROUND PIPING INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)					
				1)	2)	3)	4)	5)	
				YES	YES	YES	YES	YES	
				NO	NO	NO	NO	NO	
				YES	YES	YES	YES	YES	
				NO	NO	NO	NO	NO	
				YES	YES	YES	YES	YES	
				NO	NO	NO	NO	NO	
				YES	YES	YES	YES	YES	
				NO	NO	NO	NO	NO	
				YES	YES	YES	YES	YES	
				NO	NO	NO	NO	NO	
				YES	YES	YES	YES	YES	
				NO	NO	NO	NO	NO	
				YES	YES	YES	YES	YES	
				NO	NO	NO	NO	NO	
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:				DATE:	

Question Details

- 1) Exterior piping installed below predicted frost level, but in no case less than 5' bury depth to top of pipe.
- 2) Excavation and backfill procedures meet specification requirements.
- 3) Bedding and backfill material meet specifications.
- 4) Tracer wire is installed on non-metallic piping.
- 5) Underground warning tape installed 6"-12" below finished grade above all exterior below ground piping.

Negative Responses

Group/Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
22 14 00 – Facility Storm Drainage

D) TESTING & FINALIZATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)						
				1)	2)	3)	4)	5)	6)	7)
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____			DATE: _____			

Question Details

- 1) Piping tested utilizing water at specified pressure and duration as per specification for given piping system type.
- 2) All leaks identified during testing have been repaired and test re-done until satisfactory conditions are accomplished.
- 3) Test conducted with all piping of tested system or section visible during testing.
- 4) All testing procedures witnessed by UWM representative.
- 5) Piping identification and direction of flow is provided per specification requirements.
- 6) All penetrations through fire rated wall assemblies have been sealed per specification requirements.
- 7) All penetrations through non-rated wall assemblies have been sealed per specification requirements for given space type.

Construction Verification Checklist
22 14 00 – Facility Storm Drainage

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
CV-22 30 00 – Plumbing Equipment

Construction Verification Checklist
22 42 00 – Commercial Plumbing Fixtures

CV-22 42 00 – Commercial Plumbing Fixtures

Equipment Identification/Tag: _____

Location: _____

A) INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)									
				1)	2)	3)	4)	5)	6)	7)	8)	9)	
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____				DATE: _____					

Question Details

- 1) Fixture traps and service stops easily accessible for service.
- 2) Fixture and carriers secured per manufacturer requirements and level and plumb to finished surface.
- 3) Pipe penetrations covered with escutcheons.
- 4) Openings between walls, floors and fixtures sealed with mildew-resistant silicone sealant same color as fixture.
- 5) Fixtures tested and fully operational.
- 6) Fixture valves adjusted for intended water flow rate to fixtures to eliminate splashing, noise or overflow
- 7) Self-closing lavatory faucets adjusted to 15 second cycle.
- 8) Shower valve temperature limit stops set to 110 degree maximum outlet temperature.
- 9) Fixtures and trim cleaned using manufacturer's recommended cleaning methods and materials.

Construction Verification Checklist
22 42 00 – Commercial Plumbing Fixtures

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
22 42 00 – Commercial Plumbing Fixtures

CV-22 42 00 – Electric Water Coolers

Equipment Identification/Tag: _____

Location: _____

Group/Item	Group/Task Description	Submitted	Delivered
<i>A</i>	<i>MODEL VERIFICATION</i>		
1	Manufacturer		
2	Model		
3	Serial Number		
4	Refrigerant Type		
5	Flow (gph)		
6	Voltage / Phase / Frequency (V / - / Hz)	/ /	/ /
<input type="checkbox"/> CHECKLIST GROUP COMPLETE		INITIALS: _____	DATE: _____

Group/Item	Group/Task Description	Response	
<i>B</i>	<i>PHYSICAL CHECKS</i>		
1	Unit is free from physical damage.	YES	NO
2	The water openings are sealed with plastic plugs.	YES	NO
3	All components present.	YES	NO
4	Installation and startup manual provided.	YES	NO
5	Unit tags affixed.	YES	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE		INITIALS: _____	DATE: _____

Group/Item	Group/Task Description	Submitted	Delivered
<i>C</i>	<i>INSTALLATION</i>		
1	Unit secured as required by manufacturer and specifications.	YES	NO
2	Adequate clearance around unit for service.	YES	NO
3	All components accessible for maintenance.	YES	NO
4	Unit installed at the proper height.	YES	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE		INITIALS: _____	DATE: _____

Group/Item	Group/Task Description	Submitted	Delivered
<i>D</i>	<i>WATER PIPING</i>		
1	All piping components have been installed (in the correct order) as required by contract document or manufacturer.	YES	NO
2	Piping arranged for ease of unit removal.	YES	NO
3	Unions provided at water connections to unit.	YES	NO
4	Piping supported as required by specifications.	YES	NO
5	Piping is clean.	YES	NO
6	Piping and valves properly checked and free of leaks.	YES	NO
7	All valves are easily accessible.	YES	NO
8	Valve tags attached.	YES	NO
9	Piping insulation is complete and installed as per specifications.	YES	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE		INITIALS: _____	DATE: _____

Group/Item	Group/Task Description	Submitted	Delivered
<i>E</i>	<i>ELECTRICAL</i>		
1	Local disconnect installed in accessible and visible location.	YES	NO
2	All electrical connections are tight.	YES	NO
3	All electrical components are grounded.		
<input type="checkbox"/> CHECKLIST GROUP COMPLETE		INITIALS: _____	DATE: _____

Group/Item	Group/Task Description	Submitted	Delivered
<i>F</i>	<i>MECHANICAL STARTUP</i>		
1	Unit starts and runs without any unusual noise or vibration.	YES	NO
2	Stream and temperature adjustments made per manufacturer recommendations.	YES	NO
3	Unit interior and exterior clean and finish blemishes repaired.	YES	NO

Construction Verification Checklist
22 42 00 – Commercial Plumbing Fixtures

Group/Item	Group/Task Description	Response	
<input type="checkbox"/> CHECKLIST GROUP COMPLETE	INITIALS: _____	DATE:	_____

Negative Responses

Group/Item	Date Found	Found By	Reason for Negative Response	Resolved	Date Resolved	Resolution
				YES / NO		
				YES / NO		
				YES / NO		
				YES / NO		
				YES / NO		

Functional Performance Test
22 30 00 – Plumbing Equipment

UWM Project No. GML B1970 / UWSA Project No. B-23-001

22 08 00-39

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SECTION 22 11 00
FACILITY WATER DISTRIBUTION
BASED ON DFD MASTER SPECIFICATION DATED 10/10/17

PART 1 - GENERAL

SCOPE

This section contains specifications for plumbing pipe and pipe fittings for this project. Included are the following topics:

PART 1 - GENERAL

- Scope
- Reference
- Reference Standards
- Shop Drawings
- Quality Assurance
- Delivery, Storage, and Handling
- Design Criteria
- Welder Qualifications

PART 2 - PRODUCTS

- Domestic Water
- Dielectric Unions and Flanges
- Unions and Flanges
- Mechanical Grooved Pipe Connections

PART 3 - EXECUTION

- General
- Preparation
- Erection
- Copper Pipe Joints
- Welded Pipe Joints
- Threaded Pipe Joints
- Solvent Welded Pipe Joints
- Mechanical Hubless Pipe Connections
- Mechanical Joint Pipe Connections
- Push-On Gasketed Pipe Connections
- Mechanical Grooved Pipe Connections
- Mechanically Formed Tee Fittings
- Domestic Water
- Flushing and Disinfection of Potable Water Systems
- Underground Pipe Wrap
- Dielectric Unions and Flanges
- Unions and Flanges
- Piping System Leak Tests
- Construction Verification Items

RELATED WORK

- Section 01 91 01 or 01 91 02 – Commissioning Process
- Section 22 08 00 – Commissioning of Plumbing
- 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
- 22 05 14 - Plumbing Specialties

REFERENCE

Applicable provisions of Division 1 govern work under this section.

1	REFERENCE STANDARDS
2	ANSI A21.4
3	ANSI A21.11
4	ANSI A21.51
5	ANSI B16.3 Malleable Iron Threaded Fittings
6	ANSI B16.4 Cast Iron Threaded Fittings
7	ANSI B16.5 Pipe Flanges and Flanged Fittings
8	ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
9	ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
10	ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
11	ASTM A105 Forgings, Carbon Steel, for Piping Components
12	ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
13	ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated
14	Temperatures
15	ASTM B32 Solder Metal
16	ASTM B88 Seamless Copper Water Tube
17	ASTM B280 Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
18	ASTM B813 Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
19	ASTM D1785 Poly Vinyl Chloride (PVC) Plastic Pipe
20	ASTM D2241 Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
21	ASTM D2464 Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
22	ASTM D2466 Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
23	ASTM D2513 Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
24	ASTM D2564 Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
25	ASTM D2657 Heat Fusion Joining of Polyolefin Pipe and Fittings
26	ASTM D2774 Recommended Practice for Underground Installation of Thermoplastic Pressure Piping
27	ASTM D2855 Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
28	ASTM D3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
29	ASTM D3222 Unmodified Poly Vinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials
30	ASTM D4101 Propylene Plastic Injection and Extrusion Materials
31	ASTM F437 Threaded Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80
32	ASTM F438 Socket Type Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 40
33	ASTM F441 Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe, Schedules 40 and 80
34	ASTM F493 Solvent Cements for Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe and Fittings
35	ASTM F656 Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and
36	Fittings
37	ASTM F876 Standard Specification for Crosslinked Polyethylene (PEX) Tubing
38	ASTM F877 Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water
39	Distribution Systems
40	ASTM F1960 Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings
41	AWWA C904 Standard for Crosslinked Polyethylene (PEX) Pressure Pipe, 1/2-inch Through 3-inch, for
42	Water Service
43	AWS A5.8 Brazing Filler Metal
44	AWWA C104 Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
45	AWWA C105 Polyethylene Encasement for Ductile Iron Piping for Water
46	AWWA C110 Ductile Iron and Gray Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids
47	AWWA C111 Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
48	AWWA C151 Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or
49	Other Liquids
50	AWWA C153 Ductile Iron Compact Fittings, 3 In. Through 48 In., for Water and Other Liquids
51	AWWA C600 Installation of Ductile Iron Water Mains and Their Appurtenances
52	AWWA C651 Disinfecting Water Mains
53	AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution

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SHOP DRAWINGS

Schedule from the contractor indicating the ASTM, AWWA or CISPI specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

Statement from manufacturer on his letterhead that pipe furnished meets the ASTM, AWWA or CISPI specification contained in this section.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and Substitutions.

Order all copper, cast iron, steel, PVC and polyethylene pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the State.

DELIVERY, STORAGE, AND HANDLING

Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

DESIGN CRITERIA

Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM, and AWWA specifications as listed in this specification.

Construct all piping for the highest pressures and temperatures in the respective system.

Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in ventilation plenum spaces, including plenum ceilings unless approved for this use.

Where weld fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM A53 type F pipe is specified, grade A Type E or S, or grade B Type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

WELDER QUALIFICATIONS

1 Welding procedures, welders, and welding operators for all building service piping to be in accordance
2 with certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of
3 ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for
4 Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding
5 Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of
6 ASME B31.9 Building Services Piping.

7
8 Before any polyethylene fusion welding is performed, Contractor to submit certification that the welders to
9 be used on this project have successfully demonstrated proper welding procedures in accordance with the
10 Code of Federal Regulations, Title 49, Part 192, Section 192.285.

11
12 The Architect or Engineer reserves the right to test the work of any welder employed on the project, at the
13 State's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from
14 doing further welding on the project and all defective welds replaced.

15 16 17 **PART 2 - PRODUCTS**

18 19 **DOMESTIC WATER**

20 **ABOVE GROUND:**

21 Type L copper water tube, H (drawn) temper, ASTM B88; wrought copper pressure fittings, ANSI B16.22;
22 lead free (<2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8
23 BCuP. Copper mechanical grooved fittings and couplings on roll grooved pipe may be used in lieu of
24 soldered fittings. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings
25 for branch takeoffs up to one-half (1/2) the diameter of the main.

26 27 28 **PART 3 - EXECUTION**

29 30 **GENERAL**

31 Install pipe and fittings in accordance with reference standards, manufacturers recommendations and
32 recognized industry practices.

33 34 **PREPARATION**

35 Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior
36 of each section of pipe and fitting prior to assembly.

37 38 **ERECTION**

39 Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a
40 window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute
41 piping as required to clear such interferences. Coordinate locations of plumbing piping with piping,
42 ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult
43 drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other
44 architectural details before installing piping.

45
46 Where copper, steel, or plastic piping is embedded in masonry or concrete, provide protective sleeve
47 covering of elastomeric pipe insulation.

48
49 Install underground warning tape 6"-12" below finished grade above all exterior below ground piping.
50 Where existing underground warning tape is encountered, repair and replace.

51
52 Maintain piping in clean condition internally during construction.

1 Provide clearance for installation of insulation, access to valves and piping specialties.
2
3 Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and
4 contract without damage to itself, equipment, or building.
5
6 Do not route piping through transformer vaults or above transformers, panelboards, or switchboards,
7 including the required service space for this equipment, unless the piping is serving this equipment
8
9 Install all valves and piping specialties, including items furnished by others, as specified and/or detailed.
10 Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and
11 systems installed by others where same requires the piping services indicated in this section.
12

13 **COPPER PIPE JOINTS**

14 Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces.
15 Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning
16 operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when
17 placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder
18 appears. Wipe excess solder and flux from joint.
19

20 **DOMESTIC WATER**

21 Maintain piping system in clean condition during installation. Remove dirt and debris from assembly of
22 piping as work progresses. Cap open pipe ends where left unattended or subject to contamination.
23
24 Install interior water piping with drain valves where indicated and at low points of system to allow
25 complete drainage. Install shutoff valves where indicated and at the base of risers to allow isolation of
26 portions of system for repair. Do not install water piping within exterior walls.
27

28
29
30 **FLUSHING AND DISINFECTION OF POTABLE WATER SYSTEMS**

31 Prior to use, isolate and fill system with potable water. Allow to stand 24 hours. Flush each outlet
32 proceeding from the service entrance to the furthest outlet for minimum of 1 minute and until water appears
33 clear. Fill system with a solution of water and chlorine containing at least 10 parts per million of chlorine
34 and allow to stand for 24 hours. Flush system with potable water until chlorine concentration is no higher
35 than source water level.
36

37 Wait 24 hours after final flushing. Take samples of water for lab testing. The number and location of
38 samples shall be representative of the system size and configuration and are subject to approval by
39 Engineer. Test shall show the absence of coliform bacteria. If test fails, repeat disinfection and testing
40 procedures until no coliform bacteria are detected. Submit test report indicating date and time of test along
41 with test results.
42

43 Piping that is pressure tested shall be drained completely dry. The piping system is not to be left full of
44 stagnant water. The piping system, water heaters and water softeners shall not be filled until within 10 days
45 of occupancy to guard against microbial growth.
46

47 **PIPING SYSTEM LEAK TESTS**

48 Isolate or remove components from system which are not rated for test pressure. Test piping in sections or
49 entire system as required by sequence of construction. Do not insulate or conceal pipe until it has been
50 successfully tested.
51

1 If required for the additional pressure load under test, provide temporary restraints at fittings or expansion
 2 joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves
 3 which may be exposed to isolate potential leaks.
 4
 5 For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents
 6 or loosening of flanges/unions. Measure and record test pressure at the high point in the system.
 7
 8 Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking
 9 will not be acceptable.
 10
 11 All pressure tests are to be documented and provided to the UWM project manager.
 12

<u>System</u>	<u>Test Medium</u>	<u>Initial Test Pressure</u>	<u>Duration</u>	<u>Final Test Pressure</u>	<u>Duration</u>
Above Ground Domestic Water	Water	N/A		100 psig	8 hr

16
 17 **CONSTRUCTION VERIFICATION ITEMS**
 18 Contractor is responsible for utilizing the construction verification checklists supplied under specification
 19 Section 22 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01
 20 or 01 91 02.
 21

22 **END OF SECTION**
 23
 24
 25

1 **PIPING SYSTEM TEST REPORT**

2
3 **State of Wisconsin**
4 **Department of Administration**
5 **Division of Facilities Development**

Date Submitted: _____

6
7 **Project Name:** _____

8
9 **Location:** _____ **DFD Project No:** _____

10
11 **Contractor:** _____

12
13 Plumbing Fire Sprinkler

14 **Test Medium:** Air Water Other _____

15
16 **Test performed per specification section No.** _____

17
18 **Specified Test Duration** _____ **Hours** **Specified Test Pressure** _____ **PSIG**

19
20 **System Identification:** _____

21 **Describe Location:** _____

22 _____

23	
24 Test Date: _____	
25 Start Test Time: _____	Initial Pressure: _____ PSIG
26	
27 Stop Test Time: _____	Final Pressure: _____ PSIG
28	

29 **Tested By:** _____ **Witnessed By:** _____

30 **Title:** _____ **Title:** _____

31 **Signed:** _____ **Signed:** _____

32 **Date:** _____ **Date:** _____

33 **Comments:** _____

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SECTION 22 13 00
FACILITY SANITARY SEWERAGE
BASED ON DFD MASTER SPECIFICATION DATED 4/6/18

PART 1 - GENERAL

SCOPE

This section contains specifications for plumbing pipe and pipe fittings for this project. Included are the following topics:

PART 1 - GENERAL

- Scope
- Reference
- Reference Standards
- Shop Drawings
- Quality Assurance
- Delivery, Storage, and Handling
- Design Criteria
- Welder Qualifications

PART 2 - PRODUCTS

- Sanitary Waste and Vent

PART 3 - EXECUTION

- General
- Preparation
- Erection
- Copper Pipe Joints
- Threaded Pipe Joints
- Solvent Welded Pipe Joints
- Mechanical Hubless Pipe Connections
- Mechanical Joint Pipe Connections
- Push-On Gasketed Pipe Connections
- Mechanical Grooved Pipe Connections
- Mechanically Formed Tee Fittings
- Sanitary Waste and Vent
- Piping System Leak Tests
- Construction Verification Items

RELATED WORK

- Section 01 91 01 or 01 91 02 – Commissioning Process
- Section 22 08 00 – Commissioning of Plumbing
- 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
- 22 05 14 - Plumbing Specialties

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

- ANSI A21.4
- ANSI A21.11
- ANSI A21.51
- ANSI B16.3 Malleable Iron Threaded Fittings
- ANSI B16.4 Cast Iron Threaded Fittings
- ANSI B16.5 Pipe Flanges and Flanged Fittings

1	ANSI B16.22	Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
2	ANSI B16.29	Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
3	ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
4	ASTM A74	Cast Iron Soil Pipe and Fittings
5	ASTM A105	Forgings, Carbon Steel, for Piping Components
6	ASTM A126	Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
7	ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated
8		Temperatures
9	ASTM A861	High Silicon Iron Pipe and Fittings
10	ASTM A888	Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent
11		Piping Applications
12	ASTM B32	Solder Metal
13	ASTM B306	Copper Drainage Tube (DWV)
14	ASTM B813	Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
15	ASTM C76	Reinforced Concrete Culvert, Storm Drain and Sanitary Pipe
16	ASTM C564	Standard Specifications for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
17	ASTM C1540	Standard Specifications for Heavy Duty Shielded Couplings Joining Hubless Cast Iron
18		Soil Pipe and Fittings
19	ASTM D1785	Poly Vinyl Chloride (PVC) Plastic Pipe
20	ASTM D2241	Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
21	ASTM D2466	Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
22	ASTM D2564	Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
23	ASTM D2665	Poly Vinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe and Fittings
24	ASTM D2729	Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
25	ASTM D2774	Recommended Practice for Underground Installation of Thermoplastic Pressure Piping
26	ASTM D2855	Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
27	ASTM D3034	Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
28	ASTM D3139	Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
29	ASTM D3212	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
30	ASTM D3222	Unmodified Poly Vinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials
31	ASTM D3311	Drain, Waste and Vent (DWV) Plastic Fitting Patterns
32	ASTM F2618	CPVC Pipe and Fittings for Chemical Waste Drainage Systems
33	AWS A5.8	Brazing Filler Metal
34	CISPI 301	Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent
35		Piping Applications
36	CISPI 310	Couplings For Use In Connection With Hubless Cast Iron Soil Pipe And Fittings For
37		Sanitary And Storm Drain, Waste And Vent Piping Applications

38
39 **SHOP DRAWINGS**

40 Schedule from the contractor indicating the ASTM, or CISPI specification number of the pipe being
41 proposed along with its type and grade if known at the time of submittal, and sufficient information to
42 indicate the type and rating of fittings for each service.

43
44 Statement from manufacturer on his letterhead that pipe furnished meets the ASTM, or CISPI specification
45 contained in this section.

46
47 **QUALITY ASSURANCE**

48
49 Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and
50 Substitutions.

51

1 Order all copper, cast iron, steel, PVC and polyethylene pipe with each length marked with the name or
2 trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order
3 number, metal or alloy designation, temper, size, and name of supplier.
4

5 Any installed material not meeting the specification requirements must be replaced with material that meets
6 these specifications without additional cost to the State.
7

8 **DELIVERY, STORAGE, AND HANDLING**

9 Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.
10

11 Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid
12 condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not
13 damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect
14 fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.
15

16 Offsite storage agreements will not relieve the contractor from using proper storage techniques.
17

18 Storage and protection methods must allow inspection to verify products.
19

20 **DESIGN CRITERIA**

21 Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM, or CISPI
22 specifications as listed in this specification.
23

24 Construct all piping for the highest pressures and temperatures in the respective system.
25

26 Piping that is not in accordance with ASTM E-84/UL723 for flame spread of <25 and smoke development
27 of <50 shall not be utilized in ventilation plenum spaces, including plenum ceilings.
28

29 Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a
30 centerline radius of 1.5 pipe diameters.
31

32 Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted
33 at Contractor's option. Where the grade or type is not specified, Contractor may choose from those
34 commercially available.
35

36 Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn)
37 temper copper tubing may be substituted at Contractor's option.
38

39 **WELDER QUALIFICATIONS**

40 Welding procedures, welders, and welding operators for all building service piping to be in accordance
41 with certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of
42 ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for
43 Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding
44 Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of
45 ASME B31.9 Building Services Piping.
46

47 Before any polyethylene fusion welding is performed, Contractor to submit certification that the welders to
48 be used on this project have successfully demonstrated proper welding procedures in accordance with the
49 Code of Federal Regulations, Title 49, Part 192, Section 192.285.
50

1 The Architect or Engineer reserves the right to test the work of any welder employed on the project, at the
2 State's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from
3 doing further welding on the project and all defective welds replaced.
4
5

6 **PART 2 - PRODUCTS**

7

8 **SANITARY WASTE AND VENT**

9 **INTERIOR ABOVE GROUND:**

10 Hubless cast iron soil pipe and fittings, ASTM A888; with no-hub couplings, CISPI 301, CISPI 310,
11 ASTM A74. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute
12 or receive prior approval of the Engineer. Cast iron piping and fittings shall be of A B & I Foundry,
13 Charlotte Pipe and Foundry, or Tyler Pipe manufacturers.
14
15
16

17 **PART 3 - EXECUTION**

18

19 **GENERAL**

20 Install pipe and fittings in accordance with reference standards, manufacturers recommendations and
21 recognized industry practices.
22

23 **PREPARATION**

24 Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior
25 of each section of pipe and fitting prior to assembly.
26

27 **ERECTION**

28 Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a
29 window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute
30 piping as required to clear such interferences. Coordinate locations of plumbing piping with piping,
31 ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult
32 drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other
33 architectural details before installing piping.
34

35 Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of
36 elastomeric pipe insulation.
37

38 Maintain piping in clean condition internally during construction.
39

40 Provide clearance for installation of insulation, access to valves and piping specialties.
41

42 Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and
43 contract without damage to itself, equipment, or building.
44

45 Do not route piping through transformer vaults or above transformers, panelboards, or switchboards,
46 including the required service space for this equipment, unless the piping is serving this equipment
47

48 Install all valves and piping specialties, including items furnished by others, as specified and/or detailed.
49 Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and
50 systems installed by others where same requires the piping services indicated in this section.
51
52

1 **MECHANICAL HUBLESS PIPE CONNECTIONS**
 2 Place the gasket on the end of one pipe or fitting and the clamp assembly on the end of the other pipe or
 3 fitting. Firmly seat the pipe or fitting ends against the integrally molded shoulder inside the neoprene
 4 gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturers
 5 recommended torque.
 6

7 **SANITARY WASTE AND VENT**
 8 Flush piping inlets (floor drains, hub drains, mop basins, fixtures, etc.) with high flow of water at
 9 completion of project to demonstrate full flow capacity. Remove blockages and make necessary repairs
 10 where flow is found to be impeded.
 11

12 **PIPING SYSTEM LEAK TESTS**
 13 Isolate or remove components from system which are not rated for test pressure. Perform final testing for
 14 medical and lab gas with all system components in place. Test piping in sections or entire system as
 15 required by sequence of construction. Do not insulate or conceal pipe until it has been successfully tested.
 16

17 If required for the additional pressure load under test, provide temporary restraints at fittings or expansion
 18 joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves
 19 which may be exposed to isolate potential leaks.
 20

21 For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents
 22 or loosening of flanges/unions. Measure and record test pressure at the high point in the system.
 23

24 For air or nitrogen tests, gradually increase the pressure to not more than one half of the test pressure; then
 25 increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure
 26 is reached. Examine all joints and connections with a soap bubble solution or equivalent method. System
 27 will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the
 28 test period.
 29

30 Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking
 31 will not be acceptable.
 32

33 All pressure tests are to be documented.
 34

	Test	<u>Initial Test</u>		<u>Final Test</u>	
<u>System</u>	<u>Medium</u>	<u>Pressure</u>	<u>Duration</u>	<u>Pressure</u>	<u>Duration</u>
Sanitary Waste and Vent	Water	N/A		10' water	2 hr

38
 39 **CONSTRUCTION VERIFICATION ITEMS**
 40 Contractor is responsible for utilizing the construction verification checklists supplied under specification
 41 Section 22 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01
 42 or 01 91 02.
 43

44 **END OF SECTION**
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SECTION 22 14 00
FACILITY STORM DRAINAGE
BASED ON DFD MASTER SPECIFICATION DATED 4/6/18

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PART 1 - GENERAL

SCOPE

This section contains specifications for plumbing pipe and pipe fittings for this project. Included are the following topics:

PART 1 - GENERAL

- Scope
- Reference
- Reference Standards
- Shop Drawings
- Quality Assurance
- Delivery, Storage, and Handling
- Design Criteria
- Welder Qualifications

PART 2 - PRODUCTS

- Storm and Clear Water Waste

PART 3 - EXECUTION

- General
- Preparation
- Erection
- Solvent Welded Pipe Joints
- Mechanical Hubless Pipe Connections
- Piping System Leak Tests
- Construction Verification Items

RELATED WORK

- Section 01 91 01 or 01 91 02 – Commissioning Process
- Section 22 08 00 – Commissioning of Plumbing
- 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
- 22 05 14 - Plumbing Specialties

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

- ANSI A21.4
- ANSI A21.11
- ANSI A21.51
- ANSI B16.3 Malleable Iron Threaded Fittings
- ANSI B16.4 Cast Iron Threaded Fittings
- ANSI B16.5 Pipe Flanges and Flanged Fittings
- ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
- ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
- ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
- ASTM A74 Cast Iron Soil Pipe and Fittings
- ASTM A105 Forgings, Carbon Steel, for Piping Components
- ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings

1	ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated
2		Temperatures
3	ASTM A861	High Silicon Iron Pipe and Fittings
4	ASTM A888	Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent
5		Piping Applications
6	ASTM B32	Solder Metal
7	ASTM B88	Seamless Copper Water Tube
8	ASTM B306	Copper Drainage Tube (DWV)
9	ASTM B813	Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
10	ASTM C76	Reinforced Concrete Culvert, Storm Drain and Sanitary Pipe
11	ASTM C443	Joints for Circular Concrete Pipe Sewer and Culvert Pipe Using Rubber Gaskets
12	ASTM C564	Rubber Gaskets for Cast Iron Soil Pipe and Fittings
13	ASTM C1540	Heavy Duty Shielded Couplings for Joining Hubless Cast Iron Soil Pipe and Fittings
14	ASTM D1785	Poly Vinyl Chloride (PVC) Plastic Pipe
15	ASTM D2321	Underground Installation of Flexible Thermoplastic Sewer Pipe
16	ASTM D2241	Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
17	ASTM D2464	Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
18	ASTM D2466	Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
19	ASTM D2513	Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
20	ASTM D2564	Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
21	ASTM D2657	Heat Fusion Joining of Polyolefin Pipe and Fittings
22	ASTM D2665	Poly Vinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe and Fittings
23	ASTM D2729	Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
24	ASTM D2774	Recommended Practice for Underground Installation of Thermoplastic Pressure Piping
25	ASTM D2855	Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
26	ASTM D3034	Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
27	ASTM D3139	Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
28	ASTM D3212	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
29	ASTM D3311	Drain, Waste and Vent (DWV) Plastic Fitting Patterns
30	ASTM F2618	CPVC Pipe and Fittings for Chemical Waste Drainage Systems
31	ASTM D4101	Propylene Plastic Injection and Extrusion Materials
32	ASTM F405	Corrugated Polyethylene (PE) Tubing and Fittings
33	ASTM F437	Threaded Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80
34	ASTM F438	Socket Type Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 40
35	ASTM F441	Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe, Schedules 40 and 80
36	ASTM F656	Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and
37		Fittings
38	CISPI 301	Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and
39		Vent Piping Applications
40	CISPI 310	Couplings For Use In Connection With Hubless Cast Iron Soil Pipe And Fittings For
41		Sanitary And Storm Drain, Waste And Vent Piping Applications
42		

43 **SHOP DRAWINGS**

44 Schedule from the contractor indicating the ASTM, AWWA or CISPI specification number of the pipe
 45 being proposed along with its type and grade if known at the time of submittal, and sufficient information
 46 to indicate the type and rating of fittings for each service.

47
 48 Statement from manufacturer on his letterhead that pipe furnished meets the ASTM, AWWA or CISPI
 49 specification contained in this section.

51 **QUALITY ASSURANCE**

52

1 Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and
2 Substitutions.

3
4 Order all copper, cast iron, steel, PVC and polyethylene pipe with each length marked with the name or
5 trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order
6 number, metal or alloy designation, temper, size, and name of supplier.

7
8 Any installed material not meeting the specification requirements must be replaced with material that meets
9 these specifications without additional cost to the State.

10
11 **DELIVERY, STORAGE, AND HANDLING**

12 Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

13
14 Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid
15 condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not
16 damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect
17 fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

18
19 Offsite storage agreements will not relieve the contractor from using proper storage techniques.

20
21 Storage and protection methods must allow inspection to verify products.

22
23 **DESIGN CRITERIA**

24 Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM, AWWA or
25 CISPI specifications as listed in this specification.

26
27 Construct all piping for the highest pressures and temperatures in the respective system.

28
29 Piping that is not in accordance with ASTM E-84/UL723 for flame spread of <25 and smoke development
30 of <50 shall not be utilized in ventilation plenum spaces, including plenum ceilings.

31
32 Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a
33 centerline radius of 1.5 pipe diameters.

34
35 Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted
36 at Contractor's option. Where the grade or type is not specified, Contractor may choose from those
37 commercially available.

38
39 Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn)
40 temper copper tubing may be substituted at Contractor's option.

41
42 **WELDER QUALIFICATIONS**

43 Welding procedures, welders, and welding operators for all building service piping to be in accordance
44 with certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of
45 ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for
46 Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding
47 Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of
48 ASME B31.9 Building Services Piping.

49
50 Before any polyethylene fusion welding is performed, Contractor to submit certification that the welders to
51 be used on this project have successfully demonstrated proper welding procedures in accordance with the
52 Code of Federal Regulations, Title 49, Part 192, Section 192.285.

53

1 The Architect or Engineer reserves the right to test the work of any welder employed on the project, at the
2 State's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from
3 doing further welding on the project and all defective welds replaced.
4

6 **PART 2 - PRODUCTS**

8 **STORM AND CLEARWATER WASTE and VENT**

9 **INTERIOR ABOVE GROUND:**

10 Hubless cast iron soil pipe and fittings, ASTM A888; with no-hub couplings, CISPI 301, CISPI 310,
11 ASTM A74. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute.
12 Cast iron piping and fittings shall be of A B & I Foundry, Charlotte Pipe and Foundry, or Tyler Pipe
13 manufacturers.
14

16 **PART 3 - EXECUTION**

18 **GENERAL**

19 Install pipe and fittings in accordance with reference standards, manufacturers recommendations and
20 recognized industry practices.
21

22 **PREPARATION**

23 Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior
24 of each section of pipe and fitting prior to assembly.
25

26 **ERECTION**

27 Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a
28 window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute
29 piping as required to clear such interferences. Coordinate locations of plumbing piping with piping,
30 ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult
31 drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other
32 architectural details before installing piping.
33

34 Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of
35 elastomeric pipe insulation.
36

37 Install underground warning tape 6"-12" below finished grade above all exterior below ground piping.
38 Where existing underground warning tape is encountered, repair and replace.
39

40 Maintain piping in clean condition internally during construction.
41

42 Provide clearance for installation of insulation, access to valves and piping specialties.
43

44 Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and
45 contract without damage to itself, equipment, or building.
46

47 Do not route piping through transformer vaults or above transformers, panelboards, or switchboards,
48 including the required service space for this equipment, unless the piping is serving this equipment
49

50 Install all valves and piping specialties, including items furnished by others, as specified and/or detailed.
51 Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and
52 systems installed by others where same requires the piping services indicated in this section.
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MECHANICAL HUBLESS PIPE CONNECTIONS

Place the gasket on the end of one pipe or fitting and the clamp assembly on the end of the other pipe or fitting. Firmly seat the pipe or fitting ends against the integrally molded shoulder inside the neoprene gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturers recommended torque.

PIPING SYSTEM LEAK TESTS

Isolate or remove components from system which are not rated for test pressure. Perform final testing for medical and lab gas with all system components in place. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal pipe until it has been successfully tested.

If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves which may be exposed to isolate potential leaks.

For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

For air or nitrogen tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

All pressure tests are to be documented.

System	Test Medium	Initial Test		Final Test	
		Pressure	Duration	Pressure	Duration
Clearwater Waste and Vent	Water	N/A		10' water	2 hr
Storm and Clearwater Waste	Water	N/A		10' water	2 hr

CONSTRUCTION VERIFICATION ITEMS

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 22 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

END OF SECTION

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SECTION 22 42 00
COMMERCIAL PLUMBING FIXTURES
BASED ON DFD MASTER SPECIFICATION DATED 10/1/12

PART 1 - GENERAL

SCOPE

This section includes specifications for plumbing fixtures, faucets and trim.

PART 1 - GENERAL

- Scope
- Related Work
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data
- Design Criteria
- Energy Efficiency Requirements

PART 2 - PRODUCTS

- Plumbing Fixtures

PART 3 - EXECUTION

- Installation
- Construction Verification Items

RELATED WORK

- Section 01 91 01 or 01 91 02 – Commissioning Process
- Section 22 08 00 – Commissioning of Plumbing
- Section 22 11 00 - Facility Water Distribution
- Section 22 13 00 - Facility Sanitary Sewerage
- Section 22 14 00 - Facility Storm Drainage
- Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
- Section 22 05 14 - Plumbing Specialties

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

Plumbing products requiring approval by the State of Wisconsin Dept. of Safety and Professional Services must be approved or have pending approval at the time of shop drawing submission.

SHOP DRAWINGS

Include data concerning sizes, utility sizes, rough in-dimensions, capacities, materials of construction, ratings, weights, trim, finishes, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

DESIGN CRITERIA

- ANSI A112.6.1M-88 - Supports for Off-the Floor Plumbing Fixtures for Public Use.
- ANSI A112.18.1-94 - Finished and Rough Brass Plumbing Fixture Fittings.

- 1 ANSI A112.19.1-90 - Enameled Cast Iron Plumbing Fixtures.
- 2 ANSI A112.19.2M-82 - Vitreous China Plumbing Fixtures.
- 3 ANSI A112.19.5-79(R1990) - Trim for Water Closet Bowls, Tanks and Urinals.
- 4 ANSI Z124.1-87 - Plastic Bathtub Units.
- 5 ANSI Z124.2-87 - Plastic Shower Receptors and Shower Stalls.
- 6 ARI-1010-94 - Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers.
- 7 ASSE 1011-93 - Hose Connection Vacuum Breakers.
- 8 ASSE 1014-90 - Handheld Showers.
- 9 ASSE 1035-93 - Laboratory Faucet Backflow Preventers.

10
11

12 **ENERGY EFFICIENCY REQUIREMENTS**

13 Plumbing fixtures must meet the following maximum water usage requirements which are based upon
14 Federal Energy Management Program (FEMP) performance requirements.

- 15 a. Lavatory Faucets, flow of 2 gpm or less and .25 gallon per cycle or less (based on inlet pressure of 60
16 p.s.i.)
- 17 b. Showerheads, flow of 2.2 gpm or less (based on inlet pressure of 80 p.s.i.)
- 18 c. Urinal Flush Valves, 1.0 gallon per flush or less.
- 19 d. Water Closet Flush Valves, 1.6 gallon per flush or less.

20
21

22 **PART 2 - PRODUCTS**

23

24 **PLUMBING FIXTURES**

25 Manufacturers: Fixture descriptions establish fixture type, quality, materials, features and size. Products of
26 the following manufacturers determined to be equal by the Architect/Engineer will be accepted.

27

- 28 • Water Closets - American Standard, Kohler, Zurn.
- 29 • Water Closet Seats - Bemis, Beneke, Centoco, Olsonite Sperzel.
- 30 • Urinals – American Standard, Kohler, Zurn.
- 31 • Lavatories – American Standard, Kohler, Zurn.
- 32 • Faucets - Chicago Faucet, Kohler, Speakman, Symmons, Zurn.
- 33 • Drains - Chicago Faucet, Engineered Brass Co., Kohler, McGuire.
- 34 • Stops and Supplies - Chicago Faucet Co., McGuire. (Heavy Duty Type Only)
- 35 • Flush Valves - Coyne & Delany, Sloan Royal, Zurn AV.
- 36 • Traps - Kohler, McGuire, Dearborn, Engineered Brass Co. (17 gauge Min.)
- 37 • Carriers and Supports - Josam, Smith, Wade, Watts Drainage, Zurn.
- 38 • Washfountains - Acorn, Bradley.
- 39 • Sinks - American Standard, Elkay, Just, Kohler.
- 40 • Laundry Trays - Fiat, Mustee, Stern-Williams.
- 41 • Service Sinks - American Standard, Crane, Kohler.
- 42 • Mop Basins - Fiat, Mustee, Stern-Williams.
- 43 • Showers - Leonard, Powers, Speakman, Symmons.
- 44 • Multiple Showers - Acorn, Bradley, Willoughby.
- 45 • Bathtubs - American Standard, Crane, Kohler.
- 46 • Molded Tub and Shower Units – Aker, Aqua Glass, Fiat, Kohler, Lasco.
- 47 • Drinking Fountains - Elkay, Halsey Taylor, Haws, Filtrine, Oasis, Sunroc.
- 48 • Drinking Fountains (China) - American Standard, Crane, Kohler, Sunroc.
- 49 • Electric Water Coolers - Elkay, Halsey Taylor, Haws, Filtrine, Oasis, Sunroc.
- 50 • Security Fixtures - Acorn, Bradley, Metcraft, Willoughby.
- 51 • Emergency Eyewash Fountains and Showers - Bradley, Chicago Faucet Co., Guardian, Haws,
52 Speakman.

53

54 **WATER CLOSETS**

1 WC-1 - Wall hung back outlet white vitreous china siphon jet water closet with elongated bowl, barrier free
2 adjusted for 16-1/2" bowl height. 1-1/2" top spud, 2-1/4" passageway and 1.6 gallon flush. Handle of the
3 flush valve to be ADA compliant for activation force and located to the wide side of the stall. Flush valve
4 handle 13" above rim.

- 5 • Fixture: Kohler Kingston K-4330.
- 6 • Flush Valve: Sloan Royal 113-1.5-YK.
- 7 • Seat: Bemis 1655-SS/C white solid plastic open front.
- 8 • Carrier: Smith commercial grade adjusted for 15" bowl height.

9
10
11 **LAVATORIES**

12
13 Lavatory faucets must meet maximum water usage requirements of 2 gpm flow or less and .25 gallon per
14 cycle or less (based on inlet pressure of 60 p.s.i.)
15

16 L-1 - Self-rimming counter mount white vitreous china lavatory with 4" on center faucet openings.

- 17 • Fixture: Integral bowl provided by others.
- 18 • Faucet: Chicago Faucet No. 802-336CP. Self-closing.
- 19 • Drain: Kohler K-13885 perforated strainer and 1-1/4" tailpiece.
- 20 • Trap: 1-1/4"x1-1/2" 17 ga. cast brass trap and tubular wall bend. With C.O. plug.
- 21 • Supplies & Stops: Chicago Faucet No. 1017CP.

22
23 **ELECTRIC WATER COOLERS**

24 EWC-1 - Wall mounted bi-level electric water cooler with stainless steel basin and integrated bottle filling
25 station, self-closing front and side mounted push bars, wall hanger and 1-1/4" tailpiece, rated for 8.0 GPH at
26 80 degree inlet water, 90 degree ambient and 50 degree leaving water, 120/60/1.

- 27 • Fixture: Elkay LZSTL8WSLK
- 28 • Trap: 1-1/4"x1-1/4" 17 ga. cast brass trap.
- 29 • Stop/Supply: Chicago Faucet Co. 1013-CP or 1/2" ball valve with 3/8" riser (concealed).

30
31
32 **PART 3 - EXECUTION**

33
34 **INSTALLATION**

35 Install plumbing fixtures in accordance with manufacturers instructions. Set level and plumb. Secure in place
36 to counters, floors and walls providing solid bearing and secure mounting. Bolt fixture carriers to floor and
37 wall. Secure rough-in fixture piping to prevent movement of exposed piping.
38

39 Install each fixture with trap easily removable for servicing and cleaning. Install fixture stops in readily
40 accessible location for servicing.
41

42 Install barrier free fixtures in compliance with IBC 1108 and 3408, COMM 52, 69 and Federal ADA
43 Accessibility Guidelines. Install barrier free lavatory traps parallel and adjacent to wall and supplies and stops
44 elevated to 27" above floor to avoid contact by wheelchair users.
45

46 Provide unions at water connections to drinking fountains and electric water coolers.
47

48 Each fixture shall have a stop valve installation to control the fixture. Stop valves shall be heavy duty type
49 with brass stems and screwed or sweat inlet connections. Compression type inlets are not acceptable.
50

51 Cover pipe penetrations with escutcheons. Exposed traps, stops, piping and escutcheons to be chrome plated
52 brass, same items in concealed locations may be of rough brass finish.
53

1 Set floor mounted water closets, floor mounted service sinks; counter mounted lavs and sinks; lav and sink
2 faucets and drains with full setting bed of flexible non-staining plumber's putty. Cover exposed water closet
3 bolts with bolt covers.

4
5 Seal openings between walls, floors and fixtures with mildew-resistant silicone sealant same color as fixture.
6

7 Test fixtures to demonstrate proper operation. Replace malfunctioning units or components. Adjust valves
8 for intended water flow rate to fixtures without splashing, noise or overflow. Adjust self-closing lavatory
9 faucets to 15 second cycle. Adjust shower valve temperature limit stops to 110 degree maximum outlet
10 temperature.

11
12 Protect fixtures during construction. At completion clean plumbing fixtures and trim using manufacturer's
13 recommended cleaning methods and materials.

14
15 **CONSTRUCTION VERIFICATION ITEMS**
16 Contractor is responsible for utilizing the construction verification checklists supplied under specification
17 Section 22 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01
18 or 01 91 02.

19
20

END OF SECTION

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3 **SECTION 23 05 00**
4 **COMMON WORK RESULTS FOR HVAC**
5 **BASED ON DFD MASTER SPECIFICATION DATED 3/28/2022**

6
7 **PART 1 - GENERAL**
8

9 **SCOPE**

10 This section includes information common to two or more technical specification sections or items that are
11 of a general nature, not conveniently fitting into other technical sections. Included are the following topics:

12 **PART 1 - GENERAL**

13 Scope
14 Related Work
15 Reference
16 Reference Standards
17 Quality Assurance
18 Continuity of Existing Services
19 Protection of Finished Surfaces
20 Sleeves and Openings
21 Sealing and Fire Stopping
22

23
24 Submittals
25 Off Site Storage
26 Certificates and Inspections
27 Operating and Maintenance Data
28 Record Drawings

29 **PART 2 - PRODUCTS**

30 Access Panels and Doors
31 Identification
32 Sealing and Fire Stopping

33 **PART 3 - EXECUTION**

34 Demolition
35
36
37 Cutting and Patching
38 Building Access
39 Equipment Access
40 Coordination
41 Identification
42 Lubrication
43 Sleeves and Openings
44 Sealing and Fire Stopping
45 Agency Training

46
47 **RELATED WORK**

48 Section 01 91 01 or 01 91 02 – Commissioning Process
49 Section 07 84 00 - Fire Stopping
50 Section 23 33 00 - Air Duct Accessories.
51

52 **REFERENCE**

53 Applicable provisions of Division 1 govern work under this section.
54

55 **REFERENCE STANDARDS**

56 Abbreviations of standards organizations referenced in other sections are as follows:
57
58

59 AABC Associated Air Balance Council
60 ABMA American Boiler Manufacturers Association
61 ADC Air Diffusion Council
62 AGA American Gas Association
63 AMCA Air Movement and Control Association
64 ANSI American National Standards Institute

1	ARI	Air-Conditioning and Refrigeration Institute
2	ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
3	ASME	American Society of Mechanical Engineers
4	ASTM	American Society for Testing and Materials
5	AWWA	American Water Works Association
6	AWS	American Welding Society
7	CGA	Compressed Gas Association
8	CTI	Cooling Tower Institute
9	EPA	Environmental Protection Agency
10	GAMA	Gas Appliance Manufacturers Association
11	IEEE	Institute of Electrical and Electronics Engineers
12	ISA	Instrument Society of America
13	MCA	Mechanical Contractors Association
14	MICA	Midwest Insulation Contractors Association
15	MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
16	NBS	National Bureau of Standards
17	NEBB	National Environmental Balancing Bureau
18	NEC	National Electric Code
19	NEMA	National Electrical Manufacturers Association
20	NFPA	National Fire Protection Association
21	SMACNA	Sheet Metal and Air Conditioning Contractors' National Association. Inc.
22	UL	Underwriters Laboratories Inc.
23	ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops
24	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
25	UL1479	Fire Tests of Through-Penetration Firestops
26	UL723	Surface Burning Characteristics of Building Materials

27
28 **QUALITY ASSURANCE**

29 Refer to Division 1, General Conditions, Equals and Substitutions.

30
31 Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings,
32 or engineering parameters from those indicated on the contract documents, the contractor is responsible for
33 all costs involved in integrating the equipment or accessories into the system and for obtaining the
34 performance from the system into which these items are placed. This may include changes found necessary
35 during the testing, adjusting, and balancing phase of the project.

36
37 **CONTINUITY OF EXISTING SERVICES**

38 Do not interrupt or change existing services without prior written approval from the UW Project
39 Representative. When interruption is required, coordinate the down-time with the user agency to minimize
40 disruption to their activities. Unless specifically stated, all work involved in interrupting or changing
41 existing services is to be done during normal working hours.

42
43
44 **PROTECTION OF FINISHED SURFACES**

45 Refer to Division 1, General Requirements, Protection of Finished Surfaces.

46
47 Furnish one can of touch-up paint for each different color factory finish which is to be the final finished
48 surface of the product. Deliver touch-up paint with other "loose and detachable parts" as covered in the
49 General Requirements.

50
51 **SLEEVES AND OPENINGS**

52 Refer to Division 1, General Requirements, Sleeves and Openings.

53
54 **SEALING AND FIRE STOPPING**

55 Sealing and fire stopping of sleeves/openings between ductwork, piping, etc. and the sleeve, structural or
56 partition opening shall be the responsibility of the contractor whose work penetrates the opening. Provide
57 all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with
58 section 07 84 00 Fire Stopping.

59
60 **SUBMITTALS**

61 Refer to Division 1, General Conditions, Submittals.

62
63 Submit for all equipment and systems as indicated in the respective specification sections, marking each
64 submittal with that specification section number. Mark general catalog sheets and drawings to indicate

1 specific items being submitted and proper identification of equipment by name and/or number, as indicated
2 in the contract documents.

3
4 Before submitting electrically powered equipment, verify that the electrical power and control requirements
5 for the equipment are in agreement with the motor starter schedule on the electrical drawings. Include a
6 statement on the shop drawing transmittal to the architect/engineer that the equipment submitted and the
7 motor starter schedules are in agreement or indicate any discrepancies. See related comments in Section
8 23 05 13 in Part 1 under Electrical Coordination.
9

10 Include wiring diagrams of electrically powered equipment.

11 Submit sufficient quantities of shop drawings to allow the following distribution:

- 12 • Operating and Maintenance Manuals 2 copies
- 13 • Testing, Adjusting and Balancing Contractor 1 copy
- 14 • Division of Facilities Development 1 copy
- 15 • A/E 1 copy

16 **OFF SITE STORAGE**

17 Prior approval by UW and the A/E will be needed. The contractor shall submit Storage Agreement Form
18 AD-BDC-74 to UW for consideration of off site materials storage.
19

20 Generally, ductwork, metal for making ductwork, duct lining, sleeves, pipe/pipe fittings and similar
21 rough-in material will not be accepted for off site storage. For material that can be stored off site, no
22 material will be accepted for off site storage unless shop drawings for that material have been approved.
23

24 **CERTIFICATES AND INSPECTIONS**

25 Refer also to Division 1, General Conditions, Permits, Regulations, Utilities and Taxes.
26

27 Obtain and pay for all required State installation inspections except those provided by the
28 Architect/Engineer in accordance with code. Deliver originals of these certificates to the Division Project
29 Representative. Include copies of the certificates in the Operating and Maintenance Instructions.
30

31 **OPERATION AND MAINTENANCE DATA**

32 All operations and maintenance data shall comply with the submission and content requirements specified
33 under section GENERAL REQUIREMENTS.
34

35 In addition to the general content specified under GENERAL REQUIREMENTS supply the following
36 additional documentation:

- 37 1. Records of tests performed to certify compliance with system requirements
- 38 2. Certificates of inspection by regulatory agencies
- 39 3. Copies of all approved shop drawings.
- 40 4. Manufacturer's wiring diagrams for electrically powered equipment
- 41 5. Temperature control record drawings and control sequences
- 42 6. Parts lists for manufactured equipment
- 43 7. Warranties
- 44 8. Additional information as indicated in the technical specification sections

45 **RECORD DRAWINGS**

46 Refer to Division 1, General Requirements, Record Drawings.
47

48 In addition to the data indicated in the General Requirements, maintain temperature control record
49 drawings on originals prepared by the installing contractor/subcontractor. Include copies of these record
50 drawings with the Operating and Maintenance manuals.
51

52 **PART 2 - PRODUCTS**

53 **ACCESS PANELS AND DOORS**

1
2
3 **LAY-IN CEILINGS:**

4 Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Section 09500 are
5 sufficient; no additional access provisions are required unless specifically indicated.
6

7 **CONCEALED SPLINE CEILINGS:**

8 Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling
9 system used will be provided under Section 09500.
10

11 **METAL PAN CEILINGS:**

12 Removable sections of ceiling tile held in position by a pressure fit will be provided under Section 09500.
13

14 **PLASTER WALLS AND CEILINGS:**

15 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general
16 applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver
17 operated cam latch for general applications, key lock for use in public areas, UL listed for use in fire rated
18 partitions if required by the application. Use the largest size access opening possible, consistent with the
19 space and the equipment needing service; minimum size is 12" by 12".
20

21 **IDENTIFICATION**

22 **STENCILS:**

23 Not less than 1 inch high letters/numbers for marking pipe and equipment.
24
25

26 **SNAP-ON PIPE MARKERS:**

27 Cylindrical self-coiling plastic sheet that snaps over piping insulation and is held tightly in place without
28 the use of adhesive, tape or straps. Not less than 1 inch high letters/numbers and flow direction arrows for
29 piping marking. W. H. Brady, Seton, Marking Services, or equal.
30

31 **ENGRAVED NAME PLATES:**

32 White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting,
33 Setonply Style 2060 by Seton Name Plate Company or Emedolite- Style EIP by EMED Co., or equal by
34 Marking Services, or W. H. Brady.
35

36
37 **CEILING and ACCESS DOOR LABELS:**

38 Clear polyester tape 3/4" width with black printing W. H. Brady or equal.
39

40 **SEALING AND FIRE STOPPING**

41 **FIRE AND/OR SMOKE RATED PENETRATIONS:**

42 Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance
43 with section 07 84 00 "Fire Stopping".
44

45
46 **NON-RATED PENETRATIONS:**

47 **Pipe Penetrations Through Below Grade Walls:**

48 In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking
49 synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the
50 cored opening or a water-stop type wall sleeve.
51

52 **Pipe Penetrations:**

53 At pipe penetrations of non-rated interior walls, floors and exterior walls above grade, use urethane caulk in
54 annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood walls where
55 sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.
56

57 **Duct Penetrations:**

58 Annular space between duct (with or without insulation) and the non-rated walls or floor opening shall not
59 be larger than 2". Where existing openings have an annular space larger than 2", the space shall be patched
60 to match existing construction to within 2" around the duct.
61

62 Where shown or specified, pack annular space with fiberglass batt insulation or mineral wool insulation.
63 Provide 4" sheet metal escutcheon around duct on both sides of partition or floor to cover annular space.
64

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2
3 **PART 3 - EXECUTION**
4

5 **DEMOLITION**

6 Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to
7 be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition
8 to minimize the amount of contamination of the occupied space. Where pipe or duct is removed and not
9 reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with
10 the user agency to minimize disruption to the existing building occupants.

11
12 All pipe, wiring and associated conduit, insulation, ductwork, and similar items demolished, abandoned, or
13 deactivated are to be removed from the site by the Contractor. All piping and ductwork specialties are to
14 be removed from the site by the Contractor unless they are dismantled and removed or stored by the user
15 agency. All designated equipment is to be turned over to the user agency for their use at a place and time
16 so designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to
17 that existing before work began.

18
19 Where existing control devices, piping, or wiring are discontinued from use, remove, and turn over to
20 owner. If owner does not want them remove from premises. Remove any previously abandoned control
21 devices in a similar manner. In addition to the hardware removal, the software points and user view will
22 need to be revised to reflect the removal of devices in the project scope.

23
24 **CUTTING AND PATCHING**

25 Refer to Division 1, General Requirements, Cutting and Patching.

26
27 **BUILDING ACCESS**

28 Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the
29 building access was not previously arranged and must be provided by this contractor, restore any opening
30 to its original condition after the apparatus has been brought into the building.

31
32 **EQUIPMENT ACCESS**

33 Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance and
34 service. Coordinate the exact location of wall and ceiling access panels and doors with the General
35 Contractor, making sure that access is available for all equipment and specialties. Access doors in general
36 construction are to be furnished by the Mechanical Contractor and installed by the General Contractor.

