Procurement Services
MONTCLAIR STATE UNIVERSITY

Form: **Addendum No. 5**
Project Title: **Request for Proposal (RFP) 1636 Interdisciplinary Science Building**
Issued Date: **March 26, 2026**

This Addendum relates to the project referenced above, originally advertised on January 30, 2026.

Addendum Contents

Section #	*Item*	*Description*
1	**Modified Base Bid / Alternates #2A & #2B.**	Specified aspects of the work required for Alternates #2A and #2B are now to be included within the Single Bid (Lump Sum All Trades). See Section 1 of this Addendum No. 5 for details.
2	**Revised and/or New Drawings & Specifications**	Revised and/or new drawings, and specifications have been issued. See Section 2 of this Addendum No. 5 for details. Section 2 includes the following items: • Transmittal • Change Log • Drawings • Project Manual

This Addendum forms part of the Contract documents and modifies the original Bidding documents and any prior Addenda (*if any*), as stated herein. Unless specifically noted or specified hereinafter, all services and other provisions of the Contract documents shall remain in full force.

It is the sole responsibility of the Vendor to be knowledgeable of all of the additions, deletions, clarifications, and modifications to the RFP or project materials related to this project as set forth in all Addenda. Bidder must submit the Addendum acknowledgement below within proposal. Failure of the Bidder to provide this acknowledgement of Addendum within submission will cause the Proposal to be deemed non-responsive.

ADDENDUM ACKNOWLEDGMENT

I acknowledge that I have received and reviewed this Addendum No. 3

Vendor Name *(please print)*

Representative's Name *(please print)*

Signature of Representative

Date

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SECTION 1: MODIFIED BASE BID & ALTERNATE #2A AND #2B

Specified work previously required for **Alternates #2A and #2B** must be included within and priced under the **Single Base Bid (Lump Sum All Trades)**.

Details: The Trellis footings identified in the PV Trellis Narrative shall be included in the Single Base Bid, and NOT included as part of Alternates #2A and #2B. The footings shall be as stated in the Type 2A description, and apply to both Type 2A and Type 2B trellis designs.

Notice to Bidders: Although the requirements for the work performed under Alternates #2A and #2B have been modified, Alternate #2A and #2B are still required for pricing purposes for the remaining unchanged scope of work. Since Bidder still requires submitting costs for Alternates #2A and #2B, Section 3 “Proposal Form,” of the RFP Document has not been modified under this Addendum No. 5. However, Bidder must price the Single Base Bid, and Alternates #2A and #2B in accordance with the modifications herein.

SECTION 2: REVISED AND/OR NEW DRAWINGS & SPECIFICATIONS

(Items Begin on the following page of this Addendum No. 5)

TRANSMITTAL

5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018

Interdisciplinary Science Building

Addendum No. 05

Owner / Client:
Montclair State University
1 Normal Ave
Montclair, NJ 07043

Contractor / Construction Manager:
To Be Determined

Date: 3/23/2026

HOK Project No: 24.07023.00

Distribution:

Chris Danish (MSU)
Robert Yufer (MSU)
Erika Reuter (HOK)

Transmitted Via: Egnyte

- This Addendum is issued to furnish information which is supplemental to the Bid Documents. All work required by this Addendum shall comply with the applicable provisions of the Bid Documents and shall be incorporated in the Base Bid, unless otherwise specified.
- Only revised and / or new drawings and specifications have been issued. Drawings and specifications that have not been superseded by the enclosed Addendum documents, are to remain the basis for Bidding.
- Modifications to Drawings are denoted with a revision cloud and reference triangle; modifications to Specifications for new text (additions) will appear as dark blue underlined, deleted text will appear dark red with strikethrough when viewed in PDF format and if printed in color. Dark blue and dark red will be more visible in black and white as well.
- Reason for Addendum: Revisions to Contract documents in response to Bidder RFIs, Addition of Raised Access floor at level 1 Event Space and Imaginarium, Utility coordination with UMM DCO for thermal and fiber lines.

Remarks:

- See Description of Changes for explanation of modifications to drawings / specifications

See attached change log 2026-03-23 MSU ISB - Addendum 5_Revisions Log.pdf

HOK Architects, Inc.

Issued By:

Jennifer Brzozowski

3/23/2026

CHANGE LOG

Montclair State University
Interdisciplinary Science Building
Montclair, New Jersey

Addendum #5 Change Log
3/23/2026
HOK Project 24.07023.00

Sheet Number	Sheet Name/View Name	Detail #(s)	Comments
02 CIVIL			
CD101	DEMOLITION PLAN		ADJUSTED WATER MAIN DEMOLITION EXTENTS
CS101	SITE PLAN		ADDED DETECTABLE WARNING SURFACES AT ADA RAMPS, PER MSU COMMENT
CU101	UTILITY PLAN		NOTED SIZES OF WATER PIPING, FOR NJAW COORDINATION
CU101	UTILITY PLAN		ADDED CALLOUT FOR SANITARY CLEANOUT
CU101	UTILITY PLAN		ADDED WATER VALVES, FOR NJAW COORDINATION
CU101	UTILITY PLAN		ADDITIONAL NOTES ON CONNECTION TO EXISTING WATER MAIN
CU101	UTILITY PLAN		ADDITIONAL CONDUIT, PER CTCI/DCO COORDINATION
CU101	UTILITY PLAN		NOTED TO RESET EXISTING CASTINGS AT EXISTING MANHOLES
CU101	UTILITY PLAN		NOTED EXISTING HYDRANT TO REMAIN, FOR NJAW COORDINATION
CU101	UTILITY PLAN		"FINAL FOR WATER AND SEWER NOTE" REQUIRED FOR NJDEP TWA SUBMISSION
CU201	SANITARY PROFILES		ADDED WATER LINE CROSSINGS (FOR NJAW COORDINATION)
CU201	SANITARY PROFILES		"FINAL FOR WATER AND SEWER NOTE" REQUIRED FOR NJDEP TWA SUBMISSION
CS501	CONSTRUCTION DETAILS 1		ADDED DETECTABLE WARNING SURFACE, PER MSU COMMENT
CS502	CONSTRUCTION DETAILS 2		"FINAL FOR WATER AND SEWER NOTE" REQUIRED FOR NJDEP TWA SUBMISSION
CS503	CONSTRUCTION DETAILS 3		"FINAL FOR WATER AND SEWER NOTE" REQUIRED FOR NJDEP TWA SUBMISSION
CS504	CONSTRUCTION DETAILS 4		"FINAL FOR WATER AND SEWER NOTE" REQUIRED FOR NJDEP TWA SUBMISSION
CS505	CONSTRUCTION DETAILS 5		RELOCATED SANITARY MANHOLE DETAIL FROM SHEET CS501
CS505	CONSTRUCTION DETAILS 5		"FINAL FOR WATER AND SEWER NOTE" REQUIRED FOR NJDEP TWA SUBMISSION
03 LANDSCAPE			
L200	SITE DETAILS	1	REVISED PERMEABLE PAVER CALLOUT TO REFER TO CIVIL ENG DRAWINGS, RFI#31
04 STRUCTURE			
F100	FOUNDATION`		ADDED SECTION 6 AT ELEVATOR, LOWERED FOOTING BY 1 FOOT, INCREASED GRADE BEAM AT COL C/10 FROM 30" TO 42" TO BEAR ON FOOTING, LOWERED SLAB ON GRADE IN 2 AREAS AND ADDED SECTION E/FO201
FO204	FOUNDATION TABLES AND SCHEDULES	SCHEDULE	ADDED 42" TO GRADE BEAM 4
FO300	FOUNDATION SECTIONS - SHEET1	6	ADDED SECTION 6 AT ELEVATOR,
S002	GENERAL NOTES SHEET NO.2	24	ADD NOTE 24 UNDER SHOP DRAWINGS AND SUBMITTALS
S105	PENTHOUSE FRAMING PLAN	NOTE 1	CHANGED NORMAL WEIGHT TO LIGHT WEIGHT
S107	UPPER ROOF FRAMING PLAN	NOTE 1, SECT 1	CHANGED NORMAL WEIGHT TO LIGHT WEIGHT, CHANGED SHEET NUMBER TO 704 AT SECTION 1
S201	GROUND FLOOR SLAB EDGE PLAN		SHOWED SLAB DEPRESSION SLAB EDGE
S700	SUPERSTRUCTURE SECTIONS - SHEET NO 1	SECT 5	ADDED NOTES FOR THERMAL BRICK SUPPORT BRACKET
S701	SUPERSTRUCTURE SECTIONS - SHEET NO 2	SECT 6	SHOWED LOCATION OF THERMAL BREAK
S702	SUPERSTRUCTURE SECTIONS - SHEET NO 3	SECT 4,6	ADDED NOTES FOR THERMAL BRICK SUPPORT BRACKET
S704	SUPERSTRUCTURE SECTIONS - SHEET NO 4	SECT 1	ADDED NOTE

Sheet Number	Sheet Name/View Name	Detail #(s)	Comments
05 ARCHITECTURE			
A021	LEVEL 1 - FIREPROOFING	1	REVISED FIRE PROTECTION KEYNOTES, RFI#291
A021	LEVEL 1 - FIREPROOFING	1	REVISED FIRE PROTECTION KEYNOTES, RFI#291
A021	LEVEL 2 - FIREPROOFING	2	REVISED FIRE PROTECTION KEYNOTES, RFI#291
A021	LEVEL 3 - FIREPROOFING	3	REVISED FIRE PROTECTION KEYNOTES, RFI#291
A021	LEVEL 4 - FIREPROOFING	4	REVISED FIRE PROTECTION KEYNOTES, RFI#291
A021	A021 - FIRE PROTECTION PLANS - L1-L4	LEGEND	REVISED FIRE PROTECTION KEYNOTES, RFI#291
A022	PENTHOUSE - FIREPROOFING	1	REVISED FIRE PROTECTION KEYNOTES, RFI#291
A022	ROOF - FIREPROOFING	2	REVISED FIRE PROTECTION KEYNOTES, RFI#291
A022	A022 - FIRE PROTECTION PLANS - PENTHOUSE AND ROOF	LEGEND	REVISED FIRE PROTECTION KEYNOTES, RFI#291
A101	FLOOR PLAN - LEVEL 1	1	ADDED CALLOUT DETAILS FOR FLOOR TRANSITION ACCESS FLOOR
A101	FLOOR PLAN - LEVEL 1	1	ADDED KEYNOTE FOR CANE RAIL
A101	FLOOR PLAN - LEVEL 1	1	ADDED FLOOR PLAN KEYNOTE FOR RECESSED SLAB AT ACCESS FLOOR
A101	A101 - FLOOR PLAN - LEVEL 01	LEGEND	ADDED KEYNOTE FOR CANE RAIL
A101	A101 - FLOOR PLAN - LEVEL 01	LEGEND	ADDED FLOOR PLAN KEYNOTE FOR RECESSED SLAB AT ACCESS FLOOR
A101D	DIMENSION PLAN - LEVEL 1	1	ADD DIMENSIONS FOR ACCESS FLOOR
A101D	DIMENSION PLAN - LEVEL 1	1	ADDED DIMENSIONS FOR ACCESS FLOOR, ADDED FURRING PARTITION TO INSIDE FACE OF EWS-01
A101D	DIMENSION PLAN - LEVEL 1	1	ADDED MISSING 'A' MODIFIER TO WALL TAGS
A103	FLOOR PLAN - LEVEL 3	1	ADDED ELEVATION REFERENCE TAGS, RFI#87
A151	POWER DATA PLAN - LEVEL 1	1	ADDED TWO P/D FLOOR BOXES AT PREFUNCTION
A151	POWER DATA PLAN - LEVEL 1	1	ADDED FLOOR BOXES TO ACCESS FLOOR SYSTEM IN IMAGINARIUM
A151	POWER DATA PLAN - LEVEL 1	1	REVISED FLOOR BOX TO TYPE 'B' TO MATCH ELEC/TC PLANS
A151	POWER DATA PLAN - LEVEL 1	1	REVISED FLOOR BOXES TYPE AT ACCESS FLOOR SYSTEM IN EVENT SPACE
A151	A151 - POWER DATA PLAN - LEVEL 1	LEGEND	REVISED FLOOR BOX TYPES FOR ACCESS FLOOR SYSTEM
A201	CEILING PLAN - LEVEL 01	1	ADDED CEILING TAG
A202	CEILING PLAN - LEVEL 02	1	ADDED CEILING TAG
A202	CEILING PLAN - LEVEL 03	1	ADDED CEILING TAG
A203	CEILING PLAN - LEVEL 03	1	REVISED CEILING TAG TO MATCH FINISH GROUP SCHEDULE
A205	CEILING PLAN - PENTHOUSE	1	ADDED CEILING TAG
A302	BUILDING ELEVATION - WEST	1	REVISED GRAPHICS AT ENTRANCE DOOR GLAZING
A303	BUILDING ELEVATION - NORTH	1	REVISED GRAPHICS AT ENTRANCE DOOR GLAZING
A402	ENLARGED PLAN - ENTRANCE NORTH	1	ADDED CALLOUT DETAILS FOR WALL BASE AT ACCESS FLOOR
A451	ELEVATION - WOMEN'S RESTROOM - NORTH	3	REVISED MATERIAL CODE, RFI#90
A451	ELEVATION - MEN'S RESTROOM - SOUTH	4	REVISED MATERIAL CODE, RFI#90
A500	A500 - EXTERIOR MATERIAL SCHEDULE	SCHEDULE	REVISED MATERIAL CODE, RFI#64
A601	FOUNDATION DETAIL - EWS-03 @ GLASS	4	REVISED LOCATION OF INS-08 BEHIND GRANITE BASE AT FOUNDATION DETAILS
A601	FOUNDATION DETAIL - EWS-03 @ BRICK	5	REVISED LOCATION OF INS-08 BEHIND GRANITE BASE AT FOUNDATION DETAILS
A601	FOUNDATION DETAIL - EWS-01 @ PRECAST	2	REVISED LOCATION OF INS-08 BEHIND GRANITE BASE AT FOUNDATION DETAILS
A601	FOUNDATION DETAIL - EWS-01 @ GLASS	1	REVISED LOCATION OF INS-08 BEHIND GRANITE BASE AT FOUNDATION DETAILS
A624	SECTION DETAIL - EWS-02/03 GLAZING @ CURTAIN WALL TO S	1	ADDED ANNOTATION, RFI#163

Sheet Number	Sheet Name/View Name	Detail #(s)	Comments
A651	EXTERIOR SECTION DETAIL - EXTERIOR COLUMN ENCLOSURE H	3	ADDED FIRE PROTECTION MATERIAL CODE, RFI#291
A660	TYPICAL ROOF DRAIN DETAIL RS-02	4	ADDED SFRM TO DETAIL, RFI#295
A660	RS-02 TPO ROOF SYSTEM	3	ADDED SFRM TO DETAIL, RFI#295
A700	INTERIOR ELEVATION - LOUNGE EAST	6	REVISED MATERIAL CODE, RFI#82
A701	INTERIOR ELEVATION - L1 MAIN CORRIDOR	1	REVISED WALL MATERIAL AT BOOTHS ALCOVE, RFI#170
A701	INTERIOR ELEVATION - L1 MAIN CORRIDOR	1	REVISED MATERIAL CODE, RFI#82
A701	INTERIOR ELEVATION - COMPUTER LAB CORRIDOR	2	REVISED WALL MATERIAL AT BOOTHS ALCOVE, RFI#171
A701	INTERIOR ELEVATION - COMPUTER LAB CORRIDOR	2	REVISED GRAPHICS AT FLOATING COUNTERTOPS, RFI#85
A701	INTERIOR ELEVATION - COMPUTER LAB CORRIDOR	2	REVISED MATERIAL CODE, RFI#82
A703	INTERIOR ELEVATION - EVENT SPACE SOUTH	3	REMOVED UNREFERENCED ANNOTATION
A703	INTERIOR ELEVATION - EVENT SPACE SOUTH	3	REVISED GRAPHICS AT WALL BASE TO ALIGN WITH DETAILING
A703	INTERIOR ELEVATION - EVENT SPACE SOUTH	3	ADDED ALIGN SYMBOL AT INT ELEVATION TO CLARIFY JOINT LOCATION
A703	INTERIOR ELEVATION - EVENT SPACE NORTH	1	ADDED CALLOUT DETAILS FOR WALL BASE AT ACCESS FLOOR
A713	L2 - SOUTH CORRIDOR	1	REVISED MATERIAL CODE, RFI#88
A713	INTERIOR ELEVATION - L3 NW CORRIDOR EAST	4	REVISED MATERIAL CODE, RFI#88
A713	INTERIOR ELEVATION - L3 NW CORRIDOR EAST	4	REVISED MATERIAL CODE, RFI#88
A715	INTERIOR ELEVATION - STAFF WORKPLACE EAST	5	REVISED MATERIAL CODE, RFI#88
A715	INTERIOR ELEVATION - MED. CONF. WEST	8	REVISED MATERIAL CODE, RFI#88
A715	INTERIOR ELEVATION - MED. CONF. EAST	7	REVISED MATERIAL CODE, RFI#88
A715	INTERIOR ELEVATION - L2 HUDDLE 2	3	REVISED MATERIAL CODE, RFI#88
A715	INTERIOR ELEVATION - L2 HUDDLE 2	3	REVISED WALL FINISH TAG, RFI#172
A715	INTERIOR ELEVATION - L2 HUDDLE 1	2	REVISED WALL FINISH TAG, RFI#172
A716	INTERIOR ELEVATION - CHEMISTRY RESEARCH SOUTH	3	REVISED MATERIAL CODE, RFI#88
A717	ELEVATION - INTRODUCTORY TEACHING LAB 380 - WEST	2	REVISED MATERIAL CODE, RFI#88
A717	ELEVATION - EQUIPMENT STORAGE 351 - WEST	7	REVISED MATERIAL CODE, RFI#88
A905	A905 - AL FRAME, 2" FACE, GWB PARTITION DETAILS	17, 18, 19	ALUMINUM FRAMED GLASS PARTITION SLIDING DOOR DETAIL UPDATED
A911-03	A911-03 - INTERIOR GWB PTN AND CMU PTN TYPES		DETAIL REMOVED, RFI#187
A920	FWP-BASE-ACCESS FLOOR-RECESSED IMAG	11	DETAIL ADDED WALL BASE AT RAISED FLOOR
A920	FWP-BASE-ACCESS FLOOR-RECESSED EVENT	10	DETAIL ADDED WALL BASE AT RAISED FLOOR
A920	FWP-BASE-ACCESS FLOOR-FRP EVENT	7	DETAIL ADDED WALL BASE AT RAISED FLOOR
A920	FWP-BASE-ACCESS FLOOR	12	DETAIL ADDED WALL BASE AT RAISED FLOOR
A920	A920 - INTERIOR WALL BASE DETAILS		DETAIL DELETED
A927	SECTION DETAIL - PARTITION CURBS	2	REVISED WALL BASE DETAIL, RFI#18
06 INTERIOR			
I001	I001 - FINISH SCHEDULE	SCHEDULE	REVISED FINISH SCHEDULE MATERIAL CODE, RFI#92
I001	I001 - FINISH SCHEDULE	SCHEDULE	REVISED WALL FINISH SCHEDULE, RFI#172
I001	I001 - FINISH SCHEDULE	SCHEDULE	REVISED DIMENSION IN FINISH SCHEDULE, RFI#153
I001	I001 - FINISH SCHEDULE	SCHEDULE	REVISED MATERIAL CODE IN FINISH SCHEDULE
I001	I001 - FINISH SCHEDULE	SCHEDULE	REVISED FLOOR BASE FINISH SCHEDULE, RFI#169
I002	I002 - FINISH LEGEND	SCHEDULE	REVISED FINISH GROUP 3.6/3.7, RFI#156
I002	I002 - FINISH LEGEND	SCHEDULE	ADDED FINISH GROUP FG-7.2

Sheet Number	Sheet Name/View Name	Detail #(s)	Comments
I002	I002 - FINISH LEGEND	SCHEDULE	REVISED FINISH GROUP 2.4/2.6, RFI#167
I002	I002 - FINISH LEGEND	SCHEDULE	REVISED FINISH GROUP 4.3/4.4, RFI#174
I101	FINISH PLAN - LEVEL 1	1	REVISED CORNER GUARD ANNOTATION
I101	FINISH PLAN - LEVEL 1	1	REVISED WALL MATERIAL AT BOOTHS ALCOVE, RFI#171
I101	FINISH PLAN - LEVEL 1	1	REVISED WALL MATERIAL AT BOOTHS ALCOVE, RFI#170
I101	FINISH PLAN - LEVEL 1	1	REVISED FINISH GROUP NUMBER IN RESPONSE TO RFI#154
I102	FINISH PLAN - LEVEL 2	1	REVISED WALL FINISH TAG, RFI#172
I104	FINISH PLAN - LEVEL 4	1	REVISED FINISH GROUP #, RFI#154
08 MECHANICAL			
M102A	MECHANICAL - LEVEL 2 DUCTWORK PLAN - AREA A	1	TAG CORRECTION IN ORGANIC INSTRUMENTATION 257 FOR AV-257-S1, AV-257-S2, AV-257-S3
M102A	MECHANICAL - LEVEL 2 DUCTWORK PLAN - AREA A	1	ADDED VOLUME DAMPER TO 16x16 OA
M102B	MECHANICAL - LEVEL 2 DUCTWORK PLAN - AREA B	1	TAG CORRECTION IN ORGANIC INSTRUMENTATION 257 FOR AV-257-S1, AV-257-S2, AV-257-S3
M102C	MECHANICAL - LEVEL 2 DUCTWORK PLAN - AREA C	1	ADDED TAGS TO AV-209-H1, AV-209-H2
M105A	MECHANICAL - PENTHOUSE PLAN - AREA A	1	ADDED MOTOR OPERATED DAMPERS TO DOAS-1 DUCTWORK
M105A	MECHANICAL - PENTHOUSE PLAN - AREA A	1	REVISED RHC-3 SIZE AND DUCT TRANSITIONS
M105B	MECHANICAL - PENTHOUSE PLAN - AREA B	1	ADDED MOTOR OPERATED DAMPERS TO DOAS-2 DUCTWORK
M105B	MECHANICAL - PENTHOUSE PLAN - AREA B	1	RELOCATED UH-1 IN GENERATOR ROOM
M106	MECHANICAL ROOF PLAN	1	ADDED GENERAL ROOF NOTES
M201B	MECHANICAL - LEVEL 1 PIPING PLAN - AREA B	1	MODIFIED NOTES AT BUILDING PIPING ENTRY
M205A	MECHANICAL - PENTHOUSE PIPING PLAN - AREA A	1	MODIFIED PIPING TO RHC-3
M205B	MECHANICAL - PENTHOUSE PIPING PLAN - AREA B	1	MODIFIED PIPING TO UH-1
M301	MECHANICAL - ENLARGED PLANS	2	REVISED DOAS PAD HEIGHT TO 8"
M302	MECHANICAL - ENLARGED PLANS	1&2	SHEET ADDED. SECTION VIEWS ADDED FOR THERMAL PIPING COORDINATION
M401	MECHANICAL CHILLED WATER FLOW DIAGRAM	1	ADDED CHECK VALVE TO PIPE BRIDGE. ROTATED MIXING VALVE.
M403	MECHANICAL HOT WATER FLOW DIAGRAM	1	MODIFIED MIXING VALVE LOCATION.
M504	MECHANICAL DETAILS	CHB DETAIL	CLARIFIED 6-WAY VALVE DETAIL
M601	MECHANICAL SCHEDULES	DOAS SCH	REVISED PAD HEIGHT TO 8"
M602	MECHANICAL SCHEDULES	GV SCH	UPDATED NOTES TO INCLUDE 20" CURB HEIGHT
M602	MECHANICAL SCHEDULES	P SCH	UPDATED SCHEDULE NOTES
M602	MECHANICAL SCHEDULES	EF SCH	REVISED NOTES TO INCLUDE 20" CURB HEIGHT
M602	MECHANICAL SCHEDULES	RHC SCH	UPDATED RHC SELECTION
M602	MECHANICAL SCHEDULES	HAC SCH	UPDATED BOD PERFORMANCE
M605	MECHANICAL SCHEDULES	AV SCH	ADDED VALVES MISSING IN SCHEDULE BUT SHOWN ON PLAN. CLARIFIED TAGS.
M607	MECHANICAL SCHEDULES	PIPE MATERIALS	UPDATED TO INCLUDE GROOVED JOINTS TO HYDRONIC SYSTEMS.
09 ELECTRICAL			
E001	ELECTRICAL LEAD SHEET		ADDED FLOOR BOX SYMBOL FOR RAISED FLOOR
E002	ELECTRICAL NORMAL POWER ONE LINE DIAGRAM		REVISED CONDUIT SIZE TO MAIN BOARD; REVISED BREAKER AND WIRING FEEDING ATS-OS1