37
38
39 For equipment that is accessed above acoustical lay in ceilings or access doors, label the ceiling tile grid at
40 the ceiling tile that is to be removed for access to the equipment or the access door. The label shall be pre-
41 printed using clear polyester tape with black bold 28 size font for ceilings under 12 feet. For ceilings over
42 12 feet high, use bold 40 size font. For accessible ceilings, use an arrow to point at ceiling tile to be
43 removed for access. Label shall match equipment tag designation used on mechanical plans..

44
45 **COORDINATION**

46 Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not
47 limited to, diffusers, register, grilles, and recessed or semi-recessed heating and/or cooling terminal units
48 installed in/on architectural surfaces.

49
50 Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated
51 and that interferes with other contractor's work shall be removed or relocated at the installing contractor's
52 expense.

53
54 Cooperate with the test and balance agency in ensuring Section 23 05 93 specification compliance. Verify
55 system completion to the test and balance agency (flushing, pressure testing, chemical treatment, filling of
56 liquid systems, proper pressurization and air venting of hydronic systems, clean filters, clean strainers, duct
57 and pipe systems cleaned, controls adjusted and calibrated, controls cycled through their sequences, etc.),
58 ready for testing, adjusting and balancing work. Install dampers, shutoff and balancing valves, flow
59 measuring devices, gauges, temperature controls, etc., required for functional and balanced systems.
60 Demonstrate the starting, interlocking and control features of each system so the test and balance agency
61 can perform its work.

62
63
64 **IDENTIFICATION**

1 Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one
2 coat of black enamel against a light background or white enamel against a dark background. Use a primer
3 where necessary for proper paint adhesion. Do not label equipment such as cabinet heaters and ceiling fans
4 in occupied spaces.
5

6 Where stenciling is not appropriate for equipment identification, engraved name plates may be used.
7

8 Identify piping not less than once every 30 feet, not less than once in each room, adjacent to each access
9 door or panel, and on both side of the partition where exposed piping passes through walls, floors or roofs.
10 Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a
11 light background or white enamel against a dark background for stenciling, or provide snap-on pipe
12 markers as specified in Part 2 – Products.
13

14 Identify valves with brass tags bearing a system identification and a valve sequence number. Valve tags
15 are not required at a terminal device unless the valves are greater than ten feet from the device or located in
16 another room not visible from the terminal unit. Provide a typewritten valve schedule indicating the valve
17 number and the equipment or areas supplied by each valve; locate schedules in each mechanical room and
18 in each Operating and Maintenance manual. Schedules in mechanical rooms to be framed under clear
19 plastic.
20

21 Use engraved name plates to identify control equipment.
22

23 Label fire, smoke and combination fire smoke dampers on the exterior surface of ductwork directly
24 adjacent to access doors using a minimum of 0.5 inch height lettering reading, “SMOKE DAMPER” or
25 “FIRE DAMPER”. Smoke and combination fire smoke dampers shall also include a second line listing the
26 individual damper tag. The tags must be coordinated with the mechanical schedules. Utilize stencils or
27 manufactured labels. All other forms of identification are unacceptable. All labels shall be clearly visible
28 from the ceiling access point. For dampers that are accessed above acoustical lay in ceilings, label the
29 ceiling tile grid at the ceiling tile that is to be removed for access to the damper and use an arrow to point at
30 the tile to be removed for access. The label shall be pre-printed using clear polyester tape with black bold
31 28 size font for ceilings under 12 feet. For ceilings over 12 feet high, use bold 40 size font. Ceiling tile
32 label shall match damper tag designation used on mechanical plans.
33
34

35 **LUBRICATION**

36 Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is
37 operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the
38 manufacturer's instructions until the work is accepted by UW. Maintain a log of all lubricants used and
39 frequency of lubrication; include this information in the Operating and Maintenance Manuals at the
40 completion of the project.
41

42 **SLEEVES AND OPENINGS**

43 **DUCT SLEEVES:**

44 Duct sleeves are not required in non-rated partitions or floors.
45
46

47 **SEALING AND FIRE STOPPING**

48 **FIRE AND/OR SMOKE RATED PENETRATIONS**

49 Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance
50 with section 07 84 00 Fire Stopping.
51

52 **NON-RATED PENETRATIONS:**

53
54 At all interior walls and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both
55 sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening
56 and the pipe or insulation is completely blocked.
57

58 Duct penetrations through non-rated partitions shall require sheet metal escutcheons with fiberglass or
59 mineral wool insulation fill for spaces that include laboratories, clean rooms, animal rooms, kitchens, cart
60 wash rooms, janitor closets, toilet rooms, mechanical rooms, conference rooms, private consultation rooms,
61 where ducts are exposed and where noted on drawings elsewhere.
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AGENCY TRAINING

All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01 or 01 91 02.

END OF SECTION

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SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC
BASED ON DFD MASTER SPECIFICATION DATED 4/3/2023

PART 1 - GENERAL

SCOPE

This section includes air and water testing, adjusting and balancing for the entire project. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference
- Reference Standards
- Description
- Pre-Installation Meeting and Scheduling
- Pre-Balance Conference
- Submittals

PART 2 - PRODUCTS

- Instrumentation

PART 3 - EXECUTION

- Pre-Construction Testing of Existing Systems
- Preliminary Procedures
- Performing Testing, Adjusting and Balancing
- Deficiencies

RELATED WORK

- Section 01 91 01 or 01 91 02 – Commissioning Process
- Section 23 05 00 Common Work Results for HVAC
- Section 23 07 00 HVAC Insulation
- Section 23 08 00 Commissioning of HVAC

REFERENCE

Applicable provisions of the General Conditions, Supplementary General Conditions and General Requirements in Division 1 govern work under this section.

REFERENCE STANDARDS

- AABC National Standards for Total System Balance, Sixth Edition, 2002.
- ASHRAE ASHRAE Handbook, 2007 HVAC Applications, Chapter 37, Testing Adjusting and Balancing.
- NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems, Seventh Edition, 2005.
- TABB Tab Procedural Guide, First Edition, 2003.

DESCRIPTION

The Contractor will separately contract with an independent test and balance agency to perform all testing, adjusting, and balancing of air and hydronic systems required for this project. Work related to the testing, adjusting, and balancing that must be performed by the installing mechanical contractor is specified in other section of these specifications.

The contractor will perform pre-construction testing on existing systems as described in part 3 of this document. See mechanical sheets for systems requiring testing.

Provide total mechanical systems testing, adjusting and balancing. Requirements include the balance of air and water distribution, adjustment of new and existing systems and equipment to provide design requirements indicated on the drawings, electrical measurement and verification of performance of all mechanical equipment, all in accordance with standards published by AABC, NEBB, or TABB.

Test, adjust and balance all air and hydronic systems so that each room, piece of equipment or terminal device meets the design requirements indicated on the drawings and in the specifications.

1 Accomplish testing, adjusting and balancing work in a timely manner that allows partial occupancy of major
2 buildings, occupancy of one building when the project involves many buildings, and completion of the entire
3 project in the time stated in the Instruction to Bidders and in accordance with the completion schedule
4 established for this project.

5
6 Verify that provisions are being made to accomplish the specified testing, adjusting and balancing work. If
7 problems are found, handle as specified in Part 3 under Deficiencies.

8 9 **QUALITY ASSURANCE**

10 11 **Qualifications**

12 An independent Firm specializing in the Testing and Balancing of HVAC systems for a minimum of 3 years.
13 A Firm not engaged in the commerce of furnishing or providing equipment or material generally related to
14 HVAC work other than that specifically related to installing Testing and Balancing components necessary
15 for work in this section such as, but not limited to sheaves, pulleys, and balancing dampers.

16
17 A certified member of AABC or certified by NEBB or TABB in the specific area of work performed.
18 Maintain certification for the entire duration of the project. If certification of firm or any staff performing
19 work is terminated or expires during the duration of the project, contact UW immediately.

20
21 Technicians on this project must have satisfactorily completed work on a minimum of (3) three projects of
22 at least 50% in size, and of similar complexity. Size is defined as the quantity of each specific individual item
23 requiring testing and balancing such as, but not limited to, equipment, devices, terminal devices, and grilles
24 and diffusers.

25
26 Submit Qualifications of firm and project staff to UW upon requested.

27 28 **PRE-INSTALLATION MEETING AND SCHEDULING**

29 The test and balance agency is required to attend a pre-installation meeting with all other project contractors
30 before the construction process is started. The test and balance agency shall give the Mechanical Contractor
31 a detailed schedule of testing and balancing tasks for incorporation into the project schedule.

32 33 **PRE-BALANCE CONFERENCE**

34 90 days prior to beginning testing, adjusting and balancing, schedule and conduct a conference with the
35 Architect/Engineer, UW's Project Representative and the mechanical system and temperature control system
36 installing Contractors. Provide AE and Commissioning Provider (CxP) with a complete copy of the TAB
37 plan for the project. The objective is final coordination and verification of system operation and readiness
38 for testing, adjusting and balancing procedures and scheduling procedures with the above mentioned parties.
39 Indicate work required to be completed prior to testing, adjusting, and balancing and identify the party
40 responsible for completion of that work.

41 42 **SUBMITTALS**

43 Refer to division 1, General Conditions, Submittals. See also Related Work in this section.

44
45 Submit testing, adjusting and balancing reports bearing the seal and signature of the NEBB, AABC or TABB
46 Certified Test and Balance Supervisor. The reports certify that the systems have been tested, adjusted and
47 balanced in accordance with the referenced standards; are an accurate representation of how the systems have
48 been installed and are operating; and are an accurate record of all final quantities measured to establish normal
49 operating values of the systems.

50
51 Format: Cover page identifying project name, project number and descriptive title of contents. Divide the
52 contents of the report into the below listed divisions:

- 53
54
- 55 • General Information
 - 56 • Summary
 - 57 • Air Systems
 - 58 • Hydronic Systems
 - 59 • Special Systems

60 Contents: Provide the following minimum information, forms and data:

61
62 General Information: Inside cover sheet identifying Test and Balance Agency, Contractor, Architect,
63 Engineer, Project Name and Project Number. Include addresses, contact names and telephone numbers. Also
64 include a certification sheet containing the seal and signature of the Test and Balance Supervisor.

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Summary: Provide summary sheet describing mechanical system deficiencies. Describe objectionable noise or drafts found during testing, adjusting and balancing. Provide recommendations for correcting unsatisfactory performances and indicate whether modifications required are within the scope of the contract, are design related or installation related. List instrumentation used during testing, adjusting and balancing procedures.

The remainder of the report to contain the appropriate standard NEBB, AABC, or TABB forms for each respective item and system. Fill out forms completely. Where information cannot be obtained or is not applicable indicate same.

PART 2 - PRODUCTS

INSTRUMENTATION

Provide all required instrumentation to obtain proper measurements. Application of instruments and accuracy of instruments and measurements to be in accordance with the requirements of NEBB, AABC, or TABB Standards and instrument manufacturer's specifications.

All instruments used for measurements shall be accurate, and calibration histories for each instrument to be available for examination by DD upon request. Calibration and maintenance of all instruments to be in accordance with the requirements of NEBB, AABC, or TABB Standards

PART 3 - EXECUTION

PRE-CONSTRUCTION TESTING OF EXISTING SYSTEMS

Pre-construction testing and balancing will be required for supply and exhaust air systems as indicated on the drawings. Provide both airflow and static pressure measurements for the existing system and verify information in schedules is accurate. Communicate results with architect prior to construction. All testing and balancing to be performed as described in this section.

DAILY REPORTS

Submit to UW's Project Representative daily work activity reports for each day on which testing and balancing work is performed. Reports shall include description of day's activities and description of any system deficiencies.

PRELIMINARY PROCEDURES

Review preconstruction meeting report, applicable construction bulletins, applicable change orders and approved shop drawings of equipment, outlets/inlets and temperature controls.

Check filters for cleanliness, dampers and valves for correct positioning, equipment for proper rotation and belt tension, temperature controls for completion of installation and hydronic systems for proper charge and purging of air.

Notify UW's Project Representative on a daily basis during balancing. Identify deficiencies preventing completion of testing, adjusting and balancing procedures. Do not proceed until systems are fully operational with all components necessary for complete testing, adjusting and balancing. Installing Contractors are required to provide personnel to check and verify system completion, readiness for balancing and assist Balancing Agency in providing specified system performance.

PERFORMING TESTING, ADJUSTING AND BALANCING

Perform testing, adjusting and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards except as may be modified below.

Unless specifically instructed in writing, all work in this specification section is to be performed during the normal workday.

1
2 In areas containing ceilings, remove ceiling tile to accomplish balancing work; replace tile when work is
3 complete and provide new tile for any tile that are damaged by this procedure. If the ceiling construction is
4 such that access panels are required for the work of this section and the panels have not been provided, inform
5 the owner's project representative.
6

7
8 Cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary for
9 adequate performance of procedures. Patch using materials identical to those removed, maintaining vapor
10 barrier integrity and pressure rating of systems.
11

12 In air systems employing filters, blank off sufficient filter area to simulate a pressure drop that is midway
13 between that of a clean filter and that of a dirty filter.
14

15 Measure and record system measurements at the fan and/or pump to determine total flow. Adjust equipment
16 as required to yield specified total flow at terminals. Proceed taking measurements in mains and branches as
17 required for final terminal balancing. Perform terminal balancing to specified flows balancing branch
18 dampers, deflectors, extractors and valves prior to adjustment of terminals.
19

20 Measure and record static air pressure conditions across fans, coils and filters. Indicate in report if cooling
21 coil measurements were made on a wet or dry coil and if filter measurements were made on a clean or dirty
22 filter. Spot check static air pressure conditions directly ahead of terminal units.
23

24 Adjust outside air, return air and relief air dampers for design conditions at both the minimum and maximum
25 settings and record both sets of data. Balance modulating dampers at extreme conditions and record both
26 sets of data. Balance variable air volume systems at maximum air flow rate, full cooling, and minimum flow
27 rate, full heating; record all data.
28

29 Adjust register, grille and diffuser vanes and accessories to achieve proper air distribution patterns and
30 uniform space temperatures free from objectionable noise and drafts within the capabilities of the installed
31 system.
32

33 Provide fan and motor drive sheave adjustments necessary to obtain design performance. Provide drive
34 changes specifically noted on drawings, if any. If work of this section indicates that any drive or motor is
35 inadequate for the application, advise the owner's project representative by giving the representative properly
36 sized motor/drive information (in accordance with manufacturers original service factor and installed motor
37 horsepower requirements); Confirm any change will keep the duct/piping system within its design limitations
38 with respect to speed of the device and pressure classification of the distribution system. Required
39 motor/drive changes not specifically noted on drawings or in specifications will be considered an extra cost
40 and will require an itemized cost breakdown submitted to owner's project representative. Prior authorization
41 is needed before this work is started.
42

43 Areas or rooms designed to maintain positive, negative or balanced air pressures with respect to adjacent
44 spaces, as indicated by the design air quantities, require special attention. Adjust fan drives, distribution
45 dampers, terminals and controls to maintain indicated pressure relationship.
46

47 Final air system measurements to be within the following range of specified cfm:

48 Fans	0% to +10%
49 Supply grilles, registers, diffusers	0% to +10%
50 Return/exhaust grilles, registers	0% to -10%
51 Room pressurization air	-5% to +5%

52
53 Final water system measurements must be within the following range of specified gpm:

54 Heating flow rates	0% to -10%
55 Cooling flow rates	-5% to +5%

56
57 Contact the temperature control Contractor for assistance in operation and adjustment of controls during
58 testing, adjusting and balancing procedures. Cycle controls and verify proper operation and setpoints.
59 Include in report description of temperature control operation and any deficiencies found.
60

61 Permanently mark equipment settings, including damper and valve positions, control settings, and similar
62 devices allowing settings to be restored. Set and lock memory stops.
63

1 Leave systems in proper working order, replacing belt guards, closing access doors and electrical boxes, and
2 restoring temperature controls to normal operating settings.
3
4 Coordinate and assist CxP with all verification activities defined within section (01 91 01, 02) including
5 providing all required sampling data necessary for the commissioning process.
6
7 Verify and record, in the T&B Report, “K” factors for all VAV air terminal devices and air flow stations.
8
9 Verify and record, in the T&B Report, values of damper positions and fan speeds for all characterization
10 curves required in the 23 09 93 control sequences.
11
12 **VAV SUPPLY AND EXHAUST DUCT SYSTEM STATIC PRESSURE SET POINT**
13 For VAV supply and exhaust systems with VAV air terminal devices, determine the minimum required duct
14 static pressure at the DDC static pressure sensor location(s) needed to insure that all VAV air terminals are
15 operating at their design airflows with the most demanding VAV terminal wide open. Provide these static
16 pressure numbers to the DDC temperature controls contractor and record them in the T&B report for each
17 system.
18
19 **DEFICIENCIES**
20 Division 23 00 00 contractor to correct any installation deficiencies found by the test and balance agency that
21 were specified and/or shown on the Contract Documents to be performed as part of that division of work.
22 Test and balance agency will notify the UW's Project Representative of these items and instructions will be
23 issued to the Division 23 00 00 contractor for correction of the deficient work. All corrective work to be done
24 at no cost to the State of Wisconsin. Retest mechanical systems, equipment, and devices once corrective work
25 is complete as specified.
26
27 **FUNCTIONAL PERFORMANCE TESTING**
28 Contractor is responsible for utilizing the functional performance test forms supplied under specification
29 Section 23 08 00 Commissioning of HVAC in accordance with the procedures defined for functional
30 performance testing in Section 01 91 01 or 01 91 02. Notify the A/E and commissioning provider 5 business
31 days prior to performing functional performance testing so that they may witness.
32
33 **END OF SECTION**

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SECTION 23 07 00
HVAC INSULATION
BASED ON DFD MASTER SPECIFICATION DATED 11/18/2022

PART 1 - GENERAL

SCOPE

This section includes insulation specifications for heating, ventilating and air conditioning piping, ductwork and equipment. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Description
- Definitions
- Shop Drawings
- Operation and Maintenance Data
- Environmental Requirements

PART 2 - PRODUCTS

- Materials
- Insulation Types
- Adhesives, Mastics, Sealants, and Reinforcing Materials
- Jackets
- Accessories

PART 3 - EXECUTION

- Examination
- Installation
- Protective Jacket Installation
- Duct Insulation
- Ductwork Protective Coverings
- Duct Insulation Schedule
- Construction Verification Items

RELATED WORK

- Section 01 91 01 or 01 91 02 – Commissioning Process
- Section 23 05 00 - Common Work Results for HVAC
- Section 23 08 00 - Commissioning of HVAC
- Section 23 31 00 - HVAC Ducts and Casings

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

- ASTM B209 Aluminum and Aluminum Alloy Sheet and Plate
- ASTM C165 Test Method for Compressive Properties of Thermal Insulations
- ASTM C177 Heat Flux and Thermal Transmission Properties
- ASTM C195 Mineral Fiber Thermal Insulation Cement
- ASTM C240 Cellular Glass Insulation Block
- ASTM C302 Density of Preformed Pipe Insulation
- ASTM C272 Water Absorption of Core Materials for Sandwich Constructions
- ASTM C303 Density of Preformed Block Insulation
- ASTM C355 Test Methods for Test for Water Vapor Transmission of Thick Materials
- ASTM C449 Mineral Fiber Hydraulic Setting Thermal Insulation Cement
- ASTM C518 Heat Flux and Thermal Transmission Properties
- ASTM C533 Calcium Silicate Block and Pipe Thermal Insulation
- ASTM C534 Preformed Flexible Elastomeric Thermal Insulation
- ASTM C547 Mineral Fiber Preformed Pipe Insulation
- ASTM C552 Cellular Glass Block and Pipe Thermal Insulation
- ASTM C553 Mineral Fiber Blanket and Felt Insulation
- ASTM C578 Preformed, Block Type Cellular Polystyrene Thermal Insulation
- ASTM C591 Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

1	ASTM C610	Expanded Perlite Block and Thermal Pipe Insulation
2	ASTM C612	Mineral Fiber Block and Board Thermal Insulation
3	ASTM C921	Properties of Jacketing Materials for Thermal Insulation
4	ASTM C1136	Flexible Low Permeance Vapor Retarders for Thermal Insulation
5	ASTM C1728	Standard for Aerogel Insulation
6	ASTM D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
7	ASTM D1000	Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
8		
9	ASTM D1621	Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
10	ASTM D1622	Standard Test Method for Apparent Density of Rigid Cellular Plastics
11	ASTM D1940	Method of Test for Porosity of Rigid Cellular Plastics
12	ASTM D2126	Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
13	ASTM D2240	Standard Test Method for Rubber Property—Durometer Hardness
14	ASTM D5590	Test Method for Determining the Resistance of Coatings to Fungal Defacement
15	ASTM E84	Surface Burning Characteristics of Building Materials
16	ASTM E814	Standard Test Method for Fire Tests of Penetration Firestop Systems
17	ASTM E2336	Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems
18	MICA	National Commercial & Industrial Insulation Standards
19	NFPA 225	Surface Burning Characteristics of Building Materials
20	UL 723	Surface Burning Characteristics of Building Materials

21 **QUALITY ASSURANCE**

22 Refer to division 1, General Conditions, Equals and Substitutions

23 Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

24
25 Insulation systems shall be applied by experienced contractors. Within the past five (5) years, the contractor shall be able to document the successful completion of a minimum of three (3) projects of at least 50% of the size and similar scope of the work specified in this section.

31
32
33 **DESCRIPTION**

34 Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:

- 35 • Duct Insulation

36
37 Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the UW Project Representative.

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43 **DEFINITIONS**

44 Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

45
46
47
48 **SHOP DRAWINGS**

49 Refer to division 1, General Conditions, Submittals.

50
51 Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions. Include copies of the MICA plates that are applicable to this project.

52
53
54
55 **OPERATION AND MAINTENANCE DATA**

56 All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

57
58
59
60
61
62 **ENVIRONMENTAL REQUIREMENTS**

63 Do not store insulation materials on grade or where they are at risk of becoming wet. Do not install insulation products that have been exposed to water.

1
2 Protect installed insulation work with plastic sheeting to prevent water damage.
3

4 **PART 2 - PRODUCTS**

5 **MATERIALS**

6 Manufacturers: Armacell, CertainTeed, Manson, Childers, Dow, Extol, Fibrex, Halstead, Foster, Imcoa,
7 ITW, Johns Manville, Knauf Insulation, Owens-Corning, Pittsburgh Corning, VentureTape or approved
8 equal.
9

10 Materials or accessories containing asbestos will not be accepted.
11

12 Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame
13 spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions:
14

15 Pipe insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke
16 developed rating no higher than 450 when tested in accordance with UL 723 and ASTM E84.
17

18 **INSULATION TYPES**

19 Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall
20 be suitable to receive jackets, adhesives and coatings as indicated.
21

22 **FLEXIBLE FIBERGLASS INSULATION:**

23 Minimum nominal density of 0.75 lbs. per cu. ft., and thermal conductivity of not more than 0.30 at 75
24 degrees F mean temperature, rated for maximum service temperature of 250 degrees F.
25

26 **RIGID FIBERGLASS INSULATION:**

27 Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees
28 F mean temperature, 0.25 at 125 degrees F, 0.27 at 150 degrees F, 0.29 at 200 degrees F, 0.32 at 250 degrees
29 F, minimum compressive strength of 25 PSF at 10% deformation, rated for maximum service temperature of
30 450 degrees F.
31

32 **SEMI-RIGID FIBERGLASS INSULATION:**

33 Minimum nominal density of 3 lbs. per cu. ft., thermal conductivity of not more than 0.28 at 75 degrees F
34 mean temperature, minimum compressive strength of 25 PSF at 10% deformation, rated for service
35 temperature range of 0 degrees F to 450 degrees F. Insulation fibers perpendicular to jacket and scored for
36 wrapping cylindrical surfaces.
37

38 **ADHESIVES, MASTIC, SEALANTS, AND REINFORCING MATERIALS**

39 Products shall be compatible with surfaces and materials on which they are applied and shall be suitable for
40 use at operating temperatures of systems to which they are applied.
41

42 **FIBERGLASS INSULATION ADHESIVE:**

43 Must comply with ASTM C916, Type II: Foster 85-60, Childers CP-127, Duro Dyne SSG.
44

45 **LAGGING ADHESIVE / COATINGS:**

46 For all indoor applications used in conjunction with canvas/glass cloth: the coating must be anti-fungal and
47 shall meet ASTM D 5590 with 0 growth rating (AF): Foster 30-36 AF Seal Fas, Childers CP-137 AF Chil-
48 Seal.
49

50 Anti-fungal adhesive/coating to be used in the following locations;
51

- 52 • Exterior locations

53 **REINFORCING MESH:**

54 Use Foster 42-24 Mast A Fab, Childers Chil Glas #10 or Pittsburgh Corning PC 79.
55

56 **INSULATION JOINT SEALANT:**

57 Joint sealants to be non-shrinking and permanently flexible.
58

59 Used on all below ambient piping to prevent moisture ingress.
60

61 For Cellular Glass, Polyisocyanurate, Phenolic use Foster 95-44 Elastolar, Childers CP-70 Chil-Byl,
62 Pittsburgh Corning CW Sealant.
63

64 For Polystyrene use Foster 30-45N, Childers CP-70.

1 For Elastomeric use Armaflex 520 or equal.

3 **JACKETS**

4 **ALL SERVICE JACKETS (ASJ):**

5 Heavy duty, fire retardant material with polymer coated white kraft reinforced foil vapor retarder jacket,
6 factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02
7 perms and minimum beach puncture resistance of 50 units.

9 **FOIL SCRIM KRAFT ALL SERVICE JACKETS (FSK):**

10 Glass fiber reinforced foil kraft laminate, factory applied to insulation. Maximum permeance of .02 perms
11 and minimum beach puncture resistance of 25 units.

14 **ACCESSORIES**

15 All products shall be compatible with surfaces and materials on which they are applied and be suitable for
16 use at operating temperatures of the systems to which they are applied.

18 Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for
19 applications specified.

21 Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be
22 0.015 inch for aluminum and 0.010 inch for stainless steel.

24 Tack fasteners to be stainless steel ring grooved shank tacks.

26 Staples to be clinch style.

28 Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

30 Finishing cement to be ASTM C449.

32 Fibrous glass or canvas fabric reinforcing used with lagging adhesive shall have a minimum untreated weight
33 of 6 oz./sq. yd.

35 Fungicidal water base duct liner coating (Foster 40-20 or equal) to be compatible with vapor retarding
36 coating. This product must be EPA registered to be used inside HVAC ducts. Coating must comply with
37 ASTM D 5590 with 0 growth rating.

39 **PART 3 - EXECUTION**

41 **EXAMINATION**

42 Verify that all piping, equipment, and ductwork are tested and approved prior to installing insulation. Do not
43 insulate systems until testing and inspection procedures are completed.

45 Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

47 **INSTALLATION**

48 All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be
49 installed in strict accordance with manufacturer's recommendations, building codes, and industry standards.
50 Do not install products when the ambient temperature or conditions are not consistent with the manufacturer's
51 recommendations. Surfaces to be insulated must be clean and dry.

53 Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such
54 a manner as to protect all raw edges, ends and surfaces of insulation.

56 Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be
57 accepted. Provide neatly beveled and coated terminations at all nameplates, uninsulated fittings, or at other
58 locations where insulation terminates.

60 Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

62 Use full length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or
63 pieces cut undersize and stretched to fit will not be accepted.

1 All pipe and duct insulation shall be continuous through walls, ceiling or floor openings and through sleeves
2 except where firestop or firesafing materials are required. Vapor retarding jacket shall be maintained
3 continuous through all penetrations.
4

5 Provide a continuous unbroken moisture vapor retarding jacket on insulation applied to systems noted below.
6 Attachments to cold surfaces shall be insulated and vapor sealed to prevent condensation.
7

8 Provide a complete vapor retarding jacket for insulation on the following systems:

- 9 • Insulated Duct
- 10 • Equipment, ductwork or piping with a surface temperature below 65 degrees F

11
12 **PROTECTIVE JACKET INSTALLATION**

13 ALL SERVICE JACKETS (ASJ) and FOIL SCRIM KRAFT JACKETS (FSK):

14 Install according to manufacturer's recommendations using factory supplied lap seals and butt strip seals. In
15 addition to factory adhesive, secure lap seals and tape with clinch type staples.
16

17
18 **DUCT INSULATION**

19 GENERAL:

20 Secure flexible blanket duct insulation on sides and bottom of ductwork over 24" wide with weld pins. Space
21 fasteners 18" on center or less as required to prevent sagging. Compress insulation no more than 25%.
22

23 Secure rigid board insulation to ductwork with weld pins. Apply insulation with joints firmly butted together
24 and placed as close as possible to the equipment surface. Pins shall be located a maximum of 3" from each
25 edge and spaced no greater than 12" on center.
26

27 Install weld pins without damage to the interior galvanized surface of the duct. Clip pins back to washer and
28 cover penetrations with tape of same material as jacket. Firmly butt seams and joints and cover with 4" tape
29 of same material as jacket. Seal tape with plastic applicator and secure with staples. All joints, seams, edges
30 and penetrations to be fully vapor sealed with vapor retarding mastic.
31

32 Stop and point insulation around access doors and damper operators to allow operation without disturbing
33 insulation or jacket material.
34

35 External supply duct insulation is not required where ductwork contains continuous 1" acoustical liner.
36 Provide 4" overlap of external insulation over ends of acoustically lined sections.
37

38 Where insulated ductwork is supported by trapeze hangers, the insulation shall be installed continuous
39 through the hangers. Drop the supporting channels required to facilitate the installation of the insulation.
40 Where rigid board or flexible insulation is specified, install high density inserts to prevent the weight of the
41 ductwork from crushing the insulation.
42

43 Where insulated low temperature (below 45°F) ductwork is supported by steel metal straps or wire ropes that
44 are secured directly to the duct, the straps or ropes shall be completely covered with insulation and sealed to
45 provide a complete vapor retarding barrier.
46

47 Where insulated duct risers are supported by steel channels secured directly to the duct, extend the insulation
48 and vapor retarding jacketing to encapsulate the support channels.
49

50
51 **DUCT INSULATION SCHEDULE:**

52 Provide duct insulation on new and existing remodeled ductwork in the following schedule:
53
54

SERVICE	INSULATION TYPE	JACKET	THICKNESS
Exposed supply ducts*	Rigid Fiberglass	FSK	2"
Concealed supply ducts	Flexible Fiberglass	FSK	1.5"

55
56 * Exposed supply branch ducts located in the space they are serving do not require insulation.
57 Exposed supply main ducts running through spaces they serve shall be insulated as exposed
58 supply ducts scheduled above.

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CONSTRUCTION VERIFICATION ITEMS

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 23 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

END OF SECTION

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SECTION 23 08 00
COMMISSIONING OF HVAC
BASED ON DFD MASTER SPECIFICATION DATED 01/17/17

PART 1 - GENERAL

SCOPE

This section includes commissioning forms for construction verification and functional performance testing. Included are the following topics:

PART 1 - GENERAL

Scope
Related Work
Reference
Submittals

PART 2 - PRODUCTS

(Not Used)

PART 3 – EXECUTION

Commissioning Forms

CV-23 07 00	HVAC Ductwork Insulation
CV-23 09 14	Control Wiring and Devices
CV-23 31 00	Ductwork and Casings
CV-23 37 13	Diffuser, Grilles and Registers

Functional Performance Test Forms

FPT-23 05 93 Testing Adjusting and Balancing

RELATED WORK

Section 01 91 01 or 01 91 02 – Commissioning Process

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

SUBMITTALS

Reference the General Conditions of the Contract for submittal requirements.

Reference Section 01 91 01 or 01 91 02 Commissioning Process for Construction Verification Checklist and Functional Performance Test submittal requirements.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

COMMISSIONING FORMS

Commissioning forms are to be filled in as work progresses by the individuals responsible for installation and shall be completed for each installation phase.

Provide a description of the work completed since the last entry, the percentage of the total work completed for the system for that area and the step of installation or finalization.

Circle Yes or No for each commissioning form item. If the information requested for an item does not apply to the given stage of installation for the system, list it as “N/A”. Explain all discrepancies, negative responses or N/A responses in the negative responses section.

Once the work is 100% complete and the responses to each item are complete and resolved for a given commissioning forms group, mark as complete, initial and date in the spaces provided.

Provide copies of the commissioning forms to the commissioning agent 2 days prior to construction progress meetings.

Construction Verification Checklist
23 07 00 – HVAC Ductwork Insulation

CV-23 07 00 – HVAC Ductwork Insulation

Equipment Identification/Tag: _____

Location: _____

A) DUCTWORK INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)										
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:			DATE:							

Question Details

- 1) Ductwork clean, dry, pressure tested and approved prior to application of insulation.
- 2) Type and thickness of insulation complies with listed specification requirements for given system.
- 3) Insulation installed with smooth and even surfaces.
- 4) Insulation is secured per specification requirements for given insulation type and ductwork width.
- 5) Insulation seams and joints firmly butted together and covered with 4" tape of same material as jacket.
- 6) Insulation and vapor barrier continuous through non-rated sleeves.
- 7) Insulation is butted tightly against the fire stop with butt joints taped in rated construction.
- 8) Insulation stopped and pointed around access doors and damper operators to allow operation without disturbing insulation or jacket material.
- 9) Complete vapor barrier provided for all insulated ductwork.
- 10) Exposed fiberglass insulation covered and sealed at all permanent terminations and at end of work day.

Construction Verification Checklist
 23 07 00 – HVAC Ductwork Insulation

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
23 07 00 – HVAC Ductwork Insulation

B) DEVICE & EQUIPMENT INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)			
				1)	2)	3)	
				YES NO	YES NO	YES NO	
				YES NO	YES NO	YES NO	
				YES NO	YES NO	YES NO	
				YES NO	YES NO	YES NO	
				YES NO	YES NO	YES NO	
				YES NO	YES NO	YES NO	
				YES NO	YES NO	YES NO	
				YES NO	YES NO	YES NO	
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:		DATE:	

Question Details

- 1) Insulated easily removable galvanized steel metal boxes or insulated easily removable elastomeric insulation sections provided for equipment, devices, labels and access panels per specifications.
- 2) Air handling unit casings, chambers, or plenums (filters, mixing chambers, sound attenuators, etc.) insulated in accordance with requirements of adjacent duct insulation.
- 3) All control devices are mounted over ductwork insulation.

Negative Responses

Group/Item	Date Found	Found By	Location	Reason for Negative Response	Resolved YES / NO	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
23 09 14 – Control Wiring and Devices

CV-23 09 14 – Control Wiring and Devices

Equipment Identification/Tag: _____

Location: _____

A) WIRING INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)								
				1)	2)	3)	4)	5)	6)	7)	8)	9)
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:				DATE:				

Question Details

- 1) All cabling identified at both ends according to Section 23 09 14.
- 2) A minimum of 5' of cable provided in DDC panel for all electronic input/output devices, sensors, relays and interlocking wiring to allow for termination by the DDC Contractor.
- 3) All high voltage and low voltage wiring (includes low voltage cable) installed in metal conduit, Electrical Non-metallic Tubing (ENT), or Electrical Metallic Tubing (EMT), as scheduled per specifications.
- 4) All conduit installed and supported in accordance with electrical sections (Division 26) of this specification and the National Electrical Code.
- 5) Bushings installed at all conduit terminations.
- 6) Conduit is a minimum of 1/2 " for low voltage control wiring and pipe fill does not exceed 40%.
- 7) Control panels serving equipment fed by emergency power also served by emergency power.
- 8) "Hand/off/auto" selector switches installed on systems where automatic interlock controls are specified and "hand/off/auto" selector switches are not supplied with the equipment controlled.
- 9) All equipment requiring maintenance is accessible (valves, junction boxes, etc.).

Construction Verification Checklist
23 09 14 – Control Wiring and Devices

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
23 09 14 – Control Wiring and Devices

B) CONTROL DEVICES INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)										
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:				DATE:						

Question Details

- 1) Thermometers installed at each point of temperature transmission (sensors) and control, except reheat coils, unless the drawings indicate a thermometer is to be installed.
- 2) Room thermostats and sensors installed at the location and height indicated on the drawings and aligned with light switches and humidistats.
- 3) Any room thermostats or sensors mounted on an exterior wall mounted on a thermally insulated sub-base.
- 4) Where thermostats or sensors are mounted on exterior walls or in any location where air transfer will affect the measured temperature or humidity the conduit and any other opening that will effect the measurement are sealed.
- 5) Guards provided on thermostats in entrance hallways, other public areas, or in locations where thermostat is subject to physical damage.
- 6) For horizontal steam or hot water coils, low limit thermostat elements distributed (serpentine) horizontally across the coil to cover every square foot of coil.
- 7) For integral face and bypass coils the low limit thermostat elements are installed on the leaving face of the heating coil inside the damper enclosure.
- 8) Straightening vanes installed upstream of air flow measuring stations where required per manufacturers recommendations.
- 9) Where flow meters are located more than five feet above the floor or where they cannot be read due to equipment location, provide remote mounting of the flow meter display and programming controls four to five feet above finished floor.
- 10) For VFD installations, a separate current switch provided in parallel with the VFD motor status relay when a bypass starter is provided on the VFD to prove motor status in the bypass mode.
- 11) All control devices and boxes mounted on insulated ductwork are mounted over the insulation.

Construction Verification Checklist
23 09 14 – Control Wiring and Devices

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
23 09 14 – Control Wiring and Devices

C) FINALIZATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)								
				1)	2)	3)	4)	5)	6)	7)	8)	
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:				DATE:				

Question Details

- 1) All penetrations through fire rated wall assemblies have been sealed per specification requirements.
- 2) All penetrations through non-rated wall assemblies have been sealed per specification requirements for given space type.
- 3) All wiring is properly labeled with control ID number of circuit within 1/2" of device and terminal connection.
- 4) All control devices with the exception of dampers, valves, and terminal unit devices labeled with permanent printed labels that correspond to control drawings.
- 5) Temperature control wiring and tubing junction and pullboxes identified utilizing spray painted green covers.
- 6) Pressure and/or differential set points of pressure sensors re-adjusted after final balancing is completed.
- 7) Threshold settings for current switch adjusted to indicate belt or coupling loss after final balancing.
- 8) As-built control drawings of all systems served by each local panel provided in a location adjacent to or inside of panel cover. Provide a protective cover or envelope for drawings.

Construction Verification Checklist
23 09 14 – Control Wiring and Devices

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
23 31 00 – Ductwork and Casings

CV-23 31 00 – Ductwork and Casings

Equipment Identification/Tag: _____

Location: _____

A) GENERAL DUCTWORK INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)										
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:			DATE:							

Question Details

- 1) Ductwork is clean and free of damage prior to installation.
- 2) Ductwork is installed in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible, 2nd Edition, 1995.
- 3) Where two different metal ducts meet, the joint is installed in such a manner that metal ducts do not contact each other by using proper seal or compound.
- 4) No reductions to duct to less than six inches in any dimension and/or aspect ratio greater than 8:1 are present.
- 5) Duct is pitched toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.
- 6) All equipment and systems requiring maintenance are accessible (valves, junction boxes, etc.).
- 7) All seams, joints and penetrations sealed in accordance with SMACNA seal class "A" standards, except transfer ductwork with pressure classification below 2".
- 8) All duct openings sealed to maintain duct system cleanliness.
- 9) Ductwork supported in accordance with SMACNA HVAC Duct Construction Standards, except secure wire method is not utilized.
- 10) Sheet metal thickness complies with the requirements of Section 23 21 00.

UWM Project No. GML B1970 / UWSA Project No. B-23-001

Construction Verification Checklist
23 31 00 – Ductwork and Casings

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
23 31 00 – Ductwork and Casings

B) SUPPLY DUCTWORK INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)		
				1)	2)	3)
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:		DATE:

Question Details

- 1) Duct is pitched toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.
- 2) All seams, joins and penetrations sealed in accordance with SMACNA seal class "A", except transfer ductwork with pressure classification below 2".
- 3) Manual balancing damper installed in each branch duct and for each diffuser or grille.

Negative Responses

Group/Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
23 31 00 – Ductwork and Casings

C) KITCHEN, DUST COLLECTION & GENERAL EXHAUST DUCTWORK INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)						
				1)	2)	3)	4)	5)	6)	7)
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:			DATE:			

Question Details

- 1) Bracing and reinforcement provided to the outside of the kitchen ductwork to prevent breathing, rattling, vibration or sagging of duct.
- 2) Ductwork supports provided at intervals no greater than 5' for kitchen ductwork, and no fasteners or hangers penetrate duct.
- 3) Horizontal kitchen ductwork is pitched back to hood at 1 inch per foot.
- 4) Grease tight access doors of the same material and thickness as the duct and as large as possible, up to 24 inches in any dimension provided on duct sides of all kitchen ductwork at each change in direction, not less than every 10 lineal feet of duct, including risers, and not less than 1-1/2 inches from the bottom of the duct.
- 5) Exhaust ductwork is pitched to drain back to equipment or exhaust grille.
- 6) Water tight drain pan provided at all low points or at locations where moisture may collect, with drain pan piped to nearest floor drain.
- 7) Access doors and clean out doors provided on duct sides of dust collection exhaust ductwork at each change in direction, at junctions with vertical ducts, at devices requiring periodic inspection and maintenance, and not less than every 10 lineal feet of duct, including risers.

Construction Verification Checklist
23 31 00 – Ductwork and Casings

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
23 31 00 – Ductwork and Casings

D) FUME & PERCHLORIC ACID EXHAUST DUCTWORK INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)								
				1)	2)	3)	4)	5)	6)	7)	8)	9)
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:				DATE:				

Question Details

- 1) For all rectangular duct and round duct 36 inch diameter and larger, PCD sealant provided at the corrosive side of the gasket.
- 2) For round duct less than 36-inch diameter, slip coupling connection sealed with PCD sealant provided.
- 3) Duct sealer applied on male end connectors before and after insertion to cover the entire joint.
- 4) 316 stainless steel fasteners provided at all couplings, with maximum screw spacing of 12 inches o. c. and a minimum of 3 equally spaced screws per joint.
- 5) Fasteners not located at bottom of duct.
- 6) Any damage to the PVC coating repaired with a PVC aerosol spray or similar PVC product as soon as installation of the piece with a damaged coating is completed.
- 7) Interior and exterior joints and seams ground and polished smooth for perchloric duct.
- 8) Duct pitched to drain back to hood or other drain point detailed on the drawings.
- 9) Perchloric acid exhaust ducts labeled with 4 inch high red stenciled "Perchloric Acid Exhaust" legend every ten feet.

Construction Verification Checklist
23 31 00 – Ductwork and Casings

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
23 31 00 – Ductwork and Casings

E) DUCT ACCESSORIES INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)									
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:			DATE:						

Question Details

- 1) Turning vanes installed in all rectangular, mitered elbows in accordance with SMACNA standards and/or manufacturer's recommendations.
- 2) Fire dampers installed in sleeves with retaining angles on both sides of rated partition, with ductwork connections meeting manufacturer requirements.
- 3) Where it is necessary to set dampers out from the rated wall, install a sleeve extension encased in two hour rated fire proofing insulation. Install an access door at each fire damper, located to permit resetting the damper or replacing the fusible link.
- 4) Access doors provided in size, location and quantity specified under contract documents, including before and after all duct mounted coils.
- 5) Pressure relief doors provided on VAV systems to protect ductwork damage in the case of equipment or controls malfunction.
- 6) Flexible duct connections provided for all connections to rotating or vibrating equipment, including air handling units (unless unit is internally isolated), fans, or other motorized equipment.
- 7) Flexible duct connections in corrosive environments or fume exhaust systems, provided with a double layer of the Teflon coated fabric.
- 8) Manual volume dampers are constructed with continuous shafts according to SMACNA Duct Construction Standards Fig. 2-12 and Fig. 2-13.
- 9) Manual volume damper blades are two gauges thicker than the surrounding duct according to SMACNA Duct Construction Standards Fig. 2-12 and Fig. 2-13.
- 10) Manual volume damper handles are extended beyond the surface of external duct insulation according to Section 23 33 00.

Construction Verification Checklist
23 31 00 – Ductwork and Casings

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
23 31 00 – Ductwork and Casings

F) FLEXIBLE DUCTWORK INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)						
				1)	2)	3)	4)	5)	6)	7)
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:			DATE:			

Question Details

- 1) Flexible ductwork is clean and free from damage prior to installation.
- 2) Flexible duct used for final connections of air inlets and outlets at diffuser, register, and grille locations only.
- 3) Where flexible duct is used, it is installed with the minimum length required to make the final connections, but no greater than 5 feet in length, and no more than one (1) 90° bend.
- 4) Inner jacket of flexible duct secured in place with stainless steel metal band clamp.
- 5) Insulation vapor barrier jacket secured in place with steel or nylon draw band.
- 6) Flexible ductwork does not penetrate walls.
- 7) Individual sections of flexible ductwork are of one piece construction.

Construction Verification Checklist
23 31 00 – Ductwork and Casings

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

Construction Verification Checklist
23 31 00 – Ductwork and Casings

G) FINALIZATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)									
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:							DATE:		

Question Details

- 1) All penetrations through fire rated wall assemblies have been sealed per specification requirements.
- 2) All penetrations through non-rated wall assemblies have been sealed per specification requirements for given space type.
- 3) Each fire damper manually tested for proper operation and any defective dampers repaired or replaced. Access doors labeled “FIRE DAMPER” according to IMC requirements.
- 4) Fire/smoke damper linkages coordinated with operators so dampers are closed when the air system is not operating.
- 5) All dirt and foreign matter removed from the entire duct system and diffusers, registers, grilles and the inside of air-handling units cleaned before operating fans.
- 6) Duct systems with cleaned with high power vacuum machines where systems have been used for temporary heat, air-conditioning, or ventilation purposes during construction.
- 7) All ductwork leakage tested in accordance with test methods described in Section 5 of SMACNA HVAC Air Duct Leakage Test Manual, with test pressure equal to the duct pressure class.
- 8) Leakage rate does not exceed more than 5% of the system air quantity for low pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.
- 9) Leakage rate does not exceed more than 1% of the system air quantity for high pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.
- 10) Ductwork randomly tested for structural integrity and deflection limits do not exceed those listed in accordance with Chapter 7 of SMACNA HVAC Duct Construction Standards, 3.0 Performance Requirements.

Construction Verification Checklist
23 31 00 – Ductwork and Casings

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
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					YES / NO		
					YES / NO		

Construction Verification Checklist
23 37 13 – Diffuser, Grilles and Registers

CV-23 37 13 – Diffuser, Grilles and Registers

Equipment Identification/Tag: _____

Location: _____

A) GENERAL DUCTWORK INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)									
				1)	2)	3)	4)	5)	6)	7)	8)	9)	
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:			DATE:						

Question Details

- 1) Diffusers, grilles and registers installed as shown in contract documents.
- 2) Where it is not possible to maintain minimum 2 duct diameter straight duct into diffuser, equalizing grids are furnished.
- 3) Connections between ductwork drops and diffusers, grilles and registers sealed airtight.
- 4) Unused portions of linear slot diffusers and linear bar diffusers and grilles are blanked off.
- 5) Where diffusers, registers and grilles cannot be installed to avoid seeing inside duct, inside of duct is painted with flat black paint to reduce visibility.
- 6) In clean rooms and animal holding rooms, space between diffusers, registers and grilles and ceiling or wall to be air and watertight using clear, non-hardening, microbiological resistant silicone sealant compatible with ceiling or wall surfaces.
- 7) All diffusers, grilles and registers temporary sealed at end of work day to maintain duct system cleanliness.
- 8) All mars and blemishes are repaired.
- 9) Throw pattern and direction adjusted per contract document requirements.

Construction Verification Checklist
23 37 13 – Diffuser, Grilles and Registers

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

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FUNCTIONAL PERFORMANCE TEST FORMS

Edit the individual functional performance test forms and provide additional test forms as needed to reflect the functional performance test requirements of assemblies, components, equipment and systems to be commissioned on this project. Include test forms with final review documents; no submission is required at preliminary review.

Edit to provide test forms unique to the specific test requirements of the project and remove the "SAMPLE" watermark. Edited or unedited test forms may be used in the bidding documents. Unedited test forms must be edited by the A/E at the time of shop drawing submittal and accompany the submittals when returned to the contractor prior to functional performance testing. Incorporate changes to the contract documents into the test forms prior to testing. This option is preferred for medium and large projects where there are many functional performance tests to be done.



Functional Performance Test

23 05 93 Testing Adjusting and Balancing Verification Test

FPT-23 05 93 – Testing, Adjusting and Balancing Verification Test

Equipment Identification/Tag: _____

Location: _____

Test Duration

Date: _____ Start Time: _____ End Time _____

Estimated Duration: _____

Cx Provider(s): _____

Objectives

This test is performed to verify the accuracy of the testing, adjusting and balancing completed for the facility.

Instrumentation

AABC or NEBB specified equipment with specified accuracies.

Sampling Methodology

1. Major equipment air flow (i.e. AHU's, fans, etc.): Sample air flow performance of 100 % of all major equipment shown in the construction documents for all sample points indicated.
2. Major equipment water flow (i.e. AHU's, Chillers, Boilers, pumps, etc.): Sample water flow performance of 100 % of all major equipment shown in the construction documents for all sample points indicated.
3. Terminal devices air flow (i.e. terminal units, fan coil units, grilles, etc.): Sample air flow performance of 10% of all terminal units shown in the construction documents, with at least one sample for each terminal type for all sample points indicated.
4. Terminal and balancing devices water flow (i.e. Fan Coils, Terminal Units, Balancing valves, etc.): Sample water flow performance of 10% of all terminal units and all balance valves shown in the construction documents, with at least one sample for each terminal or valve type for all sample points indicated.
5. Critical terminal devices for Labs and Vivariums (VAV boxes, air valves, etc.): Sample air flow performance of (50%)(100 %) of all Critical terminal devices shown in the construction documents for all sample points indicated.

Note: Fume hoods will be tested by the Contractor furnishing the fume hood when they conduct the ASHRAE 110 test and calibrate the fume hood monitor.

Procedure

For each of the sample points listed under the results section, re-test the point in accordance with the procedures detailed within specification section 23 05 93. Verify procedures utilized concur with these documents and record findings in the results section below. In addition, for each point tested record the measured value and verify the result is within 10% of the original value recorded and within the specified tolerances of the design setting for the point.

Sample 100% of Terminal devices if 20% of devices sampled fall outside of either specified tolerance range of the completed Testing, Adjusting and Balancing Verification Test Results Table found in form FPT – 23 05 93, located in section 01 91 01 or 01 91 02.

Sample 100% Lab and Vivarium devices if 20% of devices sampled fall outside of either specified tolerance range of the completed Testing, Adjusting and Balancing Verification Test Results Table found in form FPT – 23 05 93, located in section 01 91 01 or 01 91 02.

Functional Performance Test

23 05 93 Testing Adjusting and Balancing Verification Test

Conclusion

Acceptable Criteria: All points listed are within listed tolerances of design and original recordings and were recorded in accordance with TAB plan and/or NEBB standards.

Comments:

Observations:

Final Status: Accepted Not Accepted

Relevant Trend Data

Static Pressure Setpoint (VFD fans ONLY), Hydronic Loop Differential Setpoint (VFD pumps ONLY).

Witnesses

Name	Signature
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Functional Performance Test

23 09 23 BAS Communication/Calibration Functional Performance Test

FPT-23 09 23 - BAS Communication/Calibration

Equipment Identification/Tag: _____

Location: _____

Test Duration

Date: _____ Start Time: _____ End Time _____

Estimated Duration: _____

Cx Provider(s): _____

Applicable Equipment: _____

Objectives

This test is performed to investigate the functionality of communication within BAS system, associated sensors, actuators and relays and the calibration of these devices.

Instrumentation

Instrument	Accuracy	Measurement
N/A	N/A	N/A

Stated Sequence

To be defined by A/E and commissioning provider at completion of construction documents.

Sampling Set

A minimum of 20% of total points monitored or controlled by BAS system is to be sampled. However, areas specified as critical in nature or associated with critical or major components (i.e. chiller, AHU, etc.) are to be sampled at a rate of 50% of total points associated with given area or equipment.

Procedure

1. For each of the points listed under the results section related to monitoring run status of equipment or responsible for actuation or control of equipment, manually override the equipment to start or actuate. Verify equipment is started and status concurs with BAS head end.
2. For each of the points listed under the results section related to monitoring temperature, pressure, humidity, etc. record the readings registered at the BAS head end and measure the conditions present at the sensor. Verify BAS and measured readings agree within scheduled tolerances listed under the results section.
3. For each of the points listed under the results section related to alarms and safeties, verify proper communication of alarm conditions for each point by manually overriding the alarm point by one of the following methods:
 - a. Disconnect relay contacts.
 - b. Force alarm condition by running a diagnostic protocol on the local control panel.
 - c. Force alarm condition by presenting a simulated alarm condition (i.e. shutting off gas to each boiler to produce a flame failure).

Results

Status & Actuation Points:

Point Name	Communication Verified	Notes
	<input type="checkbox"/> YES <input type="checkbox"/> NO	

Temperature, Pressure, Humidity Sensors:

Point Name	BAS Value	Measured Value	Tolerance	Accepted
				<input type="checkbox"/> YES <input type="checkbox"/> NO

Functional Performance Test

23 09 23 BAS Communication/Calibration Functional Performance Test

Alarms and Safeties

Point Name	Communication Verified	Notes
	<input type="checkbox"/> YES <input type="checkbox"/> NO	

Conclusion

Acceptable Criteria: All points listed have proper communication with BAS head end and are calibrated to meet tolerances specified.

Comments:

Observations:

Final Status: Accepted Not Accepted

Relevant Trend Data

N/A

Witnesses

Name	Signature
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Functional Performance Test

23 09 24 BAS Communication/Calibration Functional Performance Test

FPT-23 09 24 - BAS Communication/Calibration

Equipment Identification/Tag: _____
Location: _____

Test Duration

Date: _____ Start Time: _____ End Time _____

Estimated Duration: _____

Cx Provider(s): _____

Applicable Equipment: _____

Objectives

This test is performed to investigate the functionality of communication within BAS system, associated sensors, actuators and relays and the calibration of these devices.

Instrumentation

Table with 3 columns: Instrument, Accuracy, Measurement. All cells contain N/A.

Stated Sequence

To be defined by A/E and commissioning provider at completion of construction documents.

Sampling Set

A minimum of 20% of total points monitored or controlled by BAS system is to be sampled. However, areas specified as critical in nature or associated with critical or major components (i.e. chiller, AHU, etc.) are to be sampled at a rate of 50% of total points associated with given area or equipment.

Procedure

- 1. For each of the points listed under the results section related to monitoring run status of equipment or responsible for actuation or control of equipment, manually override the equipment to start or actuate. Verify equipment is started and status concurs with BAS head end.
2. For each of the points listed under the results section related to monitoring temperature, pressure, humidity, etc. record the readings registered at the BAS head end and measure the conditions present at the sensor. Verify BAS and measured readings agree within scheduled tolerances listed under the results section.
3. For each of the points listed under the results section related to alarms and safeties, verify proper communication of alarm conditions for each point by manually overriding the alarm point by one of the following methods:
a. Disconnect relay contacts.
b. Force alarm condition by running a diagnostic protocol on the local control panel.
c. Force alarm condition by presenting a simulated alarm condition (i.e. shutting off gas to each boiler to produce a flame failure).

Results

Status & Actuation Points:

Table with 3 columns: Point Name, Communication Verified (checkbox YES, checkbox NO), Notes.

Temperature, Pressure, Humidity Sensors:

Table with 5 columns: Point Name, BAS Value, Measured Value, Tolerance, Accepted (checkbox YES, checkbox NO).

Alarms and Safeties

Table with 3 columns: Point Name, Communication Verified (checkbox YES, checkbox NO), Notes.

Functional Performance Test

23 09 24 BAS Communication/Calibration Functional Performance Test

Conclusion

Acceptable Criteria: All points listed have proper communication with BAS head end and are calibrated to meet tolerances specified.

Comments:

Observations:

Final Status: Accepted Not Accepted

Relevant Trend Data

N/A

Witnesses

<u>Name</u>	<u>Signature</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Functional Performance Test

23 09 25 BAS Communication/Calibration Functional Performance Test

FPT-23 09 25 - BAS Communication/Calibration

Equipment Identification/Tag: _____
Location: _____

Test Duration

Date: _____ Start Time: _____ End Time _____

Estimated Duration: _____

Cx Provider(s): _____

Applicable Equipment: _____

Objectives

This test is performed to investigate the functionality of communication within BAS system, associated sensors, actuators and relays and the calibration of these devices.

Instrumentation

Table with 3 columns: Instrument, Accuracy, Measurement. All cells contain N/A.

Stated Sequence

To be defined by A/E and commissioning provider at completion of construction documents.

Sampling Set

A minimum of 20% of total points monitored or controlled by BAS system is to be sampled. However, areas specified as critical in nature or associated with critical or major components (i.e. chiller, AHU, etc.) are to be sampled at a rate of 50% of total points associated with given area or equipment.

Procedure

- 1. For each of the points listed under the results section related to monitoring run status of equipment or responsible for actuation or control of equipment, manually override the equipment to start or actuate. Verify equipment is started and status concurs with BAS head end.
2. For each of the points listed under the results section related to monitoring temperature, pressure, humidity, etc. record the readings registered at the BAS head end and measure the conditions present at the sensor. Verify BAS and measured readings agree within scheduled tolerances listed under the results section.
3. For each of the points listed under the results section related to alarms and safeties, verify proper communication of alarm conditions for each point by manually overriding the alarm point by one of the following methods:
a. Disconnect relay contacts.
b. Force alarm condition by running a diagnostic protocol on the local control panel.
c. Force alarm condition by presenting a simulated alarm condition (i.e. shutting off gas to each boiler to produce a flame failure).

Results

Status & Actuation Points:

Table with 3 columns: Point Name, Communication Verified (checkbox YES, checkbox NO), Notes.

Temperature, Pressure, Humidity Sensors:

Table with 5 columns: Point Name, BAS Value, Measured Value, Tolerance, Accepted (checkbox YES, checkbox NO).

Alarms and Safeties

Table with 3 columns: Point Name, Communication Verified (checkbox YES, checkbox NO), Notes.

Functional Performance Test

23 09 25 BAS Communication/Calibration Functional Performance Test

Conclusion

Acceptable Criteria: All points listed have proper communication with BAS head end and are calibrated to meet tolerances specified.

Comments:

Observations:

Final Status: Accepted Not Accepted

Relevant Trend Data

N/A

Witnesses

<u>Name</u>	<u>Signature</u>
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SECTION 23 31 00
HVAC DUCTS and CASINGS
BASED ON DFD MASTER SPECIFICATION DATED 06/19/2020

PART 1 - GENERAL

SCOPE

This section includes specifications for all duct systems used on this project. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Shop Drawings
- Design Criteria
- Delivery, Storage And Handling

PART 2 - PRODUCTS

- General
- Ductwork Pressure Class
- Ductwork System Class
- Materials
- Low Pressure Ductwork (Maximum 2 inch pressure class)
- Duct Sealant
- Gaskets

PART 3 - EXECUTION

- Installation
- Ductwork Support
- Low Pressure Duct (Maximum 2 inch pressure class)
- Cleaning
- Leakage Test
- Structural Test
- Construction Verification

APPENDIX

- Duct Leakage Test Report
- Duct Structural Test Report

RELATED WORK

- Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC
- Section 23 08 00 – Commissioning of HVAC
- Section 23 33 00 – Air Duct Accessories

REFERENCE

Applicable provisions of Division 1 govern work under this Section.

REFERENCE STANDARDS

ANSI SS-EN 485-2	Aluminum and Aluminum Alloys-Sheet, Strip and Plate-Part 2: Mechanical Properties
ASTM B209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM A90	Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
ASTM A167	Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A623	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A527	Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
ASTM 924	Standard Specification for General Requirements for Sheet Steel, Metallic-coated by the Hot-dip Method
ASTM C 1071	Specification for Fibrous Glass Duct Lining Insulation
ASTM C 411	Test Method for Hot Surface Performance of High Temperature Thermal Insulation

1	ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials
2	ASTM C 1338	Test Method for Determining Fungal Resistance of Insulation Materials and
3		Facings
4	ASTM G 21	Standard Practice for Determining Resistance of Synthetic Polymeric Materials
5		to Fungi
6	ASTM C 916	Standard Specification for Adhesives for Duct Thermal Insulation
7	NFPA 90A	Standard for the Installation of Air Conditioning and Ventilating Systems
8	UL 181	Standard for Safety for Factory Made Air Ducts and Air Connectors.
9	NAIMA	Fibrous Glass Duct Liner Standard

10
11 **QUALITY ASSURANCE**
12 Refer to division 1, General Conditions, Equals and Substitutions.

13
14 **SHOP DRAWINGS**
15 Refer to division 1, General Conditions, Submittals.

- 16
17 Include manufacturer's data and/or Contractor data for the following:
- 18 • Fabrication and installation drawings.
 - 19 • Schedule of duct systems including material of construction, gauge, pressure class, system class,
 - 20 method of reinforcement, joint construction, fitting construction, and support methods, all with
 - 21 details as appropriate.
 - 22 • Duct sealant and gasket material.
 - 23 • Duct liner including data on thermal conductivity, air friction correction factor, and limitation on
 - 24 temperature and velocity.

25
26 **DESIGN CRITERIA**
27 Construct all ductwork to be free from vibration, chatter, objectionable pulsations and leakage under specified

- 28 operating conditions.
29
30 Use material, weight, thickness, gauge, construction and installation methods as outlined in the following
31 SMACNA publications, unless noted otherwise:
- 32 • HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005
 - 33 • HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012
 - 34 • HVAC Systems - Duct Design, 4th Edition, 2006
 - 35 • Rectangular Industrial Duct Construction Standard, 2nd Edition, 2004
 - 36 • Round Industrial Duct Construction Standards, 2nd Edition, 1999
 - 37 • Thermoplastic Duct (PVC) Construction Manual, 2nd Edition, 1995

38
39 Use products which conform to NFPA 90A, possessing a flame spread rating of not over 25 and a smoke
40 developed rating no higher than 50.

41
42 **DELIVERY, STORAGE AND HANDLING**
43 Promptly inspect shipments to ensure that Ductwork is undamaged and complies with the specification.

- 44
45 Protect Ductwork against damage.
46
47 Protect Ductwork by storing inside or by durable, waterproof, above ground packaging. Do not store material
48 on grade. Protect Ductwork from dirt, dust, construction debris and foreign material. Where end
49 caps/packaging are provided, take precautions so caps/packaging remain in place and free from damage.
50
51 Offsite storage agreements do not relieve the contractor from using proper storage techniques.
52
53 Storage and protection methods must allow inspection to verify products.

54
55 **PART 2 - PRODUCTS**

56
57 **GENERAL**
58 All sheet metal used for construction of duct shall be 24 gauge or heavier except for round and spiral ductwork
59 and spiral duct take-offs 12" and below may be 26 gauge where allowed in SMACNA HVAC Duct
60 Construction Standards, Metal and Flexible, 3rd Edition, 2005.

61
62 Duct sizes indicated on plans are net inside dimensions; where duct liner is specified, dimensions are net,
63 inside of liner.

1
2 **DUCTWORK PRESSURE CLASS**

3 Minimum acceptable duct pressure class, for all ductwork except transfer ductwork, is 2 inch W.G. positive
4 or negative, depending on the application. Transfer ductwork minimum acceptable duct pressure class is 1
5 inch W.G. positive or negative, depending on the application.

6
7 **MATERIALS**

8 Galvanized Steel Sheet:

9 Use ASTM A 653 galvanized steel sheet of lock forming quality. Galvanized coating to be 1.25 ounces per
10 square foot, both sides of sheet, G90 in accordance with ASTM A90. Provide "Paint Grip" finish or
11 galvanneal sheet metal for ductwork that will be painted.

12
13 All couplings shall be slip-joint construction with a minimum 2 inches insertion length. Seal all couplings
14 with sealants as specified.

15
16 **LOW PRESSURE DUCTWORK (Maximum 2 inch pressure class)**

17 Fabricate and install ductwork in sizes indicated on the drawings and in accordance with SMACNA
18 recommendations, except as modified below.

19
20 Construct so that all interior surfaces are smooth. Use slip and drive or flanged and bolted construction when
21 fabricating rectangular ductwork. Use spiral lock seam construction when fabricating round spiral ductwork.
22 Sheet metal screws may be used on duct hangers, transverse joints and other SMACNA approved locations
23 if the screw does not extend more than 1/2 inch into the duct.

24
25 Use elbows and tees with a center line radius to width or diameter ratio of 1.5 wherever space permits. When
26 a shorter radius must be used due to limited space, install single wall sheet metal splitter vanes in accordance
27 with SMACNA publications, Type RE 3. Where space will not allow and the C value of the radius elbow,
28 as given in SMACNA publications, exceeds 0.31, use rectangular elbows with turning vanes as specified in
29 Section 23 33 00. Square throat-radius heel elbows will not be acceptable. Straight taps or bullhead tees are
30 not acceptable.

31
32 Where rectangular elbows are used, provide turning vanes in accordance with Section 23 33 00.

33
34 Provide expanded take-offs or 45 degree entry fittings for branch duct connections with branch ductwork
35 airflow velocities greater than 700 fpm. Square edge 90-degree take-off fittings or straight taps will not be
36 accepted.

37
38 Button punch snaplock construction will not be accepted on aluminum ductwork.

39
40 Round ducts may be substituted for rectangular ducts if sized in accordance with ASHRAE table of
41 equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by
42 written permission of the Architect/Engineer.

43
44 Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream
45 of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

46
47 **DUCT SEALANT**

48 Manufacturer: 3M 800, 3M 900, H.B. Fuller/Foster, Hardcast, Hardcast Peal & Seal, Lockformer cold
49 sealant, Mon-Eco Industries, United Sheet Metal, or approved equal. Silicone sealants are not allowed in
50 any type of ductwork installation.

51
52 Install sealants in strict accordance with manufacturer's recommendations, paying special attention to
53 temperature limitations. Allow sealant to fully cure before pressure testing of ductwork, or before startup of
54 air handling systems.

55
56 **GASKETS**

57 2 Inch Pressure Class And Lower:

58 Soft neoprene or butyl gaskets in combination with duct sealant for flanged joints.

59
60
61 **PART 3 - EXECUTION**

62
63 **INSTALLATION**

1 Verify dimensions at the site, making field measurements and drawings necessary for fabrication and
2 erection. Check plans showing work of other trades and consult with Architect in the event of any
3 interference.

4
5 Make allowances for beams, pipes or other obstructions in building construction and for work of other
6 contractors. Transform, divide or offset ducts as required, in accordance with SMACNA HVAC Duct
7 Construction Standards, Figure 4-7, except do not reduce duct to less than six inches in any dimension and
8 do not exceed an 8:1 aspect ratio. Where it is necessary to take pipes or similar obstructions through ducts,
9 construct easement as indicated in SMACNA HVAC Duct Construction Standards, Figure 4-8, Fig. E. In
10 all cases, seal to prevent air leakage. Pipes or similar obstructions may not pass through high pressure or
11 fume exhaust ductwork.

12
13 Test openings for test and balance work will be provided under Section 23 05 93.

14
15 Provide frames constructed of angles or channels for coils, filters, dampers or other devices installed in duct
16 systems, and make all connections to such equipment including equipment furnished by others. Secure
17 frames with gaskets and screws or nut, bolts and washers.

18
19 Install duct to pitch toward outside air intakes and drain to outside of building. Solder or seal seams to form
20 watertight joints.

21
22 Where two different metal ducts meet, the joint shall be installed in such a manner that metal ducts do not
23 contact each other by using proper seal or compound.

24
25 Install all motor operated dampers and connect to or install all equipment furnished by others. Blank off all
26 unused portions of louvers, as indicated on the drawings, with 1-1/2 inch board insulation with galvanized
27 sheet metal backing on both sides.

28
29 Do not install ductwork through dedicated electrical rooms or spaces unless the ductwork is serving this room
30 or space.

31
32 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

33
34 Provide adequate access to ductwork for cleaning purposes.

35
36 Provide temporary capping of ductwork openings to prevent entry of dirt, dust and foreign material.

37
38 Protect diffusers, registers and grilles with plastic wrap or some other approved form of protection to
39 maintain dirt and dust free and to prevent entry of dirt, dust and foreign material into the Ductwork.

40
41 During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent
42 construction dust from entering ductwork system.

43 44 **DUCTWORK SUPPORT**

45 Support ductwork in accordance with SMACNA HVAC Duct Construction Standards, Figure 5-5, except
46 supporting ductwork with secure wire method is not allowed.

47
48 Stainless steel air-craft cable hanging systems are allowed on round ductwork under 12 inches diameter if
49 installed utilizing two fasteners with two cable loops. Support with 3/32 inch, 7 x 7, stainless steel air-craft
50 cable, with matching serrated spring loaded wedge mechanism fasteners rated for actual load. Comply with
51 the manufacturer's installation instructions.

52 53 54 **LOW PRESSURE DUCT (Maximum 2 inch pressure class)**

55 Seal all ducts, except for transfer ducts, in accordance with SMACNA seal class "A"; all seams, joints, and
56 penetrations shall be sealed.

57
58 Install a manual balancing damper in each branch duct and for each diffuser or grille. The use of splitter
59 dampers, extractors, or grille face dampers will not be accepted for balancing dampers.

60
61 Hangers must be wrapped around bottom edge of duct and securely fastened to duct with sheet metal screws
62 or pop rivets. Trapeze hangers may be used at contractor's option.

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CLEANING

Remove all dirt and foreign matter from the entire duct system and clean diffusers, registers, grilles and the inside of air-handling units before operating fans.

Clean duct systems with high power vacuum machines where systems have been used for temporary heat, air-conditioning, or ventilation purposes during construction. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning.

LEAKAGE TEST

Test all ductwork in accordance with test methods described in Section 4 of SMACNA HVAC Air Duct Leakage Test Manual. Do not insulate ductwork until it has been successfully tested. Test pressure shall be equal to the duct pressure class.

If excessive air leakage is found locate leaks, repair the duct in the area of the leak, seal the duct, and retest.

Leakage rate shall not exceed more than 5% of the system air quantity for low pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.

Leakage rate shall not exceed more than 1% of the system air quantity for high pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.

Leakage test for ductwork downstream of air terminal devices may be omitted but will not relieve the contractor from duct sealing requirements.

Submit a signed report to the Division's Construction Representative, indicating test apparatus used, results of the leakage test, and any remedial work required to bring duct systems into compliance with specified leakage rates.

STRUCTURAL TEST

Random test all ductwork per UW direction. Do not insulate ductwork until it has been successfully tested. Test pressure shall be equal to the duct pressure class.

Deflection limits shall not exceed those listed in accordance with Chapter 11 of SMACNA HVAC Duct Construction Standards, 3.0 Performance Requirements.

Submit a signed report to the Division's Construction Representative, indicating test apparatus used, results of the structural test, and any remedial work required.

CONSTRUCTION VERIFICATION

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 23 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

APPENDIX

DUCT LEAKAGE TEST REPORT

State of Wisconsin Department of Administration Division of Facilities Development	UW Project Number: _____ Date Submitted: _____
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Project	Name: _____		
	Location: _____		
	Contractor: _____		
System	Fan No: _____	Leakage Class (CL): _____	
Data	Fan Design CFM: _____	Duct Pressure Class (PC): _____	
		Test Pressure (Pr): _____	
Test			
Equipment	Manufacturer: _____	Model No: _____	Serial No: _____

For large systems, use the reverse side for a simple sketch of the entire duct system. Then use letter designations to indicate the various duct sections being tested at one time. Also use the reverse side for test comments.

Note that due to normal construction sequencing it is usually necessary to test risers separately prior to enclosing chases.

Design Data					Field Test Data							
Duct Section	Duct Shape	Duct Surface (F ²)	Allowable Leakage		Diameter		Pressure (in. wc.)		Date	Performed By	Observed By	Actual CFM
			Leakage Factor (P ⁻⁶⁵ CL)	CFM for Section	Tube (D ₁)	Orifice (D ₂)	In Duct (P)	Across Orifice (P _{drop})				
TOTAL												

DUCT STRUCTURAL TEST REPORT

State of Wisconsin Department of Administration Division of Facilities Development	UW Project Number: _____ Date Submitted: _____
--	---

Project	Name: _____ Location: _____ Contractor: _____
System Data	Fan No: _____
Description of Test Method:	
_____ _____ _____	
Test Equipment	Manufacturer: _____ Model No: _____ Serial No: _____

Indicate the various duct sections being tested at one time. Also use the reverse side for test comments.

Design Data							Field Test Data							
Duct Test Location	Ductwork Shape		Duct Pressure Class	Allowable Ductwork Wall Deflection		Allowable Joint/Reinforcement Deflection		Pressure (in. wc.) In Duct	Measured Ductwork Wall Deflection		Measured Joint/Reinforcement Deflection		Per-formed By/ Date	Wit-nessed By/ Date
	H	W		H	W	H	W		H	W	H	W		

END OF SECTION

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SECTION 23 33 00
AIR DUCT ACCESSORIES
BASED ON DFD MASTER SPECIFICATION DATED 02/17/2022

PART 1 - GENERAL

SCOPE

This section includes accessories used in the installation of duct systems. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data

PART 2 - PRODUCTS

- Manual Volume Dampers
- Flexible Duct
- Duct Flexible Connections

PART 3 - EXECUTION

- Manual Volume Dampers
- Flexible Duct
- Duct Flexible Connections
- Construction Verification

RELATED WORK

Section 23 08 00 – Commissioning of HVAC
Section 23 31 00 – HVAC Ducts and Casings

REFERENCE

Applicable provisions of Division 1 govern work under this Section.

REFERENCE STANDARDS

NFPA 90A	Standard for Installation of Air Conditioning and Ventilating Systems
SMACNA	HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, 2005
UL 214	
UL 555 (6 th edition)	Standard for Fire Dampers and Ceiling Dampers
UL 555S (4 th edition)	Leakage Rated Dampers for Use in Smoke Control Systems

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Submit for all accessories and include dimensions, capacities, ratings, installation instructions, and appropriate identification.

Include certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance of sound attenuators.

Submit manufacturer's color charts where finish color is specified to be selected by the Architect/Engineer.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

1 **MANUAL VOLUME DAMPERS**

2 Manufacturers: Ruskin, Vent Products, Air Balance, or approved equal.

3
4 Dampers must be constructed in accordance with SMACNA Fig. 7-4, Fig. 7-5, and notes relating to these
5 figures, except as modified below.

6
7 Reinforce all blades to prevent vibration, flutter, or other noise. Construct dampers in multiple sections with
8 mullions where width is over 48 inches. Use rivets or tack welds to secure individual components; sheet
9 metal screws will not be accepted. Provide operators with locking devices and damper position indicators
10 for each damper; use an elevated platform on insulated ducts. Provide end bearings or bushings for all volume
11 damper rods penetrating ductwork constructed to a 3" w.c. pressure class or above.

12
13
14 **FLEXIBLE DUCT**

15 Manufacturers: Anco Products, Clevaflex, Thermaflex, Flexmaster or approved equal.

16
17 Factory fabricated, UL 181 listed as a class 1 duct, and having a flame spread of 25 or less and a smoke
18 developed rating of 50 or under in accordance with NFPA 90A.

19
20 Suitable for pressures and temperatures involved but not less than a 180°F service temperature and ±2 inch
21 pressure class, depending on the application.

22
23 Duct to be composed of polyester film, aluminum laminate or woven and coated fiberglass fabric bonded
24 permanently to corrosion resistant coated steel wire helix. Two-ply, laminated, and corrugated aluminum
25 construction may also be used.

26
27 Where duct is specified to be insulated, provide a minimum 1 inch fiberglass insulation blanket with
28 maximum thermal conductance of 0.23 K (75 degrees F.) and vapor barrier jacket of polyethylene or
29 metalized reinforced film laminate. Maximum perm rating of vapor barrier jacket to be 0.1 perm.

30
31
32 **DUCT FLEXIBLE CONNECTIONS**

33 Material to be fire retardant, be UL 214 listed, and meet the requirements of NFPA 90A.

34
35 Connections to be a minimum of 3 inches wide, crimped into metal edging strip, and air tight. Connections
36 to have adequate flexibility and width to allow for thermal expansion/contraction, vibration of connected
37 equipment, and other movement.

38
39 General Applications:

40 Use coated glass fiber fabric for all applications. Material for inside applications other than corrosive
41 environments, fume exhaust, or kitchen exhaust to be double coated with neoprene, air and water tight,
42 suitable for temperatures between -10°F and 200°F, and have a nominal weight of 30 ounces per square yard.

43
44 **PART 3 - EXECUTION**

45
46 **MANUAL VOLUME DAMPERS**

47 Install manual volume dampers in each branch duct and for each grille, register, or diffuser as far away from
48 the outlet as possible while still maintaining accessibility to the damper. Install so there is no flutter or
49 vibration of the damper blade(s).

50
51
52 **FLEXIBLE DUCT**

53 Flexible duct may only be used for final connections of air inlets and outlets at diffuser, register, and grille
54 locations. Where flexible duct is used, it shall be the minimum length required to make the final connections,
55 but no greater than 5 feet in length, and have no more than one (1) 90 degree bend.

56
57 Secure inner jacket of flexible duct in place with stainless steel metal band clamp. Secure insulation vapor
58 barrier jacket in place with steel or nylon draw band. Sheetmetal screws and/or duct tape will not be accepted.

59
60 Flexible duct used to compensate for misalignment of main duct or branch duct will not be accepted.

61
62 Individual sections of flexible ductwork shall be of one piece construction. Splicing of short sections will
63 not be accepted.

1 Flexible ductwork used as transfer duct shall be sized for a maximum velocity of 300 fpm.

2

3 Penetration of any partition, wall, or floor with flexible duct will not be accepted.

4

5

6 **DUCT FLEXIBLE CONNECTIONS**

7 Install at all duct connections to rotating or vibrating equipment, including air handling units (unless unit is
8 internally isolated), fans, or other motorized equipment in accordance with SMACNA Figure 7-8. Install
9 thrust restraints to prevent excess strain on duct flexible connections at fan inlets and outlets; see Related
10 Work.

11

12 For applications in corrosive environments or fume exhaust systems, use a double layer of the Teflon₂ coated
13 fabric when making the connector.

14

15

16 **CONSTRUCTION VERIFICATION**

17 Contractor is responsible for utilizing the construction verification checklists supplied under specification
18 Section 23 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01
19 or 01 91 02.

20

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END OF SECTION

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SECTION 23 37 13
DIFFUSERS, REGISTERS & GRILLES
BASED ON DFD MASTER SPECIFICATION DATED 7/11/2023

PART 1 - GENERAL

SCOPE

This section includes specifications for air terminal equipment. Included are the following topics:

PART 1 - GENERAL

Scope
Related Work
Reference
Reference Standards
Quality Assurance
Submittals
Design Criteria

PART 2 - PRODUCTS

Manufacturers
Linear Slot Diffusers
Linear Bar Diffusers and Grilles
Plenum Slot Diffusers - 180 Degree Adjustable
Plenum Slot Diffusers - with Gasketed Blade
Sidewall Registers and Grilles
Eggcrate Grille

PART 3 - EXECUTION

Installation
Construction Verification Items

RELATED WORK

Section 01 91 01 or 01 91 02 - Commissioning Process
Section 23 08 00 - Commissioning of HVAC
Section 23 31 00 - HVAC Ducts and Casings
Section 23 33 00 - Air Duct Accessories
Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
UL 181 - Factory-Made Air Ducts and Connectors.
ARI-ADC Standard 880.

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions.

SUBMITTALS

Refer to division 1, General Conditions, Submittals.

Furnish submittal information including, but not limited to, the following:

- Manufacturer's name and model number
- Identification as referenced in the documents
- Capacities/ratings
- Materials of construction
- Sound ratings
- Dimensions
- Finish
- Color selection charts where applicable
- Manufacturer's installation instructions
- All other appropriate data

1 **DESIGN CRITERIA**

2 All performance data shall be based on tests conducted in accordance with Air Diffusion Council (ADC) Test
3 Code 1062 GRD 84.

4
5 **PART 2 - PRODUCTS**

6
7 **MANUFACTURERS**

8 Acceptable manufacturers for specific products are listed under each item.

9
10 **LINEAR SLOT DIFFUSERS**

11 Carnes CH, Nailor 5000, Price SDS, Shoemaker LSD, Titus ML.

12
13 Extruded aluminum with frame type appropriate to installation with diffuser elements being removable from
14 frame. Both air pattern and flow rate adjustment with air pattern having full 180-degree adjustment. Single
15 slot diffuser vanes segmented on 2 or 3-foot centers.

16
17
18 Diffuser lengths and slot sizes as shown on drawings and/or as scheduled.

19
20 White, baked enamel finish or powder coat finish, unless otherwise indicated. Flat black diffuser vanes and
21 frame interior.

22
23 Provide diffusers with uninsulated galvanized steel plenum. Plenums constructed for specific diffuser frame
24 and border type. Provide round or oval inlet collar designed to fit standard flexible duct sizes.

25
26
27 **LINEAR BAR DIFFUSERS AND GRILLES**

28 Carnes CC, CT and CW, Greenheck XG-2000, Metal Aire 2000, Nailor 4900, Price LBP, Shoemaker LF, LS
29 and LC, Titus CT.

30
31 Extruded aluminum with frame type appropriate to side wall, sill or ceiling installation as indicated.

32
33 Diffuser and grille lengths, blade spacing, and blank off strips as shown on drawings and/or as scheduled.

34
35 Where frame and border types allow, provide supply air diffusers with straightening or equalizing vanes.
36 Fixed blades at 0 or 15-degree deflection as scheduled. Bar support maximum 9" spacing.

37
38 White, anodized aluminum finish unless otherwise indicated.

39
40 Provide alignment strips/wires for end-to-end joining of sections for a continuous appearance when
41 scheduled lengths exceed standard manufacturer lengths.

42
43 **PLENUM SLOT DIFFUSER - 180 Degree Adjustable**

44 Carnes DA, Greenheck XG-6600, Krueger PTBA, Metal Aire 6600, Nailor 5800, Price TBD3, Raymon-
45 Donco SAT and XC, Shoemaker LSD, Titus TBD-30.

46
47 Steel, furnished with T-bars compatible with ceiling components. Vane air pattern and flow rate adjustment
48 with air pattern having full 180-degree adjustment.

49
50 Provide 24-gauge galvanized steel [uninsulated] [insulated] plenum. Provide round or oval inlet collar
51 designed to fit standard flexible duct sizes.

52
53
54 Double metal thickness slot face.

55
56 White, baked enamel finish or powder coat finish, unless otherwise indicated. Flat black diffuser vanes and
57 frame interior.

58
59 **PLENUM SLOT DIFFUSER - with Gasketed Blade**

60 Carnes DA, Greenheck XG-PHP, Krueger PTBS, Metal Aire PHP, Nailor 5700, Price TBD4, Raymon-
61 Donco BA and BS, Shoemaker LSD, Titus TBD-80.

1 Steel, furnished with T-bars compatible with ceiling components. Extruded aluminum pattern with a gasket
2 on top edge to form a seal against the plenum wall or slot divider. Pattern control field adjustable from vertical
3 to horizontal discharge.
4

5 Provide 24-gauge galvanized steel [uninsulated] [insulated] plenum. Provide round or oval inlet collar
6 designed to fit standard flexible duct sizes.
7

8
9 Double metal thickness slot face.

10
11 White, baked enamel finish or powder coat finish, unless otherwise indicated. Flat black diffuser vanes and
12 frame interior.
13

14 15 **SIDEWALL REGISTERS AND GRILLES**

16 Carnes R, Greenheck XG-4000, Krueger 880, Metal Aire 4000, Nailor 51DH, Price 520 (supply) and 530
17 (return/exhaust), Shoemaker 900, Titus 300 (supply) and 350 (return/exhaust).
18

19 [Aluminum] [Steel] unless otherwise indicated, with frame type appropriate to installation.
20

21 Register and grille sizes as shown on drawings and/or as scheduled.
22

23 White, baked enamel finish or powder coat finish, unless otherwise indicated.
24

25 Screw holes on surface counter sunk to accept recessed type screws.
26
27
28
29
30

31 Fixed blade (0 or 45 degree) core return and exhaust registers and grilles.
32
33

34 **EGGCRATE GRILLE**

35 Carnes RAE and RAT, Greenheck XG-CC, Krueger EGC, Metal Aire CC, Nailor 51EC, Price 80, Shoemaker
36 600, Titus 50.
37

38 Aluminum construction with frame type appropriate to installation.
39

40 Grille face 1/2" x 1/2" or 1" x 1" grid pattern 1" deep with a minimum of 85% free area.
41

42 Grille sizes and finishes as shown on drawings and/or as scheduled.
43

44 White, baked enamel finish or powder coat finish, unless otherwise indicated.
45

46 Screw holes on surface counter sunk to accept recessed type screws.
47
48
49

50 **PART 3 - EXECUTION**

51 **INSTALLATION**

52 Install grilles, registers and diffusers as shown on drawings and according to manufacturer's instructions.
53
54

55 Furnish diffusers with equalizing grids where it is not possible to maintain minimum 2 duct diameter straight
56 duct into diffuser. Equalizing grids shall consist of individually adjustable vanes designed for equalizing
57 airflow into diffuser neck and providing directional control of airflow.
58

59 Unless otherwise indicated, size ductwork drops to diffusers or grilles to match unit collar size.
60

61 Seal connections between ductwork drops and diffusers/grilles airtight.
62

63 Blank off unused portion of linear slot diffusers and linear bar diffusers and grilles.
64

1 Where diffusers, registers and grilles cannot be installed to avoid seeing inside duct, paint inside of duct with
2 flat black paint to reduce visibility.

3
4 In clean rooms and animal holding rooms, caulk space between diffuser or grille and ceiling or wall to be air
5 and watertight. User clear, non-hardening silicone sealant compatible with ceiling or wall surfaces. Sealant
6 shall be resistant to microbiological growth.

7
8 **CONSTRUCTION VERIFICATION**

9 Contractor is responsible for utilizing the construction verification checklists supplied under specification
10 Section 23 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01
11 or 01 91 02.

12
13 END OF SECTION
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SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

The electrical work included in all other divisions is the responsibility of the contractor performing the division 26 work unless noted otherwise.

PROJECT OVERVIEW

This is a remodeling project that consists of the reconfiguration of existing lab spaces to be used as the new kinesiology department. Reconfiguration includes adding new or rewiring existing lights and receptacles, This project also includes replacement of existing electrical panels serving kinesiology department.

SCOPE

The work under this section includes basic electrical requirements, which are applicable to all Division 26 sections. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:

PART 1 - GENERAL

- Project Overview
- Scope
- Related Work
- Reference Standards
- Regulatory Requirements
- Quality Assurance
- Continuity of Existing Services and Systems
- Protection of Finished Surfaces
- Approved Electrical Testing Laboratories
- Sleeves and Openings
- Sealing and Fire Stopping
- State and/or User Agency Furnished Equipment
- Work by State and/or User Agency
- Provisions for Future Work
- Intent
- Omissions
- Submittals
- Project/Site Conditions
- Work Sequence and Scheduling
- Work by Other Trades
- Offsite Storage
- Salvage Materials
- Certificates and Inspections
- Operating and Maintenance Data
- Record Drawings

PART 2 - PRODUCTS

- Access Panels and Doors
- Identification
- Sealing and Fire Stopping

PART 3 - EXECUTION

- Cutting and Patching
- Building Access
- Equipment Access
- Coordination
- Sleeves and Openings

1 Sealing and Fire Stopping
2 Housekeeping and Clean Up
3 Agency Training
4

5 **RELATED WORK**

6 Applicable provisions of Division 1 govern work under this Section.
7

8 Section 01 91 01 or 01 91 02 – Commissioning Process

9 Section 07 84 00 – Fire Stopping
10

11 **REFERENCE STANDARDS**

12 Abbreviations of standards organizations referenced in this and other sections are as follows:
13

14 ANSI American National Standards Institute
15 ASTM American Society for Testing and Materials
16 EPA Environmental Protection Agency
17 ETL Electrical Testing Laboratories, Inc.
18 IEEE Institute of Electrical and Electronics Engineers
19 IES Illuminating Engineering Society
20 ISA Instrument Society of America
21 NBS National Bureau of Standards
22 NEC National Electric Code
23 NEMA National Electrical Manufacturers Association
24 NESC National Electrical Safety Code
25 NFPA National Fire Protection Association
26 UL Underwriters Laboratories Inc.
27 DSPS Wisconsin Department of Safety and Professional Services
28

29 **REGULATORY REQUIREMENTS**

30 All work and materials are to conform in every detail to applicable rules and requirements of the Wisconsin
31 State Electrical Code (SPS 316), the National Electrical Code (NFPA 70), other applicable National Fire
32 Protection Association codes, the National Electrical Safety Code, and present manufacturing standards
33 (including NEMA).
34

35 All Division 26 work shall be done under the direction of a currently licensed State of Wisconsin Master
36 Electrician.
37

38 All Division 26 work shall comply with SPS 101.862 and SPS 305.40 for electrical wiring integral with pre-
39 manufactured structures.
40

41 **QUALITY ASSURANCE**

42 Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or
43 engineering parameters from those indicated on the contract documents, the contractor is responsible for all
44 costs involved in integrating the equipment or accessories into the system and the assigned space, and for
45 obtaining the performance from the system into which these items are placed.
46

47 Manufacturer references used herein are intended to establish a level of quality and performance requirements
48 unless more explicit restrictions are stated to apply.
49

50 All materials, except medium voltage equipment and components, shall be listed by and shall bear the label
51 of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has
52 published standards for a particular item, then other national independent testing standards, if available,
53 applicable, and approved by UW-Milwaukee, shall apply and such items shall bear those labels. Where one
54 of the approved electrical testing laboratories has an applicable system listing and label, the entire system,
55 except for medium voltage equipment and components, shall be so labeled.
56

1 **CONTINUITY OF EXISTING SERVICES AND SYSTEMS**

2 No outages shall be permitted on existing systems except at the time and during the interval specified by the
3 user agency and by the UW Project Representative. The institution may require written approval. Any
4 outage must be scheduled when the interruption causes the least interference with normal institutional
5 schedules and business routines. No extra costs will be paid to the Contractor for such outages which must
6 occur outside of regular weekly working hours.

7
8 This Contractor shall restore any circuit interrupted as a result of this work to proper operation as soon as
9 possible. Note that institutional operations are on a seven-day week schedule.

10
11 **PROTECTION OF FINISHED SURFACES**

12 Furnish one can of touch-up paint for each different color factory finish furnished by the Contractor. Deliver
13 touch-up paint with other "loose and detachable parts" as covered in the General Requirements.

14
15 **APPROVED ELECTRICAL TESTING LABORATORIES**

16 The following laboratories are approved for providing electrical product safety testing and listing services as
17 required in these specifications:

18
19 Underwriters Laboratories Inc.
20 Electrical Testing Laboratories, Inc.

21
22 **SLEEVES AND OPENINGS**

23 Refer to Division 1, General Requirements, Sleeves and Openings.

24
25 **SEALING AND FIRE STOPPING**

26 Sealing and fire stopping of sleeves/openings between conduits, cable trays, wireways, troughs, cablebus,
27 busduct, etc. and the sleeve, structural or partition opening shall be the responsibility of the contractor whose
28 work penetrates the opening. Provide all fire stopping of fire rated penetrations and sealing of smoke rated
29 penetrations in compliance with Section 07 84 00 Fire Stopping.

30
31 **WORK BY STATE AND/OR USER AGENCY**

32
33 PCB equipment (other than light fixture ballasts) removal and disposal, if required, will be by the UW-
34 Milwaukee under separate contract.

35
36 Electrical testing not described in these contract documents will be by UW-Milwaukee under separate
37 contract.

38
39 **INTENT**

40 The Contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the
41 electrical equipment and systems installation herein specified, except such parts as are specifically exempted
42 herein.

43
44 If an item is either called for in the specifications or shown on the plans, it shall be considered sufficient for
45 the inclusion of said item in this contract. If a conflict exists within the Specifications or exists within the
46 Drawings, the Contractor shall furnish the item, system, or workmanship, which is the highest quality, largest,
47 or most closely fits the UW-Milwaukee's intent (as determined by the UW-Milwaukee Project Manager).
48 Refer to the General Conditions of the Contract for further clarification.

49
50 It must be understood that the details and drawings are diagrammatic. The Contractor shall verify all
51 dimensions at the site and be responsible for their accuracy.

52
53 All sizes as given are minimum except as noted.
54

1 Materials and labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall
2 be subject at all times to the UW-Milwaukee's and/or A/E's inspections, tests and approval from the
3 commencement until the acceptance of the completed work.

4
5 Whenever a particular manufacturer's product is named, it is intended to establish a level of quality and
6 performance requirements unless more explicit restrictions are stated to apply.

7
8 **OMISSIONS**

9 No later than ten (10) days before bid opening, the Contractor shall call the attention of the UW to any
10 materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

11
12 **SUBMITTALS**

13 Submit for all equipment and systems as indicated in the respective specification sections, marking each
14 submittal with that specification section number. Mark general catalog sheets and drawings to indicate
15 specific items being submitted and proper identification of equipment by name and/or number, as indicated
16 in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor
17 for correction and resubmission. Failing to follow these instructions does not relieve the Contractor from the
18 requirement of meeting the project schedule.

19
20 On request from UW-Milwaukee, the successful bidder shall furnish additional drawings, illustrations,
21 catalog data, performance characteristics, etc.

22
23 Submittals shall be grouped to include complete submittals of related systems, products, and accessories in
24 a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams
25 of electrically powered equipment.

26
27 The submittals must be approved before fabrication is authorized.

28
29 Submit sufficient quantities of submittals to allow the following distribution:

30

31	Operating and Maintenance Manuals	2 copies
32	User agency	1 copy
33	A/E	1 copy
34	UW-Milwaukee Field Office	1 copy

35

36 **PROJECT/SITE CONDITIONS**

37
38 Install Work in locations shown on drawings, unless prevented by project conditions.

39
40 Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to
41 work specified in other sections. Obtain permission of UW before proceeding.

42
43 Tools, materials and equipment shall be confined to areas designated by the UW and user agency.

44
45 **WORK SEQUENCE AND SCHEDULING**

46 Install work in phases to accommodate user agency's occupancy requirements. During the construction
47 period coordinate electrical schedule and operations with UW's Construction Representative.

48
49 **WORK BY OTHER TRADES**

50 Every attempt has been made to indicate in this trade's specifications and drawings all work required of this
51 Contractor. However, there may be additional specific paragraphs in other trade specifications and addenda,
52 and additional notes on drawings for other trades which pertain to this trade's work, and thus those additional
53 requirements are hereby made a part of these specifications and drawings.

1 Electrical details on drawings for equipment to be provided by others are based on preliminary design data
2 only. This Contractor shall lay out the electrical work and shall be responsible for its correctness to match
3 equipment actually provided by others.
4

5 **OFFSITE STORAGE**

6 Prior approval by UW-Milwaukee and the A/E will be needed. The contractor shall submit Storage
7 Agreement Form DOA-4528 to UW for consideration of off-site materials storage. In general, building wire,
8 conduit, fittings and similar rough-in material will not be accepted for off-site storage. No material will be
9 accepted for off-site storage unless shop drawings for the material have been approved.
10

11 **SALVAGE MATERIALS**

12 No materials removed from this project shall be reused unless specifically noted otherwise. All materials
13 removed shall become the property of and shall be disposed of by the Contractor.
14

15 **CERTIFICATES AND INSPECTIONS**

16 Obtain and pay for all required installation inspections, except those provided by UW-Milwaukee, in
17 accordance with the Wisconsin Administrative Code. Deliver originals of these certificates to UW-
18 Milwaukee's Project Representative.
19

20
21 The Electrical Contractor is responsible for coordination of UW electrical inspections. Prior to the start of
22 significant on-site electrical work, the contractor shall schedule a pre-installation meeting with the Electrical
23 Inspector to discuss the inspection requirements and review the contract requirements (also see Article 15 of
24 the General Conditions). The Electrical Contractor shall be present when the Electrical Inspector conducts
25 the electrical inspections.
26

27 **OPERATION AND MAINTENANCE DATA**

28 All operations and maintenance data shall comply with the submission and content requirements specified
29 under section GENERAL REQUIREMENTS.
30

31 In addition to the general content specified under GENERAL REQUIREMENTS supply the following
32 additional documentation:
33

34 Manufacturer's wiring diagrams for electrically powered equipment.
35

36 **RECORD DRAWINGS**

37 The Contractor shall maintain at least one copy each of the specifications and drawings on the job site at all
38 times.
39

40 UW-Milwaukee will provide the Contractor with a suitable set of contract drawings on which daily records
41 of changes and deviations from contract shall be recorded. Dimensions and elevations on the record drawings
42 shall locate all buried or concealed piping, conduit, or similar items.
43

44 The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary
45 mark-ups will be permitted.
46

47 At completion of the project, the Contractor shall submit the marked-up record drawings to the
48 Architect/Engineer prior to final payment.
49

50 **PART 2 - PRODUCTS**

51 **ACCESS PANELS AND DOORS**

52 Lay-in Ceilings:

53 Removable lay-in ceiling tiles in 2 x 2 foot or 2 x 4 foot configuration provided under other divisions are
54 sufficient; no additional access provisions are required unless specifically indicated.
55
56

1
2 Concealed Spline Ceilings:
3 Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system
4 used will be provided under other divisions.

5
6 Metal Pan Ceilings:
7 Removable sections of ceiling tile held in position by pressure fit will be provided under other divisions.

8
9 Plaster Walls and Ceilings, Concealed Cavities:
10 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications,
11 stainless steel for use in toilets, showers and similar wet areas, concealed hinges, screwdriver operated cam
12 latch for general application, key lock for use in public areas, UL listed for use in fire rated partitions if
13 required by the application. Use the largest size access opening possible, consistent with the space and the
14 equipment needing service; minimum size 20" x 30".

15
16 **IDENTIFICATION**

17 See Electrical section 26 05 53 – Identification for Electrical Systems.

18
19 **SEALING AND FIRE STOPPING**

20 **FIRE AND/OR SMOKE RATED PENETRATIONS:**

21 Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with
22 section 07 84 00 "Fire Stopping".

23
24 **NON-RATED PENETRATIONS:**

25
26 **Conduit and Cable Tray Penetrations Above Grade:**

27 At through-wall conduit and cable tray penetrations of non-rated interior and exterior walls, and floors, use
28 urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

29
30
31 **PART 3 - EXECUTION**

32
33 **CUTTING AND PATCHING**

34 Refer to Division 1, General Requirements, Cutting and Patching.

35
36 **BUILDING ACCESS**

37 Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the
38 building access was not previously arranged and must be provided by this contractor, restore any opening to
39 its original condition after the apparatus has been brought into the building.

40
41 **EQUIPMENT ACCESS**

42 Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance.
43 Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making
44 sure that access is available for all equipment and specialties. Where access is required in plaster or drywall
45 walls or ceilings, furnish the access doors to the General Contractor and reimburse the General Contractor
46 for installation of those access doors.

47
48 **COORDINATION**

49 The Contractor shall cooperate with other trades and UW-Milwaukee in locating work in a proper manner.
50 Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the
51 general installation, such work shall be done at no extra cost to UW-Milwaukee, provided such decision is
52 reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to
53 other installations before installing.

1 The Contractor shall verify that all devices are compatible for the surfaces on which they will be used. This
2 includes, but is not limited to light fixtures, panelboards, devices, etc. and recessed or semi-recessed heating
3 units installed in/on architectural surfaces.

4
5 Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated
6 and that interferes with other contractor's work shall be removed or relocated at the installing contractor's
7 expense.

8 9 **SLEEVES AND OPENINGS**

10 Conduit penetrations in existing concrete floors: Core drill openings.

11
12 Conduit penetrations through existing floors located in food service areas that do not require a T rating: Core
13 drill sleeve opening large enough to insert schedule 40 sleeve, extend sleeve 2 inches above the floor and
14 grout area around sleeve with hydraulic setting, non-shrink grout.

15
16 Where penetrating conduit weight is supported by floor, provide manufactured product or structural bearing
17 collar designed to carry load.

18
19 Floor or roof core drilling to be x-rayed prior to coring to allow for the determination and avoidance of
20 potential obstructions. Contractor to coordinate required ceiling access beneath the work area with Owner
21 and assumes replacement or repair of damaged or modified building components such as ceiling tile, drywall
22 patching, insulation, piping or other existing components as a result of access to plenum spaces.

23 24 **SEALING AND FIRE STOPPING**

25 **FIRE AND/OR SMOKE RATED PENETRATIONS:**

26 Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with
27 section 07 84 00 Fire Stopping.

28 29 **NON-RATED PENETRATIONS:**

30
31 At all interior and exterior walls, through-wall conduit penetrations are required to be sealed. Apply sealant
32 to both sides of the penetration in such a manner that the annular space between the sleeve or cored opening
33 and the conduit is completely blocked.

34 35 **PENETRATIONS SUBJECT TO WATER INTRUSION:**

36 For penetrations (both rated and non-rated) in floors subject to water intrusion or in rooms housing electrical
37 equipment (but not within walls) provide one of the following:

- 38 • Conduit penetration where steel pipe sleeve is used extend steel sleeve 2" above the floor.
- 39 • Conduit penetration where cast in place fire stopping device/sleeve is used, extend device/sleeve 2"
40 above the floor (provided it meets the device's UL listing).
- 41 • Conduit penetration where there is no steel sleeve or cast in place fire stopping device/sleeve,
42 provide 2"x 2" x 1/8" galvanized steel angles fastened to floor surrounding the penetration or group
43 of penetrations to prevent water from getting to penetration. Provide urethane caulk between angles
44 and floor and fasten angles to floor minimum 8" on center. Seal corners water tight with urethane
45 caulk.

46
47 Floors subject to water intrusion or rooms housing electrical equipment include the following locations:

- 48 • Food Service/Kitchen Areas
- 49 • Laundries
- 50 • Restrooms
- 51 • Locker/Shower Rooms
- 52 • Janitor Rooms w/ Sinks
- 53 • Wet Laboratories
- 54 • Mechanical/Plumbing Equipment Rooms
- 55 • Data/Telecommunications Rooms

- Electrical Equipment Rooms

Provide waterproof caulk sealant top coating on fire stopping system (or other approved means to protect the fire stopping system from water) in areas subject to wash down such as Food Service and Dish Washing Areas.

HOUSEKEEPING AND CLEAN UP

The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

AGENCY TRAINING

All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01 or 01 91 02.

Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 2 hours.

END OF SECTION

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SECTION 26 05 02
ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

SCOPE

The work under this section includes removal of existing walls and ceilings. Included are the following topics:

PART 1 - GENERAL

Scope

Related Work

PART 2 - PRODUCTS

Materials and Equipment

PART 3 - EXECUTION

Examination

Preparation

Demolition and Extension of the Existing Electrical Work

PCB Ballast Handling

Lamp and PCB Ballast Disposal

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

PART 2 - PRODUCTS

MATERIALS AND EQUIPMENT

Materials and equipment for patching and extending work as specified in the individual Sections.

PART 3 - EXECUTION

EXAMINATION

Verify field measurements and circuiting arrangements as shown on Drawings.

Verify that abandoned wiring and equipment serve only abandoned facilities.

Verify whether or not PCB ballasts exist in light fixtures which will be disposed of. If PCB light fixture ballasts exist, then follow requirements in **PCB BALLAST HANDLING** and **LAMP AND PCB BALLAST DISPOSAL** below.

Demolition Drawings are based on casual field observation and/or existing record documents. Report discrepancies to the User Agency, Architect/Engineer and UW Field Representative before disturbing existing installation.

Beginning of demolition means installer accepts existing conditions.

PREPARATION

Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

Coordinate utility service outages with the User Agency, UW Field Representative, and Architect/Engineer. Also, if applicable, coordinate utility service outages with the local Utility Company.

1 Provide temporary wiring and connections to maintain existing systems in service during construction. When
2 work must be performed on energized equipment or circuits, use personnel experienced in such operations
3 and follow the safe working practice requirements of NFPA 70E.

4 5 **DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK**

6
7 Remove, relocate, and extend existing installations as necessary, to accommodate new construction and to
8 meet all requirements of these specifications. Extend existing installations using materials and methods
9 compatible with existing electrical installations, or as specified.

10
11 Remove abandoned wiring to source of supply.

12
13 Remove exposed abandoned conduit and abandoned conduit above accessible ceiling finishes, unless noted
14 otherwise on drawings. Cut conduit flush with walls and floors, and patch surfaces. If certain conduits and
15 boxes are abandoned but not scheduled for removal, they shall be shown on the "As Built Drawings".

16
17 Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit and wiring
18 servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not
19 removed.

20
21 Disconnect and remove abandoned panelboards and distribution equipment.

22
23 Disconnect and remove electrical devices and equipment serving utilization equipment that has been
24 removed.

25
26 Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

27
28 Provide revised typed circuit directory in panelboards that have circuits removed.

29
30 Repair adjacent construction and finishes damaged during demolition and extension work.

31
32 Maintain access to existing electrical installations which remain active. Modify installation or provide access
33 panel as appropriate.

34
35 Provide supplemental support for conduits that are routed through demolition area, and are to remain.
36 Supplemental support shall be added so that the conduit meets the support requirements of electrical
37 specification section 26 05 33.

38 39 **PCB BALLAST HANDLING**

40 Generally, all high power factor fluorescent light ballasts manufactured before 1978 and some HID ballasts
41 contain polychlorinated biphenyl (PCB) compounds in their capacitors. The Contractor shall inspect all
42 ballasts in all light fixtures and take the actions described below.

43
44 The disposal of all ballasts labeled as "NON-PCBs" or "NO PCBs" shall become the responsibility
45 of the Contractor. If the PCB content is not stated on the ballast label, the ballast shall be handled
46 as a PCB ballast.

47
48 All PCB ballasts shall be removed from the light fixtures and shall have the wires clipped off.
49 However, before removal, all PCB ballasts shall be carefully inspected for leaks. If a ballast appears
50 to be leaking (evidenced by potting compound leaking out or by an oily film on the ballast surface)
51 the ballast must be handled per EPA and DNR PCB regulations. Basically, this means the ballast is
52 to be carefully removed from the fixture and placed in an approved drum. See paragraph below for
53 the drum specifications. The person removing the ballast from the fixture shall wear protective
54 gloves, eye protection, and protective clothing as necessary.

1 If the fixture has also been contaminated, it must be cleaned to less than 10 micrograms/100 square
2 centimeters contamination before disposal. This cleaning must be done by an approved PCB
3 contractor and is not considered a part of this contract. Contact UW for contractor approval before
4 commencing with the cleanup.

5
6 The PCB ballasts shall then be placed in US DOT approved drums (barrels). The contractor may
7 furnish their own drums or obtain them from Lamp Recyclers Incorporated (800-558-1166). The
8 quantity and size of the drums will be determined by the contractor at the time of construction,
9 30 and 55 gallon drums are typically available.

10
11 These PCB drums shall be placed in storage with the cover that came with the barrels, in a location
12 within a building, as designated by the Building Manager or UW Field Representative. The drums
13 are not to be placed outside where they are exposed to weather.

14
15 THESE PCB BALLASTS ARE NOT TO BE REMOVED FROM THE WORK SITE BY THE
16 CONTRACTOR. To do so would be a violation of DNR and DOT hazardous waste regulations and
17 may result in a fine to the Contractor.

18
19 The Contractor shall label and mark the PCB storage drums with EPA approved PCB labels and the
20 storage area with signs, marks and lines to meet the regulations of Wisconsin Code NR 157 –
21 Management of PCBs and Products Containing PCBs.

22
23 The Contractor shall also provide approved PCB absorbent materials to be stored immediately
24 adjacent to the drum storage area. Do not place loose absorbent material in the drums.

25
26 The Contractor shall provide to the UW Field Representative, in written form, a total count of these
27 ballasts (or their total weight by drum) and where they are stored.

28
29 See Lamp and PCB Ballast Disposal instructions below.

30 31 **LAMP AND PCB BALLAST DISPOSAL**

32 All lamps (fluorescent, incandescent, and HID) contain mercury and/or lead (in the base) as well as other
33 heavy metals and compounds which are regulated by the EPA and DNR during the disposal process. As a
34 result, regulations have been issued covering the handling and disposal of all lamps. Lamps which have been
35 removed from service for disposal shall be handled as follows by the Contractor:

36
37 The Contractor shall very carefully remove all lamps (fluorescent, incandescent, and HID) from
38 light fixtures before removal of the fixture from its mounted position. This is to reduce the
39 likelihood that the lamp(s) will be broken. The Contractor will be charged the cost difference
40 between disposal of broken and unbroken lamps, for all lamps broken in excess of 1% of the total
41 lamps removed in the project.

42
43 The contractor shall contact Lamp Recyclers Incorporated (800-558-1166) to coordinate the storage
44 and pickup of disposed lamps and PCB ballasts. The contractor may furnish their own containers
45 or obtain them from Lamp Recyclers Incorporated. Removed lamps and PCB ballasts shall be
46 placed in containers by the contractor, marked with the number and type of lamp and PCB ballast,
47 and placed in storage at a location on the user agency's property. The contractor shall label the area
48 as "Hazardous Material Storage". The contractor shall make arrangements for pickup of the lamps
49 and PCB ballasts with Lamp Recyclers Incorporated, shall provide a count of all stored lamps and
50 PCB ballasts, and shall fill out any required forms.

51
52 When making disposal arrangements with Lamp Recyclers Incorporated, the contractor shall make
53 sure to notify them of the UW project number, UW project name and UW Project Manager, for
54 invoicing purposes. Invoicing from Lamp Recyclers Incorporated shall be sent to the UW Project
55 Manager for direct charge payment from the project (lamp and PCB ballast disposal costs to be paid
56 by UW), and shall indicate the proper UW project number, name, and PM.

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4
5

The contractor shall coordinate the lamp and PCB ballast disposal with the UW Field Representative.