Sheet Number	Sheet Name/View Name	Detail #(s)	Comments
E003	ELECTRICAL EMERGENCY ONE LINE DIAGRAM		REVISED UPS SIZING; REVISED BREAKER AND WIRING FEEDING ATS-OS1 AND UPS-1; REVISED CONDUIT SIZING TO MAIN BOARD.
E100B	ELECTRICAL SITE PLAN		REVISED UNDERGROUND ROUTING OF TEMPORARY GENERATOR FEEDERS FROM DOCKING STATION.
E100D	LEED ACCREDIDATION - LIGHT POLLUTION REDUCTION		REVISED FIXTURE NUMBER IN EXTERIOR LIGHTING SCHEDULE TO MATCH SPEC, RFI#79
E101A	ELECTRICAL POWER PLAN - FIRST FLOOR AREA A		ADDED FLOOR BOXES TO RAISED FLOOR IN IMAGINARIUM.
E101B	ELECTRICAL POWER PLAN - FIRST FLOOR AREA B		REVISED CONDUIT LAYOUT IN RATED ELECTRICAL SHAFT.
E101C	ELECTRICAL POWER PLAN - FIRST FLOOR AREA C		REVISED FLOOR BOX TYPE IN EVENT SPACE TO RAISED FLOOR TYPE.
E101C	ELECTRICAL POWER PLAN - FIRST FLOOR AREA C		ADDED 2 FLOOR BOXES IN PREFUNCTION SPACE.
E102B	ELECTRICAL POWER PLAN - SECOND FLOOR AREA B		REVISED CONDUIT LAYOUT IN RATED ELECTRICAL SHAFT.
E102C	ELECTRICAL POWER PLAN - SECOND FLOOR AREA C		REMOVED PANEL.
E103B	ELECTRICAL POWER PLAN - THIRD FLOOR AREA B		REVISED CONDUIT LAYOUT IN RATED ELECTRICAL SHAFT.
E103C	ELECTRICAL POWER PLAN - THIRD FLOOR AREA C		REMOVED PANEL.
E104B	ELECTRICAL POWER PLAN - FOURTH FLOOR AREA B		REVISED CONDUIT LAYOUT IN RATED ELECTRICAL SHAFT.
E104C	ELECTRICAL POWER PLAN - FOURTH FLOOR AREA C		REMOVED PANEL.
E105A	ELECTRICAL POWER PLAN - PENTHOUSE AREA A		ADDED MOTOR OPERATED DAMPERS TO DOAS
E105B	ELECTRICAL POWER PLAN - PENTHOUSE AREA B		ADDED MOTOR OPERATED DAMPERS TO DOAS; INDICATED MTS LOCATION ON PLAN
E306	ELECTRICAL PANEL SCHEDULES		ADDED CIRCUITS FOR ADDED FLOOR BOXES IN IMAGINARIUM
10 FIRE ALARM			
FA102B	FIRE ALARM PLAN - SECOND FLOOR AREA B		ADDED AREA OF REFUGE LOCATION AT ELEVATOR LOBBY
FA103B	FIRE ALARM PLAN - THIRD FLOOR AREA B		ADDED AREA OF REFUGE LOCATION AT ELEVATOR LOBBY
FA104B	FIRE ALARM PLAN - FOURTH FLOOR AREA B		ADDED AREA OF REFUGE LOCATION AT ELEVATOR LOBBY
FA105B	FIRE ALARM PLAN - PENTHOUSE AREA B		ADDED AREA OF REFUGE LOCATION AT ELEVATOR LOBBY
11 PLUMBING			
P001	PLUMBING SYMBOLS AND ABBREVIATIONS		REVISED NOTE TO INCLUDE PRO-PRESS FITTINGS
P001	PLUMBING SYMBOLS AND ABBREVIATIONS		REVISED NOTE TO INCLUDE PVC FOR UNDERGROUND USE ONLY
P205	PLUMBING-PENTHOUSE LAB GAS & DOMESTIC WATER PLAN		
P401	DOMESTIC WATER RISER DIAGRAM		UPDATED DOMESTIC WATER RISER TO INCLUDE RETURN LINES
P402	DOMESTIC WATER RISER DIAGRAM		UPDATED DOMESTIC WATER RISER TO INCLUDE RETURN LINES
P403	DOMESTIC WATER RISER DIAGRAM		UPDATED DOMESTIC WATER RISER TO INCLUDE RETURN LINES
P404	PLUMBING SANITARY RISER DIAGRAM		UPDATED SANITARY RISER DIAGRAM -WATER CLOSET, FLOOR DRAIN AND HS
P405	PLUMBING SANITARY RISER DIAGRAM		UPDATED SANITARY RISER DIAGRAM -WATER CLOSET, FLOOR DRAIN AND HS
P410	LAB GAS RISER DIAGRAM		UPDATED LAB AIR SIZE
P415	RISER DIAGRAM - DISTILLED WATER		ADDED NEW DISTILLED WATER RISER DIAGRAM
13 AUDIO VISUAL			
TA-700	AUDIOVISUAL SYSTEM DIAGRAMS	3	REVISED SIGNAL LINE DIAGRAM TO REFLECT RFI RESPONSE
TA-701	AUDIOVISUAL SYSTEM DIAGRAMS	3	REVISED SIGNAL LINE DIAGRAM TO REFLECT RFI RESPONSE

Sheet Number	Sheet Name/View Name	Detail #(s)	Comments
TA-800	AUDIOVISUAL EQUIPMENT LIST	1+5	REVISED ROOM SUMMARY AND SEMINAR ROOMS TO MATCH RFI RESPONSE
TA-801	AUDIOVISUAL EQUIPMENT LIST	3	REVISED ADVANCED & INTRODUCTION TEACHING LAB TO MATCH RFI RESPONSE
14 TELECOM			
T-001	DRAWING INDEX & GENERAL NOTES	3	INDEX ADDED SHEETS T-700,T-701,T-702
T-004	SITE PLAN	3	ADD (2) 2" CONDUITS FOR UMM (DCO)
T-101	1ST FLOOR DATA PLAN	3	ADD (2) 2" CONDUITS FOR UMM (DCO)
T-102	2ND FLOOR DATA PLAN	3	ADD (2) 2" CONDUITS FOR UMM (DCO)
T-103	3RD FLOOR DATA PLAN	3	ADD (2) 2" CONDUITS FOR UMM (DCO)
T-104	4TH FLOOR DATA PLAN	3	ADD (2) 2" CONDUITS FOR UMM (DCO)
T-10P	PENTHOUSE DATA PLAN	3	ADD (2) 2" CONDUITS FOR UMM (DCO)
T-201	1ST FLOOR RCP	3	ADD (2) 2" CONDUITS FOR UMM (DCO)
T-300	CONDUIT & SLEEVES TELECOM RISER	3	ADD (2) 2" CONDUITS FOR UMM (DCO)
T-400	MDF & IDF LAYOUT & ELEVATIONS	3	ADD (2) 2" CONDUITS FOR UMM (DCO)
T-700	MODULAR EVENT SPACE PLAN	1	NEW SHEET MODULAR FLOOR
T-701	MODULAR IMAGINARIUM PLAN	1	NEW SHEET MODULAR FLOOR
T-702	MODULAR FLOOR DETAILS	1	NEW SHEET MODULAR FLOOR DETAILS

END OF DOCUMENT

DRAWINGS

NEW CONSTRUCTION OF

Interdisciplinary Science Building

1 Quad Road
Montclair, New Jersey

Prepared for

Montclair State University

Issued information

ADDENDUM #5

03/23/2026



HOK Architects, Inc.
Architecture, Lighting, Sustainability
5 Bryant Park
1065 Avenue of the Americas
New York, NY 10018

Langan Engineering & Environmental Services, LLC
Civil Engineers
300 Kimball Drive, 4th Floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape Architects
295 Newark Ave, 4th floor
Jersey City, NJ 07302

Office of Engineering & Construction Inspection Services, Inc.
Structural Engineers
485 Rt.1 South, Bldg E,
Suite 220 Iselin, NJ 08830

Concord Engineering
MEP-FP Engineers
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
Audio/Visual and Acoustics and Vibration
275 Madison Avenue,14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

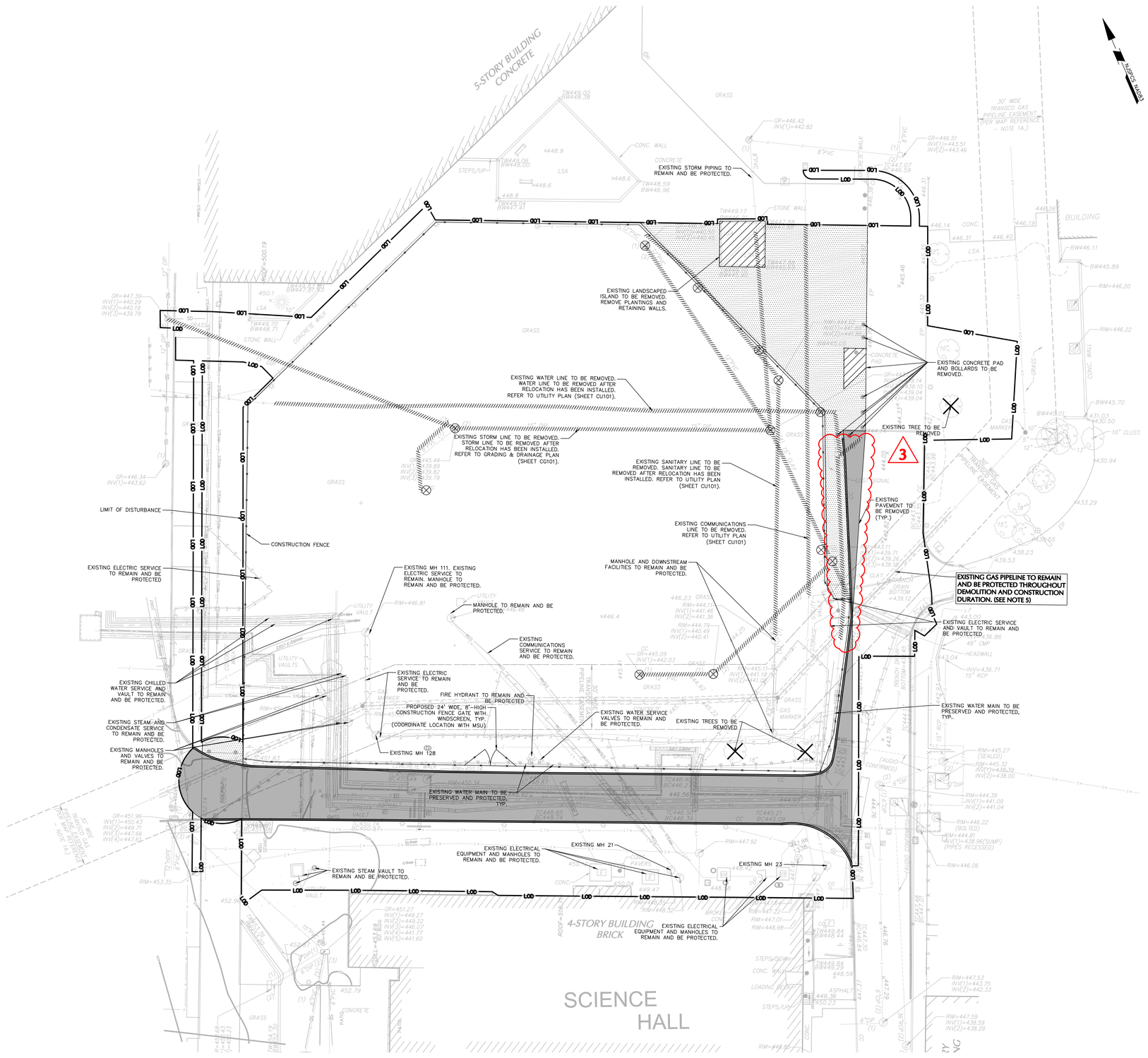
SHEET #	SHEET TITLE	Issued for CD 08/14/25	Issued for Bid 01/19/26	Addendum #5 03/23/2026
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G000	COVER SHEET	•	•	•
G001	DRAWING INDEX	•	•	•
G002	BUILDING RENDERINGS	•	•	
	01 GENERAL: 3			
	02 CIVIL			
CD101	DEMOLITION PLAN	•	•	•
CS101	SITE PLAN	•	•	•
CG101	GRADING & DRAINAGE PLAN	•	•	
ST101	DRAINAGE PLAN	•	•	
CU201	STORM PROFILES	•	•	•
CU101	UTILITY PLAN	•	•	•
CU201	STORM & SANITARY PROFILES	•	•	•
CE101	SOIL EROSION & SEDIMENT CONTROL PLAN	•	•	
CE501	SOIL EROSION & SEDIMENT CONTROL NOTES & DETAILS	•	•	
CS501	CONSTRUCTION DETAILS 1	•	•	•
CS502	CONSTRUCTION DETAILS 2	•	•	•
CS503	CONSTRUCTION DETAILS 3	•	•	•
CS504	CONSTRUCTION DETAILS 4	•	•	•
CS505	CONSTRUCTION DETAILS 5	•	•	•
	02 CIVIL: 14			
	03 LANDSCAPE			
L000	COVER SHEET	•	•	
L001	LANDSCAPE MATERIALS SCHEDULE	•	•	
L100	OVERALL LANDSCAPE KEY PLAN	•	•	
L101	MATERIALS PLAN	•	•	
L102	FURNISHING PLAN	•	•	
L103	LIGHTING PLAN	•	•	
L104	UTILITIES PLAN	•	•	
L105A	PLANTING PLAN	•	•	
L105B	PLANTING PLAN	•	•	
L106	DIMENSIONING PLAN	•	•	
L200	SITE DETAILS	•	•	
L201	SITE DETAILS	•	•	•
L202	SITE DETAILS	•	•	
L203	SITE DETAILS	•	•	
L300	PLANTING DETAILS & NOTES	•	•	
L400	LEED ACCREDITATION - OPEN SPACE	•	•	
L401	LEED ACCREDITATION - PROTECT OR RESTORE HABITAT	•	•	
L402	LEED ACCREDITATION - OUTDOOR WATER USE REDUCTION	•	•	
L403	LEED ACCREDITATION - HEAT ISLAND REDUCTION	•	•	
L404	LEED ACCREDITATION - LIGHT POLLUTION REDUCTION		•	
LI100	IRRIGATION PLANS	•	•	
LI101	IRRIGATION DETAILS	•	•	
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	04 STRUCTURE			
FO001	FOUNDATION NOTES -SHEET NO. 1	•	•	
FO100	FOUNDATION PLAN	•	•	•
FO101	FOUNDATION PLAN - BRIDGE	•	•	
FO200	TYPICAL FOUNDATION DETAILS - SHEET NO. 1	•	•	
FO201	TYPICAL FOUNDATION DETAILS - SHEET NO. 2	•	•	
FO202	TYPICAL FOUNDATION DETAILS - SHEET NO. 3	•	•	
FO203	TYPICAL FOUNDATION DETAILS - SHEET NO. 4	•	•	
FO204	FOUNDATION TABLES & SCHEDULES	•	•	•
FO205	SITE SECTIONS	•	•	
FO206	FOUNDATION SECTIONS	•	•	
FO300	FOUNDATION SECTIONS - SHEET NO. 1	•	•	•
FO301	FOUNDATION SECTIONS - BRIDGE	•	•	
S001	GENERAL NOTES -SHEET NO. 1	•	•	
S002	GENERAL NOTES -SHEET NO. 2	•	•	•
S003	SNOW DIAGRAMS		•	
S101	FRAMING PLAN - BRIDGE	•	•	
S102	SECOND FLOOR FRAMING PLAN	•	•	
S103	THIRD FLOOR FRAMING PLAN	•	•	
S104	FOURTH FLOOR FRAMING PLAN	•	•	
S105	PENTHOUSE FRAMING PLAN	•	•	•
S106	LOWER ROOF FRAMING PLAN	•	•	
S107	UPPER ROOF & EMR FRAMING PLANS	•	•	•
S201	GROUND FLOOR SLAB EDGE PLAN	•	•	•
S202	SECOND FLOOR SLAB EDGE PLAN	•	•	
S203	THIRD FLOOR SLAB EDGE PLAN	•	•	
S204	FOURTH FLOOR SLAB EDGE PLAN	•	•	
S205	PENTHOUSE FLOOR SLAB EDGE PLAN	•	•	
S206	LOW ROOF SLAB EDGE PLAN	•	•	
S207	UPPER ROOF & EMR SLAB EDGE PLAN	•	•	
S300	ELEVATIONS		•	
S400	TRUSS ELEVATIONS	•	•	
S401	TYPICAL TRUSS CONNECTION DETAILS SHEET NO.1	•	•	
S500	COLUMN SCHEDULE	•	•	
S501	TYPICAL COLUMN DETAILS	•	•	
S600	TYPICAL SUPERSTRUCTURE DETAILS - SHEET NO. 1	•	•	
S601	TYPICAL SUPERSTRUCTURE DETAILS - SHEET NO. 2	•	•	
S602	TYPICAL SUPERSTRUCTURE DETAILS - SHEET NO. 3	•	•	
S603	TYPICAL SUPERSTRUCTURE DETAILS - SHEET NO. 4	•	•	
S700	SUPERSTRUCTURE SECTIONS - SHEET NO. 1	•	•	•
S701	SUPERSTRUCTURE SECTIONS - SHEET NO. 2	•	•	•
S702	SUPERSTRUCTURE SECTIONS - SHEET NO. 3	•	•	•
S703	SUPERSTRUCTURE SECTIONS - SHEET NO. 4	•	•	
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A002	TYPICAL DEVICE MOUNTING DIAGRAMS	•	•	
A003	ICC A117.1-2017 ACCESSIBILITY DIAGRAMS FOR RESTROOMS	•	•	
A004	CODE ANALYSIS	•	•	
A005	CODE ANALYSIS - OCCUPANCY	•	•	
A006	CODE ANALYSIS - LABORATORY SUITES	•	•	
A011	LIFE SAFETY PLAN - LEVEL 01	•	•	
A012	LIFE SAFETY PLAN - LEVEL 02	•	•	
A013	LIFE SAFETY PLAN - LEVEL 03	•	•	
A014	LIFE SAFETY PLAN - LEVEL 04	•	•	
A015	LIFE SAFETY PLAN - LEVEL PENTHOUSE	•	•	
A016	LIFE SAFETY PLAN - LEVEL ROOF	•	•	
A021	FIRE PROTECTION PLANS - L1-L4	•	•	
A022	FIRE PROTECTION PLANS - PENTHOUSE AND ROOF	•	•	•
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A101	FLOOR PLAN - LEVEL 01	•	•	•
A101D	DIMENSION PLAN - LEVEL 01	•	•	•
A102	FLOOR PLAN - LEVEL 02	•	•	
A102D	DIMENSION PLAN - LEVEL 02	•	•	
A103	FLOOR PLAN - LEVEL 03	•	•	•
A103D	DIMENSION PLAN - LEVEL 03	•	•	
A104	FLOOR PLAN - LEVEL 04	•	•	
A104D	DIMENSION PLAN - LEVEL 04	•	•	
A105	FLOOR PLAN - PENTHOUSE	•	•	
A105D	DIMENSION PLAN - LEVEL PENTHOUSE	•	•	
A106	FLOOR PLAN - LEVEL ROOF	•	•	
A106D	DIMENSION PLAN - LEVEL ROOF	•	•	
A151	POWER DATA PLAN - LEVEL 1	•	•	•
A152	POWER DATA PLAN - LEVEL 2	•	•	
A153	POWER DATA PLAN - LEVEL 3	•	•	
A154	POWER DATA PLAN - LEVEL 4	•	•	
A155	POWER DATA PLAN - PENTHOUSE	•	•	
A201	REFLECTED CEILING PLAN - LEVEL 01	•	•	•
A201B	CEILING PLAN - LEVEL 1 - AREA B	•	•	
A201C	CEILING PLAN - LEVEL 1 - AREA C	•	•	
A202	REFLECTED CEILING PLAN - LEVEL 02	•	•	•
A203	REFLECTED CEILING PLAN - LEVEL 03	•	•	•
A204	REFLECTED CEILING PLAN - LEVEL 04	•	•	
A205	REFLECTED CEILING PLAN - LEVEL PENTHOUSE	•	•	•
A300.1	BUILDING 3D VIEWS - SOUTHWEST	•	•	
A300.2	BUILDING 3D VIEWS - NORTHEAST	•	•	
A301	EXTERIOR ELEVATIONS - SOUTH	•	•	
A302	EXTERIOR ELEVATIONS - WEST	•	•	•
A303	EXTERIOR ELEVATIONS - NORTH	•	•	•
A304	EXTERIOR ELEVATIONS - EAST	•	•	
A305	PARTIAL ELEVATIONS	•	•	
A306	PARTIAL ELEVATIONS	•	•	
A311	PARTIAL ELEVATIONS - EWS-01 PANEL DIAGRAMS	•	•	
A350	BUILDING SECTIONS - E/W	•	•	
A351	BUILDING SECTIONS - N/S	•	•	
A352	EXTERIOR WALL SECTIONS - SOUTH	•	•	
A353	EXTERIOR WALL SECTIONS - WEST	•	•	
A354	EXTERIOR WALL SECTIONS - NORTH	•	•	
A355	EXTERIOR WALL SECTIONS - EAST & SOUTH BAR	•	•	
A400	ACCESSORY AND EQUIPMENT SCHEDULES	•	•	
A401	ENLARGED VIEWS - MAIN ENTRANCE WEST	•	•	
A402	ENLARGED VIEWS - ENTRANCE NORTH	•	•	•
A403	ENLARGED VIEWS - LOADING DOCK	•	•	
A410	ENLARGED PLANS - ELEVATORS	•	•	
A411	ENLARGED SECTIONS - ELEVATORS	•	•	
A412	ELEVATOR CAB PLANS & ELEVATIONS	•	•	
A420	TYPICAL ELEVATOR DETAILS	•	•	
A421	TYPICAL ELEVATOR DETAILS	•	•	
A422	TYPICAL ELEVATOR DETAILS	•	•	
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A431	ENLARGED SECTIONS - STAIR 1	•	•	
A432	ENLARGED PLANS - STAIR 2	•	•	
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A445	EXIT STAIR DETAILS - STAIR 1	•	•	
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A448	RAILING DETAILS - HORIZONTAL PIPE	•	•	
A449	RAILING DETAILS - WALL MOUNTED	•	•	
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A452	ALL GENDER RESTROOM AND LACTATION ROOM	•	•	
A453	ENLARGED VIEWS - L2-4 GROUP RESTROOMS	•	•	
A500	EXTERIOR MATERIAL SCHEDULE	•	•	•
A501	EXTERIOR WALL DRAWINGS - EWS-01 TYP. BAY	•	•	
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A503	EXTERIOR WALL DRAWING - EWS-03 TYP. BAY	•	•	
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A540	EXTERIOR DRAWINGS - ENTRANCE CANOPY 3D VIEWS	•	•	
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A542	ENLARGED EXTERIOR DRAWINGS - MAIN ENTRANCE CANOPY RCP	•	•	
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A614	EXTERIOR WALL TYPE EWS-02/03 EXTERIOR PLAN DETAIL	•	•	
A616	EXTERIOR WALL TYPE EWS-04 EXTERIOR PLAN DETAIL	•	•	
A617	EXTERIOR WALL TYPE EWS-05 EXTERIOR PLAN DETAIL	•	•	
A618	EXTERIOR WALL TYPE EWS-06 EXTERIOR PLAN DETAIL	•	•	
A621	EXTERIOR WALL TYPE EWS-01 EXTERIOR SECTION DETAILS	•	•	
A622	EXTERIOR WALL TYPE EWS-01 EXTERIOR SECTION DETAILS	•	•	
A623	EXTERIOR WALL TYPE EWS-02/03 EXTERIOR SECTION DETAILS	•	•	
A624	EXTERIOR WALL TYPE EWS-02/03 EXTERIOR SECTION DETAILS	•	•	•
A626	EXTERIOR WALL TYPE EWS-04 EXTERIOR SECTION DETAILS	•	•	
A627	EXTERIOR WALL TYPE EWS-05 EXTERIOR SECTION DETAILS	•	•	
A628	EXTERIOR WALL TYPE EWS-06 EXTERIOR SECTION DETAILS	•	•	
A631	EXTERIOR WALL TYPE EWS-01 PARAPET	•	•	
A632	EXTERIOR WALL TYPE EWS-02/03 PARAPET	•	•	
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A670	EXTERIOR DETAILS - EWS TRANSTITIONS	•	•	
A680	EXTERIOR DOOR AND FRAME DETAILS	•	•	
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A913-02	TYP DETAILS - COMPOSITE INTR GWB PTN HEADS	•	•	
A913-05	TYP DETAILS - GWB SHAFTWALL HEADS	•	•	
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A914-01	TYP DETAILS - INTERIOR GWB PTN TERMINATIONS	•	•	
A914-02	TYP DETAILS - INTERIOR GWB FIRE-RATED PTN TERMINATIONS	•	•	
A914-03	TYP DETAILS - INTERIOR GWB PTN CONTROL JOINTS AND MISC CONDITIONS	•	•	
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A917-01	TYP DETAILS - INTERIOR COMPOSITE CMU PTN HEADS	•	•	
A917-02	TYP DETAILS - INTERIOR COMPOSITE CMU PTN HEADS	•	•	
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A920	INTERIOR WALL BASE DETAILS	•	•	•
A921	INTERIOR WALL FINISH DETAILS	•	•	
A922	INTERIOR WALL FINISH DETAILS	•	•	
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A927	INTERIOR PARTITION CURB DETAILS	•	•	•
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A932	TYP. CEILING DETAILS	•	•	
A933	PRE-FUNCTION CEILING DETAILS	•	•	
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A940	MILLWORK TYP. DETAILS	•	•	
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A943	INTERIOR MILLWORK DETAILS - LOUNGE	•	•	
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A950	TOILET ROOM DETAILS	•	•	
A951	PRESERVED GREENWALL DETAILS	•	•	
A952	MANUAL OPERABLE PARTITION DETAILS	•	•	
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	06 INTERIORS			
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I002	FINISH LEGEND	•	•	•
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QL101B	LABORATORY CASEWORK & EQUIPMENT PLAN - LEVEL 1 PART B	•	•	
QL102A	LABORATORY CASEWORK & EQUIPMENT PLAN - LEVEL 2 PART A	•	•	
QL102B	LABORATORY CASEWORK & EQUIPMENT PLAN - LEVEL 2 PART B	•	•	
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QL103A	LABORATORY CASEWORK & EQUIPMENT PLAN - LEVEL 3 PART A	•	•	
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M005	MECHANICAL 3RD FLOOR AIR BALANCE PLAN	•	•	
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M101A	MECHANICAL -LEVEL 1 DUCTWORK PLAN -AREA A	•	•	
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M104B	MECHANICAL -LEVEL 4 DUCTWORK PLAN -AREA B	•	•	
M104C	MECHANICAL -LEVEL 4 DUCTWORK PLAN -AREA C	•	•	
M105	MECHANICAL -PENTHOUSE PLAN	•	•	
M105A	MECHANICAL -PENTHOUSE PLAN -AREA A	•	•	•
M105B	MECHANICAL -PENTHOUSE PLAN -AREA B	•	•	•
M106	MECHANICAL -ROOF PLAN	•	•	•
M201	MECHANICAL -LEVEL 1 PIPING OVERALL PLAN	•	•	
M201A	MECHANICAL -LEVEL 1 PIPING PLAN -AREA A	•	•	
M201B	MECHANICAL -LEVEL 1 PIPING PLAN -AREA B	•	•	•
M201C	MECHANICAL -LEVEL 1 PIPING PLAN -AREA C	•	•	
M202	MECHANICAL -LEVEL 2 PIPING OVERALL PLAN	•	•	
M202A	MECHANICAL -LEVEL 2 PIPING PLAN -AREA A	•	•	
M202B	MECHANICAL -LEVEL 2 PIPING PLAN -AREA B	•	•	
M202C	MECHANICAL -LEVEL 2 PIPING PLAN -AREA C	•	•	
M203	MECHANICAL -LEVEL 3 PIPING OVERALL PLAN	•	•	
M203A	MECHANICAL -LEVEL 3 PIPING PLAN -AREA A	•	•	
M203B	MECHANICAL -LEVEL 3 PIPING PLAN -AREA B	•	•	
M203C	MECHANICAL -LEVEL 3 PIPING PLAN -AREA C	•	•	
M204	MECHANICAL -LEVEL 4 PIPING OVERALL PLAN	•	•	
M204A	MECHANICAL -LEVEL 4 PIPING PLAN -AREA A	•	•	
M204B	MECHANICAL -LEVEL 4 PIPING PLAN -AREA B	•	•	
M204C	MECHANICAL -LEVEL 4 PIPING PLAN -AREA C	•	•	
M205	MECHANICAL -PENTHOUSE -PIPING OVERALL PLAN	•	•	
M205A	MECHANICAL -PENTHOUSE PIPING PLAN -AREA A	•	•	•
M205B	MECHANICAL -PENTHOUSE PIPING PLAN -AREA B	•	•	•
M301	MECHANICAL - ENLARGED PLANS	•	•	•
M302	MECHANICAL - ENLARGED PLANS			•
M401	MECHANICAL -CHILLED WATER FLOW DIAGRAM	•	•	•
M402	MECHANICAL -STEAM FLOW DIAGRAM	•	•	
M403	MECHANICAL -HOT WATER FLOW DIAGRAM	•	•	•
M404	MECHANICAL -AIR FLOW DIAGRAM	•	•	
M501	MECHANICAL DETAILS	•	•	
M502	MECHANICAL DETAILS	•	•	
M503	MECHANICAL DETAILS	•	•	
M504	MECHANICAL DETAILS	•	•	•
M505	MECHANICAL DETAILS	•	•	
M506	MECHANICAL DETAILS	•	•	
M601	MECHANICAL SCHEDULES	•	•	•
M602	MECHANICAL SCHEDULES	•	•	•
M603	MECHANICAL SCHEDULES	•	•	
M604	MECHANICAL SCHEDULES	•	•	
M605	MECHANICAL SCHEDULES	•	•	•
M606	MECHANICAL SCHEDULES	•	•	
M607	MECHANICAL SCHEDULES	•	•	•
M608	MECHANICAL SCHEDULES	•	•	
M701	MECHANICAL CONTROL DIAGRAMS	•	•	
M702	MECHANICAL CONTROL DIAGRAMS	•	•	
M703	MECHANICAL CONTROL DIAGRAMS	•	•	
M704	MECHANICAL CONTROL DIAGRAMS	•	•	
M705	MECHANICAL CONTROL DIAGRAMS	•	•	
M706	MECHANICAL CONTROL DIAGRAMS	•	•	
M707	MECHANICAL CONTROL DIAGRAMS	•	•	
M708	MECHANICAL CONTROL DIAGRAMS	•	•	
M709	MECHANICAL CONTROL DIAGRAMS	•	•	
M710	MECHANICAL CONTROL DIAGRAMS	•	•	
	08 MECHANICAL: 74			
	09 ELECTRICAL			
E-001	ELECTRICAL LEAD SHEET	•	•	•
E-002	ELECTRICAL - NORMAL POWER ONE-LINE DIAGRAM	•	•	•
E-003	ELECTRICAL -EMERGENCY ONE-LINE DIAGRAM	•	•	•
E-004	ELECTRICAL DETAILS	•	•	
E-005	ELECTRICAL DETAILS	•	•	
E-006	ELECTRICAL DETAILS	•	•	
E-007	ELECTRICAL GROUNDING DETAILS	•	•	
E-100A	GROUNDING PLAN	•	•	
E-100B	ELECTRICAL SITE PLAN	•	•	•
E-100C	SITE LIGHTING PLAN	•	•	
E-100D	LIGHTING PROTECTION PLAN	•	•	
E-100E	LIGHTNING PROTECTION PLAN	•	•	
E-101	ELECTRICAL POWER PLAN - OVERALL FIRST FLOOR	•	•	
E-101A	ELECTRICAL POWER PLAN - FIRST FLOOR AREA A	•	•	•
E-101B	ELECTRICAL POWER PLAN - FIRST FLOOR AREA B	•	•	•
E-101C	ELECTRICAL POWER PLAN - FIRST FLOOR AREA C	•	•	•
E-102	ELECTRICAL POWER PLAN - OVERALL SECOND FLOOR	•	•	
E-102A	ELECTRICAL POWER PLAN - SECOND FLOOR AREA A	•	•	
E-102B	ELECTRICAL POWER PLAN - SECOND FLOOR AREA B	•	•	•
E-102C	ELECTRICAL POWER PLAN - SECOND FLOOR AREA C	•	•	•
E-103	ELECTRICAL POWER PLAN - OVERALL THIRD FLOOR	•	•	
E-103A	ELECTRICAL POWER PLAN - THIRD FLOOR AREA A	•	•	
E-103B	ELECTRICAL POWER PLAN - THIRD FLOOR AREA B	•	•	•
E-103C	ELECTRICAL POWER PLAN - THIRD FLOOR AREA C	•	•	•
E-104	ELECTRICAL POWER PLAN - OVERALL FOURTH FLOOR	•	•	
E-104A	ELECTRICAL POWER PLAN - FOURTH FLOOR AREA A	•	•	
E-104B	ELECTRICAL POWER PLAN - FOURTH FLOOR AREA B	•	•	•
E-104C	ELECTRICAL POWER PLAN - FOURTH FLOOR AREA C	•	•	•
E-105	ELECTRICAL POWER PLAN - OVERALL PENTHOUSE	•	•	
E-105A	ELECTRICAL POWER PLAN - PENTHOUSE AREA A	•	•	•
E-105B	ELECTRICAL POWER PLAN - PENTHOUSE AREA B	•	•	•
E-105C	ELECTRICAL POWER PLAN - PENTHOUSE AREA C	•	•	
E-106	ELECTRICAL POWER PLAN - OVERALL ROOF PLAN	•	•	
E-106A	ELECTRICAL POWER PLAN - ROOF AREA A	•	•	
E-106B	ELECTRICAL POWER PLAN - ROOF AREA B	•	•	
E-106D	LIGHTING PLAN - PENTHOUSE AREA C	•	•	
E-200A	LIGHTING SCHEDULE	•	•	
E-200B	LIGHTING CONTROL DETAILS	•	•	
E-200C	LIGHTING CONTROL DETAILS	•	•	
E-200D	LIGHTING CONTROL DETAILS	•	•	
E-201	LIGHTING PLAN -OVERALL FIRST FLOOR PLAN	•	•	
E-201A	LIGHTING PLAN - FIRST FLOOR AREA A	•	•	
E-201B	LIGHTING PLAN - FIRST FLOOR AREA B	•	•	
E-201C	LIGHTING PLAN - FIRST FLOOR AREA C	•	•	

SHEET #	SHEET TITLE	Issued for CD 08/14/25	Issued for Bid 01/19/26	Addendum #5 03/23/2026
E-202	LIGHTING PLAN -OVERALL SECOND FLOOR PLAN	•	•	
E-202A	LIGHTING PLAN -SECOND FLOOR AREA A	•	•	
E-202B	LIGHTING PLAN -SECOND FLOOR AREA B	•	•	
E-202C	LIGHTING PLAN -SECOND FLOOR AREA C	•	•	
E-203	LIGHTING PLAN -OVERALL THIRD FLOOR PLAN	•	•	
E-203A	LIGHTING PLAN - THIRD FLOOR AREA A	•	•	
E-203B	LIGHTING PLAN - THIRD FLOOR AREA B	•	•	
E-203C	LIGHTING PLAN - THIRD FLOOR AREA C	•	•	
E-204	LIGHTING PLAN -OVERALL FOURTH FLOOR PLAN	•	•	
E-204A	LIGHTING PLAN -FOURTH FLOOR AREA A	•	•	
E-204B	LIGHTING PLAN -FOURTH FLOOR AREA B	•	•	
E-204C	LIGHTING PLAN -FOURTH FLOOR AREA C	•	•	
E-205	LIGHTING PLAN -OVERALL PENTHOUSE PLAN	•	•	
E-205A	LIGHTING PLAN -PENTHOUSE AREA A	•	•	
E-205B	LIGHTING PLAN -PENTHOUSE AREA B	•	•	
E-206	LIGHTING ELEVATIONS	•	•	
E-300	ELECTRICAL PANEL SCHEDULES	•	•	
E-301	ELECTRICAL PANEL SCHEDULES	•	•	
E-302	ELECTRICAL PANEL SCHEDULES	•	•	
E-303	ELECTRICAL PANEL SCHEDULES	•	•	
E-304



THE CONTRACTOR SHALL DEMOLISH AND REMOVE ALL SITE ELEMENTS UNDER THIS CONTRACT INCLUDING, BUT NOT LIMITED TO CONCRETE WALLS, BOLLARDS, STAIRWAYS, RAILS, CONCRETE PADS, ETC. WITHIN THE CONTRACT LIMITS UNLESS OTHERWISE SHOWN TO REMAIN.

NOTES

1. BOUNDARY AND TOPOGRAPHIC INFORMATION OBTAINED DRAFT SURVEY PREPARED BY LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, LLC.
2. EXISTING UTILITY INFORMATION OBTAINED FROM AS-BUILT SURVEY ENTITLED "DCO/MONTCLAIR STATE UNIVERSITY CAMPUS CEC/CHCP PROJECT, MONTCLAIR/LITTLE FALLS, NEW JERSEY, CEC/CHCP AS-BUILT," DATED JANUARY 10, 2013, LAST REVISED JUNE 18, 2013.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL LABOR, MATERIALS, EQUIPMENT, SUPERVISION, COORDINATION EFFORTS, PERMITTING COSTS, CERTIFICATE COSTS, SERVICES, FILING FEES, TESTING COSTS, SECURITY, INSURANCE AND ALL OTHER ASSOCIATED OR RELATED ITEMS REQUIRED TO COMPLETE THE SCOPE OF WORK DESCRIBED IN THIS SECTION.
4. MONTCLAIR STATE UNIVERSITY HAS INSTALLED A TEMPORARY EIGHT-FOOT HIGH CHAIN-LINK FENCE WITH ENTRANCE GATES. REQUIRED TO PROPERLY AND SAFELY SECURE THE DEMOLITION AND CONSTRUCTION OPERATIONS IN ACCORDANCE WITH LOCAL AND STATE REQUIREMENTS. CONTRACTOR TO MAINTAIN AND RELOCATE FENCE AS NEEDED IN COORDINATION WITH MSU.
5. NOTIFY TRANSCO GAS PRIOR TO DISTURBING AREAS LOCATED WITHIN THE 30-FT WIDE TRANSCO GAS PIPELINE EASEMENT. THE EXISTING GAS PIPELINE IS TO REMAIN AND BE PROTECTED.
6. INSTALL AND MAINTAIN ROADWAY CONSTRUCTION SIGNAGE AND ASSOCIATED TRAFFIC MEASURES.
7. INSTALL AND MAINTAIN SOIL EROSION AND SEDIMENT CONTROL MEASURES. THE CONTRACTOR IS RESPONSIBLE FOR CLEANING THE ADJACENT ROADWAYS DUE TO DEMOLITION RELATED DEBRIS, DUST AND SEDIMENT AS NECESSARY OR AS DIRECTED BY THE OWNER OR OWNER'S ENGINEER.
8. IMPLEMENT ALL SAFETY MEASURES AND ANY OTHER MEASURES DEEMED NECESSARY OR REQUIRED BY GOVERNING AUTHORITIES TO PROTECT FROM HARM OR DAMAGE ADJACENT AND ON-SITE PERSONS, PROPERTY, BUILDINGS, HOMES, BUSINESSES, FACILITIES AND UTILITIES.
9. DISCONNECT AND CAP/TERMINATE ALL BUILDING SERVICES, E.G. WATER, SEWER, GAS, ELECTRIC, TELEPHONE, ETC., IN ACCORDANCE WITH ALL LOCAL REGULATIONS AND UTILITY SERVICE COMPANY REQUIREMENTS. WHERE NECESSARY, THE WORK SHALL INCLUDE THE RESTORATION OF PAVEMENT AND CURBING IMPACTED BY UTILITY REMOVAL AND DEMOLITION WORK. ALL EXISTING UTILITIES SHALL BE FIELD-VERIFIED AND ANY DISCREPANCIES SHALL BE REPORTED TO THE OWNER AND OWNER'S ENGINEER.
10. OBTAIN AND PAY FOR TEMPORARY UTILITY (WATER, ELECTRIC, TELEPHONE) AND OTHER SERVICES NECESSARY FOR PROPER EXECUTION OF THE DEMOLITION WORK.
11. REMOVE AND LEGALLY DISPOSE OF OFF-SITE HAZARDOUS MATERIALS (LIGHTING/TRANSFORMER BALLASTS, FLUORESCENT LIGHTS, ETC.) FROM THE BUILDINGS TO BE DEMOLISHED.
12. REMOVE AND DISPOSE OF OFF-SITE ALL EXISTING SITE FEATURES, INCLUDING BUT NOT LIMITED TO ALL FENCING, GATES, WALLS, STAIRWAYS, RAILINGS, AND FREE-STANDING ITEMS (E.G. BOLLARDS, SIGNS, SIGN POSTS, WALLS, CANOPIES, ETC.) WITHIN SITE AREAS.
13. COMPLETELY DEMOLISH AND RECYCLE OFFSITE, TO THE GREATEST EXTENT POSSIBLE, ALL UNCONTAMINATED CONCRETE/MASONRY DEBRIS GENERATED FROM THE WALKWAYS/PADS.
14. DEMOLISH AND COMPLETELY REMOVE ALL UTILITIES INCLUDING STORM SEWER LINES, TELEPHONE, ELECTRIC, GAS, DOMESTIC WATER SERVICE AND SANITARY SEWER LINES AND APPURTENANCES INCLUDING BUT NOT LIMITED TO PITS, SANITARY MANHOLES, PIPING, ETC., EXCEPT THOSE INDICATED TO REMAIN ON THE CONTRACT DRAWINGS.
15. DEMOLISH AND REMOVE ALL UNDERGROUND OBSTRUCTIONS INDICATED ON THE CONTRACT AND REFERENCE DRAWINGS.
16. SECURE THE WORK SITE FOR THE DURATION OF THE PROJECT ON AN AROUND-THE-CLOCK BASIS TO PREVENT UNAUTHORIZED ENTRY INTO THE SITE.
17. PROVIDE THE REQUIRED INSPECTION, TESTING AND PROGRESS REPORTS TO THE OWNER.

DEMOLITION LEGEND

- EXISTING CONCRETE TO BE REMOVED
- EXISTING UTILITY LINE TO BE REMOVED
- EXISTING WALL/LANDSCAPED ISLANDS TO BE DEMOLISHED
- EXISTING PAVEMENT TO BE REMOVED
- PROPOSED UTILITY STRUCTURE TO BE DEMOLISHED
- EXISTING CONCRETE CURB TO BE DEMOLISHED
- LOD — LIMIT OF DISTURBANCE
- PHASING LIMIT
- CONSTRUCTION FENCING

20 0 5 10 20
SCALE: 1 INCH = 20 FEET

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building
1 Quad Road
Montclair, NJ 07043

Prepared For

Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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In Association with

Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan

Professional Seals

NOT FOR CONSTRUCTION

CHRISTOPHER M. CIRROTTI — DATE SIGNED
PROFESSIONAL ENGINEER
NJ Lic No. 24GE03853800

No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

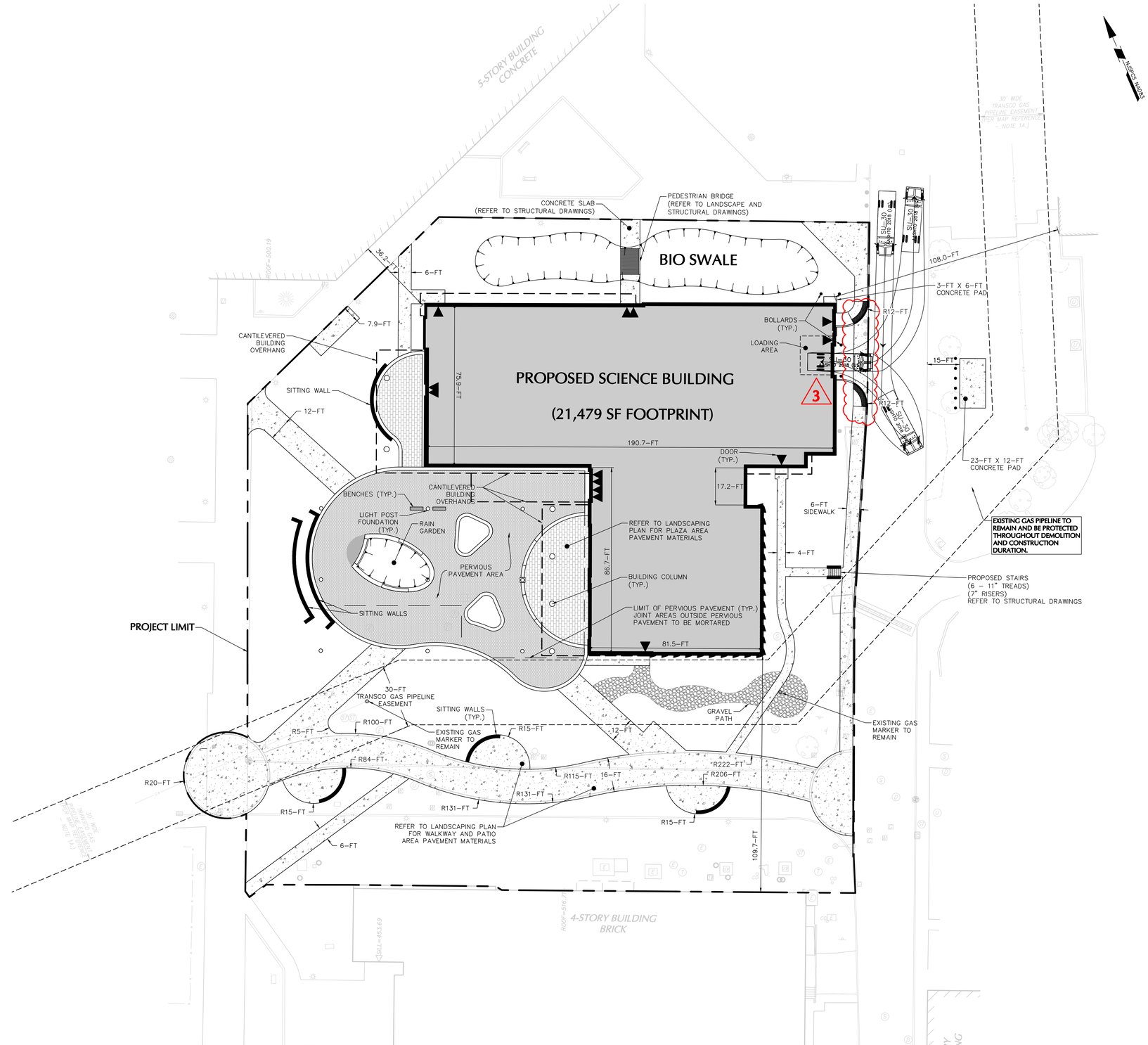
Project No: 100985401

Sheet Title

DEMOLITION PLAN

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Date 4/4/2025	Sheet Number
Drawn By SLA	CD101
Checked By PGM	