END OF SECTION

1
2 **SECTION 26 05 04**
3 **CLEANING, INSPECTION, AND TESTING OF ELECTRICAL EQUIPMENT**

4
5 **PART 1 - GENERAL**

6
7 **SCOPE**

8 The work under this section includes the required cleaning, inspection, adjustment, maintenance and testing
9 of electrical equipment, as specified herein. This applies only to new electrical and existing electrical
10 equipment being furnished, modified, worked on or serviced by this contractor for this project. Included are
11 the following topics:

12
13 **PART 1 - GENERAL**

14 Scope

15 Related Work

16 **PART 2 - PRODUCTS**

17 Not Used

18 **PART 3 - EXECUTION**

19 General Inspection and Cleaning of All Electrical Equipment

20 Grounding Systems

21 Panelboards

22 Motor Starters and Motor Control Centers

23 Cables

24 Light Fixtures

25 Occupancy Sensors

26 Battery Pack Emergency Lighting

27
28 **RELATED WORK**

29 Applicable provisions of Division 1 govern work under this Section.

30
31 Section 01 91 01 or 01 91 02 – Commissioning Process

32
33
34 **PART 2 - PRODUCTS**

35
36 Not Used.

37 **PART 3 - EXECUTION**

38
39
40 **GENERAL INSPECTION AND CLEANING OF ALL ELECTRICAL EQUIPMENT**

41 Inspect for physical damage and abnormal mechanical and electrical conditions.

42
43 Any item found to be out of tolerance, or in any other way defective as a result of the required inspection or
44 testing, shall be reported to UW. Procedure for repair and/or replacement will be outlined. After appropriate
45 corrective action is completed the item shall be re-tested.

46
47 Compare equipment nameplate information with the latest single line diagram and report any discrepancies.

48
49 Verify proper auxiliary device operation and indicators.

50
51 Check tightness of accessible bolted electrical joints. Use torque wrench method.

52
53 Make a close examination of equipment and remove any shipping brackets, insulation, packing, etc. that may
54 not have been removed during original installation.

55

1 Make a close examination of equipment and remove any dirt or other forms of debris that may have collected
2 in existing equipment or in new equipment during installation.

3
4 Clean All Equipment:

5 Vacuum inside of panelboards, switchboards, switchgear, transformer core and coils, bus ducts,
6 MCC's, fire alarm panels, communication/data panels, security panels, etc.

7 Loosen attached particles and vacuum them away.

8 Wipe all insulators with a clean, dry, lint free rag.

9 Clean insulator grooves.

10 Re-vacuum inside surfaces as directed by the UW Construction Representative or Inspector

11
12 Inspect equipment anchorage.

13
14 Inspect equipment and bus alignment.

15
16 Check all heater elements for operation and control.

17
18 Lubricate nonelectrical equipment per manufacturer's recommendations.

19
20 **GROUNDING SYSTEMS**

21 Inspect the ground system for adequate termination at all devices.

22
23 **PANELBOARDS**

24 Torque all the connections per the manufacturers spec. Verify phase wires, color coding, separate neutral
25 and mechanical bonding. Verify circuit breaker operation. Verify the directory.

26
27 Vacuum clean the panelboard enclosure.

28
29 **MOTOR STARTERS AND MOTOR CONTROL CENTERS**

30 Verify the control circuits. Confirm the fusing and the grounding of the control transformers. Torque all of
31 the connections. Confirm the overload elements and the circuit breakers (fuse) for proper sizing. Verify all
32 grounding. Operate and test each motor starter for proper operation.

33
34 **CABLES**

35 600 Volt cable:

36 Visually inspect cables, lugs, connectors and all other components for physical damage and proper
37 connections.

38 Check all cable connectors for tightness (with a torque wrench) and clearances. Torque test
39 conductor terminations to manufacturer's recommendations.

40 Perform a 1000 Vdc megger test on all secondary cables from the substation transformers to the
41 secondary switchboards and on all switchboard feeders.

42
43 Medium Voltage cable:

44 Inspect exposed sections for physical damage.

45 Inspect for visual jacket and insulation condition.

46 Visible cable bends shall be checked against ICEA or manufacturer's minimum allowable bending
47 radii -- 12 times the diameter for tape shielded cables.

48 Inspect for proper shield grounding, cable support and termination.

49 Inspect for proper fireproofing in common cable areas.

50 Verify cable is supplied and connected in accordance with single line diagram.

51 There shall be NO tests performed on existing cable without specific direction from UW.

52 Above 600 volt testing will be performed under a separate contract.

53
54 **LIGHT FIXTURES**

55 Check the bonding and proper lamping. Verify that recessed fixtures are installed with hold down clips.

56 Confirm operation of the fixture with the proper switch or sensor.

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OCCUPANCY SENSORS

Confirm operation of the sensor per the manufacturer's specification.

BATTERY PACK EMERGENCY LIGHTING

Verify the operation per the manufacturers spec and run all of the diagnostic steps. Confirm proper grounding and location.

END OF SECTION

1 Conductor sizes are based on copper.

2
3 Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as
4 required for project conditions.

5
6 Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and
7 lengths required.

8
9 **PART 2 - PRODUCTS**

10
11
12 **GENERAL**

13 All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of
14 manufacturer's stock.

15
16 All conductors shall be copper. Aluminum conductors size #1/0 and larger may be substituted for copper
17 and used for phase and neutral conductors for transformer feeders, switchboard feeders, and panelboard
18 feeders. All ground conductors shall be copper.

19
20 Aluminum conductors shall not be used for serving individual motors, chillers, VFD's and motor
21 controllers.

22
23 The following requirements shall be met when aluminum conductors are used:

24
25 Aluminum alloy conductors shall be compact stranded conductors of a recognized Aluminum
26 Association 8000 Series aluminum alloy conductor material (AA-8000 series alloy).

27
28 It is the responsibility of the contractor to increase the size of the conduit, wire gutter, or
29 enclosure, if necessary, to accommodate the aluminum conductors and meet allowable code
30 requirements.

31
32 It is the responsibility of the contractor to increase the size of the aluminum conductor and
33 associated termination lugs to match the ampacity of the copper conductor circuit shown on the
34 Drawings.

35
36 The contractor shall submit a feeder schedule to the Engineer for all conductor substitutions
37 indicating the aluminum conductor wire size and the conduit size. The contractor shall not begin
38 the installation until written approval is granted by the Engineer.

39
40 All aluminum conductors shall terminate on a mechanical screw-type connector or mechanical
41 compression-type connector. Connector shall be dual rated (AL7CU or AL9CU) and Listed by
42 UL for use with aluminum and copper conductors, and sized to accept aluminum conductors of the
43 required ampacity. When using compression-type connectors, the lugs shall be marked with wire
44 size, die index, number and location of crimps and shall be suitably color-coded. Using a suitable
45 stripping tool, remove insulation from the required length of the conductor. Wire brush the
46 conductor and apply a Listed joint compound. Tighten or crimp the connection per the connector
47 manufacturer's recommendation. Wipe off any excess joint compound.

48
49 When terminating aluminum conductors to aluminum bus, prepare a mechanical screw-type or
50 compression-type connection. Bolts shall be anodized alloy and conform to current ANSI and
51 ASTM chemical and mechanical property limits. Nuts shall be aluminum alloy and conform to
52 current ANSI standards. Washers shall be flat aluminum alloy, Type A plain, standard wide series
53 conforming to current ANSI standards. Lubricate and tighten the hardware per manufacturer's
54 recommendations.

1 When terminating aluminum conductors to copper bus, prepare a mechanical screw-type or
2 compression-type connection. Bolts shall be plated or galvanized medium carbon steel; heat
3 treated, quenched and tempered equal to current ASTM standard or SAE grade 5. Nuts shall
4 conform to current ANSI standards. Washers shall be steel, Type A plain, standard wide series
5 conforming to current ANSI standards. Belleville conical spring washers shall be of hardened
6 steel, cadmium plated or silicone bronze. Lubricate and tighten the hardware per manufacturer's
7 recommendations.

8
9 The final tightening torque shall be recorded for all aluminum conductor mechanical screw-type
10 connections and provided in report form, in the completed O&M manuals.

11
12 The contractor shall perform an infrared survey of all aluminum conductor connections after the
13 installation is complete and in normal service. Infrared surveys shall be performed during periods
14 of maximum possible loading with at least 30% of rated load of the equipment being inspected.
15 All connections with elevated temperatures shall be corrected by the contractor. The infrared
16 survey results shall be provided in report form, in the completed O&M manuals.

17
18 **No copper-to-aluminum transitions permitted when splicing onto existing copper feeders.**

19
20 Insulation shall have a 600 volt rating.

21
22 All conductors shall be stranded.

23
24 Stranded conductors may only be terminated with UL OR ETL Listed type terminations or
25 methods: e.g. stranded conductors may not be wrapped around a terminal screw but must be
26 terminated with a crimp type device or must be terminated in an approved back wired method.

27 28 **BUILDING WIRE**

29 Description: Single conductor insulated wire 90 degree C.

30
31 Insulation: Type THHN/THWN-2, XHHW-2 insulation.

32 33 **VARIABLE FREQUENCY DRIVE (VFD) WIRE**

34 All power wiring from the VFD output to the motor shall be type XHHW-2 insulation, single conductor
35 wire.

36 37 **EMERGENCY CIRCUITS (2-HOUR RATED)**

38 Description: Power cable assembly for fire pump circuits and emergency circuits requiring a minimum
39 2-hour rating.

40
41 Insulation: Type MI mineral insulated cable installed as a listed electrical circuit protective system with a
42 minimum 2-hour fire-resistive cable rating per Factory Mutual testing. UL 2196 and ULC-S139-00
43 approved.

44
45 Install and support cabling system per manufacturer's requirements.

46 47 **WIRING CONNECTORS**

48 Split Bolt Connectors: Not acceptable.

49
50 Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to
51 equipment terminals. Not approved for splicing.

52
53 Twist Type Wire Connectors: Solderless twist type spring connector (wire-nut) with insulating cover for
54 copper wire splices and taps. Use for conductor sizes 10 AWG and smaller. The manufacturer's wire fill
55 capacity must be followed. Use Silicone filled twist type spring connectors in all wet location areas.

56

1 All wire connectors used in underground or exterior pull boxes or hand holes shall be gel filled twist
2 connectors or a connector designed for damp and wet locations. Gel filled twist type connectors can be
3 used for copper conductor sizes 6 AWG and smaller for site lighting applications. The manufacturer's wire
4 fill capacity must be followed.

5
6 Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors;
7 beveled cable entrances.

8
9 Compression (crimp) Connectors: Long barrel; seamless, tin-plated electrolytic copper tubing; internally
10 beveled barrel ends. Connector shall be clearly marked with the wire size and type and proper number and
11 location of crimps. Connector must be installed with a crimper tool listed for use with the manufacturer and
12 type of compression connector.

13
14 Insulation Piercing Connectors: Molded insulated body, copper teeth, wrench tightened, UL 486B Listed.
15 May be used only for connection of a tap conductor in run and tap type applications when main conductor
16 is 8 AWG and larger.

17 **PART 3 - EXECUTION**

18 **GENERAL WIRING METHODS**

19
20 All wire and cable shall be installed in conduit.

21
22 Do not use wire smaller than 12 AWG for power and lighting circuits.

23
24 All phase, neutral and ground conductors shall be sized to prevent excessive voltage drop at rated circuit
25 ampacity. As a minimum use 10 AWG conductors for 20 ampere, 120 volt branch circuit home runs longer
26 than 100 feet (30 m), and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet (61 m).

27
28 Ground conductor size shall be increased per NEC 250.122(B) when phase and phase/neutral conductors
29 are increased in size.

30
31 Make conductor lengths for parallel conductors equal.

32
33 Splice only in junction or outlet boxes.

34
35 Identify ALL low voltage wire, 600V and lower, per section 26 05 53.

36
37 Neatly train and lace wiring inside boxes, equipment, and panelboards.

38 **WIRING INSTALLATION IN RACEWAYS**

39
40 Pull all conductors into a raceway at the same time. Use Listed water or silicone based wire pulling
41 lubricant for pulling 4 AWG and larger wires and for other conditions when necessary. Wax based
42 lubricants are not allowed. Pulling lubricant is not required for low friction type products where the cable
43 manufacturer recommends that cables be pulled without lube.

44
45 Completely and thoroughly swab raceway system before installing conductors.

46
47 Place all conductors of a given circuit (this includes phase wires, neutral (if any), and ground conductor) in
48 the same raceway. If parallel phase and/or neutral wires are used, then place an equal number of phase and
49 neutral conductors in same raceway or cable.

50
51 VFD Installations: Install VFD input wiring and output wiring in separate conduit systems. Do not mix
52 VFD input power and output power, or control wiring in a common raceway.

53
54 In high ambient spaces, mechanical rooms, utility rooms and exterior exposed conduit, 90 degree C,
55 XHHW-2 conductors shall be utilized.

1
2 **WIRING CONNECTIONS AND TERMINATIONS**

3 Splice only in accessible junction boxes.

4
5 Wire splices and taps shall be made firm, and adequate to carry the full current rating of the respective wire
6 without soldering and without perceptible temperature rise.

7
8 All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the
9 conductor.

10
11 Use solderless twist type spring connectors (wire nuts) with insulating covers for wire splices and taps,
12 10 AWG and smaller.

13
14 Use mechanical or compression connectors for wire splices and taps, 8 AWG and larger. Tape uninsulated
15 conductors and connectors with electrical tape to 150 percent of the insulation value of the wiring.

16
17 Thoroughly clean wires before installing lugs and connectors.

18
19 At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

20
21 **FIELD QUALITY CONTROL**

22 Field inspection and testing will be performed under provisions of Section 26 05 04.

23
24 Additional testing as follows shall be performed if aluminum conductors are used:

25
26 Feeders terminated with aluminum conductors shall be tested with a thermal imager and recorded.

27
28 Conductors shall be closely checked for loose or poor connections, and for signs of overheating or
29 corrosion.

30
31 Test procedures shall meet NETA guidelines.

32
33 Test results and report shall be provided to the engineer and included in O&M manual under AL
34 conductors/ tests.

35
36 Contractor shall correct all deficiencies reported in the test report.

37
38 **WIRE COLOR**

39 General:

40 Solid colored insulation is required for all THHN/THWN-2 wire. For other wire types use colored
41 wire or identify wire with colored tape at all terminals, splices and boxes. Wire shall be colored as
42 indicated below.

43
44 In existing facilities, use existing color scheme. If there is no color scheme follow the new
45 facilities scheme listed below.

46
47 In new facilities, use black and red for single phase circuits at 120/240 volts, use Phase A black,
48 Phase B red and Phase C blue for circuits at 120/208 volts single or three phase, and use Phase A
49 brown, Phase B orange and Phase C yellow for circuits at 277/480 volts single or three phase.
50 Note: This includes fixture whips except for Listed whips mounted by the fixture manufacturer on
51 the fixture and Listed as a System.

52
53 Switch legs shall be the same color as their associated circuit, except for the second switch leg
54 used for dual-level switching. The second switch leg shall be the next phase color, e.g. if the first
55 switch leg is brown (277/480V phase A), the second switch leg shall be orange (277/480V phase
56 B).

1
2 Traveler conductors run between 3 and 4 way switches shall be colored pink or purple.

3
4 Neutral Conductors: White for 120/208V and 120/240V systems, Gray for 277/480V systems. Where there
5 are two or more neutrals in one conduit, each shall be individually identified with a different stripe.

6
7 Branch Circuit Conductors: Three or four wire home runs shall have each phase uniquely color coded.

8
9 Feeder Circuit Conductors: Each phase shall be uniquely color coded.

10
11 Ground Conductors: Green colored insulation for THHN/THWN-2 wire. For other wire types use green
12 colored wire or identify wire with green tape at both ends and at all access points, such as panelboards,
13 motor starters, disconnects and junction boxes. When isolated grounds are required, contractor shall
14 provide green with yellow tracer.

15
16 **BRANCH CIRCUITS**

17 The use of single-phase, multi-wire branch circuits with a common neutral is not permitted. All single-
18 phase branch circuits shall be furnished and installed with an individual accompanying neutral, sized the
19 same as the phase conductors.

20
21 **EMERGENCY CIRCUITS**

22 All Emergency, Legally Required Standby and Optional Standby system wiring shall be installed in
23 separate raceways after their associated transfer switches. The wiring shall be separate from each other and
24 from all normal system wiring.

25
26 All emergency wiring serving NEC 700 loads, requiring minimum 2 hour fire rating shall comply with
27 NEC 700.10(D)(1).

28
29 **CONSTRUCTION VERIFICATION**

30 Contractor is responsible for utilizing the construction verification checklists supplied under specification
31 Section 26 08 00 in accordance with the procedures defined for construction verification in Section 01 91
32 01 or 01 91 02.

33
34 END OF SECTION

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SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

SCOPE

The work under this section includes grounding electrodes and conductors, equipment grounding conductors, and bonding for Electrical and Communications systems. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- References
- Performance Requirements
- Submittals
- Project Record Documents
- Regulatory Requirements

PART 2 - PRODUCTS

- Rod Electrode
- Mechanical Connectors
- Compression Connectors
- Exothermic Connections
- Conductors
- Bus/Busbar

PART 3 - EXECUTION

- Examination
- General
- Less Than 600 Volt System Grounding
- Communication System Grounding
- Field Quality Control
- Identification and Labeling
- Construction Verification Items
- Warranty

All hardware, cables and related termination and support hardware shall be furnished, installed, wired, tested, labeled, and documented by the Contractor, as detailed in this and related sections.

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Section 01 91 01 or 01 91 02 – Commissioning Process

REFERENCES

- ANSI/IEEE 142 (Latest edition) – Recommended Practice for Grounding of Industrial and Commercial Power Systems
- UL 467 – Electrical Grounding and Bonding Equipment
- IEEE 837 – IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding
- TIA-607-C – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

PERFORMANCE REQUIREMENTS

Grounding System Resistance:

- Equipment Rated 500 KVA and Less: 10 ohms maximum at building service entrance.
- Equipment Rated 500 to 1000 KVA: 5 ohms maximum at building service entrance.

- Equipment Rated more than 1000 KVA: 3 ohms building service entrance.
- Communications Busbars: 5 ohms maximum.

Testing of grounding system resistance is to be witnessed by the UW Electrical Inspector or Construction Representative.

Provide test report of grounding system overall resistance and resistance of each electrode in final O&M manuals and noted on record documents.

SUBMITTALS

Product Data: Provide data for grounding electrodes and connections.

Provide samples of ground labels.

Test Reports: Indicate overall resistance to ground and resistance of each electrode.

Manufacturer's Instructions: Include instructions for preparation, installation and examination of exothermic connectors.

PROJECT RECORD DOCUMENTS

Record locations of all electrical and telecommunications grounding electrodes, busbars and grounding conductors as installed including recorded ground resistance test results.

REGULATORY REQUIREMENTS

Conform to requirements of NFPA 70.

Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 - PRODUCTS

ROD ELECTRODE

Material: Copper-clad steel.

Diameter: 3/4 inch (19 mm) minimum.

Length: 10 feet (3.5 m) minimum. Rod shall be driven at least 9' 6" deep.

MECHANICAL CONNECTORS

The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lock washers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.

Split bolt connector types are NOT allowed. Exception: the use of split bolts is acceptable for grounding of wire-basket type cable tray, and for cable shields/straps of medium voltage cable.

The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

COMPRESSION CONNECTORS

The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99% by IACS standards.

Each connector shall be factory filled with an oxide-inhibiting compound.

1 The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.
2
3 The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the
4 required compression tool settings.
5
6 The installation of the connectors shall be made with a compression tool and die system, as recommended
7 by the manufacturer of the connectors, and shall be irreversible.
8
9 Pre-crimping of the ground rod is required for all irreversible compression connections to a ground rod.
10
11 Terminal lug for communication system grounding shall be compression type and conform to the
12 following:

13
14 Material: Tin Plated Copper (aluminum not permitted).
15 Wire Size: to match conductor
16 Number of Stud Holes: 2
17 Stud Hole Size: 3/8"
18 Bolt Hole Spacing: per TIA-607-C
19 Tongue Angle: Straight
20

21 **EXOTHERMIC CONNECTIONS**

22 As manufactured by Erico Cadweld, Harger Ultraweld or similar.
23

24 **CONDUCTORS**

25 Material: Stranded copper (aluminum not permitted).
26

27 Grounding Electrode Conductor: Bare seven-strand conductors. Size as shown on drawings, specifications
28 or as required by NFPA 70, whichever is larger.
29

30 Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by
31 NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both
32 are used at the same facility.
33

34 Branch Circuit Equipment Ground shall be proportionately increased in size when routed with phase
35 conductors increased in size.
36

37 Conductors for Telecommunications shall be as follows:

38 Telecommunications Bonding Conductor (TMGB to Service Ground): No. 3/0 minimum or as
39 shown on drawings.

40 Telecommunications Bonding Backbone (TBB; TMGB to TGB): No. 3/0 minimum or as shown
41 on drawings.

42 Telecommunications Grounding Equalizer (GE): No. 3/0 minimum or as shown on drawings.

43 Bonding Conductors shall be insulated with a Green Jacket or jacket marked with Green Tape or
44 labeled per NEC Guidelines.
45

46 **BUS/BUSBAR**

47 Material: Copper (aluminum not permitted).
48

49 Size:

50 All Power systems: 1/4" X 2", length as needed (24" minimum).

51 Telecommunications Main Ground Busbar (TMGB): 1/4" x 4" x 20" long (minimum).

52 Telecommunications Grounding Busbar (TGB): 1/4" x 2" x 12" long (minimum).
53

54 Busbars:

55 Be pre-drilled to accommodate two-hole lugs.

56 3/8" stud hole size; hole spacing per TIA-607-C.

1 Incorporate insulators and stand-off brackets that electrically isolate busbar from mounting
2 surface.

3
4 Provide main ground busbar located adjacent to main electrical service equipment to terminate all ground
5 conductors. Refer to UW grounding detail 26 05 26-1.
6

7 8 **PART 3 - EXECUTION** 9

10 **EXAMINATION**

11 Verify that final backfill and compaction has been completed before driving rod electrodes.
12

13 **GENERAL**

14 Install Products in accordance with manufacturer's instructions.
15

16 Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed
17 over mechanical ground connections.
18

19 Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to
20 move them.
21

22 Attach grounds permanently before permanent building service is energized.
23

24 Terminate each grounding conductor on its own terminal lug. Sharing a single lug by multiple conductors
25 is not allowed.
26

27 All grounding electrode conductors and individual grounding conductors shall be installed in PVC conduit,
28 in exposed locations.
29

30 Each grounding electrode conductor shall be labeled at each terminated end as to system served and
31 location of second termination.
32

33 **LESS THAN 600 VOLT ELECTRICAL SYSTEM GROUNDING** 34 35

36 Supplementary Grounding Electrode: Use effectively grounded metal frame of the building.
37

38 Provide code sized copper grounding electrode conductor from electrical room ground bus to secondary
39 switchboard ground bus, each separately derived system neutral, secondary service system neutral to street
40 side of water meter, building steel, ground rod, and any concrete encased electrodes. Provide bonding
41 jumper around water meter. Provide physical protection as required.
42

43 Equipment Grounding Conductor: Provide separate, insulated equipment grounding conductor within each
44 raceway. Terminate each end on suitable lug, bus, enclosure or bushing. Provide a ground wire from each
45 device to the respective enclosure.
46

47 Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of
48 electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle
49 ground connectors, and plumbing systems.
50

51 **COMMUNICATION SYSTEM GROUNDING** 52

53 Grounding and Bonding System for Communications shall be an isolated grounding system with a single
54 ground point. That ground point is to be the common grounding electrode system at the building electrical
55 service entrance (main ground bar located in electrical room).
56

1 The system shall be compliant with ANSI J-STD-607-B with the exception that the ground cable shall not
2 be bonded to building steel except at the electrical service entrance.

3
4 Provide Grounding Busbar for Telecommunications at each Telecommunications Room, the Main
5 Equipment Room and at the electrical service entrance per project drawings. Coordinate Busbar location(s)
6 and conductor routing per drawings with Division 27 contractor.

7
8 Provide Telecommunications Bonding Conductor from Telecommunications Main Grounding Busbar
9 (TMGB) at the Communications Entrance Facility to building common grounding electrode system.
10 Attach grounding conductor to building steel as allowed only at the main electrical service entrance.
11 Provide physical protection as required.

12
13 Provide Telecommunications Bonding Backbone (TBB) conductor from the TMGB to
14 Telecommunications Grounding Busbar (TGB) at each Telecommunication Room, Telecommunications
15 Equipment Room and Telecommunications Enclosure.

16 TBB shall be continuous and not connected through Telecommunications Grounding Busbars
17 (TGBs).

18 Bond TGBs to TBB via tap off of TBB. Gauge of conductor to be same as TBB.

19 Leave 10 feet slack in conductor from TBB to TGB at TGB location(s).

20 Do not bond TBB or TGB to building steel at TGB location(s).

21
22 Provide Grounding Equalizer(s) (GE) per project drawings. Connect GE conductor directly to TGBs being
23 interconnected.

24
25 **FIELD QUALITY CONTROL**

26 Inspect grounding and bonding system conductors and connections for tightness and proper installation.

27
28 Testing of grounding system resistance is to be witnessed by the UW Electrical Inspector or Construction
29 Representative. Provide test report of grounding system resistance in final O&M manuals and noted on
30 record drawings.

31
32 Provide resistance test at each electrical and telecommunications Busbar to ground.

33
34 **IDENTIFICATION AND LABELING**

35 Label Grounds at point of termination.

36
37 Label for TBB connection at TMGB and TGB(s) shall be plastic and include the following:

38
39
40 IF THIS CONNECTOR OR CABLE IS
41 LOOSE OR MUST BE REMOVED,
42 PLEASE CALL THE BUILDING
43 TELECOMMUNICATIONS
44 MANAGER.
45

46 **CONSTRUCTION VERIFICATION**

47 Contractor is responsible for utilizing the construction verification checklists supplied under specification
48 Section 26 08 00 in accordance with the procedures defined for construction verification in Section 01 91
49 01 or 01 91 02.

50
51 Record locations of all electrical and telecommunications grounding electrodes, busbars and grounding
52 conductors as installed including recorded ground resistance test results.

53
54 **WARRANTY**

55 See Division 1, General Conditions, and General Requirements.

56

1 All hot-dip galvanized after fabrication products must be returned to point of manufacture after coating for
2 inspection and removal of all sharp burrs.

3 4 **Stainless Steel**

5 All strut, fittings and hardware shall be made of AISI Type 304 or Type 316 stainless steel as indicated.

6 7 **CONDUIT SUPPORTS**

8 Conduit clamps, straps, supports, etc., shall be steel or malleable iron.

9
10 One-hole straps shall be heavy duty type. All straps shall have steel or malleable backing plates when rigid
11 steel conduit is installed on the interior or exterior surface of any exterior building wall.

12
13 Above suspended ceilings, bar joist conduit hangers: Spring Steel Clips with Snap-Close Clamps (Conduit
14 Supports): Conduit clamps shall pivot a full 360 degrees and shall snap close around the conduit. Push-in
15 type conduit clamps are not allowed. Spring clips shall require a hammer to install onto supporting surface.

16
17 Stud wall applications: Spring Steel Clips with Push-in or Snap-Close Conduit Clamps (Conduit Supports):
18 Conduit clamps shall pivot a full 360 degrees. Spring clips shall require a fastener to install onto stud.

19
20 Box/conduit hanger with rod/wire clip (a.k.a. antlers): One assembly provides support for electrical box and
21 conduit from drop wire or rod. Conduit clamps shall snap close around the conduit.

22
23 Spring Steel Clip products shall be provided with corrosion resistance and be warranted against failure
24 from corrosion for a period of ten (10) years from date of manufacture.

25 26 **NYLON ANCHORS**

27 Nylon anchors may only be used in limited applications with the pre-approval of the UW Electrical
28 Inspector. See Part 3 – Execution for examples of applications of where nylon anchors may be allowed.

29
30 Nylon wall plugs shall be designed for 2-way expansion, providing rapid fixing with high pull-out values.
31 Nylon wall plugs shall be molded with protruding side fins which restrict rotation and prevent fall out from
32 overhead holes. Examples of these include Mungo types MN or MU, or Fischer type S nylon plugs.

33
34 Nylon one-piece self-drilling anchors designed for use in hollow gypsum wallboard for light duty loads.
35 Anchors shall be engineered nylon or Zamac alloy. Examples of these are the Zip-It ® or Zip-It Jr. ® self-
36 drilling anchors.

37
38 Manufacturer's names and catalog numbers are used for quality and performance only. Anchors
39 manufactured by others shall be equally acceptable provided they meet or exceed in performance and
40 quality as specified.

41 42 **THREADED ROD**

43 Minimum sized threaded rod for supports shall be 3/8" for trapezes and single conduits 1-1/4" and larger,
44 and 1/4" for single conduits 1" and smaller.

45 46 **HARDWARE**

47 Corrosion resistant, or as noted for each product above.

48 49 **PART 3 - EXECUTION**

50 51 **INSTALLATION**

52 Fasten hanger rods, conduit clamps, and outlet-, junction-, and pull-boxes to building structure using pre-
53 cast insert system, preset inserts, beam clamps, or expansion anchors.

54
55 Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls;
56 expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchors on

1 concrete surfaces; sheet metal screws in sheet metal studs and wood screws in wood construction. If nail-in
2 anchors are used, they must be removable type anchors.
3
4 Powder-actuated fasteners are not permitted.
5
6 Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit. Do not fasten to
7 suspended ceiling grid system.
8
9 Do not drill structural steel members unless approved by UW.
10
11 In wet locations, mechanical rooms, and electrical rooms, install free-standing electrical equipment on
12 3.5 inch (89 mm) concrete pads.
13
14 Install surface-mounted cabinets and panelboards with a minimum of four anchors. At all cabinet and
15 panelboard locations on concrete or concrete block walls, and at ALL locations below grade, provide steel
16 channel supports to stand cabinet one inch (25 mm) off wall (7/8" Uni-strut or 3/4" painted fire-retardant
17 plywood is acceptable). In above-grade equipment rooms that have drywall walls, the cabinets and
18 panelboards may be mounted to the drywall if backing is provided in the stud walls behind the equipment.
19
20 Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud
21 walls.
22
23 Furnish and install all supports as required to fasten all electrical components required for the project,
24 including free standing supports required for those items remotely mounted from the building structure,
25 catwalks, walkways etc.
26
27 Fabricate supports from galvanized structural steel or steel channel, rigidly welded or bolted to present a
28 neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
29
30 **Support Channel**
31 Use one of the following types of support channel as appropriate for the installed environment:
32 • Indoor: Epoxy Painted Steel, Hot-dipped Galvanized Steel, or as noted on the drawings.
33
34 • Exterior and wet locations: Hot-dipped Galvanized Steel or Stainless Steel, as appropriate for the
35 environment or as noted on the drawings. Type 316 stainless steel shall be used for Food Service
36 type environments. Epoxy painted support channel shall not be used for exterior installations.
37
38 • Manholes, steam pits, steam tunnels, or corrosive environments: Stainless Steel Type 316.
39
40 • Field cuts: File and de-bur cut ends of support channel and paint to prevent rusting. For epoxy-
41 painted support channel, paint cut ends to match the original color. For hot-dipped galvanized
42 support channel, spray cut ends with cold galvanized paint.
43
44 **Support Wires**
45 Support wires that are installed in addition to the ceiling grid support wires to provide secure support for
46 raceways, cables assemblies, boxes, cabinets, and fittings shall be secured at both ends (e.g. the ceiling
47 structure at the top and the ceiling grid at the bottom) per NEC 300.11(A).
48
49 Compressed-air power-actuated fasteners may ONLY be used for the installation of separate ceiling wires
50 required for support of conduits and aircraft cable hung light fixtures.
51
52 Support wires shall be identified per specification section 26 05 53.
53
54
55 **Spring Steel Clip Conduit Supports**

1 Above suspended ceilings: Spring steel clips with snap-close clamps may be used to support conduit from
2 bar joist (steel truss) systems above suspended ceilings.

3
4 Stud wall applications: Spring steel clips with push-in or snap-close conduit clamps may be used to support
5 conduit in interior metal stud wall applications. Use screw fasteners to install conduit clamp onto stud.

6
7 Box/conduit hanger with rod/wire clip (a.k.a. antlers): These may only be used in limited applications with
8 the pre-approval of the UW Electrical Inspector.

9
10 **Nylon anchor applications**

11 Nylon anchors may only be used in limited light duty applications with the pre-approval of the UW
12 Electrical Inspector.

13
14 Nylon anchors shall be designed for the construction material in which they are intended to be installed and
15 shall be designed for the weight in which the anchors are intended to support.

16
17 Nylon wall plug applications may include attaching 4" square boxes or conduit straps to plaster-covered
18 clay tile, drywall, or hollow concrete block. Screws used with nylon wall plugs shall be #10 minimum and
19 shall be longer than the anchor.

20
21 Nylon one-piece self-drilling anchor applications may include attaching 4" square boxes or conduit straps
22 to hollow gypsum wallboard for light duty loads. Use No. 8 screws with one-piece self-drilling anchors
23 designed for 3/8" to 1" thick wallboard. Use No. 6 screws with anchors designed for 3/8" to 5/8"
24 wallboard.

25
26 END OF SECTION

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SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

SCOPE

This section describes the products and execution requirements relating to furnishing and installing raceways and boxes and related systems as part of a raceway system for electrical, communications, and other low-voltage systems for the project. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- References
- Submittals

PART 2 - PRODUCTS

- General
 - Rigid Metal Conduit (RMC) and Fittings
 - Intermediate Metal Conduit (IMC) and Fittings
 - Electrical Metallic Tubing (EMT) and Fittings
 - Flexible Metal Conduit (FMC) and Fittings
 - Liquidtight Flexible Metal Conduit (LFMC) and Fittings
 - Conduit Supports
 - Surface Metal Raceway
 - Surface Nonmetal Raceway
 - Multi-Outlet Assembly
 - Auxiliary Gutters (Wireways)
 - Conduit Water Sealant
 - Pull and Junction Boxes
 - Outlet Boxes
 - Outlet Box Extenders
 - Floor Boxes
 - Poke-Through Assemblies
 - Boxes for Audio-Video Equipment
 - Boxes for Fire Alarm Audio-Visual Notification Appliances

PART 3 - EXECUTION

- Conduit Sizing, Arrangement, and Support
- Conduit Installation
- Conduit Installation Schedule
- Surface Metal Raceway and Multi-Outlet Assembly Installation
- Nonmetallic Surface Raceway Installation
- Auxiliary Gutters (Wireways) Installation
- Coordination of Box Locations
- Pull and Junction Box Installation
- Outlet Box Installation
- Floor Box Installation
- Audio-Video System Box and Conduit Installation
- Construction Verification Items

RELATED WORK

Applicable provisions of Division 1 govern work under this section.

- Section 01 91 01 or 01 91 02 – Commissioning Process
- Section 26 08 00 – Commissioning of Electrical
- Section 26 05 26 – Grounding and Bonding for Electrical Systems

- 1 Section 26 05 29 – Hangers and Supports for Electrical Systems
- 2 Section 26 27 02 – Equipment Wiring Systems
- 3 Section 26 27 26 – Wiring Devices
- 4 Section 27 10 00 – Structured Cabling
- 5 Section 27 41 00 – Audio-Video Systems
- 6 Section 28 31 00 – Fire Detection and Alarm

7

8 **REFERENCES**

- 9 Wisconsin Administrative Code SPS 316 - Electrical
- 10 ANSI/TIA-569-C-Telecommunications Pathways and Spaces

11

12 **SUBMITTALS**

13 Surface Raceway System - submit product data and catalog sheets for all components.

14

15 Boxes - provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

16

17 Conduits in Concrete Slabs Above Grade - provide proposed conduit routing and sizing to Structural Engineer
18 prior to approval of installation to verify structural integrity and fire rating of concrete slab.

19

20

21

PART 2 - PRODUCTS

22

23 **GENERAL**

24 All steel fittings and conduit bodies shall be galvanized.

25

26 All conduit transitional fittings shall be listed for installed application.

27

28 No cast metal or split-gland type fittings permitted.

29

30 Mogul-type condulets larger than 2 inch (50 mm) not permitted except as approved or detailed.

31

32 All conduit covers must be fastened to the conduit body with screws and be of the same manufacture.

33

34 C-condulets shall not be used in lieu of pull boxes.

35

36 All boxes shall be of sufficient size to provide free space for all conductors enclosed in the box and shall
37 comply with NEC requirements.

38

39 **RIGID METAL CONDUIT (RMC) AND FITTINGS**

40 Conduit: Heavy wall threaded, galvanized steel, schedule 40.

41

42 Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

43

44 Expansion Fittings/Expansion Joints: Expansion Fittings shall be Internal Grounding type and shall not rely
45 on external bonding jumpers to maintain grounding continuity between raceway components.

46

47 **INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS**

48 Conduit: Galvanized Steel, threaded.

49

50 Fittings and Conduit Bodies: Use all Steel threaded fittings and conduit bodies.

51

52 Expansion Fittings/Expansion Joints: Expansion Fittings shall be Internal Grounding type and shall not rely
53 on external bonding jumpers to maintain grounding continuity between raceway components.

54

55 **ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS**

56 Conduit: Steel, Unthreaded thin wall galvanized tubing.

1
2 Fittings: All steel, compression or set screw type. No push-on or indenter types permitted.
3 Conduit Bodies: All steel conduit bodies.
4
5 **FLEXIBLE METAL CONDUIT (FMC) AND FITTINGS**
6 Conduit: steel, galvanized, spiral strip.
7
8 Fittings and Conduit Bodies: All steel, galvanized or malleable iron (except as allowed in Section 26 51 13).
9
10 **LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) AND FITTINGS**
11 Conduit: flexible, steel, galvanized, spiral strip with an outer Liquidtight, nonmetallic, sunlight-resistant
12 jacket.
13
14 Fittings and Conduit Bodies: ANSI/NEMA FB 1, compression type. There shall be a metallic cover/insert on
15 the end of the conduit inside the connector housing to seal the cut conduit end.
16
17 **CONDUIT SUPPORTS**
18 See section 26 05 29.
19
20 **SURFACE METAL RACEWAY**
21 Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.
22
23 Size: As shown on Drawing.
24
25 Finish: White (Contractor allowed to paint white if original finish is not white).
26
27 Fittings: Couplings, elbows, and connectors designed for use with raceway system.
28
29 Boxes and Extension Rings: Designed for use with raceway systems.
30
31 Allowed manufacturers:
32 Legrand
33 Hubbell
34
35 **SURFACE NONMETAL RACEWAY**
36 Description: Nonmetallic channel with fitted cover, suitable for use as surface raceway.
37
38 Size: As shown on Drawing.
39
40 Color: White.
41
42 Fittings: Couplings, elbows, and connectors designed for use with raceway system.
43
44 Boxes and Extension Rings: Designed for use with raceway systems.
45
46 Allowed manufacturers:
47 Legrand
48 Hubbell
49 Panduit
50
51 Coordinate with Section 12 35 53 – Laboratory Casework.
52
53 **MULTI-OUTLET ASSEMBLY**
54 Description: Sheet metal channel with fitted cover, suitable for use as a multi-outlet assembly.
55
56 Size: As indicated on Drawing.

1
2 Receptacles: Provide covers and accessories to accept convenience receptacles specified in Section 26 27 26.

3
4 Finish: White

5
6 Fittings: Couplings, elbows, outlet and device boxes, and connectors designed for use with multi-outlet
7 system.

8
9 **AUXILIARY GUTTERS (WIREWAYS)**

10 Description: General purpose type wireway without knockouts.

11
12 Size: As indicated on Drawings; length as indicated on Drawings.

13
14 Cover: Hinged cover.

15
16 Connector: Slip-in construction.

17
18 Fittings: Lay-in type with removable top, bottom, and side; captive screws.

19
20 Finish: Rust inhibiting primer coat with gray enamel finish.

21
22 **CONDUIT WATER SEALANT**

23 Description: Conduit sealant used to prevent water from entering buildings via conduits.

24
25 Sealant shall seal conduits against water and gas intrusion, such as Polywater® FST™-250 Foam Duct
26 Sealant, Raychem RDSS Rayplate Duct Sealing System, or approved alternate. Sealant shall be re-enterable,
27 shall be compatible with the conduit and conductor types being used, and shall comply with NEC 225.27,
28 230.8, and 300.5(G).

29
30 Manufacturer names and catalog numbers are used to develop quality and performance requirements only.
31 Products manufactured by others may be acceptable provided they meet or exceed the specifications.

32
33 **PULL AND JUNCTION BOXES**

34 Interior Sheet Metal Boxes: code gauge galvanized steel, screw covers, flanged and spot-welded joints and
35 corners.

36
37 Interior Sheet Metal Boxes larger than 12 inches (300 mm) in any dimension shall have a hinged cover or a
38 chain installed between box and cover. Boxes 9 square-feet or larger shall have hinged covers and a single
39 cover shall not exceed 10 square-feet.

40
41 Interior Sheet Metal Boxes connected to an exterior underground raceway, shall have a drain fitting located
42 in the bottom.

43
44 Box extensions and adjacent boxes within 48 inches of each other are not allowed for the purpose of creating
45 more wire capacity.

46
47 Junction boxes 6 inch-by-6 inch or larger size shall be without stamped knock-outs.

48
49 Wireways shall not be used in lieu of junction boxes.

50
51 **OUTLET BOXES**

52 Sheet Metal Outlet Boxes: galvanized steel, with stamped knockouts.

53
54 Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch
55 male fixture studs where required.

56

1 Concrete Ceiling Boxes: Concrete type.
2
3 Cast Boxes: Cast ferroalloy or aluminum, deep type, gasketed cover, threaded hubs.
4
5 **OUTLET BOX EXTENDERS**
6 Outlet Box Extenders: Non-Metallic, adjustable depth.
7
8 Outlet Box Extenders may only be used in limited applications with the pre-approval of the UW Electrical
9 Inspector. See Part 3 – Execution for examples of applications of where Outlet Box Extenders may be
10 allowed.
11
12 **FLOOR BOXES**
13 Floor Boxes for Installation in Cast-In-Place Concrete Floors: As indicated on drawings. Provide boxes with
14 sufficient capacity to house the devices indicated on the plans.
15
16 Type: Flush or Concealed service as indicated on drawings.
17
18 Floor Box Cover: As indicated on drawings. Floor plates shall meet and exceed UL scrub water exclusion
19 requirements for concrete, tile, carpet, and wood covered floors.
20
21 Device Plate: Stainless steel or as available from manufacturer.
22
23 Configuration: As indicated on drawings.
24
25 **POKE-THROUGH ASSEMBLIES**
26 Description: Assembly comprising of service fitting, poke-through component, fire stops and smoke barriers,
27 and junction box for conduit termination.
28
29 Fire Rating: Two-hour rated, or rated to match existing floor.
30
31 Type: As indicated on drawings.
32
33 Floor Plate: As indicated on drawings. Floor plates shall meet and exceed UL scrub water exclusion
34 requirements for concrete, tile, carpet, and wood covered floors.
35
36 Device Plate: Stainless steel or as available from manufacturer.
37
38 Configuration: As indicated on drawings.
39
40 **BOXES FOR AUDIO-VIDEO EQUIPMENT**
41 Provide floor, wall, and/or ceiling boxes for Audio-Video (AV) Equipment as indicated on the Electrical
42 and/or Audio-Video drawings.
43
44 **FLAT SCREEN MONITOR BOXES**
45 Provide a recessed wall box for mounting behind flat screen monitors, allowing the screens to sit flush against
46 the wall. These boxes shall provide a neat and secure environment for the audio, video, control and power
47 connections.
48
49 The recessed wall box shall install easily between any two standard studs in the wall. Connections and cable
50 entry can be on the top or the bottom depending on installation preference.
51
52 The recessed wall box shall be provided with one low-voltage conduit entry box and Nationally Recognized
53 Testing Laboratory (NRTL) listed single gang box for AC power.
54
55 The recessed wall box cover shall be provided in white or black and shall be suitable for painting. The cover
56 shall have a cable exit slot for the display connections and the excess cable can easily be hidden inside of the

1 box making the entire installation as clean as possible. The cover screws onto the front of the box once all
2 connections are in place.

3
4 The recessed wall box shall be designed for new or existing construction. Brackets shall be included for
5 mounting to studs in new construction as well as surface mount clips for mounting to sheet rock or plywood
6 in existing construction.

7 8 **BOXES FOR FIRE ALARM AUDIO-VISUAL NOTIFICATION APPLIANCES**

9 Recessed boxes for Fire Alarm audio, visual, and audio-visual notification appliances shall be galvanized
10 steel sheet metal with stamped knockouts. Boxes shall be painted red.

11
12 For surface mounting, use manufacturer supplied back boxes and trim plates, painted red or off white to
13 match device color, and shall contain no visible conduit knock-outs. Mark each device with its circuit
14 number.

15 16 **PART 3 - EXECUTION**

17 18 **CONDUIT SIZING, ARRANGEMENT, AND SUPPORT**

19 EMT is permitted to be used in sizes 4 inch (100 mm) and smaller for power and low-voltage systems. See
20 CONDUIT INSTALLATION SCHEDULE below for other limitations for EMT and other types of conduit.

21
22 Size power conductor raceways for conductor type installed. Conduit size shall be 1/2 inch (16 mm) minimum
23 except **all homerun conduits shall be 3/4 inch (21 mm)**, or as specified elsewhere. **Caution: Per the NEC,**
24 **the allowable conductor ampacity is reduced when more than three current-carrying conductors are**
25 **installed in a raceway. Contractor must take the NEC ampacity adjustment factors into account when**
26 **sizing the raceway and wiring system.**

27
28 Size communications and other low-voltage systems raceways as follows:

29
30 Communications, including Outlet Box: 1 inch minimum. Conduit used for single device locations
31 (e.g. Wireless Access Point, Video Surveillance Camera, and Wall mounted telephone) may be
32 3/4 inch minimum.

33
34 Control, security, signal, video, and other low-voltage applications: 3/4 inch minimum.

35
36 Fire Alarm: 1/2 inch minimum.

37
38 Floor Box and Poke-Through Assemblies:

39 Power: 3/4 inch minimum or as indicated on drawings.

40 Low-voltage: 1 inch minimum or as indicated on drawings.

41
42 Provide one raceway from each communications outlet box to above accessible ceiling.

43
44 Arrange conduit to maintain 6'-8" clear headroom and present a neat appearance.

45
46 Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent
47 piping.

48
49 Maintain minimum 6 inch (150 mm) clearance between conduit and piping. Maintain 12 inch (300 mm)
50 clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

51
52 Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using
53 galvanized pipe straps, conduit racks (lay-in adjustable hangers), clevis hangers, or bolted split stamped
54 galvanized hangers.

1 Group conduit in parallel runs where practical and use conduit rack (lay-in adjustable hangers) constructed
2 of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
3
4 Do not fasten conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used
5 for temporary conduit support during construction.
6
7 Support and fasten metal conduit at a maximum of 8 feet (2.4 m) on center.
8
9 Supports shall be independent of the installations of other trades, e.g. ceiling support wires, HVAC pipes,
10 other conduits, etc., unless so approved or detailed.
11
12 Conceal all conduits except where noted on the drawings or approved by the Architect/Engineer. Contractor
13 shall verify with Architect/Engineer all surface conduit installations except in mechanical rooms.
14
15 Changes in direction shall be made with symmetrical bends, cast steel boxes, stamped metal boxes or cast
16 steel conduit bodies.
17
18 For indoor conduits, no continuous conduit run shall exceed 100 feet (30 meters) without a junction box.
19
20 All conduits installed in exposed areas shall be installed with a box offset before entering box.
21
22 **CONDUIT INSTALLATION**
23 Cut conduit square; de-burr cut ends.
24
25 Conduit shall not be fastened to the corrugated metal roof deck.
26
27 Bring conduit to the shoulder of fittings and couplings and fasten securely.
28
29 Use conduit hubs for fastening conduit to cast boxes. Use sealing locknuts or conduit hubs for fastening
30 conduit to sheet metal boxes in damp or wet locations.
31
32 Threads to be coated with approved electrically conductive corrosion compound per NEC 300.6. Coating to
33 be listed for installed environment, i.e. food service.
34
35 Terminate all conduit (except for terminations into conduit bodies) using conduit hubs, or connectors with
36 one locknut, or utilize double locknuts (one each side of box wall).
37
38 Provide bushings for the ends of all conduit not terminated in box walls. Refer to Section 26 05 26 –
39 Grounding and Bonding for Electrical Systems for grounding bushing requirements.
40
41 Provide insulated bushings where raceways contain 4 AWG or larger conductors.
42
43 Communication and Low Voltage systems conduits shall terminate in horizontal plane.
44
45 Install no more than the equivalent of:
46
47 Three 90 degree bends between boxes for electrical systems.
48
49 Two 90 degree bends between boxes for communications and other low voltage systems.
50 Note: Offsets shall be considered 90 degrees.
51
52 No single bend may exceed 90 degrees.
53
54 Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch (50 mm) size
55 unless sweep elbows are required.
56

1 Bend conduit according to manufacturer's recommendations. Torches or open flame shall not be used to aid
2 in bending of PVC conduit.

3
4 Use suitable conduit caps or other approved seals to protect installed conduit against entrance of dirt and
5 moisture.

6
7 Provide 1/8 inch (3 mm) nylon pull string in empty conduit, except sleeves and nipples.

8
9 Install listed expansion-deflection fitting or other approved means shall be used where a raceway crosses a
10 structural joint for expansion, contraction or deflection, used in buildings, bridges, parking garages or other
11 structures.

12
13 Avoid moisture traps where possible. Where moisture traps are unavoidable, provide junction boxes with
14 drain fittings at conduit low points.

15
16 Where conduit passes between areas of differing temperatures such as into or out of cool rooms, freezers,
17 unheated and heated spaces, buildings, etc., provide conduit or box with duct seal or other means to prevent
18 the passage of moisture and water vapor through the conduit.

19
20 Route conduit through roof openings for piping and ductwork where possible.

21
22 Where communication cabling is to be installed in conduit to the wiring hub (e.g. Telecom Room), multiple
23 conduits may be consolidated into fewer, larger conduits. Capacity of shared conduits shall equal the capacity
24 of the individual conduits unless otherwise noted.

25
26 Use NRTL listed metallic grounding clamps when terminating conduit to cable tray.

27
28 Ground and bond conduit under provisions of Section 26 05 26.

29
30 Conduit is not permitted in any slab topping of two inches (50 mm) or less.

31 32 33 **CONDUIT INSTALLATION SCHEDULE**

34
35 Conduit other than that specified below for specific applications shall not be used.

- 36
37 • Concealed in Concrete Block Walls: Electrical metallic tubing, PVC conduit. Electrical
38 Nonmetallic Tubing (ENT).
- 39
40 • Emerging from Within Concrete Slab: Rigid Metal conduit.
- 41
42 • Wet Interior Locations: Exposed: Rigid metal conduit.
- 43
44 • Concealed Dry Interior Locations: Rigid metal conduit, Intermediate metal conduit, Electrical
45 metallic tubing, PVC conduit (Ground conductor).
- 46
47 • Interior Building Grounding Electrode Conductor: Schedule 80 PVC.
- 48
49 • Exposed Dry Interior Locations: Rigid metal conduit, Intermediate metal conduit, Electrical
50 metallic tubing.
- 51
52 • Motor and equipment connections: Liquidtight flexible metal conduit (LFMC) in all locations
53 except in Mechanical equipment plenum spaces where Flexible Metal Conduit (FMC) shall be
54 utilized. Minimum length shall be one foot (300 mm); maximum length shall be three feet (900

1 mm). Conduit must be installed perpendicular to direction of equipment vibration to allow
2 conduit to freely flex.

3

4 • Exposed Dry Interior Locations for HVAC control devices with Conduit Connections:
5 Electrical metallic tubing, Flexible Metal Conduit (FMC). For FMC installations, Minimum
6 length shall be one foot (300 mm), Maximum length shall be three feet (900 mm). Minimum
7 size FMC of 3/8".

8

9 • Exposed Dry Interior Locations for HVAC control devices without Conduit Connections:
10 Where HVAC equipment control panels or devices do not provide for the direct connection of
11 conduits, exposed Class 2 wiring may be extended to complete the final connections in dry
12 locations, provided it does not exceed 18 inches in length.

13

14 • Light fixtures: Refer to specification section 26 51 13.

15

16 • Plenum Spaces: Installation shall comply with requirements of NEC 300.22.

17

18 **SURFACE METAL RACEWAY AND MULTI-OUTLET ASSEMBLY INSTALLATION**

19 Use flat-head screws to fasten channel to surfaces every twenty-four (24) inches. Mount plumb and level.

20

21 Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

22

23 Maintain grounding continuity between raceway components to provide a continuous grounding path under
24 provisions of Section 26 05 26.

25

26 Fastener Option: Use clips and straps suitable for the purpose.

27

28 **NONMETALLIC SURFACE RACEWAY INSTALLATION**

29 Use flat headed screws with appropriate anchors to fasten channel to surfaces secured every twenty-four (24)
30 inches. Mount plumb and level. All surface mounted devices shall be fastened to the wall utilizing flat head
31 screws along with appropriate anchors. No device shall be adhered to the wall surface using two-faced tape
32 or any means other than as described above.

33

34 Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

35

36 In areas where the walls cannot be fished, the station cable serving these outlets shall be covered with
37 raceways. No exposed wire shall be permitted within offices, laboratories, and conference rooms or like
38 facilities.

39

40 Non-metallic raceway shall have a screw applied base. Both the base and cover shall be manufactured of
41 rigid PVC materials.

42

43 The raceway shall originate from a surface mounted box mounted adjacent to and at the same height as
44 existing electrical boxes in the room, be attached to the wall and terminate above the ceiling.

45

46 All fittings including, but not limited to, extension boxes, elbows, tees, fixture bodies shall match the color
47 of the raceway.

48

49 The raceway and all systems devices shall be UL listed and exhibit nonflammable self-extinguishing
50 characteristics, tested to specifications of UL94V-0.

51

52 In raceway for communications and other low voltage systems, the inside bend radius minimum shall be as
53 follows:

- 54 • Internal diameter of 2 in or less- 6 times the internal diameter.
- 55 • Internal diameter of more than 2 in- 10 times the internal diameter.

1
2 Conduit bends shall contain no kinks or other discontinuities.

3
4 **AUXILIARY GUTTERS (WIREWAYS) INSTALLATION**

5 Bolt auxiliary gutter to wall using two-piece hangers or steel channels fastened to the wall or in
6 self-supporting structure.

7
8 Gasket each joint in oil-tight gutter.

9
10 Mount rain-tight gutter in horizontal position only.

11
12 Maintain grounding continuity between raceway components to provide a continuous grounding path under
13 provisions of Section 26 05 26.

14
15 **COORDINATION OF BOX LOCATIONS**

16 Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment
17 connections, and code compliance.

18
19 Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location
20 of floor boxes and outlets in offices and work areas prior to rough-in.

21
22 No outlet, junction, or pull boxes shall be located where it will be obstructed by other equipment, piping,
23 lockers, benches, counters, etc.

24
25 Conduit and boxes shall not be fastened to the metal roof deck. If conduit and boxes are required to be located
26 and installed on roof decks, the conduit and boxes are required to be spaced minimum 1-5/8 inch off the
27 lowest part of the metal roof decking material, per NEC 300.4 (E).

28
29 It shall be the Contractor's responsibility to study drawings pertaining to other trades, to discuss location of
30 outlets with workmen installing other piping and equipment and to fit all electrical outlets to job conditions.

31
32 In case of any question or argument over the location of an outlet, the Contractor shall refer the matter to the
33 Architect/Engineer and install outlet as instructed by the Architect/Engineer.

34
35 The proper location of each outlet is considered a part of this contract and no additional compensation will
36 be paid to the Contractor for moving outlets which were improperly located.

37
38 Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and
39 provide 18 inch (450 mm) by 24 inch (600 mm) access doors. Boxes must be installed within 12" from edge
40 of the access door.

41
42 Locate and install to maintain headroom and to present a neat appearance.

43
44 Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and
45 methods.

46
47 Boxes installed in the building envelop shall be sealed with caulking materials or closed with gasketing
48 systems compatible with the construction materials and locations per IEC 502.4.3.

49
50 **PULL AND JUNCTION BOX INSTALLATION**

51 Pull boxes and junction boxes shall be minimum 4 inches square (100 mm) by 2-1/8 inches (54 mm) deep
52 for use with 1 inch (25 mm) conduit and smaller. On conduit systems using 1-1/4 inch (31.75 mm) conduit,
53 minimum junction box size shall be 4-11/16 inches square by 2-1/8 inches deep.

54
55 Where used with raceway(s) containing conductors of 4 AWG or larger, pull box shall be sized as required
56 unless otherwise noted on the drawings.

1
2 Where used with raceway(s) containing conductors on systems over 600V, size pull box per NEC 314 Part
3 IV unless otherwise noted as larger on the drawings.

4
5 Size pull boxes for communications per ANSI/TIA-568-C

6
7 Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install UW
8 approved access panels in non-accessible ceilings where boxes are installed. All boxes are to be readily-
9 accessible.

10
11 Provide Pull and Junction boxes for communications and other low voltage applications (a) in any section of
12 conduit longer than 100 feet, (b) where there are bends totaling more than 180 degrees between pull points
13 or pull boxes and (c) wherever there is a reverse bend in run. Locate boxes on straight section of raceway
14 (e.g. do not use boxes in place of raceway bends).

15
16 Support pull and junction boxes independent of conduit.

17 18 **OUTLET BOX INSTALLATION**

19 Do not install boxes back-to-back in walls. Provide minimum 6 inch (150 mm) separation, except provide
20 minimum 24 inch (600 mm) separation in acoustic-rated walls.

21 22 **Power:**

23 Recessed (1/4 inch maximum) outlet boxes in masonry, concrete, tile construction, or drywall shall
24 be minimum 4 inch square, with device rings. Device covers shall be square-cut except rounded
25 corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted.
26 Coordinate masonry cutting to achieve neat openings for boxes. A single gang box can be used in
27 drywall and masonry, for a single device location, when a single conduit enters box.

28
29 Shallow 4 inch square by 1 1/2 inch deep boxes can be used as device boxes for power provided the
30 box and plaster ring is sized for installed device and conductors.

31 32 **Low Voltage:**

33
34 Recessed (1/4 inch maximum) outlet boxes in masonry, concrete, tile construction or drywall shall
35 be minimum 4 11/16 inch square by 2 1/8 inch deep with single gang device ring (unless noted
36 otherwise on drawings). Device covers shall be square-cut except rounded corner plaster rings are
37 allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry
38 cutting to achieve neat openings for boxes.

39
40 Provide one conduit from each communications outlet box. Conduit runs between outlet boxes for
41 communications are not allowed. Terminate conduit above accessible ceiling.

42
43 Provide knockout closures for unused openings.

44
45 Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits,
46 both supported within 12 inches (300 mm) of box.

47
48 Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes.
49 Sectional boxes may only be used with the pre-approval of the UW Electrical Inspector for remodeling
50 applications where it is impractical to install multi-gang boxes. Provide non-metallic barriers to separate
51 wiring of different voltage systems.

52
53 Install boxes in walls without damaging wall insulation.

54
55 Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

56

1 Ceiling outlets shall be 4 inch square, minimum 2-1/8 inch (54 mm) deep except that concrete boxes and
2 plates will be approved where applicable. Position outlets to locate luminaires as shown on reflected ceiling
3 plans.

4
5 In inaccessible ceiling areas, position outlets and junction boxes within 6 inches (150 mm) of recessed
6 luminaire, to be accessible through luminaire ceiling opening.

7
8 Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately
9 positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow
10 stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.

11 Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

12
13 Provide cast ferroalloy or aluminum outlet boxes in exterior and wet locations.

14
15 Surface wall outlets shall be 4 inch (100 mm) square with raised covers for one and two gang requirements.
16 For three gang or larger requirements, use gang boxes with non-overlapping covers.

17
18
19 Outlet Box Extender applications:

20 **Outlet Box Extenders may only be used in limited applications with the pre-approval of the**
21 **UW Electrical Inspector.**

22
23 Provide box extenders for boxes that are set too far back in the wall due to un-anticipated wall
24 finishes. **Outlet Box Extenders will NOT be allowed for installations where the EC has not**
25 **accommodated for wall finishes that were expected prior to installation.** Place the box extender
26 over the existing box face to make the box face flush with the wall finish.

27 28 **FLOOR BOX INSTALLATION**

29 Set boxes level and flush with finish flooring material.

30
31 Floor boxes for communications shall each be served by conduit(s) dedicated to that box. Conduit runs
32 between floor boxes for communications are not allowed. Conduit shall be part of path that allows for cable
33 to be terminated at wiring hub (e.g. Telecom Room) on same floor on which floor box appears unless noted
34 otherwise.

35 36 **AUDIO-VIDEO SYSTEM BOX AND CONDUIT INSTALLATION**

37 Conduit requirements for AV systems cabling may differ from those of other trades. It is important that the
38 electrical contractor become familiar with these specialized requirements. AV systems cabling must be
39 enclosed within continuously grounded ferrous metallic conduit or raceway. PVC conduit is not acceptable.
40 Conduit and raceway is to be furnished and installed by electrical contractor. Conduits containing different
41 wiring classes must maintain minimum separations to minimize interferences from electrical noise. Conduits
42 sizes and quantities shown on bid documents are minimums. Separate conduit runs specified in bid
43 documents may not be combined for any purpose.

44
45 The following tables define the required minimum separations between the group divisions and other power
46 services.

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Group	Description	Level	Bandwidth
A	Microphone level AV circuits	Below -30 dB μ	20 Hz to 20 kHz
B	Line level AV circuits, Communication Circuits (Intercom)	-30 dB μ to +24 dB μ	20 Hz to 20 kHz
C	Speaker level AV circuits, including low- and high-impedance types (70V)	Greater than +24 dB μ	20 Hz to 20 kHz
D	Control Circuits Data Circuits	0-28 volt into <50k ohm 2 volt peak-peak into 100 ohm	0 Hz to 100 MHz
E	Video	1 volt peak-peak into 75 ohm	0 Hz to 10 MHz
F	Fiber Optic Circuits	N/A	N/A

Wire Class	A	B	C	D	E	F
A	Adjacent	6 inches	12 inches	12 inches	12 inches	Adjacent
B	--	Adjacent	12 inches	6 inches	6 inches	Adjacent
C	--	--	Adjacent	6 inches	6 inches	Adjacent
D	--	--	--	Adjacent	Adjacent	Adjacent
E	--	--	--	Adjacent	Adjacent	Adjacent
F	--	--	--	--	--	Adjacent
Power Conduit <60A	24 inches	24 inches	24 inches	24 inches	24 inches	Adjacent
Power Conduit 60 - 120A	48 inches	48 inches	48 inches	48 inches	48 inches	Adjacent
Power Conduit >120A	64 inches	64 inches	64 inches	64 inches	64 inches	Adjacent

- Ninety-degree crossings in close proximity are acceptable between groups A through F.
- The sizing of the conduit is to be based on the NEC requirements.
- The minimum conduit size allowed for AV cables is 3/4 inch.
- For conduit runs of 50 to 100 feet the installed number shall be reduced by 15% or the next larger size of conduit shall be used.
- If more than two 90 degree bends are to be used in a conduit run or if the run exceeds 100 feet, a pull box shall be inserted.

Conduit runs entering or exiting the audio equipment racks shall be electrically isolated from the racks. PVC or other non-conductive fittings shall be used to isolate the conduit from the audio equipment racks.

Provide AV boxes as shown on the Electrical and/or Audio-Video drawings. Install boxes at heights and locations as indicated on the drawings. Coordinate all box installations with the AV equipment provider.

Flat screen monitor boxes shall be installed so that all cabling is concealed behind the monitor. Coordinate box location with flat screen mounting brackets so that the box cover and cables are not blocked by the brackets.

CONSTRUCTION VERIFICATION

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 26 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

END OF SECTION

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SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

SCOPE

The work under this section includes the products and execution requirements relating to the installation of labels, nameplates, and directories for electrical boxes, wiring devices, and equipment, along with the labeling of power and control wiring. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Submittals

PART 2 - PRODUCTS

- Materials

PART 3 - EXECUTION

- General
- Box Identification
- Communication Conduit Labeling
- Power, Control and Signal Wire Identification
- Wiring Device Identification
- Support Wire Identification
- Nameplate Engraving for Electrical Equipment
- Panelboard Directories

RELATED WORK

Applicable provisions of Division 1 shall govern work under this section.

- Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
- Section 26 05 23 – Control-Voltage Electrical Power Cables
- Section 01 91 01 or 01 91 02 – Commissioning Process

SUBMITTALS

Include schedule for nameplates.

Prior to installation, the contractor shall provide samples of all label types planned for the project. These samples shall include examples of the lettering to be used. Samples shall be mounted on 8 -1/2” x 11” sheets, explaining their purposed use.

PART 2 - PRODUCTS

MATERIALS

Labels: All labels shall be permanent, and machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS ARE ALLOWED.

Wire Labels: All wiring labels shall be white/transparent vinyl or vinyl-cloth, self-laminating, wraparound type. Flag type labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminate over the full extent of the printed area of the label.

Tape (wiring phase identification only): Scotch #35 tape, JVCC E-Tape, or Duck Brand 667 Pro Series in appropriate colors for system voltage and phase. Embossed tape shall not be permitted for any application.

1 Nameplates: Engraved multi-layer laminated plastic. Normal system shall use nameplates with black letters
2 on white background, Emergency system (NEC 700) shall use white letters on red background, Legally
3 Required Standby system (NEC 701) shall use white letters on blue background, and Optional Standby
4 system (NEC 702) shall use black letters on yellow background.

5
6 Nameplates: Engraved multi-layer laminated plastic. Normal system shall use nameplates with black letters
7 on white background, Life Safety system (NEC 517) shall use white letters on red background, Critical
8 system (NEC 517) shall use white letters on orange background, Equipment system (NEC 517) shall use
9 white letters on blue background, and Optional Equipment system (NEC 517) shall use black letters on yellow
10 background.

11 See Box Identification and Wiring Device Identification sections for allowed usage of permanent marker.

14 **PART 3 - EXECUTION**

17 **GENERAL**

18 Clean all surfaces before attaching labels with the label manufacturer's recommended cleaning agent. Install
19 all labels firmly as recommended by the label manufacturer. Labels shall be installed plumb and neatly on
20 all equipment.

21
22 Install nameplates parallel to equipment lines. Secure nameplates to equipment fronts using screws, rivets
23 or manufacturer approved adhesive or cement.

24
25 Provide all warning labels to electrical equipment as required per NEC 110.16 and 110.21. Provide available
26 fault current labeling to service equipment as required per NEC 110.24.

27
28 Provide a sign at the service-entrance equipment indicating type and location of on-site emergency power
29 sources and on-site legally required standby power sources, per NEC 700.7 and NEC 701.7.

30
31 Fire pump disconnecting means shall be marked as "Fire Pump Disconnecting Means", per NEC
32 695.4(B)(3)(c).

33
34 Provide a sign at each service disconnect indicating "Service Disconnect", per NEC 230.70(B).

35
36 Provide permanent marking of exposed Emergency (NEC 700) cable or raceway systems, where boxes or
37 enclosures are not encountered, per NEC 700.10(A)(2).

39 **BOX IDENTIFICATION**

40 All junction and pull boxes shall be identified by color, based on the following color scheme:

41 System	42 Color(s)
43 Secondary Power – 480Y/277V	Brown
44 Secondary Power – 208Y/120V, 240/120V	White
45	
46 Emergency (NEC 700) – 480Y/277V	Brown/Red
47 Emergency (NEC 700) – 208Y/120V	White/Red
48 Life Safety (NEC 517) – 480Y/277V	Brown/Red
49 Life Safety (NEC 517) – 208Y/120V	White/Red
50	
51 Critical (NEC 517) – 480Y/277V	Brown/Orange
52 Critical (NEC 517) – 208Y/120V	White/Orange
53	
54 Legally Required Standby (NEC 701) – 480Y/277V	Brown/Blue
55 Legally Required Standby (NEC 701) – 208Y/120V	White/Blue
56	

1	Equipment (NEC 517) – 480Y/277V	Brown/Blue
2	Equipment (NEC 517) – 208Y/120V	White/Blue
3		
4	Optional Standby (NEC 702) – 480Y/277V	Brown/Yellow
5	Optional Standby (NEC 702) – 208Y/120V	Black/Yellow
6	Optional Equipment (NEC 517) – 480Y/277V	Brown/Yellow
7	Optional Equipment (NEC 517) – 208Y/120V	Black/Yellow
8		
9	Fire Alarm (see below)	Red
10	Temperature Control	Green
11	Door Access Control	Orange
12	Sound and Intercom Systems	Gray
13	Video Surveillance System	Yellow
14	Communications	Blue

15
16 The means of junction and pull box identification shall be as follows:

- 17
18 1. Boxes 8” Square or Smaller – Concealed (Above Accessible Ceilings).
19 • Color identified utilizing fully painted covers. If box contains power wiring, the box shall be
20 further identified with circuit numbers and source panel designation, using machine-generated
21 adhesive label or neatly hand-written permanent marker.
22 2. Boxes 8” Square or Smaller – Exposed.
23 • Color identified utilizing fully painted covers. If box contains power wiring, the box shall be
24 further identified with circuit numbers and source panel designation, using machine-generated
25 adhesive label or engraved nameplate.
26 3. Boxes Larger than 8” Square – Concealed (Above Accessible Ceilings).
27 • Color identified utilizing 4” x 4” minimum-sized painted patch, or color-correct machine-
28 generated adhesive label. If box contains power wiring, the box shall be further identified with
29 circuit numbers and source panel designation using machine-generated adhesive label or neatly
30 hand-written permanent marker. Letter height shall be 1/2” minimum.
31 4. Boxes Larger than 8” Square – Exposed.
32 • Color identified utilizing 4” x 4” minimum-sized painted patch, or color-correct engraved
33 nameplate. If box contains power wiring, the box shall be further identified with circuit
34 numbers and source panel designation using machine-generated adhesive label or engraved
35 nameplate. Letter height shall be 1/2” minimum.

36
37 All fire alarm boxes (covers and outer sides) shall be painted red and labeled “Fire Alarm” or “FA”. When
38 red conduit is used for the alarm system installation, there is no need to paint the box sides – paint the covers
39 only. Non-factory device boxes shall also be painted red.

40
41 Other system boxes shall be further identified as shown on drawing details or approved shop drawings.

42
43 **COMMUNICATIONS CONDUIT LABELING**

44 Provide label on all conduits installed between Telecommunication Equipment Rooms. Both ends of the
45 conduits shall be labeled. All labels shall be mechanical, no hand-written labels.

46
47 The label shall indicate the location of the far end of the conduit run and a unique conduit number.
48 (i.e. TR-1A-01 or Room #216 – 01). Refer to agency standards where applicable.

49
50 **POWER, CONTROL AND SIGNALING WIRE IDENTIFICATION**

51 Provide wire labels on each conductor in panelboard gutters, all boxes, and at load connection. Identify with
52 branch circuit or feeder number for power and lighting circuits, and with wire number as indicated on
53 schematic and interconnection diagrams or equipment manufacturer's shop drawings for control and signaling
54 wires.

55

1 All wiring shall be labeled within 2 to 4 inches of terminations. Each end of a wire or cable shall be labeled
2 as soon as it is terminated, including wiring used for temporary purposes.
3

4 **WIRING DEVICE IDENTIFICATION**

5 Wall switches, receptacles, occupancy sensors, photocells, poke-through fittings, access floor boxes, and
6 time clocks shall be identified with circuit numbers and panelboard source (ex. Panel ABC-3). In exposed
7 areas, identifications should be made inside of device covers, unless directed otherwise. Use machine-
8 generated adhesive labels, or neatly hand-written permanent marker.
9

10 **SUPPORT WIRE IDENTIFICATION**

11 Support wires that are installed in addition to the ceiling grid support wires to provide secure support for
12 raceways, cables assemblies, boxes, cabinets, and fittings shall be distinguishable from the ceiling grid
13 support wires per NEC 300.11(A). This identification shall be either approximately 6 inches of fluorescent
14 orange paint, or orange tape flags 3/4 inches high-by-2 inches wide (minimum) within 12 inches of the bottom
15 of the support wires.
16

17 **ELECTRICAL EQUIPMENT IDENTIFICATION**

18 Provide nameplates of minimum letter height as scheduled below.
19

20 All Panelboards (Distribution, Branch, Sub-feed, and Feed-Through), Switchboards and Motor Control
21 Centers: 1 inch (25 mm); identify equipment designation (same designation used by the main distribution
22 center). 1/2 inch (13 mm); identify voltage rating, source and room location of the source. Panelboards
23 serving NEC 700, 701 or 702 loads shall identify which branch they serve. Both panels in a double tub
24 application shall be labeled.
25

26 Circuit Breakers, Switches, and Motor Starters in Distribution Panelboards, Switchboards and Motor Control
27 Centers: 1/2 inch (13 mm); identify circuit number and load served, including location.
28

29 Individual Disconnect Switches, Enclosed Circuit Breakers, and Motor Starters: 1/2 inch (13 mm); identify
30 voltage, source and load served.
31

32 Transformers: 1 inch (25 mm); identify equipment designation. 1/2 inch (13 mm); identify primary and
33 secondary voltages, primary source and location, and secondary load and location.
34

35 **PANELBOARD DIRECTORIES**

36 Typed directories for panelboards shall be covered with clear plastic and shall have a metal frame. Room
37 number on directories shall be Owner's numbers, not Plan numbers unless Owner so specifies.
38

39 **END OF SECTION**

1 IEEE 1584 – Guide for Performing Arc Flash Calculations

2
3 **DATA COLLECTION FOR THE STUDY**

4 The contractor shall provide the required data for preparation of the studies. The engineer performing the
5 system studies shall furnish the contractor with a listing of the required data immediately after award of the
6 contract.

7
8 The contractor shall expedite collection of the data to assure completion of the studies as required for final
9 approval of the distribution equipment shop drawings and/or prior to release of the equipment for
10 manufacture.

11
12 **SUBMITTALS**

13 **THIRD PARTY QUALIFICATIONS**

14 Submit qualifications of individual(s) who will perform the work to the A/E for approval prior to
15 commencement of the studies.

16
17 **PRELIMINARY REPORT**

18 Submit a draft of the studies to the A/E for review prior to delivery of the final study to the Owner. Make
19 all additions or changes as required by the reviewer.

20
21 **FINAL STUDY REPORT**

22 Provide studies in conjunction with equipment submittals to verify equipment ratings required.

23
24 The results of the power system studies shall be summarized in a final report and provided in the following
25 formats. Provide (2) bound hard copies of the final report. Provide (2) electronic copies (on CD) of the final
26 report and one-line diagrams in PDF format. Provide (2) electronic copies (on CD) of the final report in MS
27 Word format and the one-line diagrams in CAD format.

28
29 Also provide (2) electronic copies (on CD) of all files generated by the SKM or EasyPower software for all
30 scenarios evaluated in the studies. The files shall permit the studies to be opened, reviewed or updated by
31 any user of the analysis software used for the studies.

32
33 The report shall typically include the following sections:

34
35 I. Overview

36 II. Short Circuit Study

37 SC-1 Purpose

38 SC-2 Explanation of Data

39 SC-3 Assumptions

40 SC-4 Analysis of Results

41 SC-5 Recommendations

42 SC-6 Fault Analysis Input Report from Software Program

43 SC-7 Fault Contribution Report

44 III. Protective Device Coordination Study

45 PDC-1 Purpose

46 PDC-2 Explanation of Data

47 PDC-3 Assumptions

48 PDC-4 Analysis of Results

49 PDC-5 Recommendations (Including NEC 700-27 Requirement)

50 PDC-6 Results from Software Program

51 PDC-7 Example Drawings

52 IV. Arc Flash Study

53 ARC-1 Purpose

54 ARC-2 Explanation of Data

55 ARC-3 Assumptions

56 ARC-4 Analysis of Results

1	ARC-5 Recommendations
2	ARC-6 Arc Flash Evaluation Report from Software Program
3	V. Prioritized Recommendations and Conclusions
4	VI. Appendices
5	APP-1 One-line Diagrams from Software Program
6	APP-2 AutoCAD One-line Diagrams
7	APP-3 Protective Device Summaries from Software Program
8	APP-4 Reference Data
9	APP-5 Sample Work Permit Form
10	APP-6 Copy of Warning Labels, including study date

11
12 The above sections shall include the following items in detail:
13

- 14 • Obtain available fault current from the local utility company.
- 15 • Short circuit studies shall evaluate the available fault current at each bus (each change of impedance),
16 including all three-phase motors.
- 17 • Coordination study recommendations for relay settings, breaker settings, and motor protection settings.
- 18 • Recommendations for improving the coordination and/or load distribution, as well as ground fault
19 requirements.
- 20 • Worst case Arc Flash values (highest incident energy) for project specific scenarios (low short circuit
21 and high short circuit for each possible power supply source).
- 22 • Arc flash values for two maintenance cases, which define the arc flash values available at the
23 equipment that would be available if the instantaneous trip of the upstream circuit breaker is set at a
24 minimum value. This is recommended if someone has to work on live equipment.
- 25 • IEEE standard one-line diagram with equipment evaluation and circuit breaker settings that clearly
26 define the system data and are easy to interpret. The diagrams should include the bus names and
27 references used in the studies.
- 28 • Recommendations to reduce the arc flash incident energy in all areas that are subject to 8 calories per
29 square centimeter or greater of available incident energy.
- 30 • Condition of Maintenance information for any existing equipment included in the study.
- 31 • Prioritized report summarizing all recommendations from this study. This shall include observed NEC
32 code violations and their corrective action.
- 33 • The contractor shall provide a one-line diagram that meets IEEE/ANSI standard 141, mounted on
34 24" x 36" (minimum) Styrofoam backboard. This one-line diagram shall be mounted in each electrical
35 room.

36
37 **PART 2 – PRODUCTS**

38
39 Not used.

40 **PART 3 – EXECUTION**

41
42
43 **SHORT CIRCUIT AND COORDINATION STUDY**

44 The short circuit, coordination, and arc flash hazard studies shall be performed using SKM Dapper, Captor
45 and PowerTool for Windows software or EasyPower product suite Windows based software packages. In
46 the short circuit study, provide calculation methods and assumptions, the base per unit quantities selected,
47 one-line diagrams, source impedance data including power company system characteristics, typical
48 calculations, and recommendations. Calculate short circuit interrupting and momentary (when applicable)
49 duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and
50 secondary terminals, low voltage switchgear lineup, switchboard, motor control center, distribution
51 panelboard, pertinent branch circuit panelboard, and other significant locations throughout the system.
52 Provide a ground fault current study for the same system areas, including the associated zero sequence
53 impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor
54 contribution, short circuit KVA, and symmetrical and asymmetrical fault currents.
55

1 In the protective device coordination study, provide time-current curves graphically indicating the
2 coordination proposed for the system, centered on conventional, full-size, log-log forms. Include with each
3 curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system
4 covered by that particular curve sheet. Include a detailed description of each protective device identifying
5 its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time
6 dial, pickup, instantaneous, and time delay settings.

7
8 Include on the curve sheets power company relay and fuse characteristics, system medium-voltage
9 equipment relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics,
10 pertinent transformer characteristics, pertinent transformer characteristics, pertinent motor and generator
11 characteristics, and characteristics of other system load protective devices. Include at least all devices down
12 to largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in
13 branch panelboards.

14
15 Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and
16 damage bands in plotted fuse characteristics. Show transformer full load and 150, 400, or 600 percent
17 currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant
18 symmetrical and asymmetrical fault currents. Terminate device characteristic curves at a point reflecting
19 the maximum symmetrical or asymmetrical fault current to which the device is exposed.

20
21 Select each primary protective device required for a delta-wye connected transformer so that its
22 characteristic or operating band is within the transformer characteristics, including a point equal to
23 58 percent of the ANSI withstand point to provide secondary line-to-ground fault protection. Where the
24 primary device characteristic is not within the transformer characteristics, show a transformer damage
25 curve. Separate transformer primary protective device characteristic curves from associated secondary
26 device characteristics by a 16 percent current margin to provide proper coordination and protection in the
27 event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for
28 other devices by at least a 0.4-second time margin.

29
30 Include complete fault calculations as specified herein for each proposed and ultimate source combination.
31 Note that source combinations may include present and future supply circuits, large motors, or generators
32 as noted on drawing one-lines.

33
34 Utilize equipment load data for the study obtained by the Contractor from contract documents, including
35 contract addendums issued prior to bid openings.

36
37 Include fault contribution of all motors in the study. Notify the Engineer in writing of circuit protective
38 devices not properly rated for fault conditions.

39
40 Provide settings for the chiller motor starters or obtain from the mechanical contractor, include in the study
41 package, and comment.

42
43 When an emergency generator is provided, include phase and ground coordination of the generator
44 protective devices, to meet NEC 700.27 requirements. Show the generator decrement curve and damage
45 curve along with the operating characteristic of the protective devices. Obtain the information from the
46 generator manufacturer and include the generator actual impedance value, time constants and current boost
47 data in the study. Do not use typical values for the generator.

48
49 Evaluate proper operation of the ground relays in 4-wire distributions with more than one main service
50 circuit breaker, or when generators are provided, and discuss the neutral grounds and ground fault current
51 flows during a neutral to ground fault.

52
53 For motor control circuits, show the MCC full-load current plus symmetrical and asymmetrical of the
54 largest motor starting current to ensure protective devices will not trip major or group operation.

55
56 **FIELD SETTINGS**

1 The Contractor shall perform field adjustments of the protective devices as required to place the equipment
2 in final operating condition. The settings shall be in accordance with the approved short circuit study,
3 protective device coordination study and arc flash risk assessment.
4

5 Necessary field settings and adjustments of devices and minor modifications to equipment to accomplish
6 conformance with the approved short circuit and protective device coordination study shall be carried out
7 by the Contractor at no additional cost to the owner.
8

9 **ARC FLASH RISK ASSESSMENT**

10 As part of the short circuit and coordination study, arc flash risk assessment shall be included. The study
11 shall include the following:
12

- 13 1. Determine and document all possible utility and generator/emergency sources that are capable of
14 being connected to each piece of electrical gear. Calculations shall be based on highest possible
15 source connection.
16
- 17 2. Calculations to conform to National Fire Protection Association (NFPA) 70E recognized means of
18 calculation standards. All incident energy units shall be calculated in calories per square
19 centimeter.
20
- 21 3. Provide recommended boundary zones and personal protective equipment (PPE) based on the
22 calculated incident energy and requirements of NFPA 70E for each piece of electrical gear.
23

24 Electrical Contractor shall provide warning labels as required by OSHA based upon the results of the arc
25 flash risk assessment. At a minimum, the labeling shall contain the following information: nominal system
26 voltage, arc flash boundary, limited approach boundary, restricted approach boundary, available incident
27 energy and the corresponding working distance or the arc flash PPE category, minimum arc rating of
28 clothing, and study date. Label shall also include the name or logo and the phone number of the company
29 performing the study.
30

31 Arc flash warning labels shall be affixed to all electrical equipment that is likely to require examination,
32 adjustment, servicing or maintenance while energized. This includes, but is not limited to, medium-voltage
33 switchgear, transformers, switchboards, panel boards, three-phase disconnect switches, transfer switches,
34 motor control centers, motor controllers, and three-phase motor disconnect switches.
35

36 END OF SECTION

1 Provide copies of the commissioning forms to the commissioning agent 2 days prior to construction progress.

2
3

CV-26 51 13 – Interior Light Fixtures, Lamps and Ballasts

4
5
6
7

Equipment Identification/Tag: _____

Location: _____

8 **A) INSTALLATION CHECKS**

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)										
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:		_____				DATE:		_____		

9 **Question Details**

- 10 1) Fixtures, ballasts, and lamps are free from damage.
- 11 2) Identical ballasts provided for each fixture type.
- 12 3) All fixtures and exit signs installed in locations specified in contract documents.
- 13 4) Fixtures do not impede access to other systems or equipment for maintenance.
- 14 5) Suspended fixtures and exit signs are hung independent of any other fixture, system, or equipment, are level, and are suspended with appropriate materials and methods defined within the contract documents.
- 15 6) Fixtures larger than 2’x4’ or greater than 50 lbs. are supported independently from ceiling framing.
- 16

- 1 7) All recessed fixtures are installed flush to ceiling or wall finish.
- 2 8) All recessed fixtures are installed to permit removal and access to lamps from below.
- 3 9) All wall mounted fixtures and exit signs are mounted at heights specified in contract documents.
- 4 10) All fixtures are supported and installed in accordance with manufacturer and specification requirements.

5 **Negative Responses**

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

6

1 **B) WIRING INSTALLATION CHECKS**

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)				
				1)	2)	3)	4)	5)
				YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____		DATE: _____		

2 **Question Details**

- 3 1) Fixture and accessories grounded and bonded to branch circuit grounding conductor.
 4 2) Maximum of 6' of flexible conduit provided for lay-in, recessed fixtures.
 5 3) All electrical connections are tight.
 6 4) All conductors are labeled per specification requirements.

7 **Negative Responses**

Group/Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

8

1 **C) STARTUP & TESTING CHECKS**

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)			
				1)	2)	3)	4)
				YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____		DATE: _____	

2 **Question Details**

- 3 1) Emergency indicating button/lamp visible and verified to be operational (if applicable).
 4 2) Associated emergency ballast tested and operation verified (if applicable).
 5 3) Occupancy sensor and associated fixture(s) tested and operation verified (if applicable).
 6 4) Lighting control schedules programmed and operation verified for all associated fixtures (if applicable).

7 **Negative Responses**

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

8

1 **D) FINALIZATION CHECKS**

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)											
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)		
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS:			_____			DATE:			_____		

2 **Question Details**

- 3 1) Protective covering removed.
- 4 2) Lens, trim ring and other architectural accessories installed.
- 5 3) Recessed fixtures are flush to finished surface with no visible gaps.
- 6 4) Code-required hardware is installed to secure recessed grid-supported fixtures in place.
- 7 5) Recessed fixtures in fire rated assemblies have been sealed per manufacturer and specification requirements to maintain assembly rating.
- 8 6) Number and type of lamps specified for each fixture installed and operational.
- 9 7) Fluorescent lamps installed in fixtures with dimming ballasts have been burned in at 100% rated output for a minimum of 100 hours.
- 10 8) Fixture adjusted and aimed for specific task or effect per contract documents and/or Architect's directions.
- 11 9) All damages to fixture finish repaired.
- 12 10) Fixtures and lens are clean.

1 **Negative Responses**

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

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END OF SECTION

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SECTION 26 09 43
DISTRIBUTED DIGITAL LIGHTING CONTROLS

PART 1 - GENERAL

SCOPE

Provide Distributed Digital Lighting Controls (controls) as indicated on the drawings and as specified herein. The controls shall consist of a series of standalone digital load controllers and intelligent low-voltage devices dedicated to the room/space they are serving. All local devices shall be connected together via an In-Room Network, enabling digital communication between devices. Digital Lighting Control Panels, where indicated on the drawings, may also be used for lighting control as part of the overall lighting control scheme.

The controls shall provide time-based, sensor-based (e.g. occupancy/vacancy and daylight sensors), and/or manual control as indicated in the lighting sequences of operation on the drawings. The controls shall turn lighting loads ON/OFF, and shall dim the lighting where indicated.

Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference Standards
- Design/Performance Requirements
- Quality Assurance
- Submittals
- Operation and Maintenance Data
- Extra Materials

PART 2 - PRODUCTS

- System Requirements
- Digital Load Controllers (Room Controllers)
- Digital Motion Sensors
- Digital Daylight Sensors
- Digital Manual Controls
- Digital LED Luminaires
- Digital Auxiliary Input/Output (I/O) Interface Modules
- Digital Lighting Control Panels (Relay and Dimming Panels)
- Configuration Tools
- Network Cables
- [Network Interfaces]

PART 3 - EXECUTION

- Delivery, Storage, and Handling
- Project Conditions
- Sensor Layouts
- Auxiliary Contacts for HVAC Interlock
- Installation
- Free-Air Cable Installation
- Field Quality Control
- Sequence of Operation
- Post Start-up Tuning
- Warranty
- Product Support and Service
- Construction Verification Items
- Agency Training

RELATED WORK

1 Applicable provisions of Division 1 govern work under this Section.

2
3 Section 01 91 01 or 01 91 02 – Commissioning Process

4 Section 26 08 00 – Commissioning of Electrical

5 Section 26 51 13 – Interior Lighting Fixtures, Lamps, and Ballasts

6
7 **REFERENCE STANDARDS**

8 NFPA 70 National Electrical Code; National Fire Protection Association

9 NEMA National Electrical Manufacturers Association

10 FCC Federal Communications Commission – Emission Standards

11 UL Underwriters Laboratories, Inc. Listings

12 UL 2043 Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-
13 Handling Spaces

14 UL 20 General-Use Snap Switches

15 UL 508 Standard for Industrial Control Equipment

16 UL 916 Standard for Energy Management Equipment

17 UL 924 Standard for Emergency Lighting and Power Equipment

18
19 **DESIGN/PERFORMANCE REQUIREMENTS**

20 Distributed Digital Lighting Controls shall accommodate the square-footage coverage requirements for each
21 area controlled utilizing digital load controllers, digital occupancy/vacancy sensors, digital daylighting
22 sensors, digital switches, digital lighting control panels, and accessories that suit the required lighting and
23 electrical system parameters.

24
25 System shall conform to requirements of NFPA 70.

26
27 System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and
28 residential application.

29
30 System shall be listed under UL sections 916 and/or 508.

31
32 **QUALITY ASSURANCE**

33 Installer Qualifications: Company certified by the manufacturer and specializing in installation of Distributed
34 Digital Lighting Control products with minimum three years documented experience.

35
36 **SUBMITTALS**

37 **Shop Drawings:**

38 Shop drawings shall include the following:

- 39 • Product Datasheets (general device descriptions, dimensions, electrical specifications, wiring
40 details, nomenclature)
- 41 • All manufacturers shall submit to the specifying engineer a line-by-line compliance comparison
42 between each specifications requirement and the system being proposed. Any ambiguities in the
43 drawings or specifications shall be brought to the attention of the specifying engineer for
44 clarification.
- 45 • Riser Diagrams – typical per room type (detailed drawings showing interconnectivity of devices)
- 46 • Other Diagrams – as needed for special operation or interaction with other system(s)
- 47 • Example Contractor Startup/Commissioning Worksheet – must be completed prior to factory start-
48 up
- 49 • Hardware and Software Operation Manuals
- 50 • Other operational descriptions as needed

51
52 Occupancy Sensor Shop Drawings

- 53 • Symbols on drawings are diagrammatic and represent design intent only. Provide manufacturer-
54 recommended layout drawings showing quantity and location of sensors, and associated wiring
55 diagrams.

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Closeout Submittals:

- Project Record Documents: Record actual installed locations **and settings for each** lighting control device and show interconnecting wiring.

- Operation and Maintenance Manual:
 - Include approved Shop Drawings and Product Data.
 - Include Sequence of Operation, identifying operation for each room or space.
 - Include manufacturer's maintenance information.
 - Operation and Maintenance Data: Include detailed information on device programming and setup.
 - Include startup and test reports.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

EXTRA MATERIALS

Provide the following spare materials:

- One (1) ON/OFF Load Controller with three relays
- One (1) ON/OFF/Dimming Load Controller with three relays
- One (1) of each type of motion sensor used
- One (1) two-button digital wall switch
- One (1) four-button digital wall switch

PART 2 - PRODUCTS

SYSTEM REQUIREMENTS

Lighting control zones shall consist of one or more intelligent lighting control components (digital load controllers), be capable of stand-alone operation, and be capable of being connected to a higher-level network backbone.

Network Characteristics

- In-Room Network:
 - The In-Room network shall be a free topology lighting control network using physical wiring connections and communication protocol designed to control a room/space/small area of a building.
 - Digital room devices connect to the In-Room network, which provides both communications and power to room devices.

Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the Global Network or the management software becoming unavailable.

All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.

System shall be capable of using a web-based software management program that enables remote system control, status monitoring, and creation of lighting control schedules and profiles.

DIGITAL LOAD CONTROLLERS (Room Controllers)

General

1 Digital load controllers shall be simple to install and shall not have dip switches or potentiometers, or require
2 special configuration.

3
4 The controllers shall include the following features:

- 5 • Standard junction box mounting.
- 6 • Low voltage connection using standard RJ-45 connectors and CAT5e cable. Other wiring
7 topologies are acceptable if controls accomplish all requirements specified in these documents.
- 8 • Each connected load shall be capable of any of the following behaviors: Manual ON, Automatic
9 ON, Automatic ON to 50 percent, or Automatic ON to Preset level or last level set.
- 10 • UL 2043 plenum rated.
- 11 • Manual override and LED indication for each load.
- 12 • Power supply to power the digital load controller itself and the peripheral sensors and controls
13 connected to the In-Room Network.
- 14 • Dual voltage (120/277 VAC, 60 Hz), rated for 20A total load, derating to 16A required for some
15 dimmed loads (forward phase dimming).
- 16 • Zero cross circuitry for each load.
- 17 • All digital parameter data programmed into an individual room controller or plug load controller
18 shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an
19 expected life of no less than 10 years.

20 21 **ON/OFF Load Controllers**

22 Controllers shall include the following:

- 23 • Multiple relay configurations per unit.

24 25 **ON/OFF/Dimming Load Controllers**

26 Controllers shall include the following:

- 27 • Multiple relay configurations per unit.
- 28 • Each dimming output channel shall have an independently configurable minimum and maximum
29 calibration trim level to set the dimming range to match the true dynamic range of the connected
30 LED driver.
- 31 • One dimming output per relay.
 - 32 ○ 0-10V Dimming: Where indicated, one 0-10 volt analog output per relay for control of
33 compatible LED drivers. The 0-10 volt output shall automatically close upon loss of
34 power to the Controller to assure full light output from the controlled lighting.
 - 35 ○ Line Voltage, Forward Phase Dimming: Where indicated, one forward phase control line
36 voltage dimming output per relay for control of compatible LED drivers, forward phase
37 compatible ELV, and incandescent loads.
- 38 • Each load shall have an independently configurable preset ON level for Normal Hours and After
39 Hours events to allow different dimmed levels to be established at the start of both Normal Hours
40 and After Hours events.

41 42 **DIGITAL MOTION SENSORS**

43 **General**

44 Sensors shall be available in wall, ceiling, corner-mounted, or wall-switch configurations.

45
46 Sensors shall use either passive infrared (PIR) sensing, or if dual technology, passive infrared and passive
47 acoustic or passive infrared and ultrasonic sensing for detecting room occupancy.

48
49 Sensors shall be able to function together with other sensors in order to provide expanded coverage areas.

50 51 **Features**

52 Sensors shall be provided with the following features:

- 53 • Sensitivity Adjustment, Time Delay, Detection Technology, and Walk-Through Mode.
- 54 • Dual-Technology Sensors shall have independent configurable trigger modes to choose proper
55 technology according to space use to eliminate false-triggers.

- 1 • Each sensor may be programmed to control specific loads within an In-Room network.
2 • Each sensor shall allow remote programming through a handheld commissioning tool via a two-
3 way infrared (IR) transceiver or by configuration through a local network device.
4

5 **Digital Wall Switch Motion Sensors**

6 Digital wall switch motion sensors shall be provided with the following features:

- 7 • Shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.
8 • One- or two-button switches for one or two switch-legs.
9 • Optional daylight sensor feature for daylighting override.
10

11
12 **DIGITAL MANUAL CONTROLS**

13 **Wall Switches**

14 Low voltage dimming and momentary pushbutton switches in 1, 2, 3, 4, 5, and 8 Button configurations.
15

16 Wall switches shall include the following features:

- 17 • Buttons may be programmed as Load or Scene Buttons.
18 • Buttons may be programmed as ON/OFF, ON only, or OFF only.
19 • Switch buttons may be bound to any load on a room controller and are not load type dependent.
20

21 **Dimmer Switches**

- 22 • Raise/lower dimming adjustment controls.
23 • Dimmer switches shall include multiple LEDs to indicate load levels.
24 • Dimmer switches shall be able to be ganged with multi-button switches under the same wallplate.
25 • Three-way and 4-way switch locations are supported for ON/OFF or Dimming control.
26

27 **Digital Scene Switches**

- 28 • Scene switches allow for Preset Scene recall and dimming override control.
29

30 **Touch Panel Controls**

31 Touch Panel Controls are allowed, but not required. Touch Panel Controls are used for adjusting lighting and
32 to set up and control preset lighting scenes in the associated room/space.
33

34 Touch panel controls shall be provided with the following features:

- 35 • Full-color multi-touch capacitive touchscreen for controlling lighting and system components
36 • Control up to 16 dynamic lighting zones/scenes per touch screen or acting as up to 16
37 ON/OFF/DIM control switches
38 • Lighting zones/scenes can be comprised of lighting intensity, color, color temperature, and
39 luminaire position
40 • Modify color and color temperature using a digital color palette and UV rating scale
41 • Proximity screen sensor for auto “wake-up”
42 • Auto dimming and user adjustable backlight
43 • Device shall enable configuration of all switches, dimmers, and lighting preset scenes via password
44 protected setup screens. User programmable screen lock limiting access to all feature controls and
45 programming
46 • Full alpha-numeric scene and zone naming
47 • Configurable interface to reflect project requirements
48 • Lighting zones/scenes support control of forward/reverse phase dimming, 0-10V, RGB, tunable
49 white, and moving fixtures
50 • Integral astronomical time clock enables lighting scenes
51 • Partition status control and visualization
52 • Direct DMX control
53 • Digital motion sensor control
54 • Digital daylight harvesting response

- Shall have the ability to control connected load through time schedules.
- RS-232/contact closure capable for 3rd party integration
- Local wireless Bluetooth connectivity with mobile app
- Device shall have a micro-USB style connector for local computer connectivity.
- Remote-mounted power supply

DIGITAL LED LUMINAIRES

Digital LED Luminaires are luminaires with embedded controls (a.k.a. “enabled” luminaires). Luminaires with embedded controls are not allowed.

DIGITAL AUXILIARY INPUT/OUTPUT (I/O) INTERFACE MODULES

General

- Operate on Class 2 power supplied by In-Room network.
- Status LEDs indicate if input is energized.
- UL 2043 plenum rated where required.

Switched Contact Closure Interface

- Utilized for automatic control via input from other sources such as switches, relay-based system, BAS, etc.
- Includes 24VDC output and input terminals for momentary or maintained third party contact closure inputs.
- Utilize input module for an Auto ON and Sweep OFF function input from other sources for the controlled area. During normal hours of operation, all local low-voltage devices are fully operational. During after hours, a timer shall be applied to all low-voltage switches or dimmers so that the room will automatically sweep off every two hours following switch activation. Provide a blink warning to alert occupants of impending OFF.
- Specific I/O devices shall have a dimming control output that can control 0-10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current.
- Specific I/O devices shall have an input that reads a 0-10 VDC signal from an external device.
- Specific I/O devices shall have a switch input that can interface with either a maintained or momentary switch and run a switch event (e.g. toggle the lighting load) or run a local/remote control profile.
- Specific I/O devices shall sense state of low-voltage outdoor photocells.
- Specific I/O devices shall sense momentary and maintained contact closures, and either toggle a connected load after a momentary contact or ramp the load high/low during a maintained contact (stopping when the contact releases).

Serial Data Interface

- Utilized for control from A/V system to send ON/OFF/Preset commands to In-Room Network.
- Includes 24VDC output and 10 pin RS232 connection.
- Coordinate programming with the Distributed Digital Lighting Control System manufacturer’s technician and the A/V system technician for successful interface between both systems.

DIGITAL LIGHTING CONTROL PANELS (RELAY and DIMMING PANELS)

General

It is the intent of this paragraph to provide a Digital Lighting Control Panel as part of an integrated lighting control system. Contractor is responsible for confirming that the panels and associated peripheral devices such as sensors and manual controls interoperate as a single system.

Digital Lighting Control Panels shall be incorporated into the lighting control system Global Network where used.

Provide lighting control panels in the locations and capacities as indicated on the plans and schedules. Each panel shall be of modular construction and consist of the following components:

- The panel cover shall have a hinged and lockable door with restricted access to line voltage section

- 1 of the panel.
- 2 • The interior construction shall provide total isolation of line voltage (Class 1) wiring from low
 - 3 voltage (Class 2) wiring within the assembled panel.
 - 4 • Direct wired switch inputs associated with each relay shall support two-wire, momentary or
 - 5 maintained contact switches.
 - 6 • Digital inputs shall support digital switches, digital I/O modules capable of receiving 0-5V or 0-
 - 7 10V analog photocell inputs, digital I/O modules capable of receiving momentary or maintained
 - 8 contact closure inputs, digital photocell modules, and digital occupancy sensors.
 - 9 • Power supply shall be a multi-voltage transformer assembly with rated power to supply all
 - 10 electronics, occupancy sensors, switches, pilot lights, and photocells associated with the lighting
 - 11 control panel as necessary to meet the project requirements.

12

13 **Relays**

14 Relays shall provide the following ratings and features:

- 15 • Panel shall provide one 0-10VDC dimming output paired with each relay.
- 16 • Each relay shall contain an LED status light and an override pushbutton. True relay state shall be
- 17 indicated by the on-board LED and shall be available to external control devices and systems via
- 18 BACnet. Isolated low voltage contacts provide for true relay status feedback and pilot light
- 19 indication.
- 20 • Relays shall be individually replaceable in a modular plug-in design.
- 21 • Relays shall be single-phase normally-closed latching type relays capable of switching 120/277
- 22 VAC or two-phase relays capable of switching 208/240/480 VAC loads.
- 23 • Relays shall be rated to switch up to a 30A ballast load at 277 VAC.
- 24 • Tested to 300,000 mechanical on/off cycles.
- 25 • Relay operation shall be automatically sequenced to reduce impact on the electrical distribution
- 26 system when large loads are controlled simultaneously.

27

28 **Digital Network Clock**

- 29 • Each panel shall include a digital clock capable to issue system wide automation commands.
- 30 • The clock module shall provide astronomic capabilities, time delays, blink warning, daylight
- 31 savings, and holiday functions and shall include battery backup for the clock function and for
- 32 program retention. The clock capability of each panel shall employ non-volatile memory and shall
- 33 retain user programming and time for a minimum of 10 years.
- 34 • The clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After
- 35 Hours to automation groups that implement pre-configured control scenarios. Scenarios shall
- 36 include:
 - 37 ○ Scheduled ON / OFF
 - 38 ○ Manual ON / Scheduled OFF
 - 39 ○ Astro ON / OFF (or Photo ON / OFF)
 - 40 ○ Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
- 41 • Schedules programmed into the clock of any one panel shall be capable of executing local
- 42 schedules or Dark/Light (photocell or Astro) events for that panel in the event that global network
- 43 communication is lost.

44

45 **CONFIGURATION TOOLS**

46 A configuration tool facilitates optional customization of In-Room networks.

- 47 • Provide two Configuration Tools for the project.
- 48 • Provide free, downloadable PC software for direct programming of In-Room Networks.

49

50 Features and functionality of the wireless configuration tool shall include but not be limited to:

- 51 • Optional customization of In-Room networks using two-way wireless communications or USB
- 52 interface.
- 53 • Must be able to read and modify parameters for room controllers, occupancy sensors, wall
- 54 switches, daylighting sensors, network bridges and relay panels, and identify room devices by type
- 55 and serial number.

- Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.

NETWORK CABLES

In-Room Networks

This specification is based on CAT5e data cables for In-Room Networks. Other wiring topologies are acceptable if controls accomplish all requirements specified in these documents.

Use manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors for In-Room Networks. If manufacturer's cables are not used, each field-terminated cable shall be tested prior to installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.

UL 2043 plenum rated where required.

BAS Integration

Provide capabilities for integration with a Building Automation System (BAS) via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the Global Management Controller: Room occupancy state; Room schedule mode; Room switch lock control; Individual occupancy sensor state; Load ON/OFF state; Load dimming level; Panel relay state; and Global Management Controller Group schedule state.

Management Software

Every device parameter (e.g. sensor time delay and photocell setpoint) shall be available and configurable remotely from the software.

Software shall require all users to log in with a User Name and Password.

Software shall provide at least three permission levels for users.

All sensitive stored information and privileged communication by the software shall be encrypted.

All device firmware and system software updates must be available for automatic download and installation via the internet.

Software shall be capable of managing systems interconnected via a WAN (wide area network).]

PART 3 - EXECUTION

DELIVERY, STORAGE, AND HANDLING

Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

PROJECT CONDITIONS

Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer. Do not install products under environmental conditions outside manufacturer's absolute limits.

Do not install equipment until following conditions can be maintained in spaces to receive equipment:

Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).

Relative humidity: Maximum 90 percent, non-condensing.

SENSOR LAYOUTS

Confirm quantity and provide appropriate coverage by sensors on a per-space requirement. Symbols on drawings are diagrammatic and represent design intent only.

Occupancy sensors shall be installed at locations indicated on the manufacturer's submittal layout drawings. Sensors shall be located to prevent false triggering of the lights to ON when no occupant is present.

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AUXILIARY CONTACTS for HVAC INTERLOCK

Provide auxiliary dry contacts for HVAC/BAS interlock via Digital Auxiliary Input/Output (I/O) Interface Modules when required. Refer to the “Occ Sensor Interlock” column in the Air Terminal Schedule on the HVAC drawings.

The occupancy sensors, room controllers, and auxiliary contacts shall be configured such that the sensors still detect occupancy and control the auxiliary contacts regardless of whether the lights are ON or OFF (e.g. the occupant has turned the lights OFF because there is enough daylight, but the occupant is still occupying the space, so the occupancy sensor senses the occupant and closes the auxiliary contacts for Air Terminal control).

The HVAC/BAS wiring to the auxiliary contacts shall be by the Division 23 contractor.

INSTALLATION

Install system in accordance with the approved system shop drawings and manufacturer's instructions.

Install all room/space devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.

If pre-terminated cable is not used for room/space wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.

Install all room-to-room digital devices using manufacturer-supplied network wire. Network wire substitution is not permitted and may result in loss of product warranty.

Low-voltage wiring topology must comply with manufacturer's specifications.

Document final wiring locations, routing, and topology on as-built drawings.

All line-voltage connections shall be tagged to indicate circuit and switched legs.

Test all devices to ensure proper communication.

Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.

Adjust time delay so that controlled area remains lighted while occupied.

Provide written or computer-generated documentation on the configuration of the system including room-by-room description including:

- Sensor parameters, time delays, sensitivities, and daylighting setpoints.
- Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
- Load Parameters (e.g. blink warning, etc.)

Tighten all panel Class I conductors at circuit breakers and at loads to torque ratings as marked on enclosure UL label.

All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

Run separate neutrals for any phase dimmed branch load circuit. Different types of dimmed loads shall have separate neutrals.

Verify all loads to be free from short circuits prior to connection to room controllers.

Control-voltage cables shall be installed in conduit. However, they may be installed free-air (without conduit)

1 above accessible ceilings if the cable meets NEC requirements for the application, unless specified to be in
2 conduit in other sections of the specifications. See requirements for free-air cable installation below.

3
4 Control cables for controlling HVAC and lighting equipment connected to emergency power shall be routed
5 in raceways separate from each other.

6 7 **FREE-AIR CABLE INSTALLATION**

8 Cabling shall be neatly run at right angles and be kept clear of other trades work.

9
10 Cabling shall be supported at a maximum of 4-foot intervals utilizing “J-Hook” or “Bridal Ring” supports
11 anchored to ceiling concrete, piping supports or structural steel beams. If cable sag at mid-span exceeds 12-
12 inches, another support shall be provided. Cable supports shall be installed to maintain cable bend to larger
13 than the minimum bend radius.

14
15 Cabling shall not be attached to or supported by existing cabling, plumbing or steam piping, ductwork,
16 suspended ceiling supports or electrical or communications conduit. Do not place cable directly on the ceiling
17 grid or attach cable in any manner to the ceiling grid wires.

18
19 To reduce or eliminate Electro-Magnetic Interference (EMI), the following minimum separation distances
20 for ‘Free-Air’ cabling installations shall be adhered to:

- 21
22 • Twelve (12) inches from power lines of less than 5kV.
23 • Thirty-nine (39) inches from power lines of 5kV or greater.
24 • Five (5) inches from lighting fixtures.
25 • Thirty-nine (39) inches from transformers and motors.

26
27 A coil of 4 feet in each cable shall be placed in the ceiling at each ‘free-air’ wired device. These
28 coils shall be secured (wire tied) at the last cable support before the cable reaches the device and shall be
29 coiled from 100% to 200% of the cable recommended minimum bend radius.

30
31 All cable shall be free of tension at both ends. Nylon strain relief connectors shall be provided at
32 each device and junction box where cables enter. In cases where the cable must bear some stress, Kellum
33 type grips may be used to spread the strain over a longer length of cable.

34
35 Cable manufacturers minimum bend radius shall be observed in all instances. Care should be taken
36 in the use of cable ties to secure and anchor the station cabling. Ties should not be over tightened as to
37 compress the cable jacket. No sharp burrs should remain where excess length of the cable tie has been cut.

38
39 All exposed vertical cable extensions to devices located below the finished ceiling shall be in
40 conduit.

41
42 Use suitable cable fittings and connectors.

43
44 When permitted in exposed ceiling areas as designated on the plan drawings, Free-Air wiring runs shall avoid
45 areas of high traffic (i.e. aisle way), shall be run as close as possible to outlining walls and shall be a minimum
46 of ten (10) feet above finished floor. Provide protection for exposed cables where subject to damage.

47 48 **FIELD QUALITY CONTROL**

49 Electrician/Low Voltage Technician: Any low voltage wiring made onsite by electrical or low voltage
50 contractor must be verified end to end with industry standard test equipment capable of printing or producing
51 a digital file of the testing results.

52
53 Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components,
54 assemblies, and equipment installations, including connections, and to assist in testing. Notify Manufacturer
55 in writing a minimum of three (3) weeks prior to system start-up and testing.

1 Tests and Inspections: Manufacturer's service representative or electrical/low-voltage contractor installing
2 low voltage cabling that is not pre-terminated from the manufacturer shall perform the following inspections
3 and prepare reports:
4

5 Tests and Inspections: Manufacturer's service representative shall perform the following inspections and
6 prepare reports:

- 7 • Verify end-to-end testing of all low voltage wiring that is not pre-terminated from the
8 manufacturer. Provide detailed results via paper or digital format downloadable from testing
9 equipment.
- 10 • Verify Class I and II wiring connections by validating system performance.
- 11 • Set IP addresses and other network settings of system front-end hardware per facility's IT.
12 instructions.
- 13 • Verify/complete task programming for all switches, dimmers, time clocks, and sensors.
- 14 • Verify that the control of each space complies with the Lighting Sequence of Operation.
- 15 • Correct any system issues and retest.