NOTES

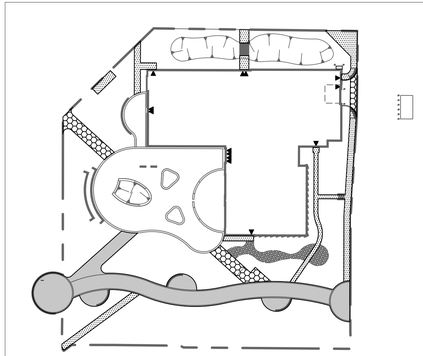
1. BOUNDARY AND TOPOGRAPHIC INFORMATION OBTAINED DRAFT SURVEY PREPARED BY LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, LLC.
2. EXISTING UTILITY INFORMATION OBTAINED FROM AS-BUILT SURVEY ENTITLED "DCO/MONTCLAIR STATE UNIVERSITY CAMPUS CEC/CHCP PROJECT, MONTLAIR/LITTLE FALLS, NEW JERSEY, CEC/CHCP AS-BUILT," DATED JANUARY 10, 2013, LAST REVISED JUNE 18, 2013.
3. CONTRACTOR SHALL PROTECT ANY EXISTING UTILITIES TO REMAIN DURING SITE CONSTRUCTION.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLIANCE WITH ALL LOCAL, STATE, AND FEDERAL PERMIT CONDITIONS REQUIRED.
5. ALL DEBRIS FROM SITE CONSTRUCTION SHALL BE REMOVED IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL REGULATIONS.
6. THE CONTRACTOR SHALL ACCEPT THE SITE AS IS. THE CONTRACTOR SHALL MAKE A THOROUGH SITE INSPECTION IN ORDER TO FIELD CHECK EXISTING SITE CONDITIONS, CORRELATE CONDITIONS WITH THE DRAWINGS AND RESOLVE ANY POSSIBLE CONSTRUCTION CONFLICTS WITH THE OWNER AND OWNER'S ENGINEER PRIOR TO COMMENCEMENT OF WORK. ANY CONDITIONS THAT DIFFER FROM THE SURVEY SHOWN ON THE DRAWINGS THAT ARE NOT BROUGHT TO THE ATTENTION OF THE OWNER AND THE OWNER'S ENGINEER PRIOR TO THE START OF WORK SHALL NOT BE CONSIDERED GROUNDS FOR A CHANGE ORDER.
7. ALL CURBS TO BE 6 INCHES UNLESS OTHERWISE SPECIFIED.
8. WHERE NEW PAVEMENT IS PROPOSED ADJACENT TO EXISTING PAVEMENT, THE EXISTING PAVEMENT SHALL BE CUT ONE (1) FOOT FROM THE EDGE TO PROVIDE A NEAT LINE AGAINST WHICH TO PAVE.
9. ALL OPEN EXCAVATIONS SHALL CONFORM TO OSHA SAFETY STANDARD. TRENCH OPENING SHALL NOT REMAIN OVERNIGHT.
10. ALL CONCRETE SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 4,000 PSI, UNLESS OTHERWISE NOTED.
11. THE PROPOSED DEVELOPMENT HAS BEEN DESIGNED TO BE COMPLIANT WITH APPLICABLE ADA REGULATIONS. THE PROPOSED PEDESTRIAN CROSSWALKS ARE IN ACCORDANCE WITH ADA REGULATIONS AND SHALL NOT HAVE JOINTS THAT PROTRUDE GREATER THAN ½ INCH.
12. THE OWNER IS TO DESIGNATE AN OSHA-COMPETENT INDIVIDUAL TO BE RESPONSIBLE FOR CONSTRUCTION SITE SAFETY DURING THE COURSE OF THE CONSTRUCTION OF SITE IMPROVEMENT PURSUANT TO NJAC 5:23-2.21(E) OF THE NEW JERSEY CONSTRUCTION CODE AND CFR 1926.32(F).
13. CONTRACTOR SHALL BE RESPONSIBLE FOR ARRANGING A PRECONSTRUCTION MEETING WITH EACH OF THE UTILITY COMPANIES, INCLUDING THE OWNER, ARCHITECT, AND ENGINEERS TO ENSURE ALL PROJECT SPECIFIC REQUIREMENTS ARE MET. CONTRACTOR SHALL COORDINATE WITH THE UTILITY COMPANIES DURING CONSTRUCTION, INCLUSIVE OF ALL REQUIRED INSPECTIONS.
14. EXCAVATED ROCK DURING THE BUILDING CONSTRUCTION TO BE SALVAGED AND USED AS LANDSCAPE FEATURES. TO BE COORDINATED WITH THE OWNER AND LANDSCAPE ARCHITECT.
15. WITHIN THE PLAZA AREA, JOINTS OUTSIDE THE PERVIOUS PAVEMENT AREAS SHALL BE MORTARED. THE PAVER AND JOINT TYPE SHALL BE COORDINATED WITH THE LANDSCAPE DRAWINGS.
16. REFER TO PRELIMINARY GEOTECHNICAL ENGINEERING STUDY REPORT BY LANGAN, DATED 14 MARCH 2025 FOR INFORMATION ON SUBSURFACE CONDITIONS.
17. NOTIFY TRANSCO GAS PRIOR TO DISTURBING AREAS LOCATED WITHIN THE 30-FT WIDE TRANSCO GAS PIPELINE EASEMENT. THE EXISTING GAS PIPELINE IS TO REMAIN AND BE PROTECTED.

SITE PLAN LEGEND

- CONCRETE SIDEWALK
- PAVERS/PERMEABLE PAVERS (REFER TO LANDSCAPE DRAWINGS)
- PORCELAIN PAVERS (REFER TO LANDSCAPE DRAWINGS)
- PROPOSED BUILDING
- DOOR
- CONCRETE CURB
- DEPRESSED CURB

PAVEMENT PLAN LEGEND

- 6-IN CONCRETE PAVEMENT
- 6-IN CONCRETE PAVEMENT WITH BORDER (REFER TO LANDSCAPE DRAWINGS)
- 4-IN CONCRETE PAVEMENT



PAVEMENT PLAN

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building
1 Quad Road
Montclair, NJ 07043

Prepared For

Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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In Association with

Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
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Key Plan

Professional Seals

NOT FOR CONSTRUCTION

CHRISTOPHER M. CIRROTTI — DATE SIGNED
PROFESSIONAL ENGINEER
NJ Lic. No. 24GE03853800

No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

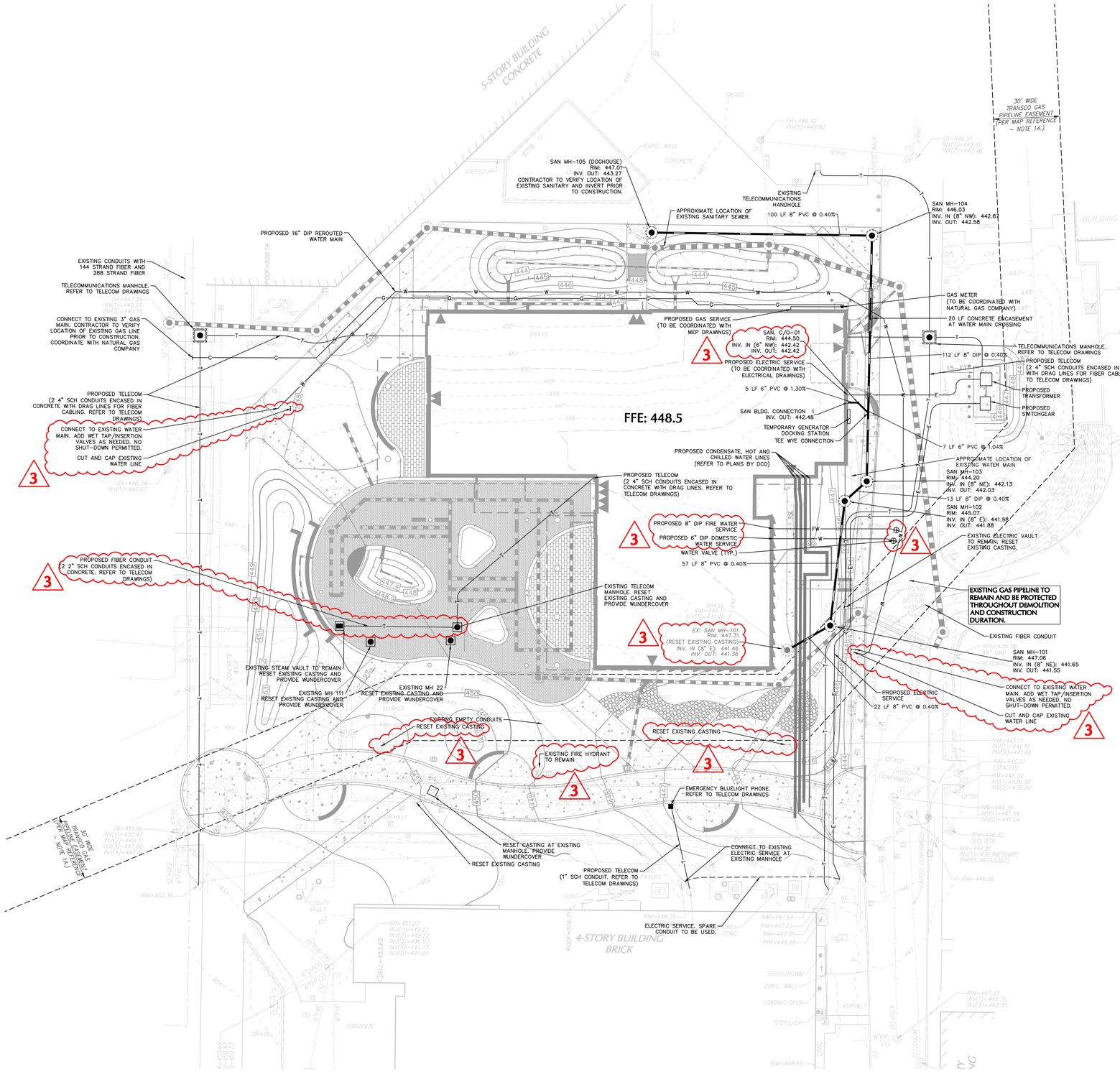
Project No: 100985401

Sheet Title

SITE PLAN

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Date	4/4/2025	Sheet Number	CS101
Drawn By	SLA		
Checked By	PGM		



NOTES

1. BOUNDARY AND TOPOGRAPHIC INFORMATION OBTAINED DRAFT SURVEY PREPARED BY LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, LLC.
2. EXISTING UTILITY INFORMATION OBTAINED FROM AS-BUILT SURVEY ENTITLED "DCO/MONTCLAIR STATE UNIVERSITY CAMPUS CEC/CHCP PROJECT, MONTLAIR/LITTLE FALLS, NEW JERSEY, CEC/CHCP AS-BUILT," DATED JANUARY 10, 2013, LAST REVISED JUNE 18, 2013.
3. CONTRACTOR TO CONFIRM ALL STRUCTURE INVERTS AND NOTIFY ENGINEER OF ANY INCONSISTENCIES PRIOR TO CONSTRUCTION.
4. CONTRACTOR TO BEGIN PIPE NETWORK CONSTRUCTION AT TIE-IN LOCATION AND BUILD UPSTREAM.
5. GAS, ELECTRIC, STEAM, AND CHILLED WATER SERVICE NETWORKS ARE SHOWN FOR SCHEMATIC PURPOSES ONLY. CONTRACTOR TO COORDINATE WITH UTILITY PROVIDER, ARCHITECT, AND MEP ENGINEER TO DETERMINE ACTUAL LOCATION AND SERVICE SIZE. CONCRETE ENCASEMENT SHALL BE PROVIDED, AS REQUIRED, IN ACCORDANCE WITH THE UTILITY CROSSING DETAILS.
6. THERE SHALL BE A MINIMUM VERTICAL SEPARATION DISTANCE OF 18 INCHES BETWEEN SANITARY SEWERS AND WATER LINES, UNLESS OTHERWISE SPECIFIED. IN AREAS WHERE THIS VERTICAL SEPARATION DISTANCE IS NOT FEASIBLE, SANITARY SEWER SHALL BE CONCRETE ENCASED. ENCASEMENT SHALL EXTEND A MINIMUM OF 10 FEET ON EITHER SIDE OF THE CROSSING. IN ADDITION, THERE SHALL BE A MINIMUM HORIZONTAL SEPARATION DISTANCE OF 10 FEET BETWEEN SANITARY SEWERS AND WATER LINES.
7. ALL WATER LINES SHALL HAVE A MINIMUM 4-FT COVER.
8. ALL SANITARY LATERAL CLEANOUTS AND MANHOLES SHALL BE HEAVY DUTY AND TRAFFIC RATED.
9. ALL SANITARY SEWER LATERALS SHALL BE PVC (SDR 26) UNLESS OTHERWISE SPECIFIED.
10. WHERE APPLICABLE, HYDRANTS SHALL BE INSTALLED A MINIMUM OF 2.5 FEET FROM FROM BACK OF CURB.
11. ALL WATER LINES SHALL BE DIP UNLESS OTHERWISE SPECIFIED.
12. PRIVATE FIRE MAINS SHALL CONFORM TO NFPA24.
13. CONCRETE ENCASEMENT SHALL BE PROVIDED, AS REQUIRED, IN ACCORDANCE WITH THE UTILITY CROSSING DETAILS.
14. ALL WATER LINES SHALL BE IN ACCORDANCE WITH THE GOVERNING AUTHORITY'S REQUIREMENTS.
15. FINAL FIRE DESIGN WILL BE BASED ON FIRE PROTECTION DRAWINGS.
16. SANITARY SEWER SHALL BE INSTALLED IN AREA OF EXISTING UTILITIES. CONTRACTOR SHALL VERIFY ALL INVERTS OF EXISTING UTILITIES PRIOR TO CONSTRUCTION AND PROCEED WITH CAUTION. CONTRACTOR TO COORDINATE WITH OWNER FOR THE RELOCATION OF ALL EXISTING UTILITIES.
17. CONTRACTOR SHALL COORDINATE GAS SERVICE WITH THE GOVERNING AUTHORITY.
18. ALL WATER AND SANITARY PIPES SHALL BE INSTALLED WITH A TRACING WIRE OR AN ELECTRONIC MARKER SYSTEM.
19. SPRINKLER LEAD-INS FOR FIRE SUPPRESSION NOT SHOWN & SHALL BE COORDINATED WITH FIRE PROTECTION ENGINEER.
20. THE FOLLOWING ARE NOT PERMITTED TO BE CONNECTED TO THE SANITARY SEWERS, EITHER DIRECTLY OR INDIRECTLY: A. GARBAGE DISPOSAL, B. AREA DRAIN OR YARD DRAIN, C. FOUNDATION UNDERDRAINS, D. RAIN CONDUCTOR OR DOWNSPOUT, E. GREASE PIT, F. AIR-CONDITIONING EQUIPMENT, G. STORMWATER INLETS OR CATCH BASINS, H. DRAINS FROM PIECES OF EQUIPMENT OR MANUFACTURING PROCESS, EXCEPT WHEN SPECIFICALLY AUTHORIZED UNDER THE PROVISIONS OF AUTHORITY RULES AND REGULATIONS, OR I. SUMP PUMP DISCHARGES.
21. ROADWAY RESTORATION WITHIN STONE STREET SHALL BE PERFORMED IN ACCORDANCE WITH MONTCLAIR STATE UNIVERSITY STANDARDS AND SPECIFICATIONS.
22. ALL MANHOLES AT SIDEWALK AND PAVER AREAS SHALL HAVE A WUNDERCOVER. REFER TO WUNDERCOVER DETAIL.
23. NOTIFY TRANSCO GAS PRIOR TO DISTURBING AREAS LOCATED WITHIN THE 30-FT WIDE TRANSCO GAS PIPELINE EASEMENT. THE EXISTING GAS PIPELINE IS TO REMAIN AND BE PROTECTED.

UTILITY PLAN LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED SANITARY PIPE
- PROPOSED WATER SERVICE
- PROPOSED ELECTRIC SERVICE
- PROPOSED GAS SERVICE
- PROPOSED TELECOM SERVICE
- PROPOSED COMMUNICATIONS SERVICE
- EXISTING SANITARY MANHOLE
- PROPOSED SANITARY MANHOLE

FINAL FOR WATER AND SEWER DESIGN

20 0 5 10 20
SCALE: 1 INCH = 20 FEET

MONTCLAIR STATE UNIVERSITY

Project
Interdisciplinary Science Building
1 Quad Road
Montclair, NJ 07043

Prepared For
Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
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MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

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Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan

Professional Seals

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CHRISTOPHER M. CIRROTTI — DATE SIGNED
PROFESSIONAL ENGINEER
NJ Lic No. 24GE03853800

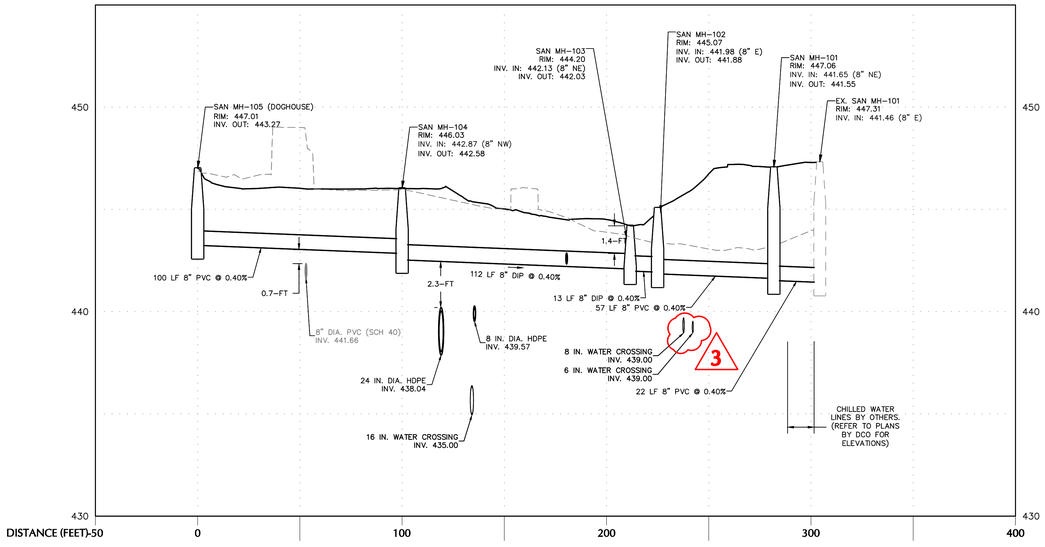
No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 100985401

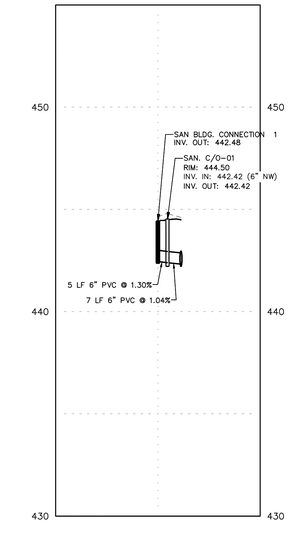
Sheet Title
UTILITY PLAN

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Date	4/4/2025	Sheet Number
Drawn By	SLA	CU101
Checked By	PGM	



SAN MH-105 (DOGHOUSE) TO EX. SAN MH-101 PROFILE



SAN. BLDG CONN. 1 TO SSWR PROFILE

3

FINAL FOR WATER AND SEWER DESIGN

VERTICAL: 3 — 0 — 1.5 — 3 — SCALE: 1 INCH = 3 FEET

HORIZONTAL: 30 — 0 — 15 — 30 — SCALE: 1 INCH = 30 FEET

MONTCLAIR STATE UNIVERSITY

Project

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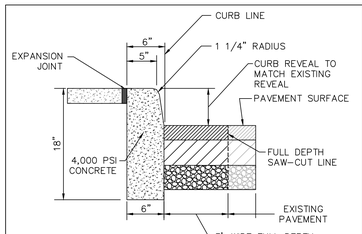
Project No: 100985401

Sheet Title

SANITARY PROFILES

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Checked By	PGM		

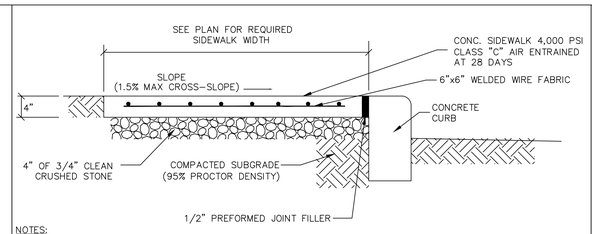


NOTES

1. CONCRETE TO TEST 4,000 P.S.I. MINIMUM ON 28 DAY TEST. AIR ENTRAINMENT 4% TO 7%, SLUMP TO BE 3" MAXIMUM.
2. TRANSVERSE JOINTS 1/2" WIDE SHALL BE INSTALLED IN THE CURB 20'-0" APART AND SHALL BE FILLED WITH PREFORMED BITUMINOUS JOINT FILLER.
3. EXPOSED CONCRETE SURFACE IS TO BE RUBBED TO PROVIDE SMOOTH FINISHED SURFACE.

6" CONCRETE CURB

NTS



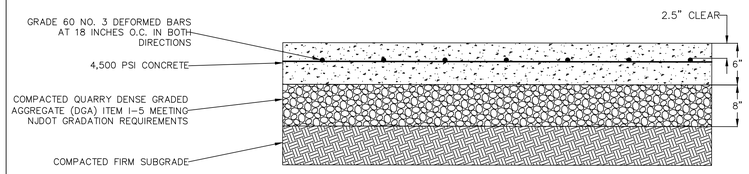
NOTES:

1. TO BE USED IN ALL SIDEWALKS THAT ARE NOT WITHIN A DRIVEWAY OR EMERGENCY ACCESS DRIVEWAY.
2. THE FORMS AND DIVIDERS SHALL BE OF STEEL OR WOOD AND OF SUFFICIENT STRENGTH TO RESIST SPRINGING OUT OF SHAPE; DEPTH OF FORMS SHALL BE AT LEAST THE THICKNESS OF CONCRETE AS SPECIFIED ON THIS DRAWING.
3. WALK SHALL BE OF MONOLITHIC CONSTRUCTION FOUR (4) INCHES THICK. TRANSVERSE SURFACE GROOVES MUST BE PROVIDED FOR AT RIGHT ANGLES TO THE SIDEWALK AND AT INTERVALS EQUAL TO WIDTH OF THE SIDEWALK.
4. AFTER THE CONCRETE IS PLACED IT SHALL BE TAMPED, SCREEDED AND FINISHED TO TRUE GRADE AND SURFACE. THE FINISH SHALL BE MADE WITH A WOOD FLOAT, FOLLOWED BY A BRUSHING WITH A WET SOFT HAIR BRUSH TO A NEAT WORKMANLIKE SURFACE.
5. TRANSVERSE EXPANSION JOINTS 1/2 INCH WIDE SHALL BE PROVIDED AT INTERVALS OF NOT LESS THAN 16 FEET AND FILLED WITH PREFORMED BITUMINOUS CELLULAR TYPE JOINT FILLER. SCORE LINES SHALL BE EVERY FOUR (4) FEET OR TO MATCH EXISTING ADJACENT SIDEWALK.
6. LONGITUDINAL JOINTS 1/2 INCH WIDE SHALL BE PROVIDED BETWEEN CURBS AND ABUTTING SIDEWALKS AND SHALL BE FILLED WITH PREFORMED BITUMINOUS TYPE FILLER.
7. DRIVEWAY APRON AND SIDEWALK AT DRIVEWAY SHALL BE SIX (6) INCHES THICK 4,000 P.S.I. AIR ENTRAINED CONCRETE.