16
17 Provide a report in table format with drawings, or using a software file that can be opened in the
18 manufacturer's system software including each room or space that has lighting control installed. Indicate the
19 following:

- 20 • Date of test or inspection.
- 21 • Loads per space.
- 22 • Fixture Address identification.
- 23 • Quantity and Type of each device installed.
- 24 • Reports providing each device's settings.

25 26 27 **SEQUENCE of OPERATION**

28 See plans for Sequence of Operation descriptions.
29

30 **POST START-UP TUNING**

31 Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from initial occupancy.
32 Provide a detailed report to the Architect/Owner of post start-up activity.
33

34 **WARRANTY**

35 Manufacturer shall provide a 5-year limited warranty on products within this installation, except where
36 otherwise noted, and consisting of a one-for-one device replacement.
37

38 **PRODUCT SUPPORT AND SERVICE**

39 Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance
40 shall consist of assistance in solving application issues pertaining to the control equipment.
41

42 **CONSTRUCTION VERIFICATION ITEMS**

43 Contractor is responsible for utilizing the construction verification checklists supplied under specification
44 Section 26 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01
45 or 01 91 02.
46

47 **AGENCY TRAINING**

48 All training provided for agency shall comply with the format, general content requirements and submission
49 guidelines specified under Section 01 91 01 or 01 91 02.
50

51 The Contractor, through their supplier, shall provide training on the system operation for the owner as part
52 of this contract. The training shall consist of one(1) two-hour session.
53
54

55 **END OF SECTION**

1 **General:** Heavy duty use toggle switch, rated 20 amperes and 120/277 volts AC. Switches shall be UL20
2 Listed and meet Federal Specification WS-896. All switches shall be heavy duty Specification Grade.

3
4 Handle: White, made of nylon or high impact resistant material.

5
6 All switches on emergency circuits shall have a red handle with matching red cover plate.

7
8 **Wall Switches for Lighting Circuits and Motor Loads Under 1/2 HP:** All switches shall be back and
9 side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG, with separate green
10 ground screw. Switches shall be as follows:

11 Hubbell 1221*,
12 Leviton 1221-S*,
13 Pass & Seymour CSB20AC1-*,
14 or approved equal. (* indicates color selection).

15
16 **Modular Wall Switches for Lighting Circuits and Motor Loads Under 1/2 HP:** Switches shall be as
17 follows:

18 Hubbell SNAP1221*NA,
19 Leviton M1221-*,
20 Pass & Seymour PT20AC1-*,
21 or approved equal. (* indicates color selection).

22 23 **RECEPTACLES**

24 **General Requirements:** NEMA Type 5-20R, white, nylon or high impact resistant face. Receptacles shall
25 be UL498 Listed and meet Federal Specification WC-596. All duplex receptacles shall be heavy duty
26 Specification Grade, 20 amp rated.

27
28 Generally, all receptacles shall be duplex convenience type unless otherwise noted.

29
30 All receptacles on emergency circuits shall have a red face with matching red cover plate.

31
32 All receptacles designated as isolated ground shall have an isolated ground triangle imprint on the face of
33 the receptacle.

34
35 All receptacles installed in bathrooms, kitchens, and within 6 feet of the outside edge of sinks shall be
36 GFCI type.

37
38 All receptacles installed in outdoor locations, garages, rooftops, and in other damp or wet locations shall be
39 GFCI type with a weather-resistant (WR) rating.

40
41 **Convenience and Straight-blade Receptacles:** All receptacles shall be back and side wired, screw clamp
42 type, suitable for solid or stranded wire up to #10 AWG, with a separate green ground screw. Receptacles
43 shall be as follows:

44 Hubbell 5362*,
45 Leviton 5362-*,
46 Pass & Seymour PS5362*,
47 or approved equal. (* indicates color selection).

48
49 **GFCI Receptacles:** Duplex convenience receptacle with integral ground fault current interrupter meeting
50 the requirements of UL standard 943 Class A, including self-test functionality and reverse line-load misfire
51 function repeatability. GFCI receptacles shall be as follows:

52 Hubbell GFR5362SG*,
53 Leviton GFNT2-*,
54 Pass & Seymour 2097*,
55 or approved equal. (* indicates color selection).

1 **GFCI Receptacles with a weather-resistant (WR) rating:** Weather-Resistant duplex convenience
2 receptacle with integral ground fault current interrupter meeting the requirements of UL standard 943
3 Class-A, including self-test functionality and reverse line-load misfire function repeatability. WR GFCI
4 receptacles shall be as follows:

5 Hubbell GFR5362SG*,
6 Leviton GFWR2-*,
7 Pass & Seymour 2097TRWR*,
8 or approved equal. (* indicates color selection).
9

10 **USB Charger and Duplex Tamper-Resistant Receptacles:** Do not use combination duplex receptacles
11 with USB chargers. Use duplex receptacles as required for the application and as specified herein. Use
12 separate 4-port USB charging devices.
13

14 **USB Charging Devices:** Single-gang 4-port USB charging station. USB ports shall meet UL94 for 5V
15 flammability rating, and shall comply with battery charging specification USB BC1.2. USB ports shall be
16 compatible with USB 1.1/2.0/3.0 devices, including Apple products. USB ports shall be rated 5VDC, 4.2A
17 minimum. Devices shall be as follows:

18 Hubbell USB4*,
19 Leviton USB4P-*,
20 Pass & Seymour TM8USB4*CC6,
21 or approved equal. (* indicates color selection).
22

23 **Locking-Blade Receptacles:** As indicated on drawings.
24

25 **Specific-use Receptacle Configuration:** As indicated on drawings.
26

27 **Modular Convenience and Straight-blade Receptacles:** Receptacles shall be as follows:

28 Hubbell SNAP5362*A,
29 Leviton M5362-*,
30 Pass & Seymour PT5362*,
31 or approved equal. (* indicates color selection).
32

33 **Modular GFCI Receptacles:** Duplex convenience receptacle with integral ground fault current interrupter
34 meeting the requirements of UL standard 943 Class A, including self-test functionality and reverse line-
35 load misfire function repeatability. GFCI receptacles shall be as follows:

36 Hubbell GFRST83SNAP*,
37 Leviton MGFN2-*,
38 Pass & Seymour PT2097*,
39 or approved equal. (* indicates color selection).
40

41 **Modular GFCI Receptacles with a weather-resistant (WR) rating:** Use back and side wired devices in
42 lieu of modular weather-resistant rated GFCI receptacles.
43

44 **EMERGENCY LIGHTING CONTROL UNITS**

45 **General Requirements:** Emergency Lighting Control Units (ELCUs) shall automatically illuminate
46 connected emergency lighting upon utility power interruption, regardless of room switch position or
47 occupancy sensor state.
48

49 The ELCU shall be UL 924 listed.
50

51 Warranty shall be 5 year replacement warranty.
52

53 Local room switch or lighting control shall turn both normal and emergency luminaires ON at the same
54 time (no dedicated emergency room switch required).
55

56 The ELCU shall have a minimum load rating of 20 Amps at 120V or 277V, 1800W Tungsten at 120V,

1 1500W Tungsten at 277V, 1 HP, or general use 20 Amp circuits.

2
3 The ELCU shall accept 120V or 277V, 60Hz Input & Output (voltage tolerance +/- 15%).

4
5 The ELCU shall include emergency power and normal power indicator LEDs, and a manual test switch.

6
7 The ELCU shall accept separate phases on the constant hot and switched hot inputs.

8
9 The ELCU shall include high voltage input surge protection up to 50,000V.

10
11 Load contacts shall be able to withstand 10 direct shorts while connected to a 20 Amp breaker without
12 permanent damage.

13
14 The ELCU shall not generate any objectionable electrical or mechanical noise.

15
16 The ELCU shall have UL 94-VO or UL 94-5VA flame rating and be approved for installation above the
17 suspended ceiling.

18
19 **Dimming Applications:** The ELCU shall automatically illuminate connected emergency lighting to full
20 brightness upon utility power interruption, regardless of dimmer or switch position or occupancy sensor
21 state.

22
23 The ELCU shall be compatible with 2-wire, 3-wire, 0-10V, and DALI dimming systems and ballasts.

24
25 The same local room switch, dimmer, or lighting control shall dim both normal and emergency luminaires
26 at the same level during normal operation.

27 28 **WALL DIMMERS**

29 General:

- 30 1. Compatible with the voltage of the circuit being controlled: 120V or 277V;
- 31 2. Compatible with the load being dimmed;
- 32 3. Linear full-range slide control;
- 33 4. Separate ON/OFF switch: single-pole, 3-way, or multiple-location operation as indicated on the
34 drawings;
- 35 5. No derating required in multi-gang applications;
- 36 6. Polycarbonate construction;
- 37 7. Color to match receptacles and/or standard toggle switches.

38
39 Line-voltage LED Dimmer:

- 40 1. Forward or reverse phase dimming control as required for the application;

41
42 0-10 V Dimmers:

- 43 1. Ratings: 30 mA sink current;
- 44 2. Adjustable dial allows users to trim the low-end dimming range;

45 46 **DEVICE PLATES AND BOX COVERS**

47 **Decorative Cover Plate:** White, smooth thermoplastic nylon. Note requirement for red plates on
48 emergency outlets and switches.

49
50 **Weatherproof Cover:** All receptacles installed in wet locations shall have an enclosure that is
51 weatherproof whether or not the attachment plug is inserted. Covers shall be gasketed metal with hinged
52 "in-use" device covers, powder coat painted. Non-metallic covers are not allowed. Covers shall be latching
53 type and shall be lockable. Covers shall be identified as "extra-duty" type per NEC 406.9(B)(1).

54
55 **Damp Location Cover:** All receptacles installed outdoors in a location protected from the weather or in
56 other damp locations shall have an enclosure that is weatherproof when the receptacle is covered

1 (attachment plug not inserted and receptacle covers closed). Covers shall be gasketed metal with hinged
2 device covers, powder coat painted. Non-metallic covers are not allowed.

3
4 **Surface Cover Plate:** Raised galvanized steel.

5
6
7 **PART 3 - EXECUTION**

8
9 **INSTALLATION**

10 See plans for device mounting heights.

11
12 Install wall switches with OFF position down.

13
14 Wall dimmers: de-rate ganged dimmers as instructed by manufacturer; do not use common neutral.

15
16 Install convenience receptacles with grounding pole on bottom.

17
18 Install box for information outlet at the same height as adjacent convenience receptacles. Locate boxes for
19 information outlet as close as practical to duplex power outlet, approximately 2-inches apart.

20
21 Install box for telephone jack for wall telephone at 46-inches to center above finished floor.

22
23 Install specific-use receptacles at heights shown on Contract Drawings.

24 Install decorative plates on switch, receptacle, and blank outlets in finished areas.

25
26 Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible
27 ceilings, and on surface-mounted outlets.

28
29 Install devices and wall plates flush and level.

30
31 Receptacles shall have a bonding conductor from grounding terminal to the metal conduit system. Self-
32 grounding receptacles using mounting screws as bonding means are not approved.

33
34 **FIELD QUALITY CONTROL**

35 Inspect each wiring device for defects.

36
37 Operate each wall switch and sensor with circuit energized, and verify proper operation.

38
39 Verify operation of each ELCU by turning off the normal power circuit breaker at the panelboard.

40
41 Verify that each receptacle device is energized.

42
43 Test each receptacle device for proper polarity.

44
45 Test each GFCI receptacle device for proper operation.

46
47 The user agency and UW personnel reserve the right to be present at all tests.

48
49 **ELCU WIRING**

50 For lights on emergency power *without* an emergency lighting control unit (ELCU), use the *emergency*
51 circuit to energize the Digital Load Controller. Route the emergency circuit through the Load Controller's
52 relay to the light fixtures. Route any non-emergency circuits controlled by the same Load Controller
53 through separate auxiliary relays (Digital Auxiliary I/O Interface Modules).

54
55 For lights on emergency power *with* an ELCU, route the *normal* power through the Load Controller relay
56 to the ELCU, then to the normal power lighting fixtures. Connect the emergency circuit to the ELCU's

1 emergency power terminals, then to the emergency lighting fixtures. The ELCU will control the emergency
2 lighting along with the normal lighting controls, but will turn the emergency lights ON in a power outage,
3 regardless of the position of the Load Controller relays (ON or OFF).

4

5 **ADJUSTING**

6 Adjust devices and wall plates to be flush and level.

7

8 Mark all conductors with the panel and circuit number serving the device with a machine generated label,
9 at the device, and on the back of the device cover.

10

11

END OF SECTION

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SECTION 26 27 28
DISCONNECT SWITCHES

PART 1 - GENERAL

SCOPE

The work under this section includes disconnect switches, fuses and enclosures. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- References
- Submittals
- Operation and Maintenance Data
- General

PART 2 - PRODUCTS

- Disconnect Switches
- Fuses

PART 3 - EXECUTION

- Installation
- Construction Verification Items

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Section 26 08 00 - Commissioning of Electrical
Section 01 91 01 or 01 91 02 – Commissioning Process

REFERENCES

NECA (National Electrical Contractors Association) "Standard of Installation"
NEMA ICS 2 – Industrial Control Devices, Controllers, and Assemblies
NEMA KS 1 – Enclosed Switches
UL 50 – Enclosures for Electrical Equipment
UL 98 – Enclosed and Dead-front Switches

SUBMITTALS

Include outline drawings with dimensions, and equipment ratings for voltage, ampacity, horsepower, and short circuit.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

GENERAL

Provide disconnect switches for loads required by code. Review HVAC and Plumbing specifications to determine what equipment is furnished with disconnect switches. Install disconnect switches whether furnished under this contract or not. It is the Electrical Contractors responsibility to determine the need for a disconnect switch for each load. The contractors shall include in their bid the code required disconnect switches whether indicated on the drawings or not.

PART 2 - PRODUCTS

DISCONNECT SWITCHES

Fusible Switch Assemblies: NEMA Type Heavy Duty; quick-make, quick-break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: designed to accommodate Class R, Class J or Class CC (motors) cartridge type fuses.

1 Nonfusible Switch Assemblies: NEMA Type Heavy Duty; quick-make, quick-break, load interrupter,
2 enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch
3 in ON position. Handle lockable in OFF position.
4

5 Enclosure:

6 Indoor: NEMA 1 code gauge steel with rust inhibiting primer and baked enamel finish.
7

8 Outdoors: NEMA 3R code gauge zinc coated steel with baked enamel finish. or NEMA 4X, 304
9 stainless steel with brushed finish, when indicated on drawings.
10

11 Corrosive Areas, Kitchen/Food service areas, Therapeutic/Pool spaces and Interior Damp/Wet locations:
12 NEMA 4X, 304 stainless steel with brushed finish.

13 Provide manufacturer's equipment ground kit in all disconnect switches.
14

15 In applications where the switch serves as the service entrance disconnect, provide service ground kit, label
16 as service disconnect and provide UL listing for service disconnect.
17

18 **FUSES**

19 Fuses 600 Amperes and Less: Dual element, time delay, 250 or 600 volt, UL Class J. Interrupting Rating:
20 200,000 rms amperes.
21

22 Fuses 601 Amperes and Larger: Low Peak, time delay, 600 volt, UL Class L. Interrupting Rating: 200,000
23 rms amperes.
24

25 Fuses 30 Amperes and less: Time-Delay, 600 volt, UL Class CC. Interrupting rating: 200,000 rms amperes.
26

27 Provide three (3) spares of each size and type fuse.
28

29 Provide cabinet/enclosure for spare fuses sized to accommodate all required spare fuses for entire facility.
30 Cabinet shall have hinged and latched cover. Label cabinet "Spare Fuses". Locate cabinet in main electrical
31 room.
32

33 **PART 3 - EXECUTION**

34 **INSTALLATION**

35 Install disconnect switches where indicated on Drawings or required by NEC.
36

37 Provide identification as specified in Section 26 05 53.
38

39 Provide label on inside of disconnect cover identifying the type and size of fuse to be utilized.
40

41 VFD installations; Provide aux contact to de energize VFD when operating local disconnect.
42

43 Generator installations; Provide monitoring micro switches for audio/ visual alarm indication at generator
44 control panel and remote annunciator panels for disconnects serving the emergency side of each automatic
45 transfer switches.
46

47 **CONSTRUCTION VERIFICATION**

48 Contractor is responsible for utilizing the construction verification checklists supplied under specification
49 Section 26 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01
50 or 01 91 02.
51

52
53 **END OF SECTION**

1 Luminaire:

- 2 • Manufacturer and catalog number,
- 3 • Type (identification) as indicated on the plans and schedule,
- 4 • Delivered lumens,
- 5 • Input watts,
- 6 • Efficacy,
- 7 • Color rendering index.

8
9 Driver:

- 10 • Manufacturer and catalog number,
- 11 • Type (Non-Dimming, Step-dimming, Continuous dimming, etc.),
- 12 • Power Factor, Crest Factor, THD, etc.

13
14 **OPERATION AND MAINTENANCE DATA**

15 All operations and maintenance data shall comply with the submission and content requirements specified
16 under section GENERAL REQUIREMENTS.

17
18 **EXTRA MATERIALS**

19 Provide one (1) of each type of LED module, light bar, or array (if applicable). If the LED's are integrated
20 into the luminaire and are not separate components, provide one (1) of each of these types of luminaires.

21
22 Provide one (1) LED driver or ballast of each type.

23
24 **DEFINITIONS**

25 Driver: The power supply used to power LED luminaires, modules, or arrays.

26
27 L70, L70, or L70%: The reported life of an LED component or system to reach 70% lumen maintenance, or
28 70% of the LED's original light output. This test is being developed by the IES and is currently
29 described by TM-21-11.

30
31 LED's: Broadly defined as complete luminaire with light emitting diode (LED) packages, modules, light
32 bars or arrays, complete with driver.

33
34 LED luminaire failure: Negligible light output from more than 10 percent of the LED's constitutes
35 luminaire failure.

36
37 **PART 2 - PRODUCTS**

38
39 **INTERIOR LUMINAIRES AND ACCESSORIES**

40 See the Luminaire Schedule on the drawings for type of luminaires and catalog numbers. Catalog numbers
41 are shown on the drawings for quality and performance requirements only. Luminaires manufactured by
42 others are equally acceptable provided they meet or exceed the performance of the indicated luminaires,
43 and meet the intent of the design.

44
45 Luminaire shall be listed by a NRTL (Nationally Recognized Testing Laboratory: e.g. UL, ETL, etc.).

46
47 Provide luminaires with quick-connect disconnecting means, similar to Thomas & Betts Sta-Kon.

48
49 **LED LUMINAIRES**

- 50 • LED Luminaires shall meet all DesignLights Consortium® (DesignLights.org) Product
51 Qualification Criteria. This does not require that the luminaire be listed on the DesignLights
52 Consortium's® Qualified Products List, but they must meet the Product Qualification Criteria.
53 The technical requirements that the luminaire shall meet for each Application Category are:
 - 54 ○ Minimum Light Output.
 - 55 ○ Zonal Lumen Requirements.

- 1 ○ Minimum Luminaire Efficacy.
- 2 ○ Minimum CRI.
- 3 ○ L70 Lumen Maintenance.
- 4 ○ Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all
- 5 LED components.

6

7 *Additional Requirements:*

- 8 • Color Temperature of 3000K-4100K for interior luminaires as listed in the Luminaire Schedule on
- 9 the plans. The color temperature of exterior LED luminaires should not exceed 4100K (nominal).
- 10 • Color Consistency: LED manufacturer shall use a maximum 3-step MacAdam Ellipse binning
- 11 process to achieve consistent luminaire-to-luminaire color for interior luminaires. Exterior
- 12 luminaires shall use a maximum 5-step MacAdam Ellipse binning process.
- 13 • Glare Control: Exterior luminaires shall meet DesignLights Consortium's® criteria for Zonal
- 14 Lumen Distribution requirements or Backlight-Uplight-Glare (BUG) standards for exterior
- 15 luminaires.
- 16 • Luminaire shall be mercury-free, lead-free, and RoHS compliant.
- 17 • Luminaire shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
- 18 • Light output of the LED system shall be measured using the absolute photometry method
- 19 following IES LM-79 and IES LM-80 requirements and guidelines.
- 20 • Luminaire shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.
- 21 • Lumen output shall not depreciate more than 20% after 10,000 hours of use.
- 22 • Luminaire and driver shall be furnished from a single manufacturer to ensure compatibility.
- 23 • Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior luminaires, and a
- 24 minimum of 70 for exterior luminaires.
- 25 • LED luminaire shall be thermally designed as to not exceed the maximum junction temperature of
- 26 the LED for the ambient temperature of the location the luminaire is to be installed. Rated case
- 27 temperature shall be suitable for operation in the ambient temperatures typically found for the
- 28 intended installation. Exterior luminaires to operate in ambient temperatures of -20°F to
- 29 122°F (-29°C to 50°C).
- 30 • Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.
- 31 • Luminaire shall have a maximum Total Harmonic Distortion (THD) of ≤20% at full input power
- 32 and across specified voltage range.
- 33 • All connections to luminaires shall be reverse polarity protected and provide high voltage
- 34 protection in the event connections are reversed or shorted during the installation process.
- 35 • All luminaires shall be provided with knockouts for conduit connections.
- 36 • The LED luminaire shall carry a limited 5-year warranty minimum for LED light engine(s)/board
- 37 array, and driver(s).
- 38 • Provide all of the following data on submittals:
 - 39 ○ Delivered lumens
 - 40 ○ Input watts
 - 41 ○ Efficacy
 - 42 ○ Color rendering index.

43

44 LED Luminaires used for Emergency Egress Lighting:

- 45 • The failure of one LED shall not affect the operation of the remaining LEDs.

46

47 Emergency LED Luminaire Compatibility with Inverters:

- 48 • Emergency Inverters shall be sine-wave type, or have written confirmation from the luminaire
- 49 manufacturer that the luminaire will function with a square-wave inverter.

50

51 **LED DRIVERS**

52 General:

- 53 • Provide driver type (non-dimmed, step-dimmed, continuous-dimming, etc.) as indicated on the
- 54 luminaire schedule on the drawings.
- 55 • Minimum Warranty of 5 years (not pro-rated) to include LED driver and all LED components.

- 1 • Driver shall have a rated life of 50,000 hours, minimum.
- 2 • Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.
- 3 • Driver shall have a minimum power factor (pf) of 0.9 and a maximum crest factor (cf) of 1.5 at
- 4 full input power and across specified voltage range.
- 5 • Driver shall operate normally for input voltage fluctuations of plus or minus 10 percent.
- 6 • Driver shall have a maximum Total Harmonic Distortion (THD) of $\leq 20\%$ at full input power and
- 7 across specified voltage range.
- 8 • Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.
- 9 • Fuse Protections: All luminaires shall have built-in fuse protection. All power supply outputs shall
- 10 be either fuse protected or be Polymeric Positive Temperature Coefficient (PTC)-protected as per
- 11 Class 2 UL listing.
- 12 • Provide all of the following data on submittals:
- 13 o Input watts
- 14 o Power Factor (pf)
- 15 o Crest Factor (cf) at full input power
- 16 o Total Harmonic Distortion (THD).

18 Dimming Drivers:

- 19 • LED driver shall be compatible with dimming controls where dimming is indicated on the plans.
- 20 Dimmable drivers shall use Dimming Constant Current (DCC), Constant Voltage, or Pulse Width
- 21 Modulation (PWM) operation.
- 22
- 23 • Step-Dimming Drivers: Easily switched from 0% to 50% to 100% output power. Both switch-leg
- 24 inputs shall control 50% of the luminaire's light output equally.
- 25 • Continuous Dimming Drivers: LED luminaires shall dim to (10%, 1%, or 0.1%) as specified in the
- 26 Luminaire Schedule on the plans without visible flicker or "popcorn effect". "Popcorn effect" is
- 27 defined as the luminaire being on a pre-set dimmed level (less than 100%), and going to 100%
- 28 prior to returning to the pre-set level when power is returned to the luminaire. Continuous
- 29 Dimming Drivers shall use 0-10V control.
- 30

31 **PART 3 - EXECUTION**

32 **INSTALLATION**

33 Verify ceiling types with Architectural plans or with existing ceilings. Verify specified luminaires are

34 compatible with specified ceiling type(s) prior to ordering luminaires.

35 Install in accordance with manufacturer's instructions.

36 Install suspended luminaires using aircraft cable, or pendants supported from swivel hangers. Heavy duty

37 chain supports may be used where indicated on the luminaire schedule. Provide aircraft cable, pendants, or

38 chain lengths required to suspend luminaire at indicated height. All aircraft cables or pendant supported

39 luminaires shall have an independent support to structure at all cable or pendant support locations. When

40 chain is used, tie-wrap the luminaire wiring method to the chain.

41 Support luminaires larger than 2 x 4 foot (600 x 1200 mm) size independent of ceiling framing.

42 Provide independent support for all luminaires over 50 lbs.

43 Locate ceiling luminaires as indicated on reflected ceiling plan.

44 Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with

45 each other. Secure to prohibit movement.

1 The Contractor shall install luminaire supports as required. Luminaire installations with luminaires
2 supported only by insecure boxes will be rejected. It shall be the Contractor's responsibility to support all
3 luminaires adequately, providing extra steel work for the support of luminaires if required. Any
4 components necessary for mounting luminaires shall be provided by the Contractor. No plastic,
5 composition or wood type anchors shall be used.
6
7 Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building
8 structure.
9
10 Install recessed luminaires to permit removal from below.
11
12 Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for
13 fire rating.
14
15 Install code required hardware to secure recessed grid-supported luminaires in place.
16
17 Install wall mounted luminaires and exit signs at height as scheduled. Use pendants supported from swivel
18 hangers in exposed ceiling/structure locations where necessary to mount exit signs at the specified height.
19
20 Install accessories furnished with each luminaire.
21
22 Make wiring connections to branch circuit using building wire with insulation suitable for temperature
23 conditions within luminaire.
24
25 Bond luminaires and metal accessories to branch circuit equipment grounding conductor.
26
27 Install specified lamps in each luminaire and exit sign.
28
29 Dimmed luminaire circuits shall have separate neutrals.
30
31 Dimmed LED luminaires shall have a positive OFF, which requires turning off the circuit to the luminaire
32 so that the luminaires don't "glow" at the lowest dimmed setting. This shall be accomplished using a
33 switch, relay, or some other means acceptable to UW.
34
35 All lamps shall be delivered to the job in sealed cartons and protected from dirt and dust during storage on
36 the project. Lamps shall be taken directly from the cartons and installed in the luminaire with special care
37 so that they do not become dusty and are not soiled in the operation.
38
39 Lamps installed in luminaires using dimming ballasts shall be burned in at 100% rated output by the
40 contractor for a minimum of 100 hours as recommended by the ballast manufacturer.
41
42 All new lamps shall be operational at the Substantial Completion of the project.
43
44 **ADJUSTING AND CLEANING**
45 Align luminaires and clean lenses and diffusers at completion of Work. Clean paint splatters, dirt, and
46 debris from installed luminaires.
47
48 Aim and adjust luminaires as indicated on Drawings or as directed by the A/E.
49
50 Touch up luminaire finish at completion of work.
51
52 **INTERFACE WITH OTHER PRODUCTS**
53 Interface with air handling accessories furnished and installed under Division 23.
54
55 Provide controls as indicated on the plans. Refer to section 26 27 26 - Wiring Devices. Controls shall be
56 compatible with the luminaires/ballasts/drivers being installed.

1
2 **ZERO-TO-10V DIMMING CONTROL WIRING INSTALLATION**

3 Zero-to-10V dimming control conductors are classified by the NEC as Class 2 conductors and shall be kept
4 separate from line-voltage conductors per NEC 725.136(A). Matching the insulation rating of Conductors
5 of Different Systems does not apply to Class 2 conductors per NEC 300.3(C)(1), Informational Note No.1.

6
7 Wall box dimmers will typically have two conduits: One conduit for line-voltage power, and one conduit or
8 conduit stub for the 0-10V control wiring.

9
10 At each luminaire, separate openings (either manufactured knock-outs or punched openings) shall be used
11 for the line-voltage power and the 0-10V wiring. The EC shall use a cable connector at the opening for the
12 0-10V wiring. Zero-to-10V conductors entering and within a luminaire enclosure shall maintain a
13 minimum separation of 6 mm (0.25 in.) per NEC 725.136(D).

14 Exposed 0-10V cables shall be installed in separate conduits from line-voltage conductors.

15 The 0-10V cables may be routed in free air where concealed above accessible ceilings. Cables routed in
16 free air shall observe the following installation requirements:

17 The 0-10V cables may be tie-wrapped to the outside of the luminaire power raceway where allowed by
18 NEC 300.11(B)(2). Tie-wraps shall be UL listed for UV resistance. Care should be taken in the use of
19 cable ties to secure and anchor the cabling. Ties shall not be over tightened as to compress the cable
20 jacket. No sharp burrs shall remain where excess length of the cable tie has been cut.

21 Cabling shall be neatly run at right angles and be kept clear of other trades work.

22 Cabling shall be secured within twelve (12) inches of direction change or termination.

23
24 Cabling shall be supported at a maximum of 5-foot intervals utilizing “J-Hook” or “Bridle Ring”
25 supports anchored to ceiling concrete, piping supports or structural steel beams. If cable sag at mid-
26 span exceeds 12-inches, another support shall be provided. Cable supports shall be installed to
27 maintain cable bend to larger than the minimum bend radius.

28 Cabling shall not be attached to or supported by existing cabling, plumbing or steam piping, ductwork,
29 suspended ceiling supports or electrical or communications conduit. Do not place cable directly on the
30 ceiling grid or attach cable in any manner to the ceiling grid wires.

31 All cables shall be free of tension at both ends. Nylon strain relief connectors shall be provided at each
32 device and junction box where cables enter. In cases where the cable must bear some stress, Kellum
33 type grips may be used to spread the strain over a longer length of cable.

34 Cable manufacturer’s minimum bend radius shall be observed in all instances.

35 Use suitable cable fittings and connectors.

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43
44 **FIELD QUALITY CONTROL**

45 Operate each luminaire after installation and connection. Inspect for proper connection and operation.

46
47 **LUMINAIRE CONNECTIONS**

48 **METAL-CLAD (MC) CABLE**

49 Metal-Clad (MC) type cable that combines power and Class 2 circuits into a single cable may be used for
50 the luminaire wiring where 0-10V dimming control wiring is required. Examples of such products are
51 Encore Wire® MC-LED™ or Southwire® MC-PCS Duo™. Manufacturer's names and catalog numbers
52 are used for quality and performance only. MC Cables manufactured by others shall be equally acceptable
53 provided they meet or exceed in performance and quality as specified.

54 Recessed, including Master-Satellite connections:
55
56

- 1 • Use a luminaire fixture whip from a J-box for recessed lay-in luminaires. Luminaire fixture whips
2 shall be aluminum or steel AC Cable (Armored Cable) or Flexible Metal Conduit (FMC). Metal
3 Clad (MC) cable that combines power and Class 2 circuits (for 0-10V dimming control) into a
4 single cable may be used as a whip for luminaires that are dimmed.
- 5 • Cable/Conduit whips shall be 3/8" (10 mm) minimum diameter, six feet (1.8 m) maximum length.
- 6 • Flexible whips or pre-wired systems between master and satellite luminaires may be supported by
7 the ceiling grid wires.
- 8 • The flexible connectors shall be steel, galvanized, clamp type with locknut, snap-in type with
9 locknut, or snap-in connector type, including those used on the master-satellite units.

10

11 Chain or Cable Hung (unfinished spaces):

- 12 • Use manufacturer's SO cord or a luminaire fixture whip from a J-box. Luminaire fixture whips
13 shall be aluminum or steel AC Cable (Armored Cable) or Flexible Metal Conduit (FMC). Metal
14 Clad (MC) cable that combines power and Class 2 circuits (for 0-10V dimming control) into a
15 single cable may be used as a whip for luminaires that are dimmed.
- 16 • Conduit whips shall be 3/8" (10 mm) minimum diameter. Conduit whip or SO cord shall be cut to
17 length (six feet (1.8 m) maximum) and shall allow movement of the chain/cable/luminaire, but
18 shall not be long enough to "loop" and shall present a neat and workmanlike appearance.
- 19 • Luminaire field wired flexible cord installations shall be connected per NEC 410.62.
- 20 • The flexible connectors shall be steel, galvanized, clamp type with locknut, snap-in type with
21 locknut, or snap-in connector type, including those used on the master-satellite units.
- 22 • Conduit whip slack shall be tie-wrapped to the chain supports. Tie-wraps shall be UL listed for
23 UV resistance.

24

25 Cable Hung (finished spaces):

- 26 • Use manufacturer's SO cord from luminaire to a J-box.
- 27 • SO cord shall be cut to length (six feet (1.8 m) maximum) and shall allow movement of the
28 cable/luminaire, but shall not be long enough to "loop" and shall present a neat and workmanlike
29 appearance.
- 30 • SO cord slack may be tie-wrapped to the cable supports. Tie-wraps shall be UL listed for UV
31 resistance.
- 32 • Luminaire field wired flexible cord installations shall be connected per NEC 410.62.

33

34 Surface Mounted (unfinished spaces):

- 35 • Provide direct conduit and box connection.

36

37 Surface Mounted (finished spaces):

- 38 • Provide direct conduit and box connection. Use surface metal raceway where indicated on
39 drawings. Conceal box and conduit where appropriate. Flexible metal conduit shall not be used
40 where the conduit is exposed.

41

42 **CONSTRUCTION VERIFICATION**

43 Contractor is responsible for utilizing the construction verification checklists supplied under specification
44 Section 26 08 00 in accordance with the procedures defined for construction verification in Section 01 91
45 01 or 01 91 02.

46

47 **AGENCY TRAINING**

48 All training provided for agency shall comply with the format, general content requirements and
49 submission guidelines specified under Section 01 91 01 or 01 91 02.

50

51

END OF SECTION

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SECTION 27 05 53
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS
BASED ON DFD MASTER SPECIFICATION DATED 03/01/23

PART 1 - GENERAL

Applicable provisions of Division 0 and 1 shall govern work of this Section.

CONTENTS

PART 1 - GENERAL

Scope

Related Work

References

Submittals

PART 2 - PRODUCTS

General

Cable and Termination Hardware

SYSTEMS

Miscellaneous

PART 3 - EXECUTION

General

Equipment Room and Fittings

Pathways

Horizontal Cable and Termination Hardware

Backbone Cable – Copper and Fiber Optic

Termination Blocks

Fiber Optic Patch Panels

Audio-Video

Abandoned Cable

SCOPE

This Section describes the general, product and execution requirements relating labeling of all communications cabling, terminations and related sub-systems for the Project.

Unless specifically included in this Section, requirements for labeling of pathway items – Junction and Pull Boxes, Communication Conduit, Surface Raceway, and Cable Tray – are covered in the respective Division 26 sections covering those items.

Provide all labeling as detailed in this and related Sections.

RELATED WORK

Section 26 05 53 - Identification for Electrical Systems; re: labeling of conduit, boxes, etc.

Section 26 05 26 - Grounding and Bonding for Electrical Systems; re: component labeling

Section 27 10 00 - Structured Cabling

REFERENCES

ANSI/TIA-606-B - Administration Standard for Telecommunications Infrastructure

SUBMITTALS

Prior to labeling of cabling, connectivity, hardware, etc., provide samples of all label types planned for the Project.

Samples shall include the intended lettering type(s) and sizes to be used.

Mount samples on 8 1/2" x 11" sheets and mark to indicate their proposed use. Submit scanned image(s) of the mounted samples.

1
2
3 **PART 2 - PRODUCTS**
4

5 **GENERAL**

6 All labels shall be permanent, and machine generated. NO HANDWRITTEN OR NON-PERMANENT
7 LABELS ARE ALLOWED unless specifically exempted by the language of this Section.
8

9 Labels and markings shall be physically and chemically resistant to damage that would affect readability.

10 Embossed tape will not be permitted for any application.

11 Labels shall match hardware layout and design and shall be as large as possible while fitting properly.

12 Refer to Part 3 for labeling formats and content.

13 Use of installing company logo on any labeling is not permitted.

14 *Exception: Where included for warranty and/or maintenance purposes, such labeling is acceptable.*
15

16 **CABLE AND TERMINATION HARDWARE**

17 **Cable Labels**

18 Labels shall be Wrap-around, adhesive type or – for Inter-Building Backbone Cables only – plastic label that
19 is secured to the cable.

20 Flag type labels are not allowed.

21 Wrap-around Labels shall be:

- 22 • White Vinyl or other appropriate substrate and incorporate a clear lamination that, when label is
23 wrapped around cable, covers printed part of label.
- 24 • Of adequate size to accommodate circumference of cable(s) being marked and properly self-
25 laminate over full extent of printed area of label. Labels on larger cables (e.g., Copper Backbone)
26 may be wrapped with clear non-removable tape.

27 **Equipment Outlet**

28 Equipment Outlet labels that are placed in recessed label holders shall be white paper on which outlet
29 information is added.

30 **Modular Patch Panel**

31 Paper Inserts integral to patch panel, Adhesive labels or factory-screened numbering.
32

33 **SYSTEMS**

34 Refer to applicable specification section for system-specific labeling requirements.
35

36 **MISCELLANEOUS**

37 Where an Equipment Outlet or plug-terminated cable is concealed above a suspended ceiling (e.g., for a
38 Wireless Access Point or Security camera), provide a marking on the ceiling to identify such a location.
39 Coordinate with agency to determine preferred identification method.
40

41 **PART 3 - EXECUTION**
42

43 **GENERAL**

44 Clean surfaces before attaching labels with the label manufacturer's recommended cleaning agent.
45

46 Install labels firmly as recommended by the label manufacturer.

47 Install labels square and neatly on all equipment.
48

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Position labels as to be visible and not obscured by termination hardware or other cabling.

Lettering shall be 10-point or larger unless noted otherwise.

EQUIPMENT ROOM AND FITTINGS

General

Identifier for communications equipment rooms to be used in labeling shall be as follows:

Telecommunications Room (TR) 2W

Telecommunication Room identifiers shall be unique in each building.

HORIZONTAL CABLE AND TERMINATION HARDWARE

General

Label all Equipment Outlets, Patch Panels, Termination Blocks, and Cables.

This is inclusive of each voice, data, video, or fiber optic outlet, or any configuration thereof, as identified on the Drawings.

Label each component using a unique code identifying the link.

Equipment Outlet

Equipment Outlet identification shall be based on and result in a logical numbering sequence in each Work Area. Labeling plans that result in random EO numbering are not acceptable.

Label Equipment Outlets on the faceplate and, if applicable, on the base or frame of the EO which is permanently attached to its mounting.

Where outlet faceplates incorporate recessed label holders, labels shall be positioned beneath clear plastic covers that are part of the faceplate assembly. Where no such label holders are present (e.g., on existing to remain outlets or wall-mounted telephone-only outlets) protect the faceplate labels with a clear over-laminate.

Labels shall be White background with Black lettering. Lettering size shall be as large as practicable (up to 16-point) to fit properly on the outlet label. No lettering shall be smaller than 12-point.

The format of the Equipment Outlet identifier shall be as follows:

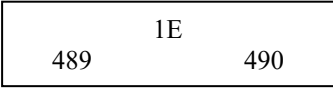
HC-###X

where: HC = Telecommunication Room Designation "2W" for this project.
= Sequential position of the Jack on the Equipment Rack mounted Patch Panels within the Telecommunication Room.

X = Special application identifier; S = Security, C = Camera, W = Wireless Access Point (WAP)

For example: "2W-489" represents a cable terminated in position 489 of the equipment rack mounted Patch Panels located within Telecommunication Room "2W".

Faceplate labels can use common HC identifiers on each label strip. For example, two links that terminate in the room designated as "2W" on positions "489" and "491" of the Equipment Rack mounted Patch Panel(s) and sharing common label strip may be represented by:



1 **Horizontal Cable**
2 Code used to label Horizontal Cables shall be same as identified for Equipment Outlet above.

3
4 Label each Horizontal Cable at the Horizontal Cross-connect (e.g., Modular Patch Panel or Termination
5 Block) and at the Equipment Outlet. If applicable, label cables at an intermediate interconnect such as a
6 Consolidation Point in a Zone Cabling installation.

7
8 At an Equipment Outlet or Modular Patch Panel, position labels within 4-inches of each cable end.

9
10 Cable ID shall repeat around the perimeter of the cable (3-times minimum) to allow the ID to be
11 visible from all angles.

12
13 At a Termination Block, position label so that it is not obscured by the designation strip (labeling) on
14 the block.

15
16 **Modular Patch Panels**

17 Patch Panel labeling format shall be same as identified for Equipment Outlet above. Connectors shall be
18 positioned in sequence of Outlet ID starting at the top left and counting from Left-to-Right then Top-to-
19 Bottom.

20
21 **ABANDONED CABLE**

22 Not applicable to this Project. Remove all cabling back to the point of termination. No labeling required.

23
24 END OF SECTION

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SECTION 27 08 00
COMMISSIONING OF COMMUNICATIONS
BASED ON DFD MASTER SPECIFICATION DATED 03/01/23

PART 1 - GENERAL

SCOPE

This section includes commissioning forms for construction verification and functional performance testing. Included are the following topics:

PART 1 - GENERAL

Scope

Related Work

Reference

Submittals

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

Commissioning When No Forms Are Available

Commissioning Forms:

CV-27 05 53 Identification for Communications Systems

CV-27 10 00 Structured Cabling

RELATED WORK

Section 01 91 01 or 01 91 02 – Commissioning Process

Section 27 08 41 – AV Systems Commissioning

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

SUBMITTALS

Reference the General Conditions of the Contract for submittal requirements.

Reference Section 01 91 01 Commissioning Process for Construction Verification Checklist and Functional Performance Test submittal requirements.

PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

COMMISSIONING FORMS

Commissioning forms are to be filled in as work progresses by the individuals responsible for installation and shall be completed for each installation phase.

Provide a description of the work completed since the last entry, the percentage of the total work completed for the system for that area and the step of installation or finalization.

Circle Yes or No for each commissioning form item. If the information requested for an item does not apply to the given stage of installation for the system, list it as “N/A”. Explain all discrepancies, negative responses or N/A responses in the negative responses section.

Once the work is 100% complete and the responses to each item are complete and resolved for a given commissioning forms group, mark as complete, initial and date in the spaces provided.

- 1 Provide copies of the commissioning forms to the commissioning agent 2 days prior to construction progress
- 2 meetings.
- 3

Construction Verification Checklist
27 05 53 – Identification for Communications Systems

CV-27 05 53 – Identification for Communication Systems

Equipment Identification/Tag: _____

Location: _____

A) LABELING

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)										
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____				DATE: _____						

Question Details

- 1) Equipment Outlet faceplates labeled as specified.
- 2) Cabling at Equipment Outlet labeled as specified.
- 3) Modular Patch Panels for Horizontal Copper Cable labeled as specified.
- 4) Termination Blocks for Horizontal Copper Cable labeled using correct color-coded (BLUE) Designation Strips
- 5) Termination Blocks for Backbone Copper Cable (including Building Entrance Terminal) labeled using correct color-coded (WHITE, GRAY or BROWN) Designation

Construction Verification Checklist
27 05 53 – Identification for Communications Systems

Strips

- 6) Fiber Optic Patch Panels for backbone fiber optic cabling labeled as specified.
- 7) Copper Cabling at Modular Patch Panels and Termination Blocks at Main Equipment Room and Telecom Room(s) labeled in accordance with specification requirements.
- 8) Fiber Optic Cabling at Patch Panels at Main Equipment Room and Telecom Room(s) labeled in accordance with specification requirements.
- 9) Innerduct for backbone fiber optic cabling (if applicable) labeled as specified.
- 10) Backboard, Equipment Racks and Cabinets, and Enclosures labeled as specified.

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

CV-27 10 00 – Structured Cabling

Equipment Identification/Tag: _____

Location: _____

A) HORIZONTAL CABLING IN CONDUIT - INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)										
				1)	2)	3)	4)	5)	6)	7)	8)			
				YES	YES	YES	YES	YES	YES	YES	YES	YES		
				NO	NO	NO	NO	NO	NO	NO	NO	NO		
				YES	YES	YES	YES	YES	YES	YES	YES	YES		
				NO	NO	NO	NO	NO	NO	NO	NO	NO		
				YES	YES	YES	YES	YES	YES	YES	YES	YES		
				NO	NO	NO	NO	NO	NO	NO	NO	NO		
				YES	YES	YES	YES	YES	YES	YES	YES	YES		
				NO	NO	NO	NO	NO	NO	NO	NO	NO		
				YES	YES	YES	YES	YES	YES	YES	YES	YES		
				NO	NO	NO	NO	NO	NO	NO	NO	NO		
				YES	YES	YES	YES	YES	YES	YES	YES	YES		
				NO	NO	NO	NO	NO	NO	NO	NO	NO		
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____				DATE: _____						

Question Details

- 1) Exposed cabling has been visually inspected for physical damage and any damaged cabling has been replaced. Cabling jacket and insulation are in good condition.
- 2) Cable color(s) matches specification requirements for given cable type.
- 3) Cable listing (e.g., General Purpose, Riser, Plenum) as specified and appropriate for installation environments.
- 4) Conduits swabbed to remove foreign material prior to pulling cables.
- 5) Cables pulled though conduit at the same time, with pulling lubricant used as required to ease pulling tensions.
- 6) Cabling is splice free.
- 7) Bend radii conforms to manufacturer recommendations for each cable type.
- 8) Appropriate slack provided in length required by specifications for given cabling type and termination point.

Negative Responses

Group/Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

B) UNENCLOSED HORIZONTAL CABLING - INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)										
				1)	2)	3)	4)	5)	6)	7)	8)			
				YES	YES	YES	YES	YES	YES	YES	YES	YES		
				NO	NO	NO	NO	NO	NO	NO	NO	NO		
				YES	YES	YES	YES	YES	YES	YES	YES	YES		
				NO	NO	NO	NO	NO	NO	NO	NO	NO		
				YES	YES	YES	YES	YES	YES	YES	YES	YES		
				NO	NO	NO	NO	NO	NO	NO	NO	NO		
				YES	YES	YES	YES	YES	YES	YES	YES	YES		
				NO	NO	NO	NO	NO	NO	NO	NO	NO		
				YES	YES	YES	YES	YES	YES	YES	YES	YES		
				NO	NO	NO	NO	NO	NO	NO	NO	NO		
				YES	YES	YES	YES	YES	YES	YES	YES	YES		
				NO	NO	NO	NO	NO	NO	NO	NO	NO		
				YES	YES	YES	YES	YES	YES	YES	YES	YES		
				NO	NO	NO	NO	NO	NO	NO	NO	NO		
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____				DATE: _____						

Question Details

- 1) Exposed cabling has been visually inspected for physical damage and any damaged cabling has been replaced. Cabling jacket and insulation are in good condition.
- 2) Cable color(s) matches specification requirements for given cable type.
- 3) Cable listing (e.g., General Purpose, Riser, Plenum) as specified and appropriate for installation environments.
- 4) Cabling supported via “J-hook” or “bridle-type” supports at spacing defined within specifications. (Bridle-type supports configured with bend-radius control.)
Supports are independent of piping, ductwork, equipment, cable tray or other conduit.
- 5) Minimum separations provided for cabling per specifications to minimize EMI.
- 6) Cabling is splice free.
- 7) Bend radii conform to manufacturer recommendations for each cable type.
- 8) Cable slack provided in length required for given cabling type and location and is secured using Hook-and-Loop Ties.

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

C) EQUIPMENT OUTLET - INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)									
				1)	2)	3)	4)	5)	6)	7)	8)	9)	
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____				DATE: _____					

Question Details

- 1) Equipment Outlet faceplate material and color are as specified.
- 2) Outlets installed at locations and heights specified in contract documents for given outlet type.
Outlets mounted at same height for given outlet type throughout facility.
- 3) Outlets are level.
- 4) Outlets are flush to finished surface.
- 5) Connector types and colors are as specified.
- 6) Connector positions and faceplate layout are as specified. Faceplate layout for a given configuration is same throughout installation.
- 7) Unused connector positions fitted with a blank insert color-matched to the faceplate color.
- 8) Connectors fitted with Dust Covers as specified and as applicable.
- 9) Outlets secured using tamper-resistant fasteners (where applicable).

Negative Responses

Group/Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

D) HORIZONTAL

F) CABLING AND PATHWAYS (GENERAL) - INSTALLATION CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)									
				1)	2)	3)	4)	5)	6)	7)			
				YES	YES	YES	YES	YES	YES	YES			
				NO	NO	NO	NO	NO	NO	NO			
				YES	YES	YES	YES	YES	YES	YES			
				NO	NO	NO	NO	NO	NO	NO			
				YES	YES	YES	YES	YES	YES	YES			
				NO	NO	NO	NO	NO	NO	NO			
				YES	YES	YES	YES	YES	YES	YES			
				NO	NO	NO	NO	NO	NO	NO			
				YES	YES	YES	YES	YES	YES	YES			
				NO	NO	NO	NO	NO	NO	NO			
				YES	YES	YES	YES	YES	YES	YES			
				NO	NO	NO	NO	NO	NO	NO			
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____			DATE: _____						

Question Details

- 1) Cable bend radii conform to manufacturer recommendations for given wire type and gauge.
- 2) Penetrations through floor and rated walls are Firestopped as specified using an Assembly rated for the wall or floor penetrated.
- 3) Penetrations through non-rated walls are sealed as specified for given penetration type.
- 4) Communications Cabling pulled in separate conduits from normal power, emergency power, security and control systems.
- 5) Conduit junction boxes are painted and tagged in accordance with specification requirements.
- 6) Pull cord provided in each conduit. Includes occupied and vacant conduit.
- 7) Cross-connects and Patching are complete and documented as specified.

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

G) TESTING, DOCUMENTATION, WARRANTY AND TRAINING CHECKS

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)									
				1)	2)	3)	4)	5)	6)	7)	8)	9)	
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____					DATE: _____				

Question Details

- 1) Maximum Horizontal Copper Cable (Voice/Data) length is less than 295' for all cables installed.
- 2) Copper Horizontal Twisted-pair Cabling Tested as specified.
- 3) Test Results are documents as specified and submitted for review.
- 4) Documentation as required for Extended Warranties has been submitted to manufacturer.
- 5) Training covering the installed system to Agency Staff, and/or contract maintenance personnel is complete.

Negative Responses

Group/ Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

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SECTION 27 10 00
STRUCTURED CABLING
BASED ON DFD MASTER SPECIFICATION DATED 03/01/23

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PART 1 - GENERAL

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SCOPE

This section describes the products and execution requirements relating to furnishing and installation of Communications Cabling and Termination Components and related sub-systems as part of a Structured Cabling System for the project. The specified cabling may support “voice”, “data”, audiovisual and networked security applications as noted.

Work may also include removal and recycling of unused, un-documented and otherwise "abandoned" cables. Refer to project drawings and Part 3 of this Section under "Salvage Materials".

Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- References
- Design Intent
- Quality Assurance
- Submittals
- Schedule

PART 2 - PRODUCTS

- Horizontal Permanent Link
- Horizontal Twisted-Pair Cable
- Equipment Outlet
- Modular Patch Panel
- Horizontal Jumper Management
- Spares and Miscellaneous Materials

PART 3 - EXECUTION

- General
- Equipment Rack Layout
- Salvage Materials
- Cleaning and Inspection
- Cable Installation
- Equipment Outlet
- Cable Termination
- Cross-connect Wiring and Patching
- Identification and Labeling
- Testing and Acceptance
- Documentation
- Training
- Warranty

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

- Section 01 91 01 – Commissioning Process
- Section 26 05 00 – Common Work Results for Electrical
- Section 26 05 04 – Cleaning, Inspection and Testing of Electrical Equipment
- Section 26 05 26 – Grounding and Bonding for Electrical Systems
- Section 26 05 29 – Hangers and Supports for Electrical Systems
- Section 26 05 33 – Raceway and Boxes for Electrical Systems
- Section 26 05 53 – Identification for Electrical Systems
- Section 27 05 53 – Identification for Communications Systems
- Section 27 08 00 – Commissioning of Communications

1 **REFERENCES**

2 All work and materials shall conform in every detail to the rules and requirements of the National Fire
3 Protection Association, the Wisconsin Electrical Code and present manufacturing standards.

4 All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a
5 particular item, then other national independent testing standards shall apply and such items shall bear those
6 labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

7
8 Other applicable standards (plus applicable update bulletins and errata) are as follows:

9 General

- 10 • ANSI/IEEE C2 - National Electrical Safety Code
11 • SPS Chapter 316 – Wisconsin Dept. of Safety and Professional Services Electrical Code

12 Structured Cabling and Infrastructure

- 13 • TIA-568.0-D, -568.1-D, -568-C.2, -569-C, -598-C, -606-B and TIA standards referenced therein.
14 568.3-D Fiber Optic
15 • ANSI/TIA-862-B – Structured Cabling Infrastructure Standard for Intelligent Building Systems
16 • ANSI/TIA-1152 – Requirements for Field Test Instruments and Measurements for Balanced Twisted-
17 Pair (Cabling)
18 • IEEE/ANSI 142-1982 - Recommended Practice for Grounding of Industrial and Commercial Power
19 Systems.
20 • ICEA publication S-80-576-2002
21 • ANSI/TIA-526-14-C and -526-7
22 • IEC 61300-3-35 - Fibre Optic Interconnecting Devices and Passive Components – Basic Test and
23 Measurement Procedures
24 • TIA-607-C - Commercial Building Grounding (Earthing) and Bonding Requirements for
25 Telecommunications

26
27 **DESIGN INTENT**

28 **General**

29 The Structured Cabling System is based on a hierarchy of cables and termination locations.

30
31 All cables and related termination, support and grounding hardware, bonding, shall be furnished, installed,
32 wired, tested, labeled, and documented by the Contractor, as detailed in the following sections.

33
34 Provide all labor and materials necessary to construct the system as described herein. This includes - but is
35 not limited to - furnishing and installing cable, cable supports, innerduct, racking and termination
36 components, termination, testing, labeling, and documentation.

37
38 Refer to Part 2 – PRODUCTS, Part 3 - EXECUTION and the project drawings for applicable cable and
39 connectivity types and installation requirements.

40
41 **Horizontal Cabling**

42 Horizontal Cabling System links the termination in the work area (Equipment Outlet (EO) or modular plug
43 at a communications or security device) to the Horizontal Cross-connect serving the location (e.g.,
44 Telecommunications Room (TR) or Equipment Room (ER)). This cabling and the related connectors (both
45 ends) is referred to as the “Permanent Link” in this section.

46
47 Security devices may include Card Access Credential Readers and/or Controllers.

48
49 **QUALITY ASSURANCE**

50 **Manufactured Items**

51 The manufacturer(s) of cabling and connectivity components shall be a company specializing in and having
52 a minimum of five years documented experience in producing products similar to those specified in this and
53 related sections.

1 **Contractor Qualifications**

2 The contractor shall have been in this line of business for a minimum of five (5) years and have successfully
3 completed one or more projects of scope 50% or more of the magnitude specified by these documents.

4
5 Contractor shall have necessary certifications to provide for Guarantees as specified herein.

6
7 Contractor shall be an active participant in Installers Program operated by Manufacturer of Cabling or
8 Termination Components used. Contractor shall be a participant in this program at time of Bidding and
9 remain so throughout project.