CONCRETE SIDEWALK

NTS

CONCRETE SECTION	SURFACE COURSE - 'X'	BASE COURSE - 'Y'	REBAR SPACING
STANDARD DUTY	6 INCHES	8 INCHES	18 INCHES O.C.

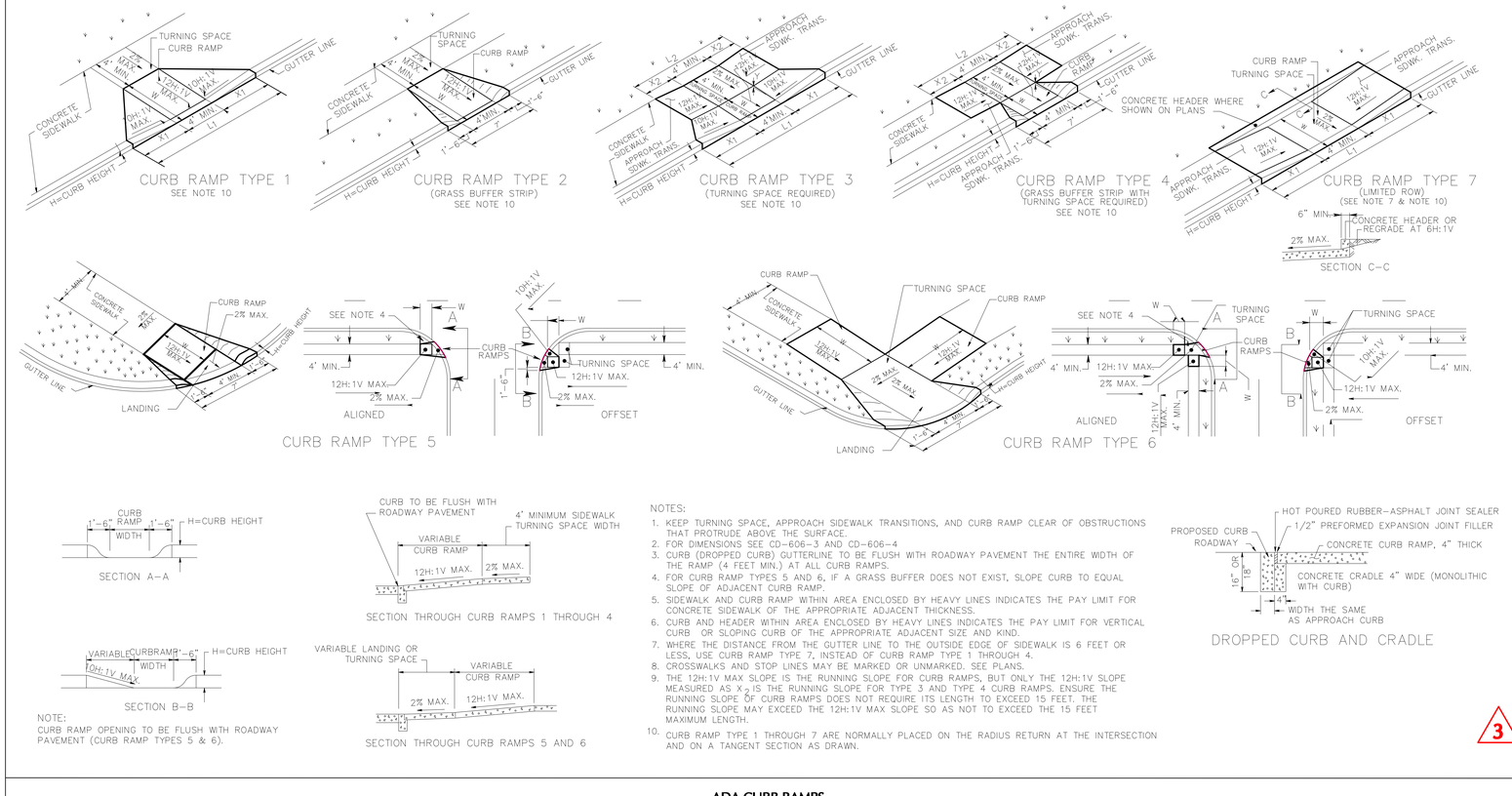


NOTES:

1. ALL PAVEMENT SUBGRADE AREAS SHALL BE COMPACTED WITH AT LEAST 4 PASSES OF A SMOOTH DRUM ROLLER HAVING A MINIMUM STATIC DRUM WEIGHT OF 5-TONS IN THE PRESENCE OF A QUALIFIED GEOTECHNICAL ENGINEER PRIOR TO PLACEMENT OF THE SUBBASE MATERIAL. ANY SOFT AREAS SHALL BE REMOVED AND REPLACED WITH APPROVED, COMPACTED FILL.
2. PRIOR TO PAVING, THE COMPACTED SUBBASE SHALL BE PROOFROLLED USING A FULLY-LOADED TRI-AXIAL DUMP TRUCK IN THE PRESENCE OF A QUALIFIED GEOTECHNICAL ENGINEER. ANY SOFT AREAS EXHIBITING EXCESSIVE PUMPING OR RUTTING SHALL BE COMPACTED TO AT LEAST 95% OF ITS MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D-1557.
3. THE EXTERIOR CONCRETE SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 4,500 PSI, A WATER CONTENT RATIO OF 0.45, AND 6% AIR ENTRAINMENT. CEMENT SHALL BE TYPE I, II, OR IL, UNLESS OTHERWISE SPECIFIED BY THE ENGINEER. THE USE OF FLY ASH AND SLAG SHALL BE APPROVED BY THE ENGINEER AND NOT EXCEED THE FOLLOWING: FLY ASH - 20% AND SLAG - 30%. USE NATURAL SAND ONLY. CALCIUM CHLORIDE ACCELERATOR ALLOWED WHEN AIR TEMPERATURE LESS THAN 50 DEGREES F.
4. REFER TO PAVEMENT JOINT DETAILS FOR JOINT REQUIREMENTS.
5. STEEL REINFORCEMENT SHALL BE PROPERLY SUPPORTED DURING CONCRETE PLACEMENT.
6. USE LIGHT BROOM FINISH PERPENDICULAR TO THE BUILDING, KEEP BROOM MARKS PARALLEL TO JOINTS.
7. APPLY DISSIPATING CURING COMPOUND TO FINISHED CONCRETE IN ACCORDANCE WITH ASTM C309. APPROVED BRANDS ARE KUREZ DR VOX FROM EUCLID AND SPECREZ FROM SPEC CHEM.
8. GENERAL CONTRACTOR SHALL HOLD A PRE-CONSTRUCTION MEETING AT LEAST 7 DAYS BEFORE STARTING CONCRETE WORK ATTENDED BY THE OWNER, GENERAL CONTRACTOR, CONCRETE CONTRACTOR, SITE CONTRACTOR (RESPONSIBLE FOR SUBGRADE AND SUBBASE PLACEMENT), SLAB CONSULTANT (IF HIRED), CIVIL ENGINEER, AND TESTING AGENCY.
9. CONCRETE CONTRACTOR SHALL SUBMIT MIX DESIGN AND TEST RESULTS FOR COMPRESSIVE STRENGTH, SLUMP, AND AIR CONTENT A MINIMUM OF 14 DAYS PRIOR TO USE.
10. THE OWNER'S TESTING AGENCY SHALL TEST SAMPLES OF CONCRETE FOR COMPRESSIVE STRENGTH, AIR CONTENT, SLUMP DENSITY, AND TEMPERATURE FROM THE 1ST TRUCK OF EACH DAY AND THEN EACH 150 CUBIC YARDS. EACH COMPRESSIVE STRENTH TEST SHALL CONSIST OF 4 CYLINDERS (6"X12") TO BE TESTED AS FOLLOWS: 1 AT 7 DAYS, 2 AT 28 DAYS, A 1 RESERVE.
11. CONFORM TO ACI 306.1 FOR COLD WEATHER CONCRETING AND ACI 305.1 WHEN ANY COMBINATION OF HIGH TEMPERATURE, LOW RELATIVE HUMIDITY, AND WIND VELOCITY TEND TO IMPAIR THE QUALITY OF THE CONCRETE. DO NOT POUR CONCRETE IF EVAPORATION RATE EXCEEDS 0.20 LB/SQ FT/HOUR. PROTECT CONCRETE FROM FREEZING FOR 24 HOURS AFTER PLACING. CONCRETE SHALL NOT BE PLACED IN STANDING WATER.

CONCRETE PAVEMENT SECTION

NTS



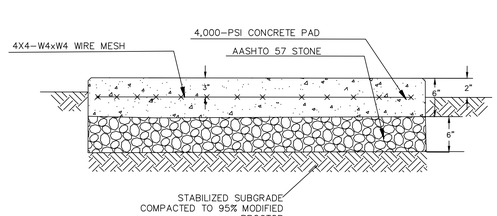
NOTE:
CURB RAMP OPENING TO BE FLUSH WITH ROADWAY PAVEMENT (CURB RAMP TYPES 5 & 6).

NOTES:

1. KEEP TURNING SPACE, APPROACH SIDEWALK TRANSITIONS, AND CURB RAMP CLEAR OF OBSTRUCTIONS THAT PROTRUDE ABOVE THE SURFACE.
2. FOR DIMENSIONS SEE CD-606-3 AND CD-606-4
3. CURB (DROPPED CURB) GUTTERLINE TO BE FLUSH WITH ROADWAY PAVEMENT THE ENTIRE WIDTH OF THE RAMP (4 FEET MIN.) AT ALL CURB RAMPS.
4. FOR CURB RAMP TYPES 5 AND 6, IF A GRASS BUFFER DOES NOT EXIST, SLOPE CURB TO EQUAL SLOPE OF ADJACENT CURB RAMP.
5. SIDEWALK AND CURB RAMP WITHIN AREA ENCLOSED BY HEAVY LINES INDICATES THE PAY LIMIT FOR CONCRETE SIDEWALK OF THE APPROPRIATE ADJACENT THICKNESS.
6. CURB AND HEADER WITHIN AREA ENCLOSED BY HEAVY LINES INDICATES THE PAY LIMIT FOR VERTICAL CURB OR SLOPING CURB OF THE APPROPRIATE ADJACENT SIZE AND KIND.
7. WHERE THE DISTANCE FROM THE GUTTER LINE TO THE OUTSIDE EDGE OF SIDEWALK IS 6 FEET OR LESS, USE CURB RAMP TYPE 7, INSTEAD OF CURB RAMP TYPE 1 THROUGH 4.
8. CROSSWALKS AND STOP LINES MAY BE MARKED OR UNMARKED. SEE PLANS.
9. THE 12H:1V MAX SLOPE IS THE RUNNING SLOPE FOR CURB RAMPS, BUT ONLY THE 12H:1V SLOPE MEASURED AS X_2 IS THE RUNNING SLOPE FOR TYPE 3 AND TYPE 4 CURB RAMPS. ENSURE THE RUNNING SLOPE OF CURB RAMPS DOES NOT REQUIRE ITS LENGTH TO EXCEED 15 FEET. THE RUNNING SLOPE MAY EXCEED THE 12H:1V MAX SLOPE SO AS NOT TO EXCEED THE 15 FEET MAXIMUM LENGTH.
10. CURB RAMP TYPE 1 THROUGH 7 ARE NORMALLY PLACED ON THE RADIUS RETURN AT THE INTERSECTION AND ON A TANGENT SECTION AS DRAWN.

ADA CURB RAMPS

NTS

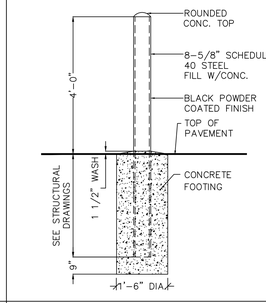


NOTES:

1. SIZE OF THE CONCRETE PAD SHALL BE BASED ON THE ACTUAL EQUIPMENT USED.
2. CONCRETE MIX SHALL BE AS PER THE SPECIFICATIONS.

ELECTRICAL TRANSFORMER PAD

NTS



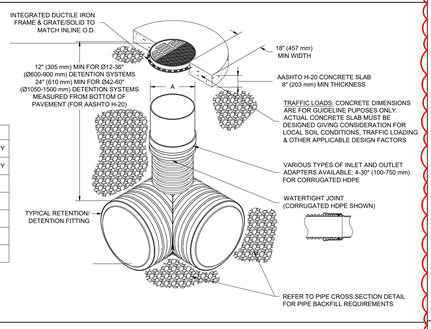
STEEL BOLLARD

NTS

NOTES

1. 8-30" (200-750 mm) GRATES/SOLID COVERS SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
2. 12-30" (300-750 mm) FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
3. DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS
4. DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS & HANCOR DUAL WALL) & SDR 35 PVC
5. FOR COMPLETE DESIGN AND PRODUCT INFORMATION: WWW.NYLOPLAST-US.COM
6. TO ORDER CALL: 800-821-6710

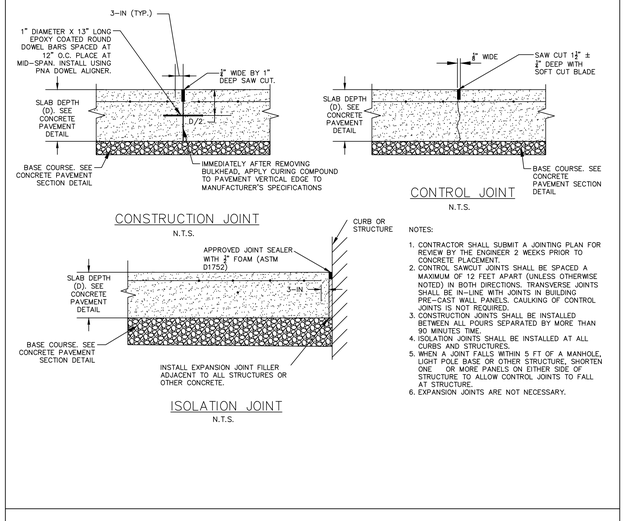
A	PART #	GRATE/SOLID COVER OPTIONS		
8" (200 mm)	2708AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
10" (250 mm)	2710AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
12" (300 mm)	2712AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
15" (375 mm)	2715AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
18" (450 mm)	2718AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
24" (600 mm)	2724AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
30" (750 mm)	2730AG	PEDESTRIAN AASHTO H-20	STANDARD AASHTO H-20	SOLID AASHTO H-20



YARD DRAIN

NTS

DROPPED CURB AND CRADLE



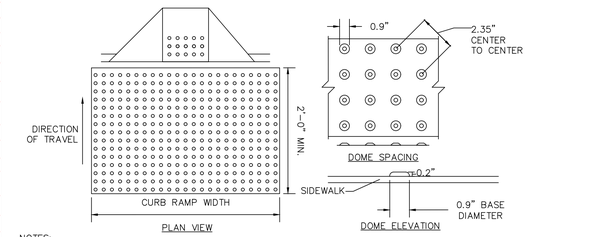
NOTES:

1. CONTRACTOR SHALL SUBMIT A JOINTING PLAN FOR REVIEW BY THE ENGINEER 2 WEEKS PRIOR TO CONCRETE PLACEMENT.
2. CONTROL SAWCUT JOINTS SHALL BE SPACED A MAXIMUM OF 12 FEET APART (UNLESS OTHERWISE NOTED) IN BOTH DIRECTIONS. TRANSVERSE JOINTS SHALL BE IN-LINE WITH JOINTS IN BUILDING PRE-CAST WALL PANELS. CAULKING OF CONTROL JOINTS IS NOT REQUIRED.
3. CONSTRUCTION JOINTS SHALL BE INSTALLED BETWEEN ALL POURS SEPARATED BY MORE THAN 90 MINUTES TIME.
4. ISOLATION JOINTS SHALL BE INSTALLED AT ALL CURBS AND STRUCTURES.
5. WHEN A JOINT FALLS WITHIN 5 FT OF A MANHOLE, LIGHT POLE BASE OR OTHER STRUCTURE, SHORTEN ONE OR MORE PANELS ON EITHER SIDE OF STRUCTURE TO ALLOW CONTROL JOINTS TO FALL AT STRUCTURE.
6. EXPANSION JOINTS ARE NOT NECESSARY.

CONCRETE PAVEMENT JOINTS

NTS

3



NOTES:

1. DETECTABLE WARNINGS SHALL BE CONSTRUCTED PER MANUFACTURER'S SPECIFICATIONS.
2. WIDTH OF DETECTABLE WARNING AREA SHALL BE FULL WIDTH OF RAMP.
3. LENGTH OF DETECTABLE WARNING AREA SHALL BE MINIMUM 2 FEET REGARDLESS OF SECTION WIDTH FOR CURB RAMPS. THE DETECTABLE WARNING SHALL EXTEND THE FULL DEPTH OF THE RAMP AND COMPLY WITH ADAAG 4.29.2.
4. DETECTABLE WARNING AREA CAN BE SQUARE WHERE USED IN A CURB RADIUS.
5. DETECTABLE WARNING DOMES SHALL BE ALIGNED ON A SQUARE GRID PARALLEL ALIGNMENT IN THE PREDOMINANT DIRECTION OF OF TRAVEL TO PERMIT WHEELS TO TRAVEL BETWEEN DOMES.
6. DETECTABLE WARNING DOMES SHALL BE PLACED SO THE EDGE NEAREST THE CURB IS 6 INCHES TO 8 INCHES FROM CURB LINE.
7. MAT EDGES SHALL BE BEVELED TO ELIMINATE TRIP HAZARD.
8. DETECTABLE WARNING COLOR SHALL CONTRAST WITH ADJOINING SURFACES. CONTRACTOR SHALL SUBMIT SHOP DRAWING FOR "SAFETY YELLOW" OR APPROVED EQUAL.
9. CONTRACTOR SHALL OBTAIN LOCAL AUTHORITY, OWNER'S ENGINEER, AND OWNER'S APPROVAL FOR COLOR AND MANUFACTURER PRIOR TO INSTALLATION.

ADA DETECTABLE WARNING SURFACE

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MONTCLAIR STATE UNIVERSITY

Project

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Prepared For

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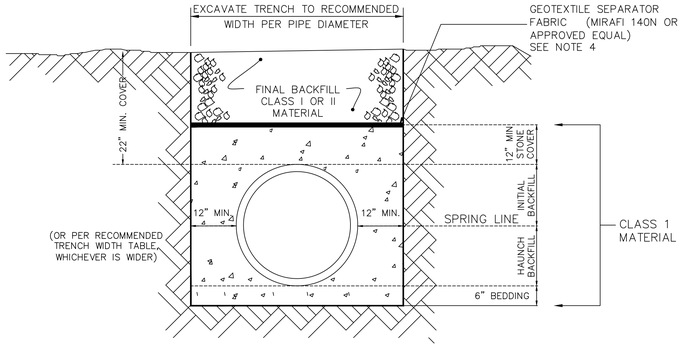
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CONSTRUCTION DETAILS 1

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Date	4/4/2025
Drawn By	SLA
Checked By	PGM
Sheet Number	CS501

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HDPE PIPE BACKFILL DETAIL

NOTES:

1. BEDDING, HAUNCH, INITIAL BACKFILL AND COVER SHALL BE CLASS 1 MATERIAL. CLASS 1 MATERIAL MUST BE EVENLY SPREAD INTO THE HAUNCH AND BETWEEN CORRUGATIONS. IF CLASS 1A MATERIAL IS USED, THE CLASS 1A MATERIAL SHOULD BE SPREAD IN 6–INCH–THICK LIFTS AND NOMINALLY COMPACTED USING A HAND–OPERATED COMPACTION EQUIPMENT. IF CLASS 1B MATERIAL IS USED, THE CLASS 1B MATERIAL SHOULD BE SPREAD IN 6–INCH–THICK LIFTS AND COMPACTED TO AT LEAST 95% OF THE MATERIALS MAX DRY DENSITY.
2. FINAL BACKFILL MATERIAL SHALL BE EITHER CLASS I (A OR B) OR CLASS II MATERIAL. THESE MATERIALS CAN EITHER BE IMPORTED OR PROCESSED FROM ONSITE MATERIAL GENERATED DURING ROCK EXCAVATION.
3. FINAL BACKFILL SHALL BE COMPACTED TO AT LEAST 95% OF THE MATERIAL'S MAXIMUM DRY DENSITY AS DETERMINED BY A MODIFIED PROCTOR COMPACTION TEST (ASTM D1557).
4. THE SEPARATOR FABRIC IS REQUIRED UNLESS OTHERWISE DIRECTED BY THE GEOTECHNICAL ENGINEER. THE NEED FOR A SEPARATOR FABRIC TO PREVENT SOIL PARTICLE MIGRATION SHALL BE DETERMINED BY THE GEOTECHNICAL ENGINEER ONCE GRADATION DATA IS PROVIDED FOR ALL PROPOSED BACKFILL MATERIALS.

GENERAL NOTES:

1. MATERIALS: UNLESS OTHERWISE SPECIFIED ON THE PLANS OR HEREIN, CORRUGATED POLYETHYLENE PIPE SHALL CONFORM TO AASHTO M–294, LATEST EDITION, STANDARD SPECIFICATION FOR CORRUGATED POLYETHYLENE PIPE.
2. RESINS: CORRUGATED POLYETHYLENE PIPE SHALL BE MANUFACTURED FROM HIGH DENSITY POLYETHYLENE VIRGIN COMPOUNDS, AND SHALL CONFORM TO THE REQUIREMENTS OF ASTM D–3350 FOR THE CELL CLASSIFICATION 335400C.
3. COUPLING BANDS: EXCEPT AS OTHERWISE REQUIRED HEREIN, COUPLING BANDS AND OTHER HARDWARE FOR CORRUGATED POLYETHYLENE PIPE SHALL DEMONSTRATE THAT THEY MEET THE SOIL TIGHTNESS REQUIREMENTS OF AASHTO SECTION 26 "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES."

   COUPLING BANDS SHALL LAP EQUALLY ON EACH OF THE PIPES BEING CONNECTED TO FORM A TIGHTLY CLOSED JOINT AFTER INSTALLATION.

   THE CORRUGATIONS IN THE BAND SHALL INDEX THE CORRUGATIONS IN THE PIPE ENDS TO ENGAGE AT LEAST TWO FULL CORRUGATIONS FROM THE END OF EACH PIPE.

   WHEN INFILTRATION OR EXFILTRATION IS A CONCERN, THE COUPLING BANDS MAY BE REQUIRED TO HAVE GASKETS. THE GASKET MATERIAL SHALL BE CLOSED–CELL EXPANDED RUBBER OR NEOPRENE.

   OTHER COUPLINGS MAY BE BELL & SPIGOT AND CONFORM TO THE REQUIREMENTS OF AASHTO M294.
4. DESIGNATION OF TYPE: THE PIPE MAY BE ONE OR BOTH OF THE FOLLOWING TYPE:

   TYPE S: THIS PIPE WILL HAVE A FULL CIRCULAR CROSS– SECTION, WITH AN OUTER CORRUGATED PIPE WALL AND A SMOOTH INNER LINER.

   TYPE D: THIS PIPE SHALL CONSIST OF AN ESSENTIALLY SMOOTH WATERWAY BRACED CIRCUMFERENTIALLY WITH CIRCULAR RIBS WHICH ARE FORMED SIMULTANEOUSLY WITH A SMOOTH OUTER WALL.
5. INSTALLATION: CORRUGATED POLYETHYLENE PIPE SHALL BE INSTALLED IN ACCORDANCE WITH TABLE 1 AND ASTM D–2321, LATEST EDITION, "STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY FLOW APPLICATIONS."