10
11 Contractor shall have on the project team at a minimum one (1) certified Installer trained by the
12 manufacturer(s) of the cabling, hardware and accessories installed under this project.

13
14 At least (1) member of each test team shall be factory trained/certified in use of the test equipment. The
15 project foreman shall have been factory trained in the use of the test equipment.

16
17 **SUBMITTALS**

18 **General**

19 Under the provisions of Division 1, prior to the start of work, submit:

- 20
21 • Shop Drawings
22
23 • Contractor Qualifications
24
25 • Schedule of Values (part of GPC or STC submittal)
26

27 Group Submittals to include complete documentation of related systems, products and accessories in a single
28 submittal.

29
30 Submittals shall be electronic format (ADOBE Portable Document format “.pdf”) copies of manufacturer
31 datasheets.

32
33 Identify each proposed product with a mark or reproducible highlight.

34
35 Where multiple options for a particular product may apply (color, construction, features, etc.), identify
36 the applicable option(s).

37
38 Where applicable, mark dimensions in units to match those specified.

39
40 The Engineer shall review the Submittals and through annotation and/or a cover sheet, provide comment.

41
42 Work shall not proceed without the Engineer’s review of the submitted items.

43
44 Additional submittals (Test Plan, Test Results, Documentation, Record Documents, etc.) required during and
45 in follow-up to construction are detailed in Part 3.

46
47 **Shop Drawing Submittal**

48 Submit documents including:

- 49
50 • Manufacturer’s Product data for all products proposed indicating construction, materials, ratings, and
51 all other parameters identified in Part 2 (Products) below. Structured Cabling submittal shall include
52 Test Data confirming Horizontal Cabling Channel Performance.
53
54 • Manufacturer’s installation instructions.
55

1 **Contractor Qualifications**

2 Provide certification documents confirming contractor status as an active participant in Installers Program
3 operated by Manufacturer of Cabling or Termination Components used.

4
5 Upon request, furnish project experience as identified under “Quality Assurance / Contractor Qualifications”
6 above.

7 For each project listed provide:

- 8 • Name and location of installation.
- 9 • Date of initial operation of system by owner. (Minimum period of operation for referenced project
10 shall be 12 months.)
- 11 • Owner's representative to contact and their telephone number.

12
13 **Schedule of Values Submittal**

14 As part of the General Prime Contractor (GPC) or Single Trade Contractor (STC) submittal, include in the
15 breakdown of the proposed values for work to be performed:

- 16 • Materials (Cable, Connectivity, Equipment Racks, etc.)
- 17 • Installation (by building if applicable)
- 18 • Testing
- 19 • Documentation
- 20 • Training
- 21 • Additional categories as appropriate

22
23 **SCHEDULE**

24 Interim testing and documentation may be required to support systems (e.g., Elevator, Mechanical,
25 Security) that preceded building occupancy. Confer with agency and UW prior to construction for
26 additional direction.

27
28 **PART 2 - PRODUCTS**

29
30 **HORIZONTAL PERMANENT LINK**

31 **General**

32 The Horizontal Cable System is based on the installation of 4-pair, copper twisted-pair cables from the
33 Equipment Outlet to the Horizontal Cross-connect (wiring hub). The combined cable and termination
34 hardware is referred to as the “Permanent Link”.

35
36 Unshielded Twisted-Pair (UTP) is the default choice for the horizontal cable unless noted otherwise.

37
38 Where a shielded cable is called for, the cable shall incorporate an overall foil shield under the cable jacket
39 and no shielding around individual pairs.

40
41 This cable is referred to herein as “F/UTP - Foiled Unshielded Twisted Pair”. “ScTP - Screened Twisted-
42 pair” is also sometimes used in industry publications to describe the cable type.

43
44 Cable and Termination Components (Jack, Patch Panel / Wiring Blocks) are specified to function as a
45 System. The compatibility of the Cable to be installed with the proposed termination components shall be
46 recognized and documented by the Termination Component Manufacturer.

47
48 All Horizontal Link Cable shall be of the same manufacturer throughout the project.

49
50 All Horizontal Link connectivity components shall be of the same manufacturer throughout the project.

51 *Exception:* Where identified for 4-pair cable termination at a security device (e.g., camera, card access
52 controller) or wireless access point, Modular Plug may be from a manufacturer other than that providing
53 other Horizontal Link connectivity.

1 **Application**

2 There shall be no distinction between Horizontal Cables designated for “DATA” and “VOICE” (Telephone
3 and/or other analog) applications.
4

5 Horizontal Cables for network-type Security devices (e.g., IP Video Surveillance Camera), if applicable, are
6 considered “Data” cables for the purpose of this specification.
7

8 **Performance**

9 Where Cable, Component and Permanent Link performance is specified to “Exceed Category 6”,
10 performance shall be defined as follows:
11

- 12 • Manufacturer’s published literature shall document performance margins over worst-case ANSI/TIA-
13 568-C.2 Category 6 Channel requirements for Power Sum Attenuation-to-Crosstalk Ratio (PSACR).
14 Channel – as tested – shall include 4-connections (minimum). Data shall be verified by an
15 independent source (e.g., ETL, Intertek).
16

17 Performance Margins shall be greater than zero (0) at all frequencies up to and including 250-MHz.
18

19 *Exceptions:*

- 20 1. Where a Modular Plug is identified for 4-pair cable termination at a device, the above requirement
21 for performance margins does not apply. Performance of the link shall meet the requirements of the
22 standard (e.g., Category 6).
23

24 Where Cable, Component and Permanent Link performance is specified to “Meet Category 6A”,
25 performance shall be defined as follows:
26

- 27 • Meet or exceed ANSI/TIA Category 6A criteria.
28

29 Performance Margins exceeding those defined by the referenced standard are not required. PSACR shall
30 remain positive at all frequencies up to 500-MHz.
31

32 Cable and connecting components that comprise the “Permanent Link” shall meet or exceed the requirements
33 for “DTE Power via the MDI” to provide at least 25.5 W at the Powered Device as defined by the IEEE
34 802.3at-2009 “Power over Ethernet Plus (PoE+)” standard.
35

36 **Project Requirements**

37 Cable shall be listed as being suitable for use in environment defined.
38

39 **Cable Rating:**

- 40 • Indoor: CMR or approved substitutes as defined by the NEC. CATV equivalents apply for coaxial
41 cable where specified.
42

43 Cable and connectivity type, performance and features for included applications are as follows:

- 44 • Workstation Link (to Equipment Outlet)
45 Performance Meet Category 6A
46 Cable type 4-pair w/ Discontinuous Foil over UTP
47 Cable Jacket Color Blue
48 Modular Jack Pinning and Color
49 T568A; Color White
50
- 51 • Wireless Access Point (WAP) Location
52 Performance Meet Category 6A
53 Cable type 4-pair w/ Discontinuous Foil over UTP
54 Cable Jacket Color Blue
55 Terminate in 8P8C Modular Plug (Siemon Z-Plug or equivalent).
56 Modular Jack/Plug Pinning and Color

1 T568A; Color White

- 2
- 3 • Audiovisual Link (Point to Point)
- 4 Performance Meet Category 6A
- 5 Cable type 4-pair w/ Discontinuous Foil over UTP
- 6 Cable Jacket Color Blue
- 7 Modular Jack Pinning and Color
- 8 T568A; Color Blue
- 9

10 **HORIZONTAL TWISTED-PAIR CABLE**

11 **General**

12 All Cables and Termination hardware shall be technically compliant with and installed in accordance with
13 the referenced ANSI/TIA documents and perform as required to provide the margins stated herein.

14 All cables shall be suitable for installation in the environment defined.

15 Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of
16 the National Electrical Code and shall meet the specifications of NEMA (low loss), UL 444, and ICEA.

17 Construction:

18 Horizontal Cables shall be constructed of individually twisted pairs with 24-AWG (Category 5e) or 23-AWG
19 (Category 6 and 6A) - as applicable - insulated solid copper conductors.

20 Pairs shall be identified by a banded color code in which conductor insulation is marked with a dominant
21 color and banded with a contrasting color as follows:

- 22 Pair 1: White-Blue / Blue (or Blue/White)
- 23 Pair 2: White-Orange / Orange (or Orange/White)
- 24 Pair 3: White-Green / Green (or Green/White)
- 25 Pair 4: White-Brown / Brown (or Brown/White)
- 26

27 **Indoor Applications**

28 Cable performance shall be as required to meet the Permanent Link and Channel performance as specified in
29 the above Article “HORIZONTAL PERMANENT LINK”.

30 Cable Rating shall be as identified in the above article “HORIZONTAL PERMANENT LINK”.

31 Cable Jacket color(s) shall be as identified in the above article “HORIZONTAL PERMANENT LINK”.

32 Cable shall be packaged in a way that minimizes tangling and kinking of the cable during installation.
33 Examples are open reels or packages that incorporate a rotating reel.

34 **Horizontal Cable Termination**

35 Refer to Part 2 articles “EQUIPMENT OUTLET”, “MODULAR PATCH PANEL” and “TERMINATION
36 BLOCKS”.

37 Termination hardware performance shall be as required to meet the criteria defined in “HORIZONTAL
38 CABLING / Performance” above.

39 **EQUIPMENT OUTLET**

40 **General**

41 Horizontal cables shall each be terminated at their designated workstation location in the connector types
42 described in the sub-sections below. Included are Modular Jacks, [Fiber Optic Connectors][and Coaxial
43 Connector assemblies]. These connector assemblies shall snap into a mounting frame. The combined
44 assembly is referred to as the Equipment Outlet (EO).

1 EO mounting configurations shall be as follows:
2
3 Flush in new or where existing boxes are in place.
4
5 Mounted on Modular Furniture (base panel) - Modular Furniture Type shall be defined prior to
6 construction.
7
8 Mounted in a Floor Box or Poke-Through Assembly.
9
10 The Equipment Outlet Frame-wall- and furniture-mount assemblies-shall accommodate:
11
12 A minimum of four (4) Modular Jacks when installed on a wall-mounted assembly.
13
14 A minimum of two (2) Modular Jacks when installed on modular furniture. Design shall accommodate
15 bend radius of installed cables.
16
17 The outlet frame shall incorporate a mechanism for adjusting the surface plate to a plumb position.
18
19 Refer to the project drawings for configuration requirements for mounting in a Floor Box or Poke-Through
20 Assembly.
21
22 Connector mounting in the faceplate/frame shall be as follows.
23
24 Wall-mount: Flush
25
26 Furniture-Mount: Flush
27
28 Floor Box or Poke-Through Assembly: Flush
29
30 The same orientation and positioning of Jacks and Connectors shall be utilized throughout the installation.
31 Prior to installation, submit the proposed configuration for each EO type for review by the Engineer.
32
33 Wall Mount Outlet Faceplates shall incorporate recessed designation strips at the top and bottom of the frame
34 for identifying labels. Designation strips shall be fitted with clear plastic covers.
35
36 Unused jack positions shall be fitted with a removable blank inserted into the opening.
37
38 Faceplate of the EO shall be constructed of High Impact Plastic.
39
40 Faceplate Color shall (1) match other utilities in the building or (2) when installed in Surface Raceway (if
41 applicable), match the color of the Raceway.
42
43 Modular Jack design shall include a Dust Cover which remains with the jack assembly when the jack is in
44 use. No damage to the Jack pinning shall result from insertion or removal of these covers. Dust covers,
45 which result in deformation of the jack pinning, shall not be accepted.
46
47 **Outlet for Wall-mounted Telephone Sets**
48 Outlets intended for wall-mounted telephone sets shall be installed where identified ("W") on the Project
49 Drawing(s). The Wall Plate shall be of Stainless-Steel construction, accommodate one (1) modular jack as
50 previously defined, mounted on a standard single gang outlet box or bracket and include mating lugs for wall
51 phone mounting.
52
53 **4-pair Copper Connector (Modular Jack)**
54 Connector type for 4-pair, copper twisted-pair cabling shall be an 8-pin, 8-conductor (8P8C) Modular Jack.
55

1 The interface between the jack and the 4-pair cable shall be an insulation-displacement type contact.
2 Termination components shall be designed to maintain the cable's pair twists as closely as possible to the
3 point of mechanical termination to meet performance requirements.

4
5 Modular Jacks shall be UL verified and listed.

6
7 Modular Jack spring wire contacts shall have a minimum of 50 micro-inches of gold plating.

8
9 Modular Jack performance shall be as required to meet the specified Permanent Link and Channel
10 performance as specified in the above Article "HORIZONTAL PERMANENT LINK".

11
12 Connector type used for 4-pair F/UTP cabling-if applicable-shall match the requirements described above
13 plus:

- 14 • Be of all metal construction or incorporate an overall metal shield.
- 15 • Provide an integral mechanism for achieving shield continuity between the connector and cable.

16
17 Modular Jack pinning and Color(s) shall be as identified in the above article "HORIZONTAL PERMANENT
18 LINK".

19 20 **Modular Plug**

21 Where identified for 4-pair cable termination at a communications or security device, Modular Plug shall:

22
23 Support termination of solid copper conductors of the AWG specific to the cable type specified.

24
25 Meet the performance limits for the cable type specified as identified in the above article
26 "HORIZONTAL PERMANENT LINK".

27
28 Incorporate an overall shield when used to termination F/UTP cable type.

29
30 Incorporate gold plated contacts.

31
32 Provide for cable retention means other than the crimped conductors.

33
34 Be a snag-less design.

35
36 Retain conductors by means other than crimp on cable.

37
38 Incorporate strain-relief. A boot is optional.

39 40 **MODULAR PATCH PANEL**

41 Patch Panels shall incorporate Modular Jacks meeting the specifications for the Equipment Outlet detailed in
42 the above article "EQUIPMENT OUTLET".

43
44 Jack colors should match those used at the Equipment Outlet.

45
46 Modular Patch Panel shall be rack-mounted.

47
48 Rack-mounted panel shall be Flat.

49
50 Modular Patch Panel configuration shall not exceed 48 ports (2 rows of 24 ports each) in a 2 RU panel.

51
52 Panel designs which feature removable modular jack assemblies may be partially populated. (See PART 3).

53
54 Modular Patch Panel cable termination shall:

- 55 • Have the ability to seat and cut 8 conductors (4 pairs) at a time and shall have the ability of terminating
56 22- through 26-gauge plastic insulated, solid and stranded copper conductors.

- 1 • Be designed to maintain the cable's pair twists as closely as possible to the point of mechanical
- 2 termination.
- 3 • Include color coded designation strips or other markings to identify conductor position.
- 4
- 5 Modular Patch Panels shall incorporate cable support and/or strain relief mechanisms to secure cables at the
- 6 termination block and to ensure that all manufacturers minimum bend radius specifications are adhered to.
- 7
- 8 Modular Patch Panel performance shall be as required to meet the specified Permanent Link and Channel
- 9 performance.
- 10
- 11 Panels on which F/UTP cable is terminated shall incorporate:
- 12 • Ground clip(s) or spade(s) to achieve continuity between the connector shield and cable shield.
- 13 • Ground lugs (2).
- 14

15 **HORIZONTAL JUMPER MANAGEMENT**

16 Equipment Rack shall be equipped with Horizontal Jumper Management Hardware as to allow an orderly

17 routing of twisted pair, optical fiber and coaxial jumpers from the patch panels to the customer provided

18 network equipment.

19

20 Horizontal Jumper management hardware shall be:

- 21
- 22 • A 2 RU (3.5”), plastic or painted steel panel.
- 23
- 24 • Configured with plastic “fingers” or a minimum of five (5) Jumper distribution rings (1.75" x 3.75"
- 25 minimum dimension).
- 26
- 27 • Configured with a cover.
- 28

29 **SPARES AND MISCELLANEOUS MATERIALS**

30 Deliver per Division 1 - General Requirements, “Loose and Detachable Parts”.

31

32 **Spares**

33 Provide:

- 34 • Modular Jacks matching the type(s) provided—consider performance and color(s).
- 35
- 36 • Equipment Outlet Faceplate of the type(s) provided.
- 37
- 38 • 1000-foot box matching the Horizontal Cable type(s) provided. Consider performance and color(s).
- 39 Box shall be new and unopened.
- 40

41 Base spare jack and faceplate quantity on the scope of the initial installation:

42 <u>Installed Jacks</u>	<u>Spare Jacks</u>	<u>Spare Faceplates</u>
43 Initial 100	(10)	(3)
44 200 – 500	(10) additional	(3) additional
45 Each additional 500	(10) additional	(3) additional

46

47 **PART 3 - EXECUTION**

48

49 **GENERAL**

50 Refer to Project Drawings which indicate Equipment Outlet locations, major cable routes and termination

51 location(s) within each building. Coordinate duct allocation with the Agency.

52

53 Furnish and install all cables, connectors, hardware and equipment as shown on drawings and as specified

54 above.

55

1 It is the contractor's responsibility to survey the site and include all necessary costs to perform the installation
2 as specified.

3
4 Identifying and report to the UW Construction Representative any existing damage to walls, flooring, tiles
5 and furnishings in the work area prior to start of work. All damage to interior spaces caused by the installation
6 of cable, raceway or other hardware must be repaired by the Contractor. Repairs must match preexisting
7 color and finish of walls, floors and ceilings. Any contractor-damaged ceiling tiles are to be replaced by the
8 contractor to match color, size, style and texture.

9
10 Where unacceptable conditions are found, bring this to the attention of the UW Construction Representative
11 immediately. A written resolution will follow to determine the appropriate action to be taken.

12
13 Project Design Intent is for cable fill in conduit for communications to not exceed 40% based on the
14 maximum number of cables anticipated (initial requirement plus 25% growth) and a nominal assumed cable
15 outside dimension of 0.25 inches". Identify to the UW Construction Rep. shared pathways that do not provide
16 this capacity.

17
18 Beginning installation means contractor accepts existing conditions.

19
20 Should it be found by the Engineer that the materials or any portion thereof furnished and installed under this
21 contract fail to comply with the specifications and drawings with the respect or regard to the quality, value
22 of materials, appliances or labor used in the work, it shall be rejected and replaced by the Contractor and all
23 work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good
24 at the Contractor's expense.

25
26 Furnish, install, test and document all cables, termination components and support hardware unless noted
27 otherwise.

28 29 **EQUIPMENT RACK LAYOUT**

30 Position termination hardware between 18- and 72-inches above the finished floor unless otherwise
31 directed on drawings.

32
33 Position Fiber Optic Termination Hardware above other hardware.

34
35 Layout equipment with Horizontal Management positioned at the top of the rack and adjacent to
36 termination hardware as specified.

37 38 **SALVAGE MATERIALS**

39 Remove and recycle unused, undocumented and otherwise "abandoned" cables prior to the completion of the
40 project.

41
42 The Agency shall be responsible for identifying and labeling all abandoned cable within the boundary of this
43 project.

44
45 "Abandoned Cable" is defined per NEC 2011 Articles: 640, 645, 725, 760, 770, 800, 820 and 830.
46 Further definition is contained in NFPA-75, NFPA-76 and NFPA-90A.

47
48 Disconnect abandoned Equipment Outlets and remove devices.

49
50 Remove cabling and communications devices in walls, floors, and ceilings scheduled for removal.

51
52 Provide blank cover for abandoned Equipment Outlet boxes that are not removed.

53
54 Schedule work with Owner/Agency and other contractors.

55

1 Except where noted on the project drawings, materials removed shall become the property of and shall be
2 disposed/recycled by the Contractor.

3
4 Maintain materials and equipment to be turned over to the UW/agency and/or reused in condition equal
5 to that existing before work began. Repair or replace materials or equipment damaged by the Contractor
6 at no additional cost to the State.

7 8 **CLEANING AND INSPECTION**

9 Refer to specification Section 26 05 04 – Cleaning, Inspection and Testing of Electrical Equipment.

10 11 **CABLE INSTALLATION**

12 **General**

13 Install all cables in continuous lengths from endpoint to endpoint. No splices shall be allowed unless noted
14 otherwise.

15
16 Cable shall be suitable for and meeting the Listing requirements of the installation environment through
17 which it passes.

18
19 Furnish all required installation tools to facilitate cable pulling without damage to the cable jacket. Such
20 equipment is to include, but not limited to, sheaves, winches, cable reels, cable reel jacks, duct entrance
21 tunnels, pulling tension gauge and similar devices. All equipment shall be of substantial construction to allow
22 steady progress once pulling has begun. Makeshift devices, which may move or wear in a manner to pose a
23 hazard to the cable, shall not be used.

24
25 Pull all cable by hand unless installation conditions require mechanical assistance. Where mechanical
26 assistance is used, care shall be taken to ensure that the maximum tensile load for the cable as defined by the
27 manufacturer is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of
28 a “break-away” or other approved method.

29
30 Where recommended by the cable manufacturer, use a swivel between the pull-line and pulling grip to
31 prevent the pull-line from imparting a twist to the cable.

32
33 Complete all work using qualified personnel utilizing state-of-the-art equipment and techniques. During
34 pulling operation an adequate number of workers shall be present to allow cable observation at all points of
35 duct entry and exit, as well as to feed cable and operate pulling machinery.

36
37 Pull cable in accordance with cable manufacturer’s recommendations and ANSI/IEEE C2 standards.
38 Manufacturer’s recommendations shall be a part of the cable submittal. Recommended pulling tensions and
39 pulling bending radius shall not be exceeded.

40
41 Install cable unenclosed, in a secured metal raceway, in cable tray or in modular furniture as designated on
42 the plan drawings. All cable shall be free of tension at both ends.

43
44 Avoid abrasion and other damage to cables during installation.

45
46 Pulling Lubricant may be used to ease pulling tensions. Lubricant shall be of a type that is non-injurious to
47 the cable jacket and other materials used. Lubricant shall not harden or become adhesive with age.

48
49 All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Mesh-type
50 (e.g., “Kellem”) grips may be used to spread the strain over a longer length of cable.

51
52 Manufacturer’s minimum bend radius specifications shall be observed in all instances.

53
54 Within the equipment room in which cabling is terminated, use only Hook and Loop (e.g., “Velcro”) ties
55 from room entry to the point of termination. This is to facilitate the addition of future cables.

56

1 A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

2
3 **Protection of cable and devices from foreign materials:**

4 Coordinate with other trades and provide adequate physical protection during construction to prevent foreign
5 material application or contact with cables and devices.

6
7 Foreign material is defined as any material that would negatively impact the validity of the
8 manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental
9 or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in
10 contact with the cable, cable jacket or cable termination components.

11
12 Overspray of paint on any cable, cable jacket, termination component or device will not be accepted.

13
14 Use of any cleaning agents to remove overspray shall be per the cable manufacturer's written consent.

15
16 Replace any component or assembly affected by a foreign material. This shall be at no additional cost to the
17 project.

18
19 Should the manufacturer and/or warrantor of the structured cabling system desire to physically inspect the
20 installed condition and certify the validity of the structured cabling system (via a signed and dated statement
21 by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole
22 discretion, agree to accept said warranty in lieu of having the affected cables replaced.

23
24 In the case of plenum cabling, in addition to the statement from the manufacturer, submit a letter from
25 the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be
26 intact and acceptable.

27
28 **Horizontal Cable Installation**

29 Refer to the project Drawings which identify the location of the Horizontal Cross-connect and Equipment
30 Outlet (EO) locations.

31
32 Route Horizontal Cabling on each Floor to the Telecommunications Room (TR) on that floor or to the
33 designated TR if on another floor.

34
35 The maximum Horizontal Cable length shall not exceed 295-feet (90-meters). This length is measured from
36 the termination in the wiring closet to the equipment outlet and must include any slack required for the
37 installation and termination.

38
39 Route horizontal cabling in a fashion as to avoid unnecessarily long runs. Identify and report to the
40 engineer prior to installation any area that cannot be reached within the above constraints.

41
42 Where installed unenclosed:

43
44 Route cable at right angles and clear of other trades work.

45
46 Support cables utilizing "J-Hook", "Bridle Ring" or similar supports anchored to ceiling concrete, or
47 structural steel beams. Cable support devices shall be designed to maintain cables bend to larger than
48 the minimum bend radius. J-Hooks shall incorporate a metal wire or other type closure to retain the
49 cables. Bridle Rings shall be equipped with "saddles" to maintain the required bend radius.

50
51 Space supports at a maximum 4-foot interval unless limited by building construction. Cable "sag" at
52 mid-span shall not exceed 6-inches. Place additional supports as required to clear other trades work.

53
54 Do not attach cables to or support cables using existing plumbing or steam piping, ductwork, raceways
55 or cabling.

1 Route cable to allow removal of ceiling tiles. Do not place cable directly on the ceiling grid or attach
2 cable in any manner to the ceiling grid wires.
3

4 Limit cable bundles (e.g., those secured with cable ties) to (24) or fewer cables in each bundle.
5

6 Cable routing shall not limit maintenance access to mechanical systems, piping (e.g., valves, takeoffs for
7 future work), controls and other systems.
8

9 Take care in the use of cable ties to secure and anchor the horizontal cabling. Do not overtighten ties as to
10 compress the cable jacket. No sharp burrs should remain where excess length of the cable tie has been cut.
11

12 Protect cable sheaths from damage from sharp edges. Where a cable passes over a sharp edge, provide a
13 bushing or grommet to protect the cable.
14

15 At Equipment Outlet locations, provide slack in each horizontal cable under 250-feet in length to allow for
16 change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support
17 (e.g., J-Hook, Bridle Ring, etc.) before the cable leaves the ceiling. Minimum coil diameter shall be 8-inches.
18 Secure coils with Hook & Loop cable ties.
19

20 Slack cable length shall—unless noted otherwise on the project drawings—be as follows:
21

- 22 • Where cables enter a fishable wall, conduit, surface raceway or box: 4-feet.
- 23
- 24 • Location where cables are installed into movable partition walls or modular furniture via a service
25 pole: 15-feet.
- 26
- 27 • At Wireless Access Point (WAP) locations: 20-feet.
28

29 At all Telecommunication Rooms (TR), provide approximately 10-feet of slack in each horizontal cable to
30 allow for changes in the telecommunication room layout without re-cabling.
31

32 This slack shall not be required where a horizontal cable length in excess of 295-feet would result.
33

34 Secure cable slack to the cable runway above the equipment racks.
35

36 Cable bends shall be 200% of the cable recommended minimum bend radius or greater.
37

38 Minimum separation distances between communications wires and cables, and any electric light, power,
39 Class 1, non-powered fire alarm, or medium power network-powered broadband communications circuit
40 shall comply with NEC Article 800.
41

42 In addition, to reduce or eliminate EMI, the following minimum separation distances shall be adhered to:
43

44 Thirty-nine (39) inches from transformers and motors.
45

46 Cabling installed unenclosed or in cable tray shall be separated from fluorescent lamps and associated
47 fixtures by a minimum of 5 inches (125 mm).
48

49 Zero pathway separation distance is permitted when electrically conductive communications cables,
50 power conductors or both are enclosed in metallic pathways that meet the following conditions:
51

- 52 ▪ Metallic pathway(s) completely enclose the power conductors and are continuous;
- 53 ▪ Metallic pathway(s) are properly bonded and grounded per ANSI/TIA-607-B; and
- 54 ▪ Walls of the pathway(s) have a minimum thickness 1 mm (0.04 in) nominal if made of steel (1/2”
55 EMT minimum)

1 No separation is required between power and communications cables crossing at right angles. The cables
2 shall not, however, be supported by the power cabling.

3
4 Sleeve all openings and fire-stop per prevailing code and building construction ratings upon completion of
5 cable installation.

6 7 **Grounding**

8 Where a cable incorporates metal armor, strength elements, shielding or other metallic elements (not
9 including conductors), Bond those elements to an approved ground using a #6 AWG solid copper conductor.
10 Cable grounding hardware and method shall be per manufacturer's recommendations.

11
12 The grounding shall be as close as practicable to the point of entrance.

13 14 **EQUIPMENT OUTLET**

15 **General**

16 Mount outlets flush in wall-, ceiling- and/or ceiling mounted boxes, in floor boxes and/or poke-through
17 assemblies, on Surface Raceway and in modular furniture. Refer to project drawings for applicable outlet
18 types.

19
20 Mount level.

21
22 Unless noted otherwise on drawings, default mounting height (from finished floor to center line of outlet) in
23 new installation shall be as follows:

24
25 Standard Equipment Outlet 18-inches

26
27 Outlet for Wall-Mounted Telephone per ADA

28
29 Assemble and terminate connectors per manufacturer's recommendations.

30
31 In shielded installations, assemble to ensure continuity between connector shield and cable shield.

32
33 Fit all Connectors (e.g., modular jacks and coaxial type) with a dust cover. If the modular jack design requires
34 an integral dust cover, ensure that the covers are securely seated.

35 36 **Wireless Access Point (WAP) Locations**

37 Unless noted otherwise on drawings, mount Equipment Outlet intended for use with a Wireless Access Point
38 (WAP) as follows:

39
40 Drop Ceilings - Cut ceiling tiles and deliver cabling into 4-11/16" square, deep outlet box mounted on a
41 grid box hanger (a.k.a. "tile bridge").

42
43 Exposed Ceilings (surface mount) - cabling piped to a 4-11/16" square, deep outlet box. Unless mounted
44 to structure, support outlet box using threaded rod or other means. Mount so assembly is horizontal.

45
46 Reduce 2-gang or larger openings to 1-gang using "mud ring".

47
48 Equipment Outlet locations for Wireless Access Points as shown on drawings are approximate. Coordinate
49 final locations with Agency.

50 51 **CABLE TERMINATION**

52 **General**

53 At the Telecommunications Rooms, position all Data and Voice Cables on termination hardware in sequence
54 of the Outlet I.D. starting with the lowest number.

1 Termination Hardware (Blocks and Patch Panels) Positioning and Layout must be reviewed and approved
2 by the Engineer prior to construction. The review does not exempt the Contractor from meeting any of the
3 requirements stated in this document.

4
5 At each Equipment Outlet (or communications or security device where cable is terminated in a Modular
6 Plug), terminate cabling per manufacturer's recommendations and as identified in the above article
7 "HORIZONTAL PERMANENT LINK".

8
9 Where F/UTP cabling is installed, maintain continuity of the shield from Modular Patch Panel to EO or
10 Modular Plug.

11 **Cable Termination - Modular Patch Panels**

12 Install Modular Patch Panel(s) in a fashion as to allow future horizontal cabling to be terminated on the panel
13 without disruption to existing connections.

14
15 Size Modular Patch Panels to accommodate a minimum of 20% growth in the quantity of equipment outlets
16 relative to the initial installation.

17
18 Panel designs which feature removable modular jack assemblies may be partially populated.

19
20 Cables designated for various systems (e.g., Network, WiFi, Security) shall be terminated on shared patch
21 panels.

22
23 At Equipment Outlet and Modular Patch Panel, ensure that the twists in each horizontal cable pair are
24 preserved per manufacturer's recommendations, typically to within 0.5-inch of the termination. Remove the
25 cable jacket only to the extent required to make the termination.

26
27 Bond F/UTP cable shield and drain wire to connecting hardware per manufacturer's instructions. Bond
28 connecting hardware to the Telecommunications grounding system.

29
30 Provide horizontal cable management hardware above and below each Modular Patch Panel.

31 *Exception:* Where angled patch panels are specified, provide horizontal management above and below
32 patching area. In large installations, add management in the middle of the patching area. Refer to
33 project drawings.

34 **IDENTIFICATION AND LABELING**

35
36 Refer to Section 27 05 53 "Identification for Communications Systems" for Identification and Labeling
37 guidelines for this Project.

38
39 Label all Backbone and Horizontal Cable, Outlet Faceplates, and Termination components (e.g., Voice
40 Termination Blocks & Modular Patch Panel).

41
42 Prior to installation, provide samples of all label types planned for the project. These samples shall include
43 examples of the lettering to be used.

44 **TESTING AND ACCEPTANCE**

45 **General**

46
47 Prior to testing, provide a Test Plan for each cable type including equipment (makes/models) to be used, set-
48 up, pass/fail limits and results format. A sketch of each test set-up (hand-drawn is OK) and results report
49 examples are encouraged.

50
51
52 The Test Plan shall consider the requirements identified below plus any manufacturer-required test,
53 test method or reporting format needed to support the specified warranties.

1 Test results format should include proposed filenames and be organized by Cable Type, Subsystem
2 (Horizontal or Backbone), Building and Equipment Room. Prefix filenames with the UWSA project
3 number.
4

5 Content of native format records should be organized to allow for interim records to be combined
6 into the composite results package required at project closeout.
7

8 Failure to provide the above information shall be grounds for the Engineer and/or UW to reject any and all
9 Documentation of Results on related testing and to require a repeat of the affected test(s).
10

11 Visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring
12 pattern defined herein. Provide to the Engineer with a written certification that this inspection has been made.
13

14 Conduct acceptance testing according to a schedule coordinated with the Agency and UW.
15

16 Agency and UW representatives may be in attendance to witness the test procedures. Provide a
17 minimum of one (1) week advance notice to allow for such participation.
18

19 Provide Test Plan as part of this notice or sooner.
20

21 Supply all equipment and personnel necessary to conduct the acceptance tests.
22

23 Test equipment and measurement methods shall comply with the standards referenced in PART 1.
24

25 All equipment used in testing shall be maintained and calibrated per manufacturer's guidelines. Provide
26 documentation of equipment calibration.
27

28 Set Test Unit Limits to match specified performance requirements. For example, for Category 6 Horizontal
29 Cabling, limits should be set to "Category 6 Permanent Link". Test limit for fiber optic cable should be set
30 to consider cable length, connectors and, if applicable, splices as detailed in PART 2 and below.
31

32 Perform tests related to connected equipment by others only with the permission and presence of the agency
33 and/or responsible contractor.
34

35 The Engineer or UW may request that a random field re-test—not to exceed 10% of the installed cabling—be
36 conducted on the cable system to verify documented findings. Tests shall be a repeat of those defined above.
37 If findings contradict the documentation submitted by the Contractor, additional testing can be requested to
38 the extent determined necessary by the Engineer, including a 100% re-test. Any and all re-tests shall be at
39 no additional cost to the project.
40

41 All cabling shall be 100% fault free. Should it be determined by the Engineer that the materials or any portion
42 thereof furnished and installed under this contract fail to comply with the specifications and drawings with
43 regard to quality, performance, value of materials, appliances or labor used in the work, it shall be rejected
44 and replaced by the Contractor and all work disturbed by changes in consequence of said defects or
45 imperfections made good at the Contractor expense.
46

47 Where the installation includes use of existing or agency-provided cabling and/or connectivity components,
48 links that fail to meet the specified limits (e.g., Category 6) shall be evaluated by the contractor to determine
49 the likely cause of the failure. Contractor shall propose a plan for corrective action to the UW Construction
50 Representative and Engineer for approval prior to any rework and/or cable or component replacement. Such
51 corrective actions and related re-tests will be considered additions to contractor scope.
52

1 **Documentation**
2 See Article DOCUMENTATION for required content and formats.
3
4 **Horizontal 4-pair Copper Cabling**
5 General
6 Test from the Equipment Outlet to the Modular Patch Panel (or Wiring Block) at the TR on which the cables
7 are terminated.
8
9 Cables shall be installed and dressed at the patch panel and secured in the outlet box at the Equipment Outlet
10 location with the faceplate in place.
11
12 The cabling must pass all the specified requirements. Conditional passing test results that are within the
13 measurements accuracy of the test equipment (e.g., “*PASS”) are not acceptable.
14
15 When the EO is located on/in the wall behind modular furniture, a patch cord may be inserted into the EO to
16 allow the furniture to be returned to its normal location. Cable testing, in this case, will be done with the
17 patch cord. If the cable test fails only due to the length of the patch cord, the UW will accept the cable as
18 passing. Provide list of such locations in Test Results documentation.
19
20 Horizontal cables shall be free of shorts within the pairs, and be verified for continuity, pair validity and
21 polarity, and Wire Map (Conductor Position on the Modular Jack).
22
23 Correct any defective, split or mis-positioned pairs.
24
25 Additional testing of Cabling Systems rated at TIA Category 5e and higher shall be performed to confirm
26 proper functioning and performance.
27
28 Performance Testing
29 Test Performance per ANSI/TIA-568-C.2 Permanent Link test configuration and procedures.
30
31 Test using a test instrument designed for use with the installed cable type(s) and specified standards. The
32 instrument shall verify “PASS” on each cable and record the results of all tests, comparing measured values
33 with standards-based limits.
34
35 Test Transmission Performance of Horizontal Cabling to include the following:
36
37 Length
38 Attenuation (Insertion Loss)
39 Pair-to-Pair NEXT Loss
40 PSNEXT Loss
41 Attenuation-to-Crosstalk Ratio (ACR)
42 Power-sum ACR (PSACR)
43 Propagation Delay
44 Delay Skew
45 Return Loss
46 DC Loop Resistance
47 ANSI/TIA-1152 Optional++ Tests including:
48 Transverse Conversion Loss (TCL)
49 Equal Level Transverse Conversion Transfer Loss (ELTCTL)
50 DC Resistance Imbalance (in-pair & pair-to-pair)
51
52 The maximum length of horizontal cable Permanent Link shall not exceed 90 meters (295 feet).
53
54 Program test unit to match Net Propagation Velocity (NPV) of the installed cable type.
55

1 In the event results of the tests are not satisfactory, make changes as necessary and repeat the test or tests
2 which disclosed faulty or defective material, equipment or installation method.

3 4 Special Considerations

5 Where Cabling is terminated in a Modular Plug at the device location (e.g., Video Surveillance Camera or
6 Wireless Access Point), test per standards for a Modular Plug Terminated Link (MPTL)..

7
8 Where the horizontal cabling includes an interconnect (e.g., where a zone cable is extended from a
9 Consolidation Point to the work area Equipment Outlet (EO)), testing of the Permanent Link shall be from
10 the Horizontal Cross-connect at the Telecom Room to the EO and include the interconnect.

11
12 Where a Surge Protector is in place as part of the Horizontal Permanent Link, performance testing shall
13 include the Surge Protector as part of the link.

14
15 Where F/UTP cabling is installed, testing shall include Shield Continuity.

16 **DOCUMENTATION**

17 **General**

18 Provide project documentation as detailed in the sub-sections below.

19
20
21 Submit all documentation in electronic form.

22
23 In addition, provide (1) paper copies of Record Drawings.

24
25 Where documentation provided in electronic form requires unique software (e.g., NATIVE formats) other
26 than Adobe Acrobat Reader for viewing test results, provide one (1) copy of such software. The software
27 shall run on MICROSOFT *Windows operating system*. Software shall include license if applicable.

28
29 Organize documentation by Building, Telecom Room and cable type.

30
31 Name file(s) and records to include building, route or other cable identifiers that match labeling formats used.
32 Prefix file name with the UWSA project number.

33
34 Provide test results and describe the conduct of the tests including the date of the tests, the equipment used,
35 and the procedures followed. At the request of the Engineer, provide copies of the original test results.

36
37 Where interim documentation has been submitted, submit a composite results package containing all
38 records at project closeout.

39
40 Where the installation includes re-use of existing cabling and/or components, documentation shall include a
41 summary of such materials including manufacturer/part and where used.

42 43 **Test Data - Copper Media**

44 Test results shall include a record of test frequencies, cable type, conductor pair and cable I.D. (see 27 05 53),
45 measurement direction, test equipment type, model and serial number, calibration date, test date, reference
46 setup, and crew member name(s).

47
48 Submit Test Results for each Horizontal Link and each Backbone Cable in electronic form as follows:

49
50 In the native format of the test instrument (e.g., flw for Fluke, .sdf for Agilent or Ideal, etc.).

51
52 Summarized in a fashion that includes a graphical display of key test parameters. The Summary shall
53 be in Adobe Acrobat (.pdf) format and include all records. Individual .pdf documentation of individual
54 records (e.g., for each horizontal cable) are not required.

55
56 Summary should display Margins (Headroom) for each cable.

1
2 Individual records for Horizontal Cabling shall identify Outlet ID using a consistent format for all records to
3 allow for sorting.
4
5 **Record Drawings**
6 Provide Record Drawings which denote as-built information.
7
8 Include cable routes and outlet locations.
9
10 Identify Telecommunications and other low-voltage Outlet locations by their sequential number as
11 defined elsewhere in these documents. Numbering, icons and drawing conventions used shall be
12 consistent throughout all documentation provided.
13
14 The UW will provide floor plans in electronic (*AutoCAD* .dwg) format on which as-built construction
15 information can be added. Modify these documents to denote as-built information as defined above and
16 return to the Engineer for acceptance. Coordinate the schedule for creation of these drawings, including
17 interim and final sets, during construction to accommodate scheduled occupancy.
18
19 Refer to DFD “CAD Standards Manual” for file format, naming and other applicable guidelines.
20
21 Identify each drawing submitted by the Contractor as part of the Project Documentation as a “Record
22 Drawing” (RD) and include a) the contractor name and/or logo, and b) the date of the drawing.
23
24 Retain all fonts, color, layer, Model Space/Paper Space conventions established in the base drawings by
25 the Contractor in preparation of the As-built drawings.
26
27 Prior to generation of the drawings, provide a sample file to the Engineer for review and approval.
28
29 All documentation, including hard copy and electronic forms shall become the property of the State.
30
31 **Construction Verification**
32 Provide applicable construction Verification Checklists included in specification Section 27 08 00 and in
33 accordance with the procedures defined for in specification Section 01 91 01 or 01 91 02.
34
35 **TRAINING**
36 Provide training covering the installed system to Agency Staff, and/or contract maintenance personnel.
37
38 Training to include:
39 • Overview of System Topology and General Concepts
40 • Overview of Products Used
41 • Overview of Labeling Formats
42 • Overview of Test Results and their meaning
43 • Overview of Documentation (Record Documents, O&M Manuals)
44
45 Other project team members (e.g., UW Project Manager, Engineer, others) may, at their discretion, participate
46 in the session as a presenter.
47
48 Coordinate with UW Construction Representative, Agency Staff, and Engineer to schedule session(s).
49 Provide adequate notification to accommodate participant schedules.
50
51 Training shall be held at Project Site and shall be conducted during normal working hours.
52 For purposes of bidding, assume (1) Training Session(s). Coordinate training with Agency to
53 accommodate staff schedules.
54
55 Number of Students per session shall be 6 or less.
56

1 Provide electronic copies of training material plus plus paper copies for each student plus (2)
2 additional copies.

3
4 Owner reserves the right to record session(s) for use as future refresher materials for Agency technical staff.

5
6 **WARRANTY**

7 See Division 1, GENERAL CONDITIONS, and GENERAL REQUIREMENTS - Guarantee Documents for
8 general requirements.

9
10 Where all materials are contractor-provided, minimum Warranty Period for Structured Cable System sub-
11 systems shall be as follows:

12
13 Horizontal Copper Permanent Link – 15 years. Warranty shall be direct from manufacturer(s) of cabling
14 and connecting components to Owner.

15 Exception: Where cabling is terminated in a modular plug, such links shall be covered by a 2-year system
16 warranty. Cabling and Connecting Components shall carry a 15-year manufacturer’s component
17 warranty.

18
19 Warranties shall include all labor, material, and travel time.

20
21 Where the project includes re-use of existing cabling and/or components or installation of agency-furnished
22 materials, contractor warranty shall be per Division 1 and cover contractor-provided materials. Cable and
23 connecting component warranties shall be as indicated above.

24
25 Provide Warranty Certification of the Horizontal Copper Permanent Link from the manufacturer(s) of cabling
26 and connecting components as part of system documentation.

27
28 Submit documents to manufacturer as required for Extended Warranties.

29
30 END OF SECTION

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SECTION 28 10 00
ACCESS CONTROL SYSTEM
BASED ON DFD MASTER SPECIFICATION DATED 03/01/23

PART 1 - GENERAL

SCOPE

This specification section describes the products and execution requirements relating to the furnishing, installation, testing, and commissioning of a complete Access Control System and placing it into satisfactory operation.

This system is an extension of the existing Schneider Electric Andover Access Control System.

In general, work consists of installation of new access control equipment, hardware and devices and all associated cabling as part of this project.

CLASS 1 NOTICE:

Notice is hereby given in accordance with Section 16.855(10), Wisconsin Statutes, that the Division believes it is in the best interests of the State to contract the following work from only one source, without the usual statutory procedures:

- Schneider Andover Continuum

Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Quality Assurance
- References
- Inspections and Permits
- Submittals

PRODUCTS

PART 2 -

- General
- Credential Readers
- Miscellaneous Field Devices
- Cabling

PART 3 - EXECUTION

- General
- Coordination
- Continuity of Existing Services and Systems
- Installation
- Identification and Labeling
- Acceptance Testing
- Documentation
- Warranty

Major features of the Access Control System and responsibilities to furnish and/or install equipment, install cabling, and terminate cabling are as follows:

Division 08 contractor-furnished, Division 08 contractor-installed

- ADA Door Operators
- ADA Door Operator Pushbuttons
- Electric Latches and Strikes
- Push-bars with integrated request-to-exit switches
- Power-transfer Door Hinges
- Door-Position Switches

1
2 Division 28 contractor-furnished, Division 28 contractor installed

- 3 - Cabling:
4 ADA door operators to ADA door operator pushbuttons
5 Field Device to Controller (incl. signal and power)
6 Network Cabling (Controller to Network Switch)
7 Cable Termination at Field Devices
8 Cable Termination at Controller
9 - Credential Readers
10 - Door lock Power Supplies
11 - Request-to-Exit Devices (PIR)
12 - Door Release Pushbuttons

13
14 Agency-furnished, Agency-installed or Existing

- 15 - Badging System
16 - Central Equipment Hardware
17 - Central Equipment Software / Credential Database
18 - Database Updates (door assignments, scheduling other programming)

19
20 All raceways and pull boxes, conduit and cables supports, grounding hardware, and bonding as required for
21 a full and functioning system shall be installed and documented by this Division 28 Contractor, as detailed
22 in this and related section(s).

23
24 **RELATED WORK**

25 Applicable provisions of Division 1 govern work under this Section.

- 26
27 Section 01 91 01 or 01 91 02 – Commissioning Process
28 Section 08 71 00 – Door Hardware
29 Section 26 05 26 – Grounding and Bonding for Electrical Systems
30 Section 26 05 29 – Hangers and Supports for Electrical Systems
31 Section 26 05 33 – Raceway and Boxes for Electrical Systems
32 Section 26 05 36 – Cable Tray for Electrical Systems
33 Section 26 05 53 – Identification for Electrical Systems
34 Section 27 05 53 – Identification for Communications Systems
35 Section 27 10 00 – Structured Cabling

36
37 **QUALITY ASSURANCE**

38 **Bidder Qualifications**

39 The intent of these quality assurance requirements is to ensure that the installing contractor has the
40 capabilities to engineer, install, and commission the devices as specified under this section.

41
42 Installing contractor must be a firm specializing and experienced in Access Control system installation for
43 no less than 3 years.

44
45 Installing contractor must be a branch office or an authorized representative of the manufacturer of the
46 specified Access Control System” as required to support the warranty stated herein. Such authorization must
47 have been in effect for a period of not less than three years at the time of Bidding and remain so throughout
48 project.

49
50 Installation of equipment and cabling shall be done by qualified staff in the direct employ or directly
51 subcontracted and under the supervision of the manufacturer or Authorized Representative.

52
53 **REFERENCES**

54 All work and materials are to conform to applicable rules and requirements of the Wisconsin State Electrical
55 Code (SPS 316), the National Electrical Code (NFPA 70), other applicable National Fire Protection

1 Association codes, the National Electrical Safety Code, Federal Communications Commission (FCC) rules,
2 and present manufacturing standards (including NEMA).

3
4 All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a
5 particular item, then other national independent testing standards shall apply, and such items shall bear those
6 labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

7
8 Other applicable standards are as follows:
9 FCC Part 15 as applicable to the equipment type(s) included
10 UL 294 Standard for Access Control System Units

11 **INSPECTIONS AND PERMITS**

12 Refer also to Division 1, General Conditions, Permits, Regulations, Utilities and Taxes.

13
14 Obtain and pay for all required state or local installation inspections and permits except those provided by
15 the Architect/Engineer. Deliver originals of required certificates UW Construction Representative. Include
16 copies of the certificates and reports in the Operating and Maintenance Manuals.

17 **SUBMITTALS**

18 **General**

19 Under the provisions of Division 1, prior to the start of work, submit:

- 20 • Bidder Qualifications
- 21 • Shop Drawings

22
23 Group Submittals to include complete documentation of related systems, products, and accessories in a single
24 submittal.

25 Submittals shall be electronic format (ADOBE Portable Document format “.pdf”) thereof.

26 **Bidder Qualifications**

27 Furnish documentation of contractor capabilities as identified under “Quality Assurance / Bidder
28 Qualifications” above.

29
30 Where installing contractor is an authorized representative of the Card Access System manufacturer, submit
31 written confirmation of such authorization from the manufacturer. Indicate in letter of authorization that
32 installing contractor has successfully completed all necessary training required for engineering, installation,
33 and commissioning of equipment. Letter should indicate the start date of such authorization.

34 **Shop Drawings**

- 35 • Product data for all equipment, hardware cabling and miscellaneous components proposed.
- 36 • Schematic drawings - specific to project - of all circuits from the field devices to the required
37 connection points. The diagrams shall show schematic wiring of equipment and all connections to be
38 made to devices. Terminal connections in the equipment shall be numbered to correspond to the
39 diagrams for use in making connections. Wiring diagrams shall be coordinated so that terminal
40 numbering, circuit designation and equipment or device designations are the same on all drawings. All
41 drawings must be submitted and approved by the Engineer before installation starts, but such approval
42 will not waive specification requirements unless specifically stated.

43 Mark submittal package with specification section number. Do not mix sections in a single submittal.

44 Work shall not proceed without Engineer approval of the submitted items.

45 No substituted materials shall be installed except by written approval from the Engineer.

46 **Test Plan**

47 Submit Test Plan during construction. See Part 3.

1 **Work Permit**

2 None required.

3
4 **Mock-ups**

5 Upon request, provide a mock-up of Control Panel enclosure. Include applicable hardware, cabling, interface
6 types (barrier strip, modular jack, etc.).

7
8
9 **PART 2 - PRODUCTS**

10
11 **GENERAL**

12 All contractor-furnished items shall be compatible with the existing system as identified above.

13
14 New system devices installed as part of this project will integrate into the existing campus-wide system. No
15 substitutions will be allowed unless otherwise noted.

16
17 Licensing where applicable will be provided by the owner.

18
19 **CREDENTIAL READERS**

20 **Proximity Card Reader**

21
22 Frequency: 125 kHz and 13.56 MHz.

23
24 Output format: Wiegand and Open Supervised Device Protocol (OSDP)

25
26 Read Range: up to 8.0 inches (Wall-mount); up to 6.0 inches (Mullion-mount). Dependent upon installation
27 conditions and credential type.

28
29 Power: 5-16 VDC

30
31 Polycarbonate housing, IP55 rated for indoor and outdoor use, operating temperature of -22 to 150 degrees
32 Fahrenheit.

33
34 Reader provides visual – typically a change in color of LED from red to green – and an audible indication of
35 acceptance or denial of credentials when card is presented to the reader.

36
37 Wall-mount: HID multiCLASS SE RP40. Mounts in 1-gang electrical box.

38
39 Mullion-mount: HID multiCLASS SE RP10 or multiCLASS SE RP15.

40
41 Proximity Card Readers manufactured by others shall be considered equals provided they meet or exceed
42 in performance and quality as specified.

43
44 Color: Architect to select standard color option. Confirm during shop drawing review.

45
46 **MISCELLANEOUS FIELD DEVICES**

47 **Request-to-Exit (REX)**

48 Refer to drawings and schedules for applicable REX type(s).

49
50 Integral to Door Hardware type: By Division 08 Contractor.

51
52 Motion-Sensor type:

- 53
- 54 • Passive infrared (PIR) sensing with an adjustable 8 ft. x 10 ft. coverage area.
 - 55 • Designed for wall mounting above a door.
 - 56 • Listed as an access control device under the UL 294 standard.
 - 57 • Configured with a minimum of two from “C” relay contacts with an adjustable latch time.
 - Programmable for fail-safe or fail-secure modes. Configured with an activation LED.

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Door Release Pushbuttons

Code required exit pushbuttons shall be wired to directly remove power to the lock at the door location and not through the electronic card key control panel.

Time delay to relock shall be adjusted for 30 second

SCHLAGE Cat. No. 631-AL-EX or approved equal.

CABLING

General

All cables shall be suitable for installation in the environment defined.

Any cabling installed unenclosed shall meet a CMP rating (or approved substitutes as defined by the referenced NEC).

Cables shall be Underwriters Laboratory (UL) listed and comply with Article 800 (Communications Circuits) of the National Electrical Code.

Use consistent wire colors throughout the project for field device and other connections.

Field Device to Controller

Per manufacturer’s recommendations.

Horizontal (Telecom) Cabling

Refer to specification Section 27 10 00 – Structured Cabling for cable and termination requirements for horizontal links designated for Access Control System locations.

PART 3 - EXECUTION

GENERAL

The complete installation shall be done in a neat, workmanlike manner in accordance with Division 26 of these documents and manufacturer's recommendations.

Review the project drawings to identify rough-in, cabling and device requirements all controlled and monitored doors.

COORDINATION

Coordinate with the Division 08 contractor regarding the doorframes and hardware equipment which is associated with the Access Control System. Verify rough-in and installation requirements for all door frame mounted and/or door mounted control and monitoring equipment.

Prior to start of construction, confirm installation requirements with the Agency. The coordination shall include, but not be limited to, hardware, cabling and wiring requirements including types, sizes, color-coding schemes, labeling, wire way requirements, termination responsibilities, and cable identification requirements.

Prior to the start of system installation, schedule and facilitate a pre-installation meeting with the pertinent hardware, lock, exit device, and door closer manufacturers’ representative(s), UW Milwaukee Police Department representative, and related trades to coordinate materials, techniques, and to sequence complex hardware items and system installation. Proper installation and adjustment of hardware is to be reviewed. Convene at least one week prior to commencement of access control installation. Provide written documentation of the meeting including date, attendee/participant list and minutes. Distribute to A/E, Agency and UW within seven (7) days of the meeting date.

1 Coordinate with Division 26 installer to confirm required cabling pathways, device rough-ins, and line-voltage power requirements.

2
3
4 Coordinate hardware placement, cabling, and interface requirements relating to elevator cab-mounted credential readers (if applicable) with the elevator contractor.

5
6
7 Prior to system start-up, provide support to agency for updates to central equipment and software as required to add the new components to the overall system. Consider field device locations, controller addresses and other information, network links, etc. as applicable.

8
9
10
11 **CONTINUITY OF EXISTING SERVICES AND SYSTEMS**

12 No outages shall be permitted on existing systems except at the time and during the interval specified by Agency and site representatives. Obtain written approval for any outages.

13
14
15 Schedule any outage when the interruption causes the least interference with normal site schedules and business routines. No extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours.

16
17
18
19 Refer to General Requirements.

20
21 Restore any service interrupted as a result of this work to proper operation as soon as possible.

22
23 **INSTALLATION**

24 **General**

25 Receive, store and install Access Control System equipment and cabling as specified.

26
27 Comply with the manufacturer's instructions and recommendations for installation of all products.

28
29 Provide all system wiring between all components in accordance with manufacturer's guidelines. Each cable for each device shall be home run. No splices are allowed unless otherwise noted.