CLASSES OF EMBEDMENT AND BACKFILL MATERIALS

CLASS	TYPE	SOIL GROUP SYMBOL D 2487	DESCRIPTION	PERCENTAGE PASSING SIEVE SIZES 1 1/2 IN. (40 MM)	NO. 4 (4.75 MM)	NO. 200 (0.075 MM)
IA	MANUFACTURED AGGREGATES OPEN–GRADED, CLEAN.	NONE	ANGULAR, CRUSHED STONE OR ROCK, CRUSHED GRAVEL, BROKEN CORAL, CRUSHED SLAG, CINDERS OR SHELLS: LARGE VOID CONTENT, CONTAIN LITTLE OR NO FINES.	100 %	≤10 %	<5 %
IB	MANUFACTURED, PROCESSED AGGREGATES; DENSE–GRADED, CLEAN	NONE	ANGULAR, CRUSHED STONE (OR OTHER CLASS IA MATERIALS) AND STONE/SAND MIXTURES WITH GRADATIONS SELECTED TO MINIMIZE MIGRATION OF ADJA–CENT SOILS; CONTAIN LITTLE OR NO FINES (SEE X1.8.).	100 %	≤50 %	<5 %
II	COARSE–GRAINED SOILS, CLEAN	GW	WELL–GRADED GRAVELS AND GRAVEL–SAND MIXTURES; LITTLE OR NO FINES.	100 %	<50 % "COARSE FRACTION"	<5 %
		GP	POORLY–GRADED GRAVELS AND GRAVEL–SAND MIXTURES; LITTLE OR NO FINES.			
		SW	WELL–GRADED SANDS AND GRAV–ELY SANDS; LITTLE OR NO FINES.		< 50 % OF "COARSE FRACTION"	
		SP	POORLY–GRADED SANDS AND GRAVEL SANDS; LITTLE OR NO FINES.			
	COARSE–GRAINED SOILS, BORDERLINE CLEAN TO W/ FINES	E.G. GW–GC, SP–SM.	SANDS AND GRAVELS WHICH ARE BORDERLINE BETWEEN CLEAN AND WITH FINES.	100 %	VARIES	5 % TO 12 %
III	COARSE–GRAINED SOILS, WITH FINES	GM	SILTY GRAVELS, GRAVEL–SAND SILT MIXTURES.	100 %	<50 % OF "COARSE FRACTION"	12 % TO 50 %
		GC	CLAYEY GRAVELS, GRAVEL–SAND–CLAY MIXTURES.			
		SM	SILTY SANDS, SAND–SILT MIXTURES.		< 50 % OF "COARSE FRACTION"	
		SC	CLAYEY SANDS, SAND–CLAY MIX–TURES.			

HIGH DENSITY CORRUGATED POLYETHYLENE PIPE HEIGHT OF COVER H–20 AND E–80 LIVE LOADS

NOMINAL DIAMETER IN. (MM)	MINIMUM COVER IN. & (MM) H–20	E–80
12 (300)	12 (300)	24 (600)
15 (375)	12 (300)	24 (600)
18 (450)	12 (300)	24 (600)
24 (600)	12 (300)	24 (600)
30 (750)	12 (300)	24 (600)
36 (900)	12 (300)	24 (600)
42 (1050)	12 (300)	24 (600)
48 (1200)	12 (300)	24 (600)
60 (1500)	24 (600)	24 (600)

RECOMMENDED TRENCH WIDTH

DIAMETER	O.D.	TRENCH WIDTH
12"	14.45"	31"
15"	17.65"	34"
18"	21.10"	39"
24"	28.30"	48"
30"	36.10"	66"
36"	42.25"	78"
42"	47.00"	83"
48"	53.00"	89"
60"	66.30"	102"

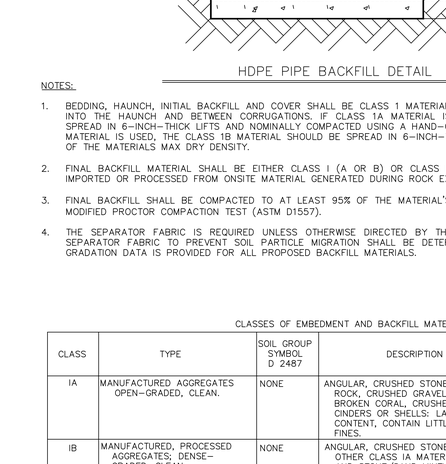
The trench width must be wide enough to accomodate compaction equipment.

MAXIMUM COVER FOR ADS AND MEGAGREEN PIPES (PER ASTM F2648), FT(MM)

DIAMETER OF PIPE IN. (MM)	CLASS 1 COMPACTED FT. (M)	CLASS 2 95% FT. (M)	CLASS 2 90% FT. (M)	CLASS 3 95% FT. (M)
12 (300)	27 (8.2)	21 (6.4)	14 (4.3)	12 (3.6)
15 (375)	27 (8.2)	21 (6.4)	14 (4.3)	13 (3.9)
18 (450)	25 (7.6)	18 (5.5)	13 (3.9)	11 (3.3)
24 (600)	22 (6.7)	16 (4.8)	11 (3.3)	12 (3.6)
30 (750)	16 (4.8)	12 (3.6)	8 (2.4)	6 (1.8)
36 (900)	21 (6.4)	15 (4.5)	10 (3.0)	10 (3.0)
42 (1050)	17 (5.2)	13 (3.9)	9 (2.7)	7 (2.1)
48 (1200)	18 (5.5)	13 (3.9)	9 (2.7)	10 (3.0)
60 (1500)	20 (6.0)	15 (4.5)	10 (3.0)	10 (3.0)

HDPE PIPE INSTALLATION

NTS

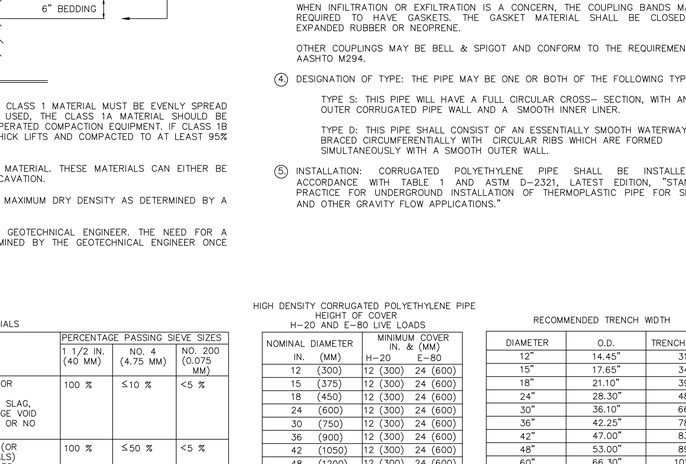


NOTES:

1. THE CONTRACTOR SHALL PROVIDE ALL APPROPRIATE AND NECESSARY FITTINGS AND ADAPTORS.
2. CLEANOUT LINE TO BE 8" DIAMETER. PIPE MATERIAL TO BE EITHER PVC OR DIP BUT SHOULD BE CONSISTENT WITH SEWER MATERIAL.

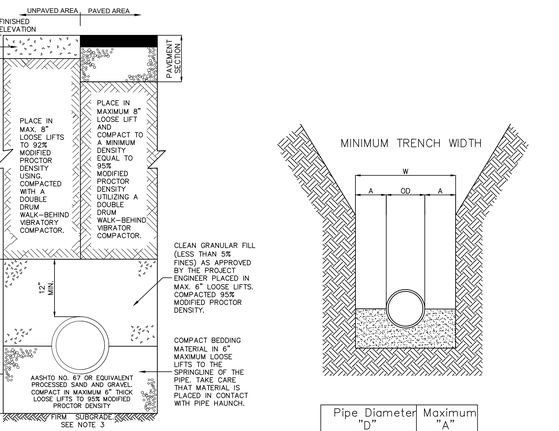
STORM CLEANOUT

NTS



CONCRETE ENCASEMENT

NTS



NOTE:

1. MAXIMUM TRENCH WIDTH "W" TAKEN AT TOP OF PIPE.

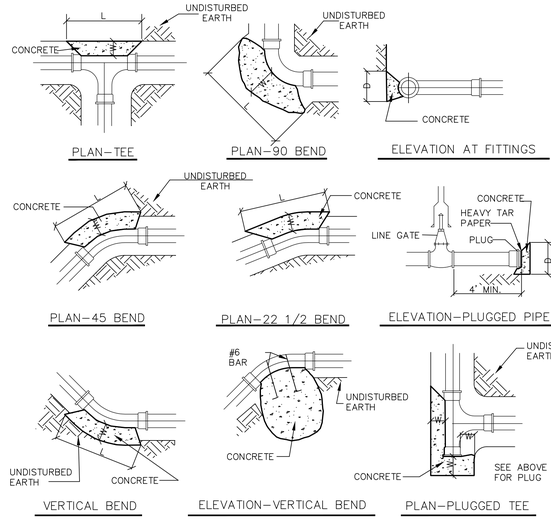
Pipe Diameter "D"	Maximum "A"
6" to 15"	8"
16" to 21"	10"
24" to 30"	12"
33" to 42"	15"
48" & Larger	18"

NOTES:

1. ALL TRENCH EXCAVATIONS ARE TO BE DONE IN COMPLIANCE WITH OSHA REGULATIONS.
2. MINIMUM TRENCH WIDTHS TO BE IN ACCORDANCE WITH THE CHART ABOVE.
3. IF SOFT SOIL IS ENCOUNTERED AT BEDDING SUBGRADE, THE SOFT SOIL IS TO BE REMOVED (TO A MAXIMUM DEPTH OF 2 FT) AND REPLACED WITH ¾" CLEAN CRUSHED STONE.
4. TRENCH BACKFILL SHALL BE PREDOMINANTLY GRANULAR FILL MATERIAL AS APPROVED BY THE PROJECT ENGINEER. MATERIAL EXCAVATED FROM THE TRENCH MAY BE USED FOR BACKFILL PROVIDED IT IS PREDOMINATELY SAND AND IS AT WATER CONTENT THAT THE MATERIAL CAN BE READILY COMPACTED TO THE DENSITY REQUIRED.
5. WITHIN PUBLIC RIGHT OF WAY BENEATH PAVEMENT, THE BACKFILL MATERIAL SHALL BE CLEAN CRUSHED STONE EQUIVALENT TO AASHTO NO. 67 OR ¾" STONE, UNLESS AUTHORITY HAVING JURISDICTION REQUIRES OTHERWISE.
6. MAGNETIC UNDERGROUND MARKING TAPE TO BE PROVIDED FOR PLASTIC WATER, AND SANITARY FORCE MAINS. BURY 18" FROM FINISHED GRADE.
7. IN AREAS WHERE THERE IS NOT SUFFICIENT WIDTH FOR A DOUBLE DRUM WALK BEHIND VIBRATORY COMPACTOR THE LIFT THICKNESS SHALL BE DECREASED AS NECESSARY TO ACHIEVE COMPACTION WITH APPROPRIATE EQUIPMENT.
8. MAXIMUM PARTICLE SIZE FOR TRENCH BACKFILL SHALL BE 2 INCHES UNLESS APPROVED OTHERWISE BY PROJECT ENGINEER.
9. BACKFILL CONTAIN NO DELETERIOUS OR CONTAMINATED MATERIAL.

PIPE TRENCH DETAIL FOR SANITARY, WATER AND STORM PIPING

NTS



BASIS:
2,000 LB/SQ.FT. SOIL RESISTANCE 250
PSI WATER PRESSURE CORRECTION
FACTORS FOR OTHER SOILS:
SOFT CLAY 4
SAND 2
SAND & GRAVEL 1.33
SHALE 0.4

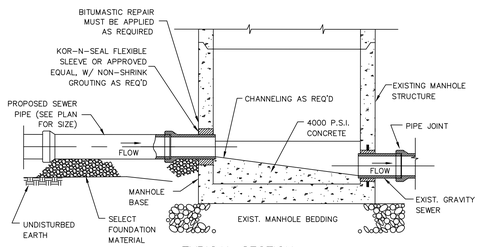
NOTE:
1. IF SOFT MATERIALS ARE ENCOUNTERED, THE THRUST BLOCKS SIZES SHALL BE ADJUSTED ACCORDINGLY.
2. CONCRETE TO BE 3000 PSI.

THRUST BLOCK SCHEDULE

PIPE SIZE	TEE L	TEE D	22 1/2 L	22 1/2 D	45 L	45 D	90 L	90 D	W
6"	18"	15"	15"	12"	15"	12"	15"	15"	21"
8"	2'	18"	18"	12"	18"	12"	2'	18"	2'
12"	3'	2'	2'	12"	2'	12"	3'	2'	28"
16"	4'	2.5'	2'	12"	2.33'	15"	4'	2.5'	31"
20"	5.25'	3'	2'	18"	3'	2'	5.25'	3'	33"
24"	7.5'	3'	3'	18"	4'	2.5'	7.5'	3'	3'

THRUST BLOCKS

NTS



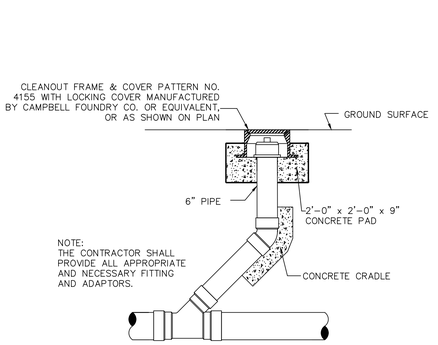
TYPICAL SECTION

CONSTRUCTION NOTES:

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING OPERATION OF THE EXISTING SEWERS CONNECTED TO THE EXISTING MANHOLE. AT NO TIME SHALL THE CONSTRUCTION OF THE NEW SEWER MAIN IMPEDE THE OPERATION OF THE EXISTING SANITARY SEWERS.
2. WHERE NEW PIPE IS TO BE CONNECTED INTO AN EXISTING MANHOLE, THE CONTRACTOR SHALL CORE DRILL ALL HOLES INTO MANHOLE AND SHALL PERFORM ALL CUTTING AND PATCHING NECESSARY FOR CHANNEL AND BENCH RECONSTRUCTION TO CHANNEL FLOW INTO EXISTING SEWER. PIPE SHALL BE SEALED USING KOR–N–SEAL MANHOLE ADAPTERS OR EQUAL, AND NON–SHRINK GROUT. EXISTING BENCH SHALL BE CHIPPED AND CUT AWAY TO ALLOW FOR NEW CHANNEL TO BE CONSTRUCTED AND TO PROVIDE A GOOD, SOUND SURFACE FOR BONDING WITH NEW CONCRETE CHANNEL AND BENCH. ALL LOOSE CONCRETE, RUST OF REINFORCING RODS, AND OTHER FOREIGN MATERIALS SHALL BE REMOVED AND THE CAVITY CLEANED WITH WATER OR AIR UNDER PRESSURE, AS NECESSARY. APPLY EPOXY BONDING AGENT PRIOR TO POURING CONCRETE. THE CONCRETE USED TO CONSTRUCT BENCHES AND CHANNELS SHALL HAVE A MINIMUM 28–DAY COMPRESSIVE STRENGTH OF 4000 P.S.I.
3. ANY DAMAGE TO THE EXISTING MANHOLE CAUSED BY THE CONSTRUCTION OPERATIONS SHALL BE REPAIRED TO THE SATISFACTION OF THE ENGINEER.

CONNECTION TO EXISTING STORM/SANITARY STRUCTURE

NTS



SANITARY CLEANOUT

NTS

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building
1 Quad Road
Montclair, NJ 07043

Prepared For
Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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In Association with

Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan

3

FINAL FOR WATER AND SEWER DESIGN

Professional Seals

NOT FOR CONSTRUCTION

CHRISTOPHER M. CIRROTTI DATE SIGNED
PROFESSIONAL ENGINEER
NJ Lic No. 24GE03853800

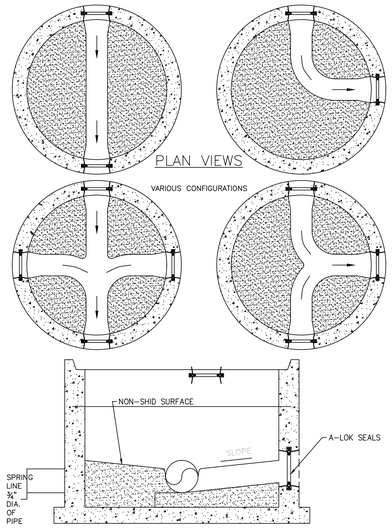
No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 100985401
Sheet Title

CONSTRUCTION DETAILS 2

Original is 42 x 30. Do not scale contents of this drawing.

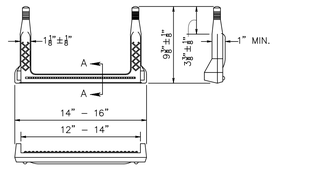
Date	4/4/2025
Drawn By	SLA
Checked By	PGM
Sheet Number	CS502

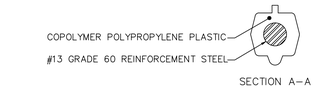


NOTES:
1. THE INVERT IS POURED AT THE PLANT USING PRECISION FORMS TO CREATE A SMOOTH, ACCURATE CHANNEL THAT MINIMIZES TURBULENCE AND RESULTS IN OPTIMUM FLOW.

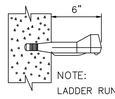
SANITARY MANHOLE INVERTS

NTS





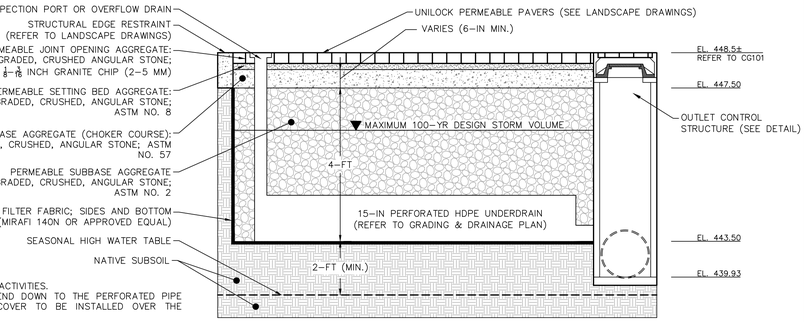
SECTION A–A



NOTE:
LADDER RUNGS FACING TRAFFIC 12" C TO C

MANHOLE LADDER RUNGS

NTS

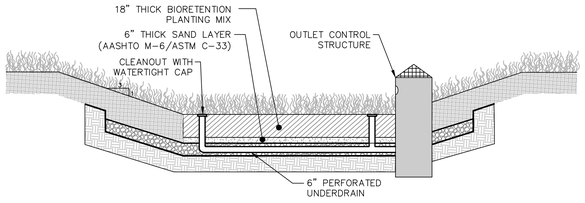


NOTES:
1. INSPECTION PORTS:
   - LARGE ENOUGH TO ALLOW FOR MAINTENANCE ACTIVITIES.
   - FLUSH WITH THE SURFACE COARSE AND EXTEND DOWN TO THE PERFORATED PIPE NETWORK. DECORATIVE COVERS BY WUNDERCOVER TO BE INSTALLED OVER THE INSPECTION PORT.
   - PLACED AT LEAST 3 FEET FROM ANY EDGE.
2. ALL AGGREGATE MATERIAL SHALL BE WASHED PRIOR TO PLACEMENT, TO MINIMIZE STONE DUST AND OTHER FINE PARTICLES.
3. SURFACE COURSE:
   - UNILOCK ECO–HEX PAVER (REFER TO LANDSCAPE DRAWINGS).
   - JOINT SIZE TO BE PER MANUFACTURER'S SPECIFICATIONS.
   - PAVERS TO BE INSTALLED PER MANUFACTURER'S SPECIFICATIONS.
   - MAINTENANCE PROCEDURES TO BE ESTABLISHED PER MANUFACTURER'S RECOMMENDATIONS.
4. CHOKER COURSE:
   - 6–INCHES (MINIMUM) OF CLEAN, WASHED AASHTO NO 57 BROKEN STONE. THICKNESS VARIES, REFER TO GRADING & DRAINAGE PLAN.
5. STORAGE BED:
   - AASHTO NO 2 OPEN–GRADED BROKEN STONE.
   - PLACED IN LIFTS AND COMPACTED USING PLATE COMPACTORS. THE MAXIMUM RECOMMENDED LIFT THICKNESS IS 6 INCHES.
7. POST CONSTRUCTION TESTING IS REQUIRED AND MUST CONFORM TO THE METHODS OF ASTM C1781: STANDARD TEST METHOD FOR SURFACE INFILTRATION RATE OF PERMEABLE UNIT PAVEMENT SYSTEMS.
8. FILTER FABRIC (MIRAFI 140N OR APPROVED EQUAL) IS REQUIRED ALONG THE SIDES OF THE ENTIRE SYSTEM.
9. PERMEABLE PAVER SYSTEMS MUST BE KEPT FREE OF SEDIMENT DURING CONSTRUCTION. EXCAVATION TO FINAL DESIGN ELEVATION MAY ONLY OCCUR AFTER ALL UPSTREAM DRAINAGE AREAS ARE COMPLETED AND STABILIZED.
10. STRUCTURAL EDGING TO BE PROVIDED AROUND THE PERIMETER OF THE PERMEABLE PAVERS. REFER TO LANDSCAPE DRAWINGS FOR LOCATIONS.

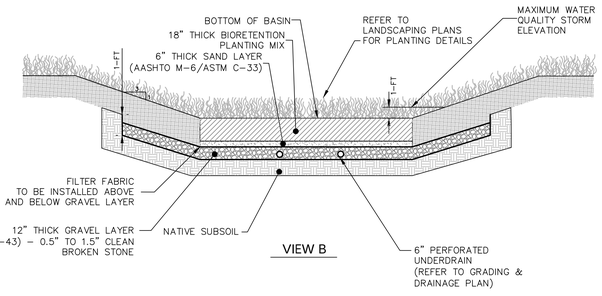
PERMEABLE PAVERS WITH UNDERDRAINS								
BOTTOM OF STORAGE BED	TOP OF STORAGE BED	WATER SURFACE ELEVATION						SHWT ELEVATION
		CURRENT			FUTURE			
		2-YEAR	10-YEAR	100-YEAR	2-YEAR	10-YEAR	100-YEAR	
443.5	447.5	444.37	444.90	445.7	444.54	445.09	446.2	437

PERMEABLE PAVERS WITH UNDERDRAIN

NTS



VIEW A



VIEW B

NOTES:

1. BIORETENTION SWALES (INCLUDING THE MULCH, SOIL BED, SAND AND GRAVEL LAYER) SHALL BE CONSTRUCTED IN CONFORMANCE WITH NEW JERSEY STORMWATER BEST MANAGEMENT PRACTICES MANUAL SECTION 9.7 FOR SMALL–SCALE BIORETENTION SYSTEMS.
2. 3 INCHES OF GRAVEL LAYER SHALL BE PROVIDED ABOVE THE PERFORATED UNDERDRAIN AND A MINIMUM OF 3 INCHES OF GRAVEL LAYER SHALL BE BELOW THE PERFORATED UNDERDRAIN. GRAVEL SHALL MEET AASHTO M–43 – 0.5" TO 1.5" CLEAN BROKEN STONE.
3. AT LEAST ONE (1) INSPECTION PORT, WITH A REMOVABLE CAP, MUST BE PROVIDED AT THE UPSTREAM AND DOWNSTREAM ENDS OF THE PERFORATED SECTION OF THE NETWORK OF PIPES AND BE FLUSH WITH THE SURFACE OF THE SURFACE LAYER.
4. INSPECTION PORT EXTERIOR OF UNDERDRAINS SHALL BE COVERED IN SUCH A WAY AS TO PREVENT THE MIGRATION OF MATERIAL INTO THE STRUCTURE.
5. THE DEPTH OF RUNOFF GENERATED BY THE MAXIMUM DESIGN STORM SHALL BE MARKED ON ALL INSPECTION PORTS.
6. CONTRACTOR SHALL PROVIDE SUBMITTALS FOR SAND, BIORETENTION MEDIA AND STONE FOR REVIEW.