30
31
32 Intermediate termination points within a wire run would be considered a splice. If intermediate termination points are allowed, with prior approval of the Agency and the Engineer, provide pull boxes and terminal strips permanently labeled with the numbering scheme per Agency's requirements.

33
34
35
36 Mount all credential readers where shown on plans. Placement shall be in accordance with Americans with Disabilities Act (ADA) requirements.

37
38
39 Locate all request-to-exit motion detectors directly above the door frame, centered on the door opening (as applicable). Adjust sensitivity to permit operation on motion of persons within 2'-0" of door. Avoid false activation by persons passing by where possible.

40
41
42
43 Provide wiring to request-to-exit devices located in electrified door hardware.

44
45 **Controller Installation - General**

46 Install, wire, and power per manufacturer's recommendations.

47
48 **Cable Installation - General**

49 Route Cable for field devices in raceway unless otherwise noted.

50
51 Route system cabling to equipment per the Access Control System installation diagrams. Provide all interconnecting cabling from the head-end, between controllers, and between peripheral devices.

52
53
54 Route cabling/conduit on secure side of door.

1 Where cables are to be installed unenclosed (without raceway) the cable shall meet NEC requirements for
2 the application and installation environment. See Cable Installation - Unenclosed below.
3
4 Route in conduit, all exposed vertical cable extensions to devices located below the finished ceiling.
5
6 Install and terminate cable as required at each door location.
7
8 Observe cable manufacturers minimum bend radius in all instances. Take care in the use of cable ties to
9 secure and anchor the station cabling. Do not overtighten cable ties as to compress the cable jacket. No
10 sharp burrs should remain where excess length of the cable tie has been cut.
11
12 All cable shall be free of tension at both ends. Provide strain relief connectors at each device and junction
13 box where cables enter.
14
15 Use suitable cable fittings and connectors.
16
17 **Cable Installation – Unenclosed**
18 Where unenclosed cable installation is permitted and as designated on the plan drawings, route cabling to
19 avoid areas of high traffic (i.e., aisle way) and as close as possible to outlining walls. Cable route shall be a
20 minimum of ten (10) feet above finished floor. Provide protection for exposed cables where subject to
21 damage.
22
23 Route cabling neatly at right angles and be kept clear of other trades work.
24
25 Support cabling at a maximum of 4-foot intervals utilizing “J-Hook” or “Bridle Ring” supports anchored to
26 structure. Cable sag at mid-span shall not exceed 6-inches. Install supports to maintain cable bend to larger
27 than the minimum bend radius.
28
29 Do not attach-to or support cabling from existing cabling, plumbing or steam piping, ductwork, suspended
30 ceiling supports, or electrical or communications conduit. Do not place cable directly on the ceiling grid or
31 attach cable in any manner to the ceiling grid wires.
32
33 Provide 4-foot slack in each cable in accessible ceiling at each device location. Secure cable slack—coiled
34 from 100% to 200% of the cable recommended minimum bend radius— (wire tied) at the last cable support
35 before the cable reaches the device and shall be.
36
37 **Field Device Installation**
38 Field devices are shown on the drawing locations diagrammatically and shall not be used for dimensioning
39 of final location. The exact location of door control devices shall be determined by the Division 28 contractor
40 and verified with the General and Division 08 contractors.
41
42 Multiple devices (i.e., intercoms, card readers, etc.) at door locations shall be mounted adjacent to each other.
43
44 Mount Credential Readers at 42" AFF to center unless noted otherwise on drawings.
45
46 Card reader stations shall not be mounted back-to-back on a common wall. Maintain separation to eliminate
47 one card reader reading through the wall to a card reader on the opposite side.
48
49 When mounting credential readers on a new surface-mounted box, match box dimensions to the dimensions
50 of the credential reader. (Example: For mounting HID ProxPro II 5455 or reader of similar dimension, a
51 Wiremold V5752 2-gang alarm device box, or equivalent, is appropriate.)
52
53 Coordinate with Division 26 all 120-volt connections to access control panels, and at remote and local door
54 power supply locations as indicated on the drawings.
55

1 **Door Control Interface Wiring**

2 Obtain from the Division 08 contractor all necessary cut sheets, wiring diagrams, and manufacturer’s
3 installation instructions.

4
5 Install door control wiring at each door location according to manufacturer’s wiring instructions and as
6 provided by the hardware supplier, including standard locations and all special function controls for
7 interlocking doors and fire release door locations.

8
9 **Emergency Door Release**

10 There are two types of emergency door release events:

11 • **Condition 1 – Emergency Fire Alarm**

12 Doors that receive their lock power from centralized power supplies adjacent to the access control panels:
13 This door type, which, when scheduled to be unlocked in a Condition 1 - Emergency Fire Alarm
14 condition, shall unlock from a fire alarm interface control module at the centralized power supply. When
15 activated, the fire alarm interface control module removes power to the power supply that feeds the
16 locks.

17
18 Doors that are associated with crash bars and rim mounted electric locks: The electrical in-rush current
19 of these devices makes it necessary to control these locks from a local power supply provided with the
20 device. This door type, which, when scheduled to be unlocked in a Condition 1 - Emergency Fire Alarm
21 condition, shall unlock from a fire alarm interface control module located at the door’s local power
22 supply.

23
24 • **Condition 2 – Emergency Response**

25 Doors that receive their lock power from centralized power supplies adjacent to the access control panels:
26 This door type, which, when scheduled to be unlocked in a Condition 2 - Emergency Response condition,
27 shall unlock from the key switch control located per the drawings at the fire alarm control panel located
28 in the lobby. When activated, the key switch removes power to the power supply that feeds the locks.

29
30 Doors that are associated with crash bars and rim mounted electric locks: The electrical in-rush current
31 of these devices makes it necessary to control these locks from a local power supply provided with the
32 device. This door type, which, when scheduled to be unlocked in a Condition 2 - Emergency Response
33 condition, shall unlock from the same key switch control as noted above. When activated, the key switch
34 removes power to the power supply that feeds the locks.

35
36 **Network**

37 Where identified in PART 1, provide network electronics as required for links between Control Panels and
38 to Central Equipment. Configure (IP address & other settings.) per agency direction. Otherwise, confirm
39 network requirements to agency.

40
41 **IDENTIFICATION AND LABELING**

42 Label all installed electronic access control cabling and equipment.

43
44 Prior to installation, the provide samples of all label types planned for the project. These samples shall include
45 examples of the lettering to be used.

46
47 Label cables with the architectural door number for the opening served, the room number the opening is
48 located in, the type of door device they serve (“reader”, “REX”, “lock”, etc.), a unique numerical
49 identification number for the control panel it originates in, and the room number the control panel is located
50 in, on both ends of the cable. Example: “DOOR 1234A / RM 1234 / READER / CP 1 / RM B123”.

51
52 All system wiring shall be color coded as required by Agency. Maintain color coding and labeling throughout
53 the system at all accessible locations to the cabling.

1 **ACCEPTANCE TESTING**
2 **General**
3 Conduct acceptance testing according to a schedule coordinated with the Agency and UW.
4
5 Prior to testing, provide a summary of the proposed test plan. Test plan shall include – at minimum –
6 proposed schedule, list of tests to be performed, equipment to be used, set-up, expected results and
7 documentation format.
8
9 Testing shall not proceed without approval by the Engineer.
10
11 Schedule shall allow time for correction of defects and remedial work.
12
13 Representatives of the Owner may be in attendance to witness the test procedures. Provide a minimum of
14 one (1) week advance notice to allow for such participation.
15
16 Supply all equipment and personnel necessary to conduct the acceptance tests.
17
18 Perform tests related to connected equipment of others only with the permission and presence of Contractor
19 responsible for that equipment.
20
21 Assist the User Agency in the final system checkout and commissioning of the Access Control System.
22
23 Document all tests. Refer to the Article “DOCUMENTATION” below which details requirements.
24
25 **Cable Testing**
26 Visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring
27 pattern defined herein. Provide the Engineer with written certification that this inspection has been made.
28
29 Test all cables to verify continuity in both door-open and door-closed conditions.
30
31 Test all cables for open circuits, ground faults or line-to-line short circuits.
32
33 **System Testing**
34 At minimum, verify the following are properly wired and labeled:
35 • Field Devices and Control Panels.
36 • Associated equipment such as Power Supplies.
37
38 Prior to the commencement of the Acceptance Tests, verify the installation and configuration of software
39 related to the operation and control of the Access Control System.
40
41 Assist User Agency in testing overall functionality of the Access Control System. The tests shall include
42 verification of the following:
43 • The functional operation of each controlled access door and circuit.
44 • Demonstrate normal and abnormal modes of operation and required responses to each.
45
46 **DOCUMENTATION**
47 **General**
48 Upon completion of the installation, provide documentation of controlled door locations, door-to-controller
49 port mapping, addresses, and other information as required to support agency updates to system database and
50 maintenance.
51
52 Provide additional system documentation as detailed in the sub-sections below.
53 Provide approved test results and documentation in Operating and Maintenance Manuals.
54
55 At the request of any of the parties listed above, provide copies of the original test results.
56

1 Provide chart listing test results for each controlled door.
2
3 Inform owner of any maintenance agreement(s) which applies to provided software, along with cost of future
4 updates or extensions.
5
6 All documentation, including hard copy and electronic forms shall become the property of the State.
7

8 **Operation and Maintenance Manuals**

9 Submit quantities required by Division 1 and Section 26 05 00.

10
11 Provide documents in electronic format (Adobe Acrobat .pdf) and (when requested) hard copy.
12

13 At minimum, O&M Manuals shall include:

- 14 • Drawings annotated to show as-installed field device locations, cable routes, and major equipment
15 locations.
- 16 • Cabling Schematics
- 17 • Approved Submittals
- 18 • Test plan and test report sheets

19
20 **WARRANTY**

21 This Contractor shall guarantee the following for a period of two (2) years from date of substantial completion
22 of this work:

- 23 • All provided materials and equipment.
- 24 • Installation of all equipment, hardware, cabling, and related components.

25
26 Warranties shall include labor, materials, and travel time.
27

28 See Division 1, GENERAL CONDITIONS, and GENERAL REQUIREMENTS - Guarantee Documents and
29 the individual technical sections for further requirements.
30

31 If while fulfilling requirements of this warranty, the Contractor disturbs other work, the Contractor shall
32 arrange for such disturbed work to be restored to its original condition by the responsible Contractor. This
33 shall be at no cost to the State.
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**SECTION 28 31 00
FIRE DETECTION AND ALARM**

Included are the following topics:

PART 1 - GENERAL

- Scope
- Description of Work
- Related Work
- Regulatory Requirements
- Manufacturer Provided Services
- Quality Assurance
- Qualifications
- Submittals
- Plan Review for Fire Alarm Systems
- Project Record Drawings
- Operation and Maintenance Data
- Product Delivery, Storage and Handling
- Spare Parts
- Supervision
- Power Requirements

PART 2 - PRODUCTS

- Conventional Initiating Devices
- Audio Visual Notification Appliances

PART 3 - EXECUTION

- General
- Raceways
- Conductors
- Device Mounting
- Identifications
- Testing
- Warranty

PART 1 - GENERAL

SCOPE

The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations associated with the installation of the Fire Alarm System as shown on the drawings and as herein specified.

DESCRIPTION OF WORK

The fire alarm scope consists of adding new devices that are compatible with the existing system. Contractor shall field verify existing system prior to the start of construction.

The Fire Alarm System shall be configured as a local protective signaling system, as defined in NFPA-72, and shall use/incorporate the following features, as a minimum:

- The latest intelligent analog, addressable technology (detectors/sensors and modular panel equipment) currently available from the manufacturer.

The existing building FACP is to be field verified prior to the start of construction.

UL and NFPA listed for use with and be manufactured by the same manufacturer of the fire alarm system being provided in the building(s) in this project.”

- Network Connections, Data, Audio, and Signaling Line Circuits, which functionally link together multiple panels or Transponders shall be wired in an NFPA Style 6 (Class A) arrangement.

- Initiating Device Circuits (IDCs) shall be limited to short runs from Monitor Modules to the connected device, unless specifically stated otherwise herein, and shall be configured as NFPA Style B (Class B), with individual zone supervision.

1
2 Notification Appliance Circuits (NACs) shall be configured as NFPA Style Y (Class "B"). Audible
3 NACs serving Speakers shall be installed using shielded cable, such that the speakers do not generate
4 unwanted noises, due to crosstalk with other circuits.

5
6 Data Circuits to Annunciators shall be configured as NFPA Style 4 (Class "B"). All annunciators shall
7 be fully supervised.
8

9 **RELATED WORK**

10 The work covered by this section of the specifications shall be coordinated with the related work as specified
11 elsewhere under the following project sections:
12

13 Section 01 74 19 – Construction Waste Management
14 Section 01 91 01 or 01 91 02 – Commissioning Process
15 Section 07 84 00 – Fire Stopping
16 Section 26 05 00 – Common Work Results for Electrical
17 Section 26 05 02 – Electrical Demolition
18 Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cable
19 Section 26 05 26 – Grounding and Bonding for Electrical Systems
20 Section 26 05 29 – Hangers and Supports for Electrical Systems
21 Section 26 05 33 – Raceway and Boxes for Electrical Systems
22 Section 26 05 36 – Cable Trays for Electrical Systems
23 Section 26 05 53 – Identifications for Electrical Systems
24 Section 26 27 26 – Wiring Devices
25 Section 27 10 00 – Structured Cabling
26

27 **REGULATORY REQUIREMENTS**

28 The complete installation shall conform to the applicable sections of the latest edition of the following Codes
29 and Standards:
30

31 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA):

32 NFPA 70 National Electrical Code (NEC) generally, and Article 760 in particular
33 NFPA 72 National Fire Alarm Code
34 NFPA 101 Life Safety Code
35 IBC International Building Code
36 IFC International Fire Code
37 IMC International Mechanical Code
38

39 STATE OF WISCONSIN – DEPARTMENT OF SAFETY AND PROFESSIONAL SERVICES (DSPS)

40 SPS 361.30 Plan Review and Approval
41

42 NATIONAL ELECTRICAL MANUFACTURER’S ASSOCIATION (NEMA)

43 UNDERWRITERS’ LABORATORIES, INC. (UL)

44
45 UL 38 Manual Signaling Boxes for Fire Alarm Systems
46 UL 217 Smoke Alarms
47 UL 268 Smoke Detectors for Fire Alarm Systems
48 UL 464 Audible Signaling Devices for Fire Alarm and Signaling Systems, Including
49 Accessories
50 UL 497B Protectors for Data Communications and Fire-Alarm Circuits
51 UL 521 Heat Detectors for Fire Protective Signaling Systems
52 UL 864 Control Units and Accessories for Fire Alarm Systems
53 UL 1480 Speakers for Fire Alarm and Signaling Systems, Including Accessories
54 UL 1481 Power Supplies for Fire-Protective Signaling Systems
55 UL 1971 Signaling Devices for the Hearing Impaired
56 UL 2572 Mass Notification Systems
57

58 US ARMY CORPS of ENGINEERING

59 UFGS 28 31 76 Interior Fire Alarm and Mass Notification System, Addressable
60

61 **MANUFACTURER PROVIDED SERVICES**

62 A manufacturer-trained service technician shall provide the following installation supervision. This Techni-
63 cian shall be certified by the equipment manufacturer and shall have a minimum of two (2) years of service
64 experience in the fire alarm industry.

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The technician's name shall appear on equipment submittals and a letter of certification from the fire alarm manufacturer shall be sent to the project engineer. The manufacturer's service technician shall be responsible for the following items:

Pre-installation visit to the job site to review equipment submittals and verify method by which the system should be wired.

Periodic job site visits to verify installation and wiring of system, and to perform any partial system programming – required to permit portions of the existing system to be removed.

Upon completion of wiring, final connections shall be made under the supervision of this technician, and final checkout and certification of the system.

At the time of final checkout, technician shall give operational instructions to the Owner and/or his representative on the system.

All job site visits shall be dated and documented in writing and signed by the Electrical Contractor. Any discrepancy shall be noted on this document and a copy kept in the system job folder that shall be available to the Project Engineer any time during the project.

QUALITY ASSURANCE

Unless specifically stated otherwise, each and all items of the fire alarm system shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label.

Notification Appliances may be products of a single, different manufacturer – provided that the Primary Equipment Provider or Manufacturer provides written documentation of compatibility and agrees to assume any and all responsibility for compatibility with the Control Equipment.

In addition to previously listed UL standards, all control equipment shall be listed under the following UL Standards:

UOJZ UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable.

QUALIFICATIONS

All equipment shall be supplied by a firm, which specializes in fire alarm and smoke detection systems with a minimum of five (5) years-documented experience. The company shall be an authorized distributor of the proposed equipment.

All work shall be performed by a licensed contractor, who is regularly engaged in the installation and servicing of fire alarm systems. Proof of five (5) years documented experience and of factory authorization to furnish and install the equipment proposed shall be furnished prior to contract award, if required by Division of Facilities Development.

Contractor shall be located within three (3) hours of travel time or less from the site of this project.

SUBMITTALS

Under the provisions of Section 26 05 00 and Division 1, submit the following for approval prior to ordering any equipment in accordance with requirements of Division 1, General Conditions. Submit a total of ten (10) sets.

Copies of CAD Files (AutoCAD, latest version) for the Fire Alarm floor plans will be made available to the successful bidder for preparation of the required shop drawings and as-builts.

REQUIRED SUBMITTAL MATERIALS

The following items, and any additional items required per Section 26 05 00, shall be included within the submittal package:

Although they may be submitted under separate cover, Submittal Brochures / Booklets / Binders and Shop Drawings shall be submitted together and shall be treated as a complete set.

COVER SHEET

The submittals shall contain a cover sheet, which shall include the following information:

Submittal Date

1 Specification Section(s)
2 Electrical Contractor (Contact Name, name, address, and telephone number)
3 Project Name, Project City, Project State, and Project Address.
4

5 TABS AND TABLE OF CONTENTS

6 The Table of Contents shall appear immediately behind the Cover Sheet and shall contain a complete
7 listing of all tabs contained within the binder / booklet.
8

9 Tabbed index sheets shall be inserted into each of the binders, such that each binder is clearly sub-
10 divided into sections. Tabbed sections shall be provided, at minimum, for the following:
11

12 One section for each building – All submittal data, which applies to any particular building,
13 shall be located within the tabbed section for the corresponding building. All submittal data
14 within each “building” section shall appear in the same order.
15

16 One section for manufacturer’s data sheets – divided into sub-sections for the following:
17

18 Panel Equipment (Panels, Panel Components / Modules, Printers, Annunciators, etc.)
19 Addressable Field Devices (Initiating and Control / Monitoring / Isolation)
20 Non-Addressable Field Devices (Initiating Devices, relays, etc.)
21 Notification Appliances
22 Fire-Fighter Communications Equipment if applicable
23

24 EQUIPMENT LIST

25 A complete equipment list of all components, including the following: Quantity, Manufacturer, Part
26 Number, and Description. If the supplier uses different part numbers from those of the actual
27 manufacturer, the actual manufacturer and part numbers as they appear – marked on the shipping box /
28 packages, shall also be identified on this list.
29

30 Each Equipment List shall include a complete listing of the modules, components, and software
31 included for each modular FIRE Alarm Control Panel, Network Panel, Transponder, Outboard Gear
32 Panel or Annunciator. Such items shall be listed in a manner that clearly indicates that such items
33 are parts of / components of a larger unit. Simply stating a single part number and description for
34 such panels shall be unacceptable.
35

36 A separate list shall be included for each section, with items grouped by system.
37

38 For projects involving multiple systems, separate equipment lists shall be provided - one for each
39 system.
40

41 Spare Parts shall also be listed separately and shall be identified clearly as “Spare Equipment”.
42

43 PRODUCT DATA

44 Manufacturer's product data sheets, and equipment description of all system components. These data
45 sheets shall be highlighted or suitably marked, so that included items and options are indicated. On data
46 sheets that include multiple products, products that are not used shall be crossed out.
47

48 Product Data Sheets shall be organized, in order, corresponding to the first occurrence of the
49 corresponding item on the equipment list.
50

51 SEQUENCE OF OPERATION

52 The existing Sequence of Operation shall remain.
53

54 BATTERY CALCULATIONS

55 These calculations shall clearly illustrate both the Standby and Alarm loads, due to the various field
56 devices and panel components / modules. It is generally recommended to submit such calculations in a
57 “spreadsheet” format. These calculations shall include any reserve / additional capacity, as required
58 elsewhere within these specifications. Final results shall indicate both the minimum battery capacity
59 required and the capacity actually provided.
60

61 ADDRESSABLE DEVICE / DESCRIPTOR LIST - Prior to programming the system, submit a chart or
62 printout, listing every system address provided for purposes of alarm initiation, status monitoring,
63 supervised signaling, and auxiliary controls. This printout shall include the corresponding device type
64 and field programmable “custom labels”, as they will be displayed on the New System – at the FACP

1 and Local Annunciator. The addresses listed within this document shall directly correspond to the
2 addresses marked on the submitted floor plan drawings. This list will be modified as needed by the
3 Owner and returned to the contractor for final programming into the system.
4

5 NAC WIRE DROP CALCULATIONS

6 Calculations shall be provided for all Notification Appliance Circuits (NAC) in the building. It is
7 recommended that this calculation should follow a "spreadsheet" format, and should clearly indicate the
8 following:
9

- 10 The name of the circuit
- 11 Point of origin of the circuit
- 12 Complete list of all devices served by the circuit, including location and type of each device.
- 13 Alarm Current Draw for each device, at the applied voltage.
- 14 Applied Voltage (Based on anticipated battery voltage after specified stand-by & alarm operation).
- 15 Acceptable Operating Voltage for each type of device on circuit.
- 16 Calculated Voltage at each device on circuit.

17
18 These calculations should mathematically prove that all Notification Appliances on the circuit will
19 receive acceptable power for proper operation, under "worst-case-scenario" conditions.
20

21 SHOP DRAWINGS

22 All submitted drawings shall be created using AutoCAD, and shall be coordinated so that terminal
23 numbering, circuit designation and equipment or device designations are the same on all drawings. All
24 drawings must be submitted and approved by the engineer before ordering or fabrication starts, but such
25 approval will not waive any specification requirements unless specifically stated. UW shall provide
26 copies of the floor plan drawings, in AutoCAD, to the successful bidder.
27

28 Each and every sheet of the Shop Drawings shall be clearly and prominently identified as "SHOP
29 DRAWINGS – PREPARED BY "NAME OF CONTRACTOR". The name and company logo for the
30 Electrical Contractor should be added to the title block in each sheet, and a revision date shall be inserted
31 on each sheet.
32

33 The submitted Shop Drawings shall include the following types of drawings:
34

35 PROJECT-SPECIFIC DRAWINGS

36 Project-Specific Drawings. These drawings shall include the following:
37

38 SYSTEM RISER DRAWING

39 A separate riser drawing shall be furnished for each system. Each System Riser shall illustrate
40 all fire alarm circuits, which serve the facility, and shall incorporate the following information,
41 in a clear, concise format:
42

- 43 Point of origin of each circuit (usually a Panel, or a Module within a panel)
- 44 Circuit type and labeling
- 45 Area served by each circuit
- 46 Wire / cable type and size
- 47 Locations of Panelboards where primary system power is obtained
- 48 The following information for each Field Device:
 - 49 Device Type
 - 50 Circuit(s) to which device is connected
 - 51 Locations of any End-Of-Line Resistor (EOLR)
 - 52 (And the circuit terminated by any such EOLR)

54 BLOCK DIAGRAMS

55 Showing layout and operation of the entire system.
56

57 FLOOR PLANS

58 These drawings shall consist of edited versions of the Contract Documents, which shall include
59 the following information:
60

- 61 Device Addresses - The addresses shown on these drawings shall directly correspond to
62 the chart or printout, as specified previously, which spells out specific information about
63 each device, including the field programmable "custom label".
64

1 TYPICAL DEVICE / MODULE WIRING DETAILS

2 Component and module wiring diagrams – intended to illustrate terminations and wiring
3 connections to each typical Field Device (Detectors, Notification Appliances, etc.), and each
4 typical panel component / module utilized within the system. This set of drawings shall only
5 include diagrams for modules and components which are actually used in the provided
6 system(s).

7
8 These drawings shall incorporate clear labeling / nomenclature, which shall clearly indicate the
9 corresponding field device or module, to which it corresponds.

10
11 OMISSION OF ANY OF THE ABOVE MATERIALS FROM THE SUBMITTALS SHALL RESULT IN
12 AN IMMEDIATE REJECTION OF THE SUBMITTALS FOR THIS PROJECT. If the Contractor has any
13 questions concerning the preparation of these materials, please contact the Engineer.

14
15 **PLAN REVIEW FOR FIRE ALARM SYSTEMS**

16 In accordance with Wis. Admin. Code § SPS 361.30, the State of Wisconsin has adopted the component
17 review of all Fire Protection Systems for buildings that require plan submittal effective January 1, 2012.
18 Exceptions to required review will only be as follows:

19
20 <https://dsps.wi.gov/Documents/Programs/FireSuppressAlarm/FireAlarmSubmittalGuidelines.pdf>

21
22 Projects involving the alteration or addition of 20 or fewer devices to an existing fire alarm system
23 do not need to be submitted. A “device” includes both detection devices and notification
24 appliances. This includes, but is not limited to, all the following: fire alarm control panels, power
25 supply panels, annunciators, horns, strobes, combination horn/strobes, speakers, combination
26 speaker/strobes, smoke detectors, heat detectors, pull stations, and door holders. Relay modules or
27 monitoring modules are not considered alarm devices.

28
29 **Note:** Replacement fire alarm control panels must be listed for use with all the existing devices
30 installed on the fire alarm system.

31
32 For the purpose of plan review requirements, detection or monitoring systems which are not
33 connected to the building fire alarm system (e.g., smoke detection in an unoccupied storage
34 facility with off-site monitoring, sprinkler system monitoring or elevator recall operations in a
35 building without a fire alarm system), are not required to be submitted for review.

36
37 Projects where only single- and multiple-station smoke alarms are required.

38
39 Hospitals, Nursing Homes, CBRF and Hospice buildings (reviewed by DHS).

40
41 DSPS retains jurisdiction for plan review and inspection for all State-owned buildings with the exception of
42 the City of Madison. City of Madison will conduct inspections of State-owned buildings in the City of
43 Madison jurisdiction. Submit copy of DSPS approval letter with City of Madison Fire Department Work
44 permit if applicable.

45
46 <https://www.cityofmadison.com/fire/documents/2019%20MASTER%20PLAN%20REVIEW%20PERMIT%20APPLICATION.pdf>

47
48
49 Per SPS 302.10, plan review fees shall be **doubled** for projects where the installation, erection,
50 or construction was initiated without the required DSPS approval.

51
52 **CONTRACTOR’S RESPONSIBILITY**

53 The Electrical Contractor shall determine if DSPS plan review or permitting is required for the project in
54 accordance with Wis. Admin. Code and DSPS requirements. The Electrical Contractor or delegated sub-
55 contractor is also responsible for preparing and submitting required documentation and fees for DSPS Fire
56 Alarm plan review and permitting (if applicable).

- 1 a) Department of Safety and Professional Services approval is required prior to the start of fire alarm
2 system construction. The contractor shall prepare and submit the required documents in a timely
3 fashion to meet this requirement. If the contractor starts fire alarm system construction before
4 approval is given by the Department of Safety and Professional Services, the contractor is
5 responsible for all additional fees required by the Department of Safety and Professional Services.
6 b) Initially, prepare one set of the Department of Safety and Professional Services fire alarm
7 submittals and send it to the A/E for approval before proceeding with actual submittal to DSPS.
8 c) Contractor shall follow UW's AutoCAD standards when preparing fire alarm shop drawings,
9 using information consistent with the project's construction drawings.
10 d) After obtaining A/E approval to proceed with the Department of Safety and Professional Services
11 fire alarm submittal, prepare four (4) sets of the fire alarm shop drawings as approved by the A/E
12 that will be sent to the Department of Safety and Professional Services by the contractor. These
13 shop drawings shall be stamped, signed and dated by a Wisconsin registered architect,
14 professional engineer or electrical designer taking responsibility for the shop drawings. Signing
15 and sealing shall comply with SPS 361.31(1). Note that each shop drawing copy must be
16 stamped, signed and dated unless there is a drawing index sheet, in which case only the four index
17 sheets need to be stamped, signed and dated. Where the submitter is both the designer and
18 installer of the fire alarm system, a signature only will suffice [Ch. 443.14(6), Stats.]. It shall be
19 an original signature and date.
20 e) Prepare one bound booklet of the fire alarm system device cut sheets and all calculations
21 (indicating device power calculations, voltage drop calculations and battery calculations). These
22 booklets do not need to be stamped, signed or dated.
23 f) Prepare a letter of transmittal listing all items being sent to the Department of Safety and
24 Professional Services. Copy the A/E on the letter of transmittal only.
25 g) Complete the Application for Review, Buildings, HVAC, Fire and Components – SBD-118 form.
26 h) Calculate the SDB-118 submittal fee; write a check for the appropriate amount, payable to Safety
27 and Professional Services.
28 i) Schedule a plan review date with Department of Safety and Professional Services, Division of
29 Safety and Buildings by visiting these websites and completing the online request form.
30

31 **PROJECT RECORD DRAWINGS**

32 Installing Electrical Contractor shall submit to the Architect/Engineer for approval the as-built drawings for
33 the entire work done under this project prior to final payment.
34

35 Work shall be done on AutoCAD using the contract drawings provided to the Contractor by UW in the form
36 of AutoCAD files. A hard copy of same shall also be submitted.
37

38 These drawings shall show:

39 Locations and addresses of Initiation Devices, Notification Appliances, isolation devices, status-
40 monitoring devices, supervised signaling devices, and auxiliary control devices. All these devices
41 shall be shown as connected to system wiring.

42 Circuit and Address information for each field device listed above.

43 Conduit layout.

44 Number/size/type of conductors in each conduit run

45 Riser diagrams

46 Location of end-of-line devices
47

48 Riser diagrams shall be specific for this project, and shall include location of emergency 120VAC panel,
49 panel designation and circuit number used to feed each fire alarm panel. Also, indicate if panel is backed up
50 by an emergency generator.
51

52 Riser diagrams shall include locations (room or area number) of notification, initiating, end-of-line devices
53 and addresses for all addressable field devices.
54

55 Also see requirements in Division 1, General Conditions.
56

57 **OPERATION AND MAINTENANCE DATA**

58 All operations and maintenance data shall comply with the submission and content requirements specified
59 under section GENERAL REQUIREMENTS.
60

1 In addition to the general content specified under GENERAL REQUIREMENTS supply the following
2 additional documentation:

- 3 1. A material guide, which shall contain the replacement part numbers and description of all
4 components used. If this information is included in an instruction section for any of the equipment,
5 it will not be necessary to duplicate the list. In either case, the parts list shall be associated with its
6 respective chassis, modules or kit wherein it is found. A total listing of parts without such grouping
7 will not be acceptable.
- 8 2. Catalog data or literature
- 9 3. Manufacturer's operating instructions.
- 10 4. Manufacturer's maintenance instructions
- 11 5. Installation instructions
- 12 6. Name, address and telephone number of sources for parts (i.e., keys, guards, etc.) not supplied by
13 the Fire Alarm Manufacturer
- 14 7. Copies of all approved shop drawings
- 15 8. An updated copy of the submitted sequence of operation, revised to reflect any implemented
16 changes.

17 **PRODUCT DELIVERY, STORAGE AND HANDLING**

18 Receive equipment at job site. Verify applicable components and quantity delivered.

19
20
21 Handle equipment to prevent internal components' damage and breakage, as well as denting and scoring of
22 enclosure finish.

23
24 Do not install damaged equipment.

25
26 Store equipment in a clean, dry space and protect from dirt, fumes, water, and construction debris and
27 physical damage. Make arrangements with the Owner at the pre-construction meeting for storage of
28 equipment on the premises.

29 **SPARE PARTS**

30 Contractor shall provide the following spare parts in quantities shown:

31
32
33 Quantity: Type of Device
34 (2) Heat detectors

35 **SUPERVISION**

36 The system shall report a TROUBLE condition when any supervised circuit becomes disarranged,
37 disconnected, or is manually disabled or overridden. Each supervised circuit shall be independently protected
38 for short-circuit conditions and shall be arranged so that faults on any one circuit do not prevent the proper
39 operation of any other circuit in the system.
40

41 The following devices/circuits shall be supervised, as a minimum:

- 42 ALL communication links.
- 43 ALL Signaling Line Circuits
- 44 ALL Initiating Device Circuits.
- 45 All sprinkler flow and tamper switches.
- 46 ALL Notification Appliance Circuits.
- 47 Auxiliary manual control circuits.
- 48 Manual control switches for off normal position
- 49 Remote Control Relays / Control Modules.
- 50 Primary, AC Incoming power to the system.
- 51 The system's batteries.
- 52 System Expansion Modules
- 53 Auxiliary module LED's.

54
55
56 The system shall have provisions for disabling and enabling all circuits individually for maintenance or
57 testing purposes.

58
59 Each independently supervised circuit shall include a discrete LCD readout, to indicate disarrangement
60 conditions per circuit.

61 **POWER REQUIREMENTS**

1 Primary 120 VAC power, to all Fire Alarm equipment shall consist of dedicated branch circuits. These
2 circuits shall be of a 3-conductor type, including a suitably sized green ground wire – SHARED NEUTRALS
3 AND CONDUIT GROUNDS SHALL BE UNACCEPTABLE.
4

5 All fire alarm power supplies, as well as any other supplemental power supplies, shall be installed in
6 compliance with NFPA-70 – National Electrical Code (Latest Edition).
7

8 Where the new control panel is to remain at same location as the existing panel, the contractor may re-use
9 the existing branch circuit, if it meets the previously stated requirements stated above.
10

11 All batteries used in conjunction with the fire alarm system shall be installed in accordance with NFPA-70 –
12 National Electrical Code (Latest Edition).
13

14 If these batteries are not located within or immediately adjacent to the fire alarm equipment, the location of
15 such batteries shall be clearly indicated within the fire alarm equipment served by them, and the batteries and
16 their enclosure shall be clearly marked as “FIRE ALARM”
17

18 All external circuits requiring system-operating power shall be 24VDC and shall be individually supervised
19 and fused at the control panel.
20

21 **PART 2 - PRODUCTS**

22 **MULTIPLEX/INTELLIGENT INITIATING DEVICES**

23
24 All devices shall be supervised for trouble conditions. The system control panel shall be capable of
25 displaying the type of trouble condition (open, short, device missing/failed). Failure of a device shall not
26 hinder the operation of other system devices.
27

28 **DEVICE IDENTIFICATION**

29 Each intelligent device must be uniquely identified by an address code entered on each device at time of
30 installation. The use of jumpers to set address shall not be acceptable.
31

32 Device addressing schemes which use permanently imbedded electronically-identifiable “serial number”
33 which is similar to the address imbedded within Personal Computer Network Interface Cards shall be
34 acceptable.
35

36 Fire Alarm Systems utilizing hand-held or briefcase-style programming tools, which are used to
37 electronically assign addresses and/or programming parameters to devices shall be acceptable. However,
38 one such programmer tool shall be provided to the Owner at no additional cost.
39

40 The address along with the loop number and end-of-line device if present shall be indicated, and be visible
41 from the ground, on the device in the field using machine generated marking. Contractor shall provide a
42 sample of such labeling scheme before using it.
43

44 End-of Line devices shall also be identified by means of permanent, machine generated label, affixed to the
45 device.
46

47 Device identification schemes that do not use uniquely set addresses but rely on electrical position along the
48 communication channel are unacceptable. These systems cannot accommodate tapping and the addition of
49 an intelligent device between existing devices requires re-programming all existing devices beyond added
50 device.
51

52 The system must verify that proper type device is in place and matches the desired software configuration.
53

54 **INTELLIGENT DETECTORS - GENERAL**

55 Smoke and heat detectors must be approved by the State Engineer prior to installation.
56

57 Each detector shall incorporate the following features:
58

59 LED(s), which shall flash to indicate communication with the Fire Alarm System, and which also
60 illuminate in a steady manner when the detector is in an alarm status

61 A means to allow field function testing of the detector

62 A low-profile design / shape

63 An insect screen

64 Voltage and RF transient suppression techniques, in order to minimize false alarms

1
2 Smoke detectors shall communicate the actual smoke chamber values to the system control panel.

3
4 Smoke detectors shall be listed for sensitivity testing from the control panel. Sensitivity test results shall be
5 logged and downloaded to a printer.

6
7 The detectors shall be plug-in units, which mount to a common base, and shall be UL 268 approved.

8
9 Each detector shall be compatible with the fire alarm panel and shall obtain its operating power from the
10 SLC, to which it is connected. (Where relay or sounder-equipped bases are used, it shall be acceptable to
11 require a separate 24 VDC or NAC connection.) Each detector shall be reset by actuating the control panel
12 reset switch.

13
14 If field conditions so require the smoke detection devices shall not be installed until the construction is
15 completed.

16
17
18 Acceptable manufacturers include:

19 Siemens
20 Edwards
21 Kidde
22 Johnson Controls

23
24 The manufacturer must allow for interfacing with the existing system.

25
26
27 **INTELLIGENT DETECTOR BASES**

28 Bases shall be suitable for either smoke or heat detector mounting.

29
30 Either the base or the head shall contain electronic circuits that communicate the detector's status (normal,
31 alarm, sensitivity status, trouble, etc.) to the control panel over two wires. The same two wires shall also
32 provide power to the base and detector. Contacts between the base and head shall be of the bifurcated type
33 using spring-type, self-wiping contacts.

34
35 The base shall be lockable. The locking feature must be field-removable when not required.

36
37 Upon removal of the detector's head, a trouble signal shall be transmitted to the control panel.

38
39 The detector base shall be sealed against rear airflow entry.

40
41 Each detector's base or head shall contain LED(s), which shall flash when the detector is being scanned by
42 the control panel. The LED(s) shall turn on steady when the detector is in an alarm condition.

43
44 **MULTI-CRITERIA DETECTORS**

45 The Intelligent multi-criteria detector shall have advanced software to continuously sample the air in an
46 environment and adjust its detection parameters and alarm threshold accordingly. It shall do this
47 automatically, without user intervention.

48
49 Detector shall incorporate either thermal and photoelectric technologies or thermal, photoelectric and
50 carbon monoxide technologies.

51
52 Detector shall have on-board microprocessor and advanced software that focuses on rejecting nuisance
53 alarms.

54
55
56 Carbon monoxide alarm signals shall be displayed as SUPERVISORY signals on the fire alarm system
57 displays.

58
59 **SMOKE/HEAT DETECTOR GUARDS**

60 Smoke/heat detector guard shall be of two-piece construction perforated metal for ease of installation and
61 maintenance of equipment once installed and shall have the following properties:

62 Constructed of 16-gauge perforated steel with 3/16" diameter on 1/4" staggered centers
63 Welded on all sides with reinforcement for a solid unit construction

1 Painted with white epoxy coating
2 Dimensions I.D. 7 1/2" x 7 1/2" x 4" deep
3 Shall have provisions for electrical conduit
4 Shall have tamper-proof screws
5
6
7

8 **INTERFACE MODULES - GENERAL**

9 If external power to Addressable Interface Modules is required, such power shall be 24VDC, and shall be
10 derived from a supervised fire alarm power supply.

11
12 Addressable Interface Modules may be provided in either a Class B or Class A supervision version.

13
14 In the Class B version, the wiring shall be supervised by an end-of-line device.

15
16 In the Class A version, the wiring shall be looped back through a separate conduit/route and connected to the
17 module to allow continual operation of the controlled devices even if the wiring sustains a single break.

18
19 The interface modules shall be supervised and uniquely identified by the control panel. Device identification
20 shall be transmitted to the control panel for processing according to the program instructions.

21
22 **INTERFACE MODULES - SUPERVISED CONTROL**

23 Supervised Control Modules shall be utilized where needed, for control of Notification Appliances.

24
25 For Notification Appliances, speakers, and other device control with Class B or Class A wiring supervision,
26 the interface module shall provide a double-pole/double-throw relay output, with supervision.

27
28 These interface modules shall communicate the supervised wiring status (normal, trouble) to the fire alarm
29 control panel and shall receive from the fire alarm control panel a command to transfer the relay.

30
31 **INTERFACE MODULES - SUPERVISED MONITORING**

32 Addressable Monitor Modules shall be suited for monitoring of water-flow, valve tamper, fire Suppression
33 Control Panels, and other non-intelligent detectors and systems.

34
35 Addressable Monitor Modules shall be provided in any needed configuration, and may be used to interface
36 any of the following initiation devices to a Signaling Line Circuit, as follows:

37 Conventional 2-wire smoke detectors, including providing suitable power to the IDC.

38
39 Normally Open, dry contact type devices - with class B or class A wiring supervision:

40 These interface modules shall communicate the Initiating Device Circuit status (normal,
41 alarm, trouble) to the control panel.

42
43 **INTERFACE MODULES - NON-SUPERVISED CONTROL**

44 This interface module shall provide double-pole/double-throw relay switching for loads up to
45 120VAC. It shall contain easily replaceable 2-amp fuses, one on each common leg of the relay.

46
47 **FAULT ISOLATOR MODULE (FIM)**

48 The system shall employ Fault Isolator Modules (FIM) on the Signaling Line Circuits. These FIM units shall
49 be utilized in order to isolate portions of SLCs, in the event of short circuit conditions. The SLC segment
50 protected by each FIM shall be separated from the SLC in a manner such that a single short-circuit condition
51 may not affect more than 25 Addressable Field Devices / Detectors, which are served by the isolated SLC
52 segment.

53
54 The FIM shall be located as close as practical to the point where the isolated SLC sub-circuit branches and
55 shall also be located at an accessible location.

56
57 **CONVENTIONAL INITIATING DEVICES**

58 **NON-ADDRESSABLE HEAT DETECTORS**

59 Non-Addressable Heat Detectors shall of the fixed temp type and only to be used at locations where the
60 ambient conditions are unsuitable for Analog Addressable units, or where the required operation (set point /
61 response index, etc.) cannot be achieved with Analog Addressable units. Where used, these devices shall be
62 UL listed for their intended purpose. These heat detectors do not have to be made by the same manufacturer
63 supplying the other fire alarm equipment for the project.
64

1 Acceptable manufacturers include:

2 Siemens
3 Edwards
4 Kidde
5 Johnson Controls

6
7 The manufacturer must allow for interfacing with the existing system.
8
9

10 **PART 3 - EXECUTION**

11 **GENERAL**

12 The complete installation shall be done in a neat, workmanlike manner in accordance with the applicable
13 requirements of NFPA 70 - Article 760 and the manufacturer's recommendations.
14

15
16 Smoke detectors shall not be mounted until the construction is completed unless they are covered with plastic
17 bags or fitted covers immediately after installation to maintain cleanliness. Remove plastic bags or fitted
18 covers from smoke detectors after final construction cleaning is complete.
19

20 Clean All Equipment:

21 Vacuum inside of fire alarm panels, NAC panels, etc.
22 Loosen attached particles and vacuum them away.
23 Wipe all surfaces with a clean, dry, lint free rag.
24 Re-vacuum inside surfaces as directed by the UW Construction Representative or Inspector.
25

26 **RACEWAYS**

27 NOTE: ALL FIRE ALARM SYSTEM WIRING SHALL BE INSTALLED WITHIN METALLIC
28 CONDUIT.
29

30 All wiring shall be in a conduit system separate from other building wiring. See Section 26 05 33 – Raceway
31 and Boxes for Electrical Systems for specifications.
32

33 All wiring shall be in minimum ½" steel raceway.

34
35 40% fill factor shall be applied to all conduit sizes.
36

37 The contractor shall size conduit and boxes by circular mil size of each cable in each conduit or box. The
38 circular mil sizing can be found on the manufacture's spec sheet, then use the NEC codebook to make
39 calculation to follow NEC Chapter 9 Tables and Annex C for box and conduit fill.
40

41 The contractor is encouraged to use red conduit for fire alarm systems.
42

43 There shall be no sharp edges with installed materials.
44

45 Use only identified conduit entries or request approval for other penetrations in cabinets; (certain areas
46 require clear space for interior components / batteries). Cabinet shall be grounded to either a cold water pipe
47 or grounding rod.
48

49 Existing conduit and surface metal raceway that is ½" in size or larger may be reused if found to have
50 adequate space provided that it only serves the fire Alarm system and doesn't contain any AC wiring. All
51 existing conduit that is reused MUST be brought up to the current State of Wisconsin Electrical Code and
52 Approved for usage by the Engineer prior to work being done.
53

54 **CONDUCTORS**

55 All wire and cable associated with this system shall be as required by the equipment manufacturer. The
56 following information is intended for estimating purposes only. However, the minimum wire gauges and
57 colors specified shall be strictly adhered to. All cable shall be installed as per NEC Article 760.
58

59 All cables and wires #14 AWG and larger shall be stranded.
60

61 Fire alarm wiring shall be held in place at the device box, by means of a two-screw connector, (do not use
62 squeeze or crimp type connectors).
63

1 All wiring shall be completely supervised. In the event of a primary power failure, disconnected standby
2 battery, disarrangement of any components, any open circuits or grounds in the system, an audible and visual
3 trouble signal shall be activated until the system is restored to normal.
4
5 All conductors shall be color-coded. Coding shall be consistent throughout the facility. Green wire shall be
6 used only for equipment ground.
7
8 Fire alarm risers, notification appliance circuits and interconnections to remote panels (per NFPA 72) shall
9 have a minimum 2Hr fire alarm rating. All notification appliance circuits shall be protected from the fire
10 alarm panel of origination to the signaling zone they serve.
11
12 Where fire alarm circuits enter or leave a building, additional transient 75 to 90-volt gas tube protection shall
13 be provided for each conductor.
14
15 Cable for Intelligent detector Loops shall be 18 to 12 AWG twisted pair with a shield jacket or per
16 manufacturers recommendations installed in 1/2" conduit. Shield continuity must be maintained and
17 connected to earth ground only at the control panel.
18
19 SLC wiring must not be in the same conduit with AC power wiring or other high current circuits. T-taps or
20 branch circuit connections are allowed for all class B SLCs.
21
22 Cable for RS-232C devices (CRT, PRINTER) shall be dual pair twisted- shielded.
23
24 Cable for RS-485 devices (Remote Annunciators) shall be twisted-shielded pair (Belden 9841 or equivalent)
25 for the data signal. Power wiring shall be 12 AWG.
26
27 All splices or connections shall be made within approved junction boxes and with approved fittings. Boxes
28 shall be red and labeled "FIRE ALARM SYSTEM" or "FA" by decal or other approved markings.
29
30 Speaker and strobe circuits shall have separate conductors and shall operate independently of each other.
31
32 Speaker wiring shall be #18 AWG twisted-shielded cable or per manufacturers recommendations.
33
34 Strobe wiring shall be #14 AWG minimum.
35
36 Tray cable is not acceptable for use as fire alarm system wiring installed in conduit.
37
38 **DEVICE MOUNTING**
39 Unless otherwise noted on the drawings, plans, specifications or by the Architect or Engineer; the
40 recommended mounting heights, and requirements are as follows:
41
42 **HEAT AND SMOKE DETECTORS**
43 The location of detectors shown on the plans is schematic only. The detectors must be located according to
44 code requirements.
45
46 Surface mounted detectors shall be installed using back boxes equal to the base's size. Standard octagon and
47 square boxes are not acceptable.
48
49 Detectors should be located on the highest part of a smooth ceiling so that the edge of the detector is no closer
50 than 4 inches from a sidewall. Ceilings with beams, joists or soffits that exceed 8 inches in depth require
51 special planning and closer spacing.
52
53 If it is necessary to mount a detector upon a sidewall, the top of the detector (the sensing chamber portion of
54 the device) shall be located no closer than 4 inches from the ceiling and no further away than 12 inches.
55
56 Smoke detectors should be installed to favor the air flow towards return openings and not located closer than
57 3 feet from air supply diffusers which could dilute smoke before it reaches the detector. No detectors shall
58 be installed in direct airflow.
59
60 Duct smoke detector installation to be by this contractor and should be installed in the locations shown on
61 the mechanical and electrical plans. Ensure that the duct smoke detectors are in serviceable
62 locations. Consult with the mechanical designer for alternate locations if these are shown in non-
63 serviceable locations. When locations on mechanical plans are not available, install in locations called for
64 that provide accessibility for service. For duct smoke detectors that are associated with shaft smoke

1 dampers, ensure the sampling tubes protruding into the duct are located within five feet of the smoke
2 damper and there are no air inlets or outlets between the sampling tubes and the damper. Do not install
3 within four feet of a fan discharge.
4

5 Heat and smoke detectors should be located near the center of the open area which they are protecting, thus
6 providing coverage generally for 15-foot radius for heat and smoke detectors. Questionable locations shall
7 be verified with Architect or Engineer before installation takes place.
8

9 Heat and smoke detectors, both Intelligent and non-addressable, shall be installed in accordance with their
10 UL Listed Spacing. The quantity of Heat and smoke detectors depicted on the drawings is based on the 900
11 square foot per detector rule. If detectors with significantly different spacing requirements are selected by
12 the Fire Alarm equipment provider/contractor, then additional detectors, if required, shall be provided at no
13 additional cost to the project.
14

15 **IDENTIFICATION**

16 Attach the label containing the address and SLC designation to:

17 Each addressable detector. Label shall be visible and readable from the floor, 3/16" minimum
18 character size (1/4" is recommended).

19 Each manual pull station. Label shall be placed on the top part.

20 Each Addressable Module. Label shall be attached to the faceplate.
21

22 Label shall consist of black writing on white or clear background.
23

24 All fire alarm boxes shall be painted red and labeled "Fire Alarm" or "FA". When red conduit is used for the
25 fire alarm system installation, there is no need to paint the boxes. Non-factory device boxes shall also be
26 painted red.
27

28 All circuits must be labeled with the name of circuit and the area being served by the circuit.
29

30 Wire/cable splices in junction boxes shall be labeled indicating where the wire/cable is coming from and
31 where it is going.
32

33 All conductors terminated in control panels, annunciator panels and extension panels shall be labeled.
34

35 All audio-visual devices shall be labeled by each circuit and the order of the device on that circuit such as
36 "Circuit No. 2, strobe No. 05 of 10".
37

38 All labels shall be permanent, and be machine generated. NO HANDWRITTEN OR NON-PERMANENT
39 LABELS SHALL BE ALLOWED. Submit a sample for approval before using any labeling schemes.
40

41 Label size shall be appropriate for the conductor or cable size(s) and design. All labels to be used shall be
42 self-laminating, white/transparent vinyl and be wrapped around the cable (sheath). Flag type labels are not
43 allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled
44 and properly self-laminate over the full extent of the printed area of the label.
45

46 Adhesive type labels not permitted except for phase and wire identification.
47

48 **TESTING**

49 Before proceeding with any testing, all persons, facilities and building occupants who receive alarms or
50 trouble signals shall be notified by the contractor to prevent unnecessary response or building occupant
51 distress. At the conclusion of testing, those previously notified shall be notified that testing has been
52 concluded.
53

54 The manufacturer's authorized representative shall provide on-site supervision of installation of the complete
55 fire alarm system installation, perform a complete functional test of the system, and submit a written report
56 to the Contractor attesting to the proper operation of the completed system prior to final inspection.
57

58 Contractor shall pre-test every device in the system before the system is considered ready for final inspection.
59

60 The completed and pre-tested fire alarm system shall be fully tested in accordance with NFPA-72 by the
61 Contractor in the presence of the Engineer, UW representative, Owner's representative, the local Fire
62 Marshal, and Authorized Commercial Building Inspector.
63

1 The Engineer or his authorized representative may suspend or discontinue the tests at any time performance
2 is considered unsatisfactory. Resumption of testing will cover untested elements and any replaced elements.
3 The contractor shall furnish all test personnel, test instruments and equipment of the accuracy necessary to
4 perform the test. Arrangements for testing must be made with the UW representative and the Engineer at
5 least two weeks before the proposed testing date.
6

7 Upon the completion of a successful test, and prior to the final request for payment the Contractor shall:

- 8 Certify the system to the Owner in writing.
- 9 Complete the NFPA 72 record of completion form.
- 10 Provide as-built and O&M manuals.
- 11 Provide a signed statement that the Owner had received the specified system operation and maintenance
12 training and indicated spare parts.

13
14 ***FINAL PAYMENT WILL NOT BE PROCESSED UNLESS THESE DOCUMENTS ARE COMPLETE***
15 ***AND ON-HAND.***

16 **WARRANTY**

17 The Contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent
18 mechanical and electrical defects for a period of two (2) years from the date of substantial completion of the
19 project.
20

21 At the end of the project, the Contractor shall post the warranty period along with the company's name and
22 telephone number inside the fire alarm panel.
23

24 Any occupied facility shall not be without a UL and an NFPA approved and fully operational fire alarm
25 system for a period longer than two (2) hours. Emergency response shall be provided within two (2) hours
26 of the notification, to the contractor, of the failure of the system to perform operationally per UL and NFPA
27 standards. Non-emergency service calls shall be responded to within twenty-four (24) hours of the
28 notification to the contractor.
29

30 Emergency situations may include, but not limited to:

- 31 System can't be acknowledged or reset
- 32 System is non-responsive to commands
- 33 System in non-responsive to actuated alarm devices
- 34 Malfunction of notification/initiating circuit(s)
- 35 System going into alarm/trouble without indicating the source
- 36 System is dead (no power), etc.

37
38
39 Repairs and/or replacement arising from emergency situations shall be completed within twenty-four (24)
40 hours of the time of notification. Other than emergency, actual repairs and /or replacement shall be provided
41 within seventy-two (72) hours of the time of notification during normal working hours, Monday through
42 Friday, excluding holidays. If the repairs involve parts that are not shelve items and require lead time, the
43 contractor shall inform the Owner within twenty-four (24) hours from the time of notification of the exact
44 time when the repairs will be completed.
45

46 If repair and/or replacement cannot be made within the prescribed time, then other means and methods of
47 protection shall be provided to ensure the safety of the building's occupants during which time the system is
48 not in compliance with the standards. This may involve up to and include hiring Owner approved qualified
49 personnel to stand a fire watch, all at the contractor's expense.
50

51 Warranty service for the equipment shall be provided by the system supplier's factory trained representative.
52 Further, Warranty shall include all parts, labor, and necessary travel.
53

54 **SPECIAL CONSIDERATIONS**

55 Contractor shall refer to Division 1, General Requirements, "SPECIAL SITE CONDITIONS".
56

57
58 The contractor must maintain the existing fire alarm system operational during the construction period.
59 During periods of construction where dust or dirt may contaminate the existing detectors, the contractor shall
60 cover the detectors to avoid nuisance alarms and trouble-calls.
61

62 Individual zones and/or devices of the existing fire alarm system can be bypassed by the contractor during
63 construction under the following requirements:
64

1 The Superintendent of Buildings and Grounds is notified of which zones and/or devices are inoperative
2 and for how long in writing, hand delivered.

3
4 The contractor covers all manual-pull stations that are not active and post temporary fire alarm
5 notification procedures next to each inactive manual-pull station.

6
7 Ensure the fire alarm system is fully operational before leaving the job site.

8
9
10
11

END OF SECTION