POST CONSTRUCTION TESTING

1. POST CONSTRUCTION TESTING MUST BE PERFORMED IN ACCORDANCE WITH THE CONSTRUCTION AND POST–CONSTRUCTION OVERSIGHT AND SOIL PERMEABILITY TESTING SECTION IN CHAPTER 12 OF THE NJ BMP MANUAL. TO ENSURE THAT THE AS–BUILT SYSTEM FUNCTIONS AS DESIGNED, POST CONSTRUCTION TESTING MUST INCLUDE:
   – PERMEABILITY RATE OF THE SOIL BED
   – HYDRAULIC CAPACITY OF THE UNDERDRAINS
   – OVERALL BASIN DRAIN TIME

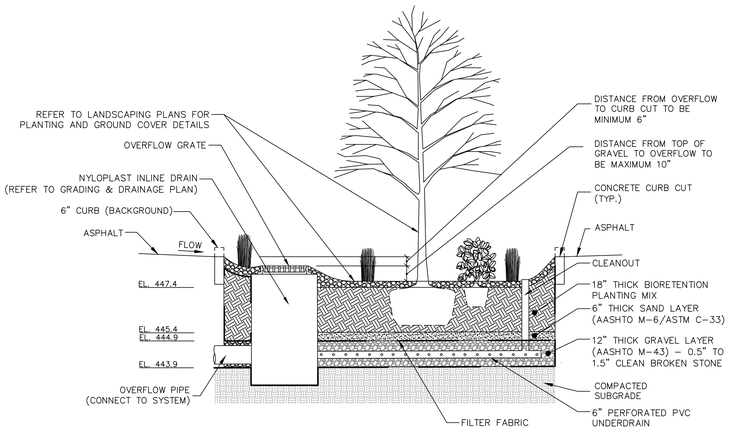
BIORETENTION MEDIA (SOIL BED) NOTES:

1. SOIL BED TO BE A MINIMUM OF 18–24" IN DEPTH, IN ACCORDANCE WITH THE TABLE BELOW.
2. THE SOIL BED MUST CONSIST OF THE FOLLOWING MIX, BY VOLUME:
   – 85–95% SAND*
   – 3–7% ORGANICS
   – 2–5% CLAY CONTENT
   * NO MORE THAN 25% SAND AS FINE OR VERY FINE SANDS; NO MORE THAN 15% SILT AND CLAY
3. PRE–MIXED SOIL MUST BE CERTIFIED TO BE CONSISTENT WITH THE REQUIREMENTS ABOVE BY EITHER THE VENDOR OR BY A PROFESSIONAL ENGINEER LICENSED BY THE STATE OF NEW JERSEY; IN ADDITION, THE ENGINEER MUST BE PRESENT WHEN THE SOIL IS MIXED.
4. THE PH OF THE SOIL IS RECOMMENDED TO BE BETWEEN 5.5 AND 6.5
5. CALCULATION OF RUNOFF RETENTION, POROSITY, FIELD CAPACITY, AND WILTING POINT OF THE SOIL BED MUST BE OBTAINED EITHER FROM A PUBLISHED RESEARCH ARTICLE OR TESTED IN ACCORDANCE WITH THE ASTM D–6836 METHOD OR THE SOIL SURVEY INVESTIGATIONS REPORT NO. 42, KELLOGG SOIL SURVEY LABORATORY METHODS MANUAL, PUBLISHED BY NRCS.
6. SOIL BED MATERIAL MUST BE PLACED IN LIFTS NOT TO EXCEED 6". ADDITIONAL MATERIALS MAY BE NECESSARY TO ACCOUNT FOR SETTLING OVER TIME.

BIORETENTION SWALE								
BOTTOM OF BASIN (TOP OF BIO MEDIA LAYER)	TOP OF BASIN	WATER SURFACE ELEVATION						SHWT ELEVATION
		CURRENT			FUTURE			
		2-YEAR	10-YEAR	100-YEAR	2-YEAR	10-YEAR	100-YEAR	
444	446	445.13	445.32	445.44	445.22	445.37	445.49	437

BIORETENTION SWALE

NTS



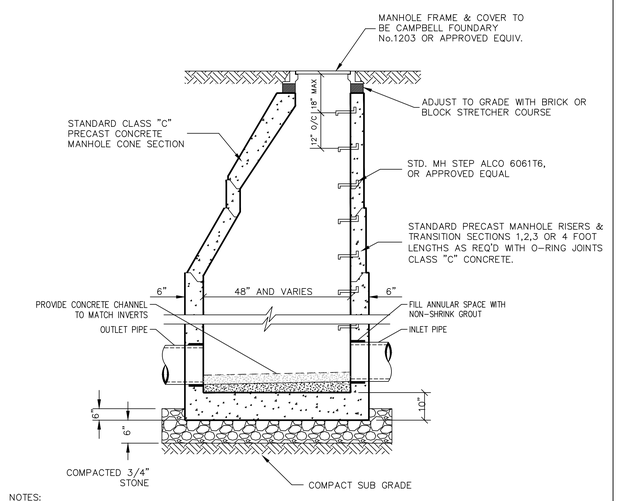
NOTES:

1. REFER TO GRADING AND DRAINAGE PLANS FOR EXACT LOCATION OF CATCH BASINS AND MANHOLES.
2. INVERTS PROVIDED ON GRADING AND DRAINAGE PLANS.
3. REFER TO BIORETENTION SWALE DETAIL FOR NOTES ON INSTALLATION, BIORETENTION MEDIA, AND POST–CONSTRUCTION TESTING.

RAIN GARDEN								
BOTTOM OF BASIN (TOP OF BIO MEDIA LAYER)	TOP OF BASIN	WATER SURFACE ELEVATION						SHWT ELEVATION
		CURRENT			FUTURE			
		2-YEAR	10-YEAR	100-YEAR	2-YEAR	10-YEAR	100-YEAR	
447.4	448.9	447.95	448.18	448.24	448.11	448.19	448.27	437

RAIN GARDEN

NTS

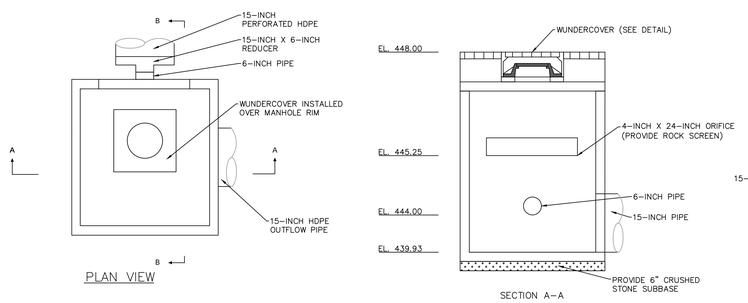


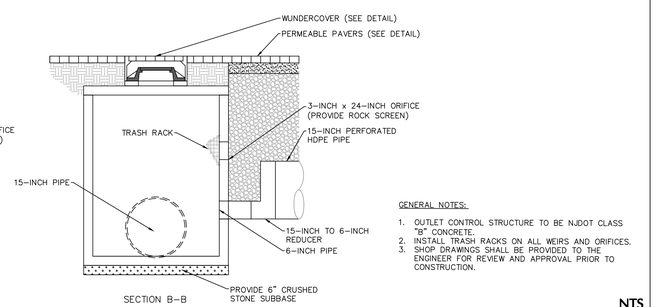
NOTES:

1. DIAMETER OF MANHOLE SHALL BE REVIEWED BY THE CONTRACTOR TO DETERMINE A LEGEND OF STANDARD MANHOLE DIMENSIONS WITH RESPECT TO PROPOSED PIPE SIZES, NUMBER AND GEOMETRTY. OVER SIZE MANHOLES SHALL BE PROVIDED IF MINIMUM 6" WALL DIMENSION BETWEEN PIPES IS NOT MANUFACTURED.
2. MANHOLES SHALL BE STANDARD PRECAST CONCRETE UNITS AND SHALL BE DESIGNED AND CONSTRUCTED BY THE MANUFACTURER TO SUPPORT TRUCK HS20 LOADING.
3. EXISTING PIPES AND PROPOSED PIPES TO BE ACCOMMODATED IN PRECAST DESIGN DURING SHOP DRAWING REVIEW.

STORM MANHOLE

NTS





GENERAL NOTES:

1. OUTLET CONTROL STRUCTURE TO BE NJDOT CLASS "B" CONCRETE.
2. INSTALL TRASH RACKS ON ALL WEIRS AND ORIFICES.
3. SHOP DRAWINGS SHALL BE PROVIDED TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO CONSTRUCTION.

OCS-102

NTS

MONTCLAIR STATE UNIVERSITY

Project
Interdisciplinary Science Building
1 Quad Road
Montclair, NJ 07043

Prepared For
Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan

3

FINAL FOR WATER AND SEWER DESIGN

Professional Seals

NOT FOR CONSTRUCTION

CHRISTOPHER M CIRROTTI DATE SIGNED
PROFESSIONAL ENGINEER
NJ Lic No. 24GE03863800

No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 100985401

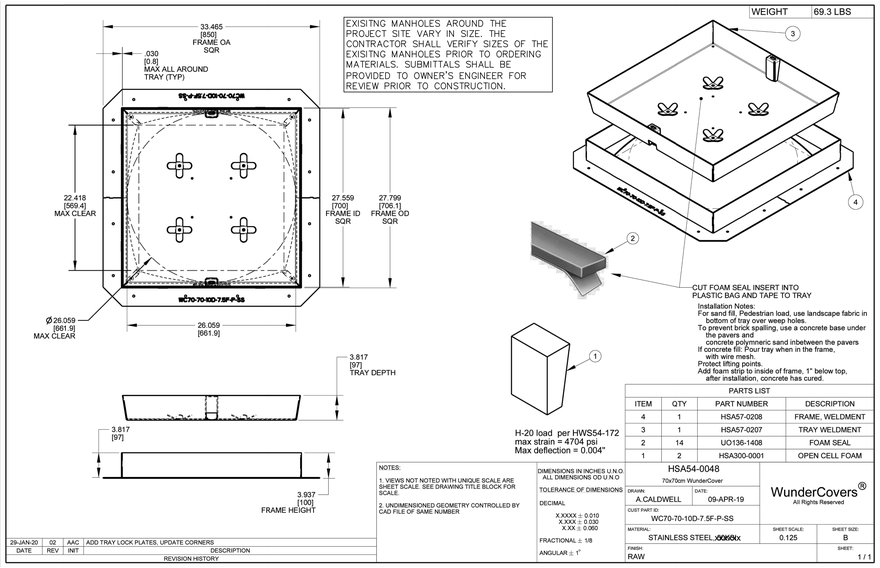
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CONSTRUCTION DETAILS 3

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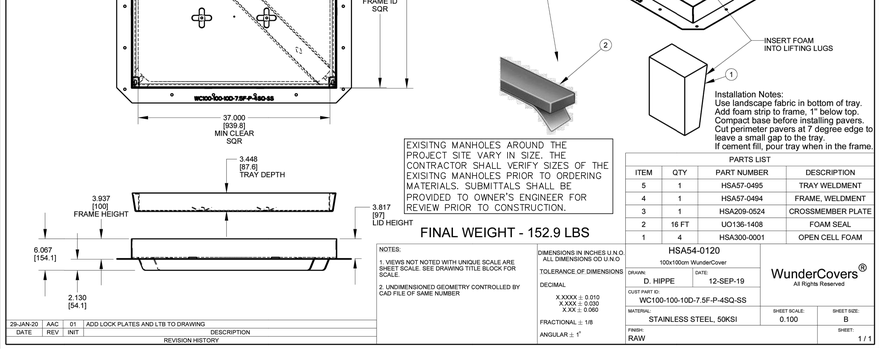
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Drawn By SLA
Checked By PGM

Sheet Number CS503



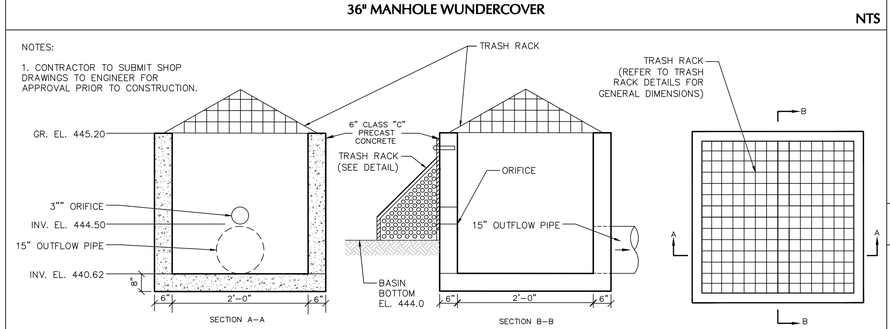
24" MANHOLE WUNDERCOVER

NTS



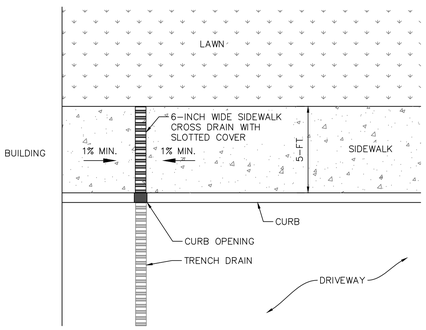
36" MANHOLE WUNDERCOVER

NTS



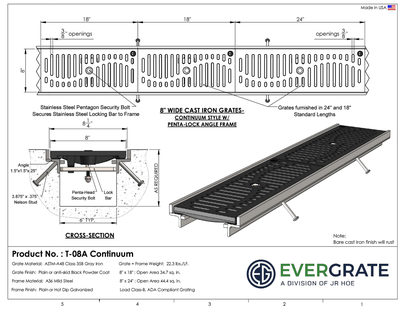
OCS-102

NTS



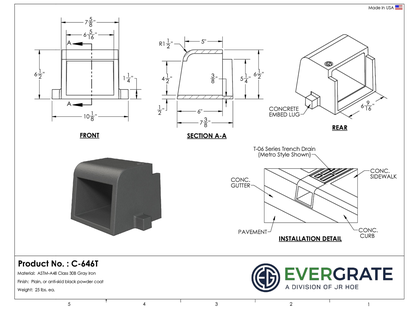
PLAN VIEW

NTS



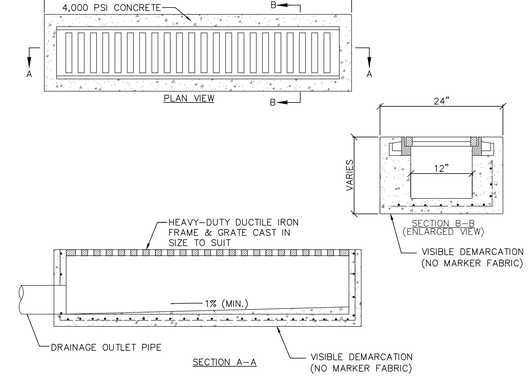
SIDEWALK CROSS DRAIN

NTS



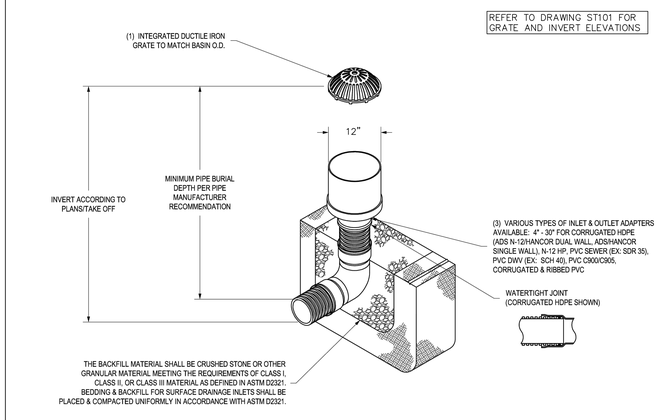
CURB OPENING

NTS



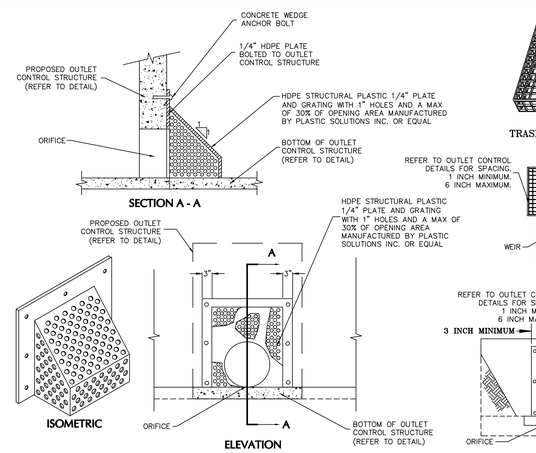
TRENCH DRAIN

NTS



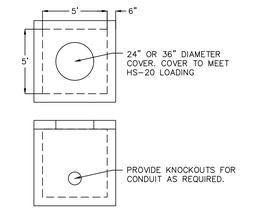
NYLOPLAST INLINE DRAIN WITH DOME GRATE (OCS-103)

NTS



OUTLET CONTROL STRUCTURE TRASH RACKS

NTS



TYPICAL 5' X 5' ELECTRICAL/TELECOM HANDHOLE

NTS

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building
1 Quad Road
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Prepared For

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HOK Architects, Inc.
5 Bryant Park
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New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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152 Huron Ave
Clifton, NJ 07013

Key Plan

3

FINAL FOR WATER AND SEWER DESIGN

Professional Seals

NOT FOR CONSTRUCTION

CHRISTOPHER M. CIRROTTI
PROFESSIONAL ENGINEER
NJ Lic No. 24GE03853800
DATE SIGNED

No. | Description | Date
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2 | ISSUED FOR BID | 2026-01-19
3 | ADDENDUM #5 | 2026-03-23

Project No: 100985401

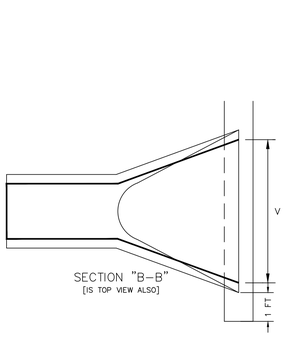
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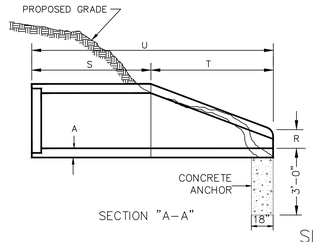
CONSTRUCTION DETAILS 4

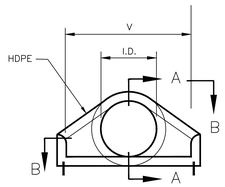
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Date 4/4/2025
Drawn By SLA
Checked By PGM

Sheet Number CS504







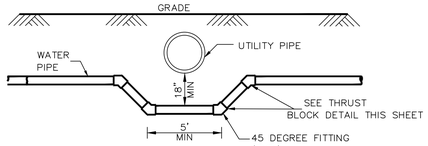
NOTE:
1. FLARED END SECTION MUST BE ANCHORED AT LEAST 3 FT BELOW GRADE AT POINT OF OUTFALL.

SIZING SUMMARY

ID	12	15	13	21	24	27	30	33	36	42	48	54	60	66	72
A	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4	4 1/2	5	5 1/2	6	6 1/2	7
R	4	6	9	9	9 1/2	10 1/2	12	13 1/2	15	21	24	27	30	33	36
S	48	46	46	38	30	25 1/2	19 3/4	39 1/4	34 3/4	35	26	35	39	30	36
T	24	27	27	35	43 1/2	48	54	58 1/2	63	63	72	65	60	66	69
U	6'–0"	6'–1"	6'–1"	6'–1"	6'–1 1/2"	6'–1 1/2"	6'–1 3/4"	8'–1 3/4"	8'–1 3/4"	8'–2"	8'–2"	8'–4"	8'–3"	8'–0"	8'–3"
V	24	30	36	42	48	54	60	66	72	72	84	90	96	102	108

FLARED END SECTION

NTS

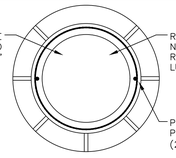


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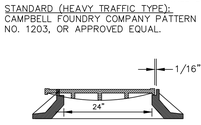
1. ONE FULL LENGTH OF WATER PIPE SHOULD BE CENTERED UNDER THE CROSS PIPE SO THAT ALL JOINTS WILL BE AS FAR FROM THE CROSSING AS POSSIBLE.

DEPRESSED WATER LINE INSTALLATION

NTS



PLAN – MANHOLE FRAME



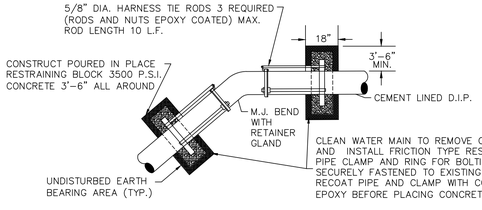
SECTION – MANHOLE FRAME

MANHOLE COVERS AND FRAMES SHALL BE:
STANDARD (HEAVY TRAFFIC TYPE):
CAMPBELL FOUNDRY COMPANY PATTERN NO. 1203, OR APPROVED EQUAL.

CONSTRUCTION NOTES:
1. MANHOLE FRAME AND COVER CASTINGS SHALL CONFORM TO THE LATEST ASTM A–48 CLASS 30 SPECIFICATION.
2. FRAME AND COVERS SHALL BE COATED WITH TWO COATS OF ASPHALTUM VARNISH.

STORM MANHOLE COVER

NTS



NUMBER AND SIZE OF RODS REQUIRED AND PIPE LENGTH IN FEET * TO BE RESTRAINED

PIPE SIZE IN INCHES	90°TEE OR DEAD END PLUG			45°			22 1/2°		
				NO.	SIZE		NO.	SIZE	
4.	2	3/4"	30'	2	3/4"	10'	2	3/4"	5'
6.	2	3/4"	40'	2	3/4"	10'	2	3/4"	5'
8.	4 OR 2	3/4" OR 7/8"	50'	2	3/4"	15'	2	3/4"	5'
10.	4 OR 2	3/4" OR 1"	60'	2	3/4"	20'	2	3/4"	5'
12.	4	7/8"	70'	2	3/4"	20'	2	3/4"	5'
14.	4	1"	80'	2	3/4"	25'	2	3/4"	5'
16.	4	1"	80'	2	3/4"	25'	2	3/4"	5'

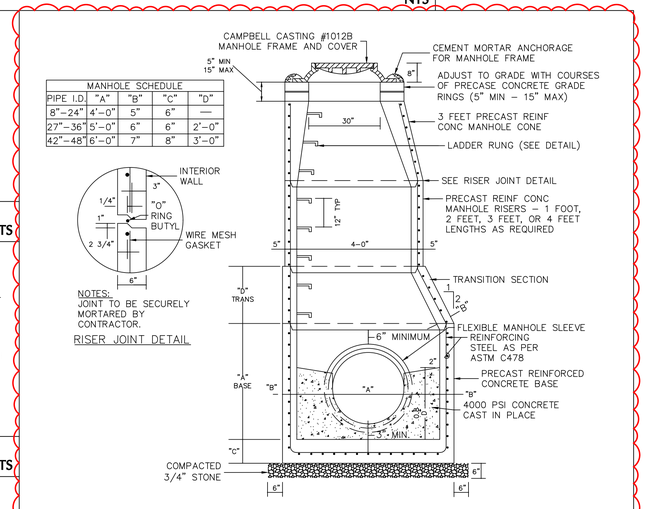
* LENGTH OF PIPE TO BE RESTRAINED IS FOR EACH SIDE OF BEND

NOTE:
CONTRACTOR TO MAKE TEST PIT TO DETERMINE DATA REQUIRED FOR FABRICATION PRIOR TO ORDERING FITTINGS, (TYPICAL)

NOTES:
1. USE OF MECHANICAL JOINT RETAINER GLANDS SHALL PROVIDE A THRUST RESTRAINT SYSTEM EQUIVALENT TO THAT LISTED IN THE TABLE FOR CLAMPS AND RODS.
2. LENGTHS ARE BASED ON THE FOLLOWING 2. CRITERIA: 150 P.S.I. MAXIMUM PRESSURE AND 3'–6" OF COVER. TABLE IS FOR USE WITH C.I./D.I.P. ONLY. IF TEST CONDITIONS ARE MORE SEVERE OR LARGER PIPES ARE PROPOSED, THEN SPECIAL COMPUTATIONS MUST BE MADE BY THE ENGINEER.

VERTICAL BEND RESTRAINTS

NTS



3

SANITARY MANHOLE

NTS

MONTCLAIR STATE UNIVERSITY

Project
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Prepared For
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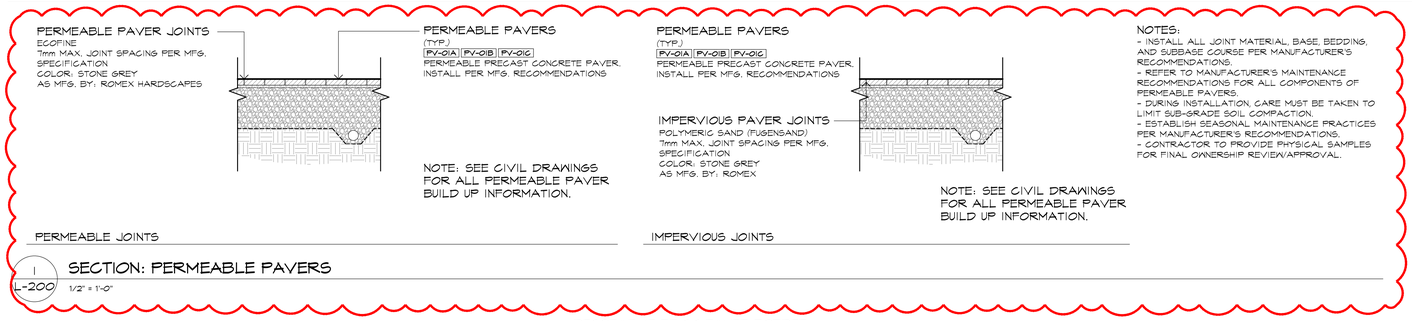
Project No: 100985401

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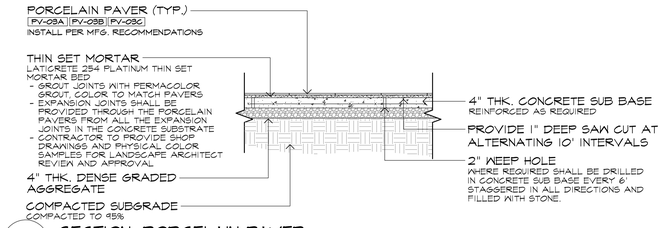
CONSTRUCTION DETAILS 5

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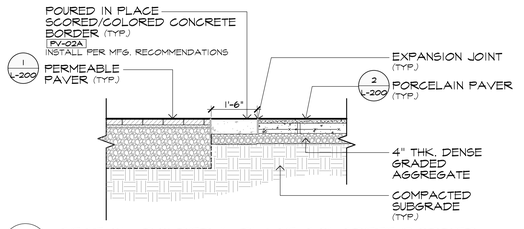
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Checked By PGM	



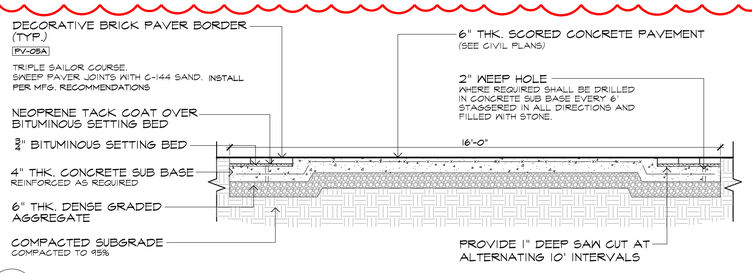
1 L-200 SECTION: PERMEABLE PAVERS
1/2" = 1'-0"



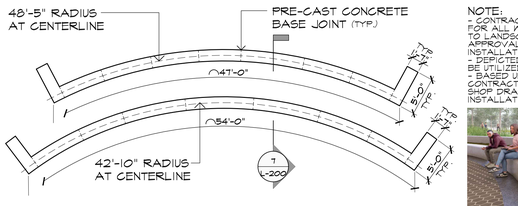
2 L-200 SECTION: PORCELAIN PAVER
1/2" = 1'-0"



3 L-200 SECTION: POURED IN PLACE CONCRETE BORDER
1/2" = 1'-0"



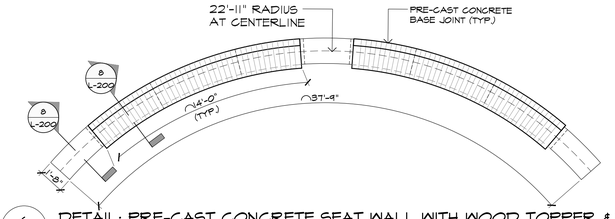
4 L-200 DETAIL: QUAD ROAD PAVEMENT
1/2" = 1'-0"





NOTE:
- CONTRACTOR TO SUBMIT SHOP DRAWINGS FOR ALL WALL AND SEATWALL COMPONENTS TO LANDSCAPE ARCHITECT FOR REVIEW AND APPROVAL PRIOR TO FABRICATION AND INSTALLATION
- DEPICTED DETAILS ON THIS SHEET ARE TO BE UTILIZED PER BASIS OF DESIGN
- BASED UPON 2 PROPOSED ALTERNATES CONTRACTOR SHALL SUBMIT SAMPLES AND SHOP DRAWINGS TO L.A. PRIOR TO INSTALLATION

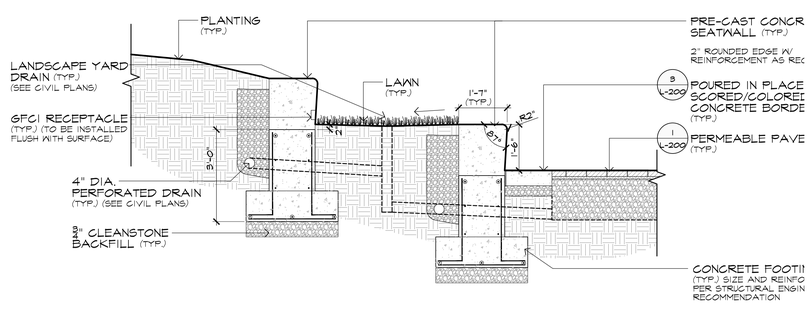
IMAGE FOR ILLUSTRATIVE PURPOSES ONLY.



6 L-200 DETAIL: PRE-CAST CONCRETE SEAT WALL WITH WOOD TOPPER & BACK ENLARGEMENT (TYP. @ CLASSROOM)
1/4" = 1'-0"

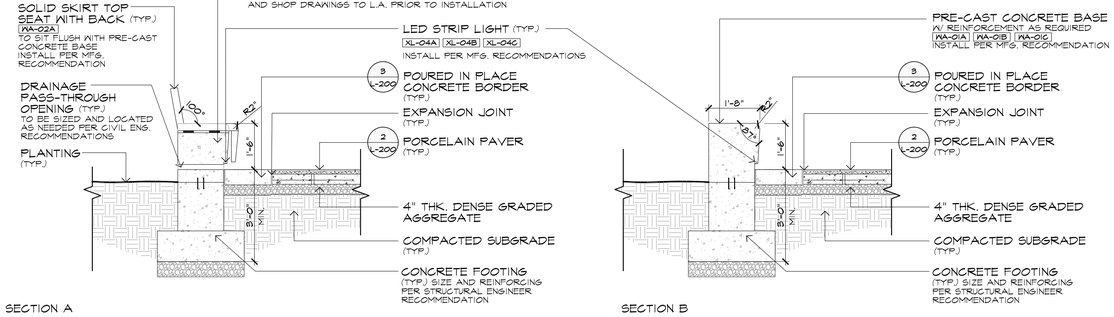


IMAGE FOR ILLUSTRATIVE PURPOSES ONLY.



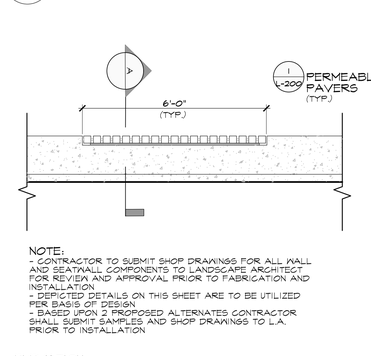
5 L-200 DETAIL: RETAINING SEAT WALL STEPS ENLARGEMENT
1/8" = 1'-0"

7 L-200 DETAIL: RETAINING SEAT WALL STEPS
1/2" = 1'-0"

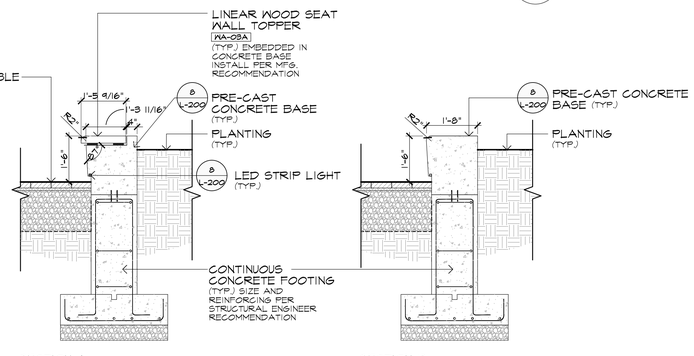


SECTION A SECTION B

8 L-200 DETAIL: PRE-CAST CONCRETE SEATWALL WITH WOOD TOPPER & BACK (TYP. @ CLASSROOM)
1/2" = 1'-0"



ELEVATION



SECTION A SECTION B

9 L-200 DETAIL: PRE-CAST CONCRETE SEATWALL WITH LINEAR WOOD TOPPER (TYP. @ PLAZA)
1/2" = 1'-0"

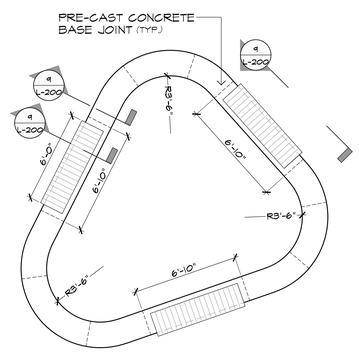




IMAGE FOR ILLUSTRATIVE PURPOSES ONLY.

10 L-200 DETAIL: PRE-CAST CONCRETE SEATWALL WITH LINEAR WOOD TOPPER ENLARGEMENT (TYP. @ PLAZA)
1/4" = 1'-0"

MONTCLAIR STATE UNIVERSITY

Project
Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For
Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
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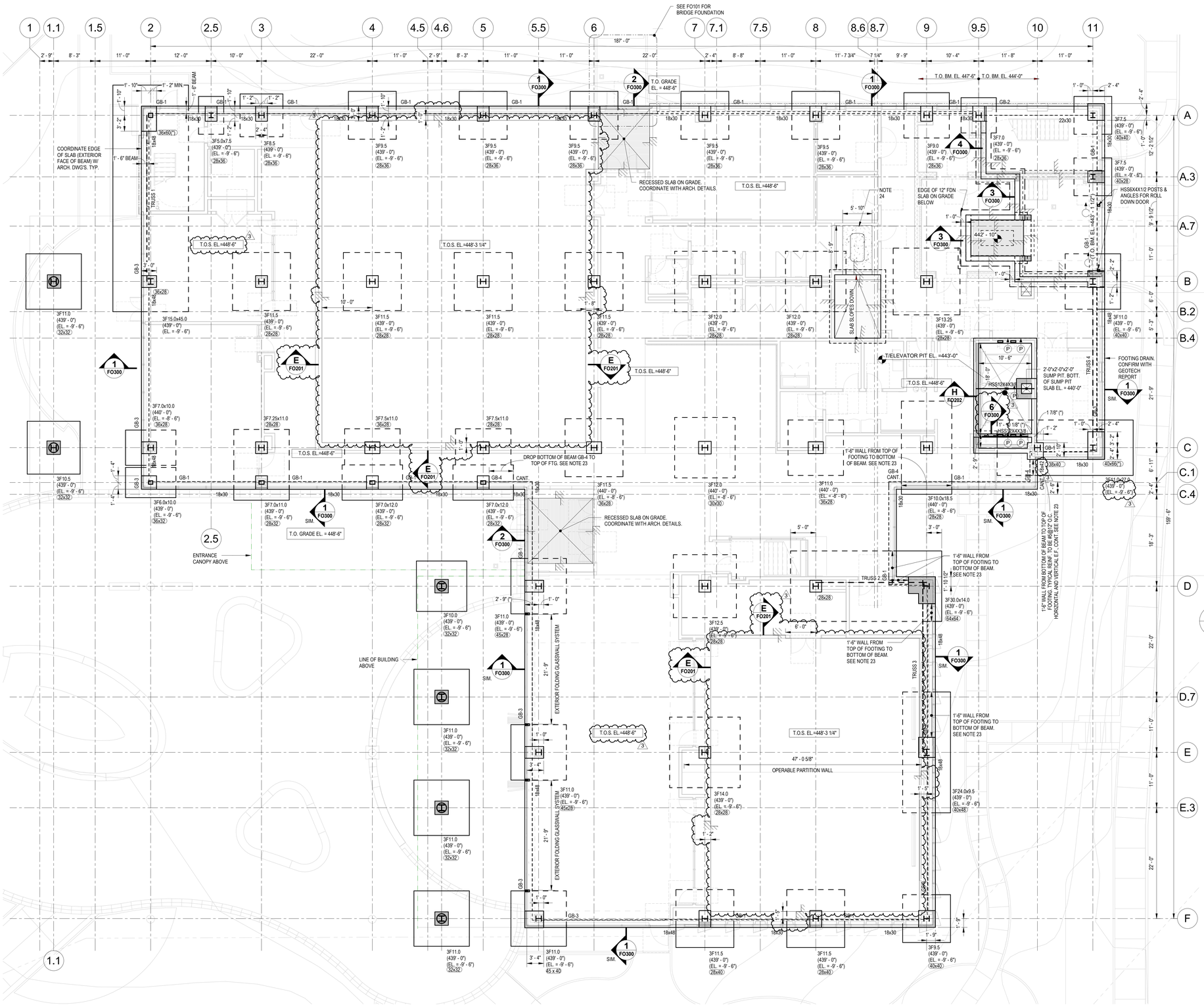
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1	ISSUED FOR CONTRACT DOCUMENTS	2025.08.14
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3	ADDENDUM #5	2026.03.23

Project No: 24-166 Scale: AS SHOWN

Sheet Title
Site Details

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number
L200



1 FOUNDATION PLAN
FO100 SCALE : 1/8" = 1'-0"

NOTES:

1. TOP OF SLAB ON GRADE AT FIRST FLOOR EL.= 448'-6" UNLESS SHOWN OTHERWISE ON PLAN. COORDINATE WITH ARCHITECTURAL DRAWINGS.
2. SLAB ON GRADE TO BE 6" THK. STONE CONCRETE (4,000 PSI N.W. NON-AIR ENTRAINED W/ MAX. W/C RATIO = 0.4), U.O.N. ON PLAN. FOR REINFORCEMENT, SEE TYPICAL DETAILS ON FO200 SERIES DRAWINGS.
3. FOR SUBGRADE UNDER SLABS ON GRADE, SEE TYPICAL DETAILS ON FO200 SERIES DRAWINGS.
4. BOTTOM OF ALL FOOTINGS TO BE AT ELEVATION 439.0', BEARING ON GLACIAL TILT (BKSF MIN.) -4'-0" MINIMUM BELOW LOWER FINISH GRADE. SUBGRADE UNDER EACH FOOTING TO BE INSPECTED AND APPROVED BY NJPE
5. FOR FOOTING SCHEDULE, SEE DRAWING FO204.
6. FOR COLUMN SCHEDULE, SEE DRAWING S500.
7. FOR BUTTRESS AND PIER SCHEDULE, SEE DRAWING FO204. SHOWN ON PLAN (PLAN E-W X PLAN N-S)
8. FOR FOUNDATION SECTIONS, SEE FO-300 SERIES DRAWINGS.
9. FOR TYPICAL FOUNDATION DETAILS AND NOTES, SEE FO200 SERIES DRAWINGS.
10. SEE SITE SURVEY DRAWING, DEMOLITION PLAN, LANDSCAPE DRAWINGS, PLUMBING DRAWINGS, ARCHITECTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS FOR PROPOSED AND EXISTING UNDERGROUND UTILITIES.
11. GENERAL EXCAVATION SHALL BE A MINIMUM OF 12" BELOW BOTTOM OF SLAB ON GRADE TO ALLOW FOR DRAINAGE COURSE AND UNIFORM BEARING OF THE SLAB. ANY SILTY SAND AT FINAL SUBGRADE SHOULD BE PROOF ROLLED.
12. SEE PLUMBING AND MECHANICAL DRAWINGS FOR ALL SLEEVE AND FLOOR DRAIN LOCATIONS AND DETAILS. G.C. TO COORDINATE. FOR SLOPE TO DRAIN, SEE ARCH. AND MECH. DRAWINGS.
13. CENTER LINE OF FOOTING & STEEL COLUMN ABOVE TO COINCIDE U.O.N. ON PLANS AND SECTIONS.
14. TOP OF SLAB ELEVATIONS, EDGE OF SLAB, AND EXTENT OF SLAB DEPRESSIONS TO BE COORDINATED/VERIFIED WITH ARCHITECTURAL DRAWINGS.
15. FOR TYPE AND EXACT LOCATION OF ELECTRICAL CONDUITS, SEE ELECTRICAL DRAWINGS. FOR ENCASEMENT DETAILS, SEE FO200 SERIES DRAWINGS.
16. SEE PLUMBING, CIVIL, AND ELECTRICAL DRAWINGS FOR EXACT LOCATION AND SIZE OF OPENINGS. SEE TYPICAL DETAILS FOR REINFORCEMENT AT OPENINGS.
17. COORDINATE FINAL SIZE/LOCATION OF MEP EQUIPMENT PADS WITH APPROVED EQUIPMENT CONFIGURATIONS & MEP DWG'S. SEE TYP. EQUIPMENT PAD DETAIL ON FO200 SERIES FOR REINF.
18. COORDINATE EXACT SIZE AND THICKNESS OF PADS WITH MECHANICAL DRAWINGS.
19. COORDINATE LAYOUTS AND DIMENSIONS OF ALL PITS WITH ARCH. / MEP DRAWINGS.
20. G.C. TO COORDINATE FINAL LOCATIONS OF ALL EQUIPMENT PADS & HOUSEKEEPING PADS W/ ARCH. & MEP DRAWINGS.
21. INFLUENCE LINE BETWEEN LOWER AND HIGHER FOOTING TO FOLLOW 2 HORIZONTAL :1 VERTICAL SLOPE. SEE GEOTECHNICAL ENGINEER REPORT FOR MORE INFO.
22. FOR EXTENT AND DEPTH OF DEPRESSION SEE ARCH. DRAWINGS.
23. DROP BOTTOM OF BEAM TO TOP OF FOOTING. PROVIDE #5 CONTINUOUS HORIZONTAL AND VERTICAL AT EACH FACE INTO FOOTING BELOW AND GRADE BEAM ABOVE.
24. PROVIDE 8" SLAB REINFORCED WITH #4@12 MID HEIGHT EACH WAY. SEE DETAIL 5/FO300 FOR REBAR PLACEMENT. EXCAVATE 2'-0" BELOW DEPTH OF TANK. PROVIDE COMPACTED GRAVEL AT ALL AREAS BELOW AND AROUND TANKS FOR WIDTH AND LENGTH OF CONCRETE SLAB.
25. ▨ - INDICATES SLAB DEPRESSION. COORDINATE WITH ARCHITECTURAL AND SEE DETAIL E/FO201.

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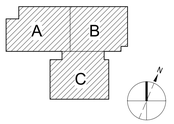
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Project No: 24.07023.00

Sheet Title

FOUNDATION PLAN

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Sheet Number

FO100

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BUTTRESS/PIER SCHEDULE

COL. NO / FLOOR	A											A.3	B										C											C.1				D					D.7	E			E.3	F					COL. NO / FLOOR
	2	2.5	3	4	5	6	7	8	9	9.5	11	11	1.1	2	3	4	5	6	7	8	9	11	1.1	2	3	4	5	6	7	8	9	10	11	2	3	4	5	4.6	5.5	7	8	9	4.6	5.5	7	9	4.6	4.6	5.5	7	8	9	
LEVEL 1																																																				LEVEL 1
EL= 0'-0" (448'-6") 1'-0" T/FOOTING	36x60 14-#11	28x36 10-#9	28x36 10-#9	28x36 10-#9	28x36 10-#9	28x36 10-#9	28x36 10-#9	28x36 10-#9	28x36 10-#9	28x36 10-#9	40x40 14-#10	40x28 12-#9	32x32 8-#10	36x28 10-#9	28x28 8-#9	28x28 8-#9	28x28 8-#9	28x28 8-#9	28x28 8-#9	28x28 8-#9	28x28 8-#9	40x40 14-#10	32x32 8-#10	36x28 10-#9	28x28 8-#9	36x28 10-#9	28x28 8-#9	30x28 10-#9	30x30 8-#9	36x28 10-#9	28x28 8-#9	38x40 12-#10	40x66 20-#10	36x32 10-#10	28x32 10-#9	28x32 10-#9	28x32 10-#9	32x32 8-#10	45x28 14-#9	28x28 8-#9	28x28 8-#9	64x64 28-#11 SEE PLAN	32x32 8-#10	45x28 14-#9	28x28 8-#9	40x48 15-#10	32x32 8-#10	32x32 8-#10	45x40 14-#10	28x40 12-#9	28x40 12-#9	40x40 14-#10	EL= 0'-0" (448'-6") T/FOOTING
EL= SEE PLAN SERVICE LOADS ON FOOTING IN KIPS																																																			EL= SEE PLAN SERVICE LOADS ON FOOTING IN KIPS
FLOOR / COL. NO	2	2.5	3	4	5	6	7	8	9	9.5	11	11	1.1	2	3	4	5	6	7	8	9	11	1.1	2	3	4	5	6	7	8	9	10	11	2	3	4	5	4.6	5.5	7	8	9	4.6	5.5	7	9	4.6	4.6	5.5	7	8	9	FLOOR / COL. NO
	A											A.3	B										C											C.1				D					D.7	E			E.3	F					

NOTES:

1. HEAVY LINE BELOW 1ST FLOOR ELEVATION INDICATES TOP OF CONCRETE BUTTRESS. HEAVY LINE BELOW INDICATES TOP OF FOOTINGS. THE ELEVATIONS IN SCHEDULE ARE TO BE CONFIRMED WITH 1ST FLOOR FRAMING PLANS, FOUNDATION PLANS, SECTIONS AND COLUMN SCHEDULE. GC TO COORDINATE.
2. FOR FOUNDATION NOTES, SEE DWG. FO001.
3. FOR ARRANGEMENT OF VERT. BARS IN BUTTRESSES, SEE TYPICAL DETAIL ON THE FO200 SERIES DWG'S.
4. 1ST DIMENSION OF PIER, PEDESTAL OR BUTTRESS IS IN "TRUE" E-W DIRECTION. (LEFT - RIGHT)
5. FOR BASE PLATE DETAILS AND ARRANGEMENT OF ANCHOR BOLTS SEE COL. SCHEDULE ON THE S500 SERIES DWG'S.
6. * - INDICATES COLUMN IN LATERAL SYSTEM. G.C. TO COORDINATE PIER/BUTTRESS SIZE W/ STEEL FABRICATOR'S CONNECTION DETAILS. IF BASE PL EXTENSION IS REQ'D., G.C. IS RESPONSIBLE FOR COORDINATING & CONFIRMING IF THE PIER SIZE IN SCHEDULE ABOVE WILL HAVE ENOUGH ROOM TO FIT BASE PL EXTENSION. IF PIER IS NOT LARGE ENOUGH, THE G.C. MUST NOTIFY THE E.O.R. & PROVIDE A MINIMUM REQUIRED SIZE W/ REINFORCEMENT FOR REVIEW & APPROVAL. IF ANY PIERS NEED TO BE ENLARGED, IT WILL BE AT NO ADDITIONAL COST TO THE OWNER.

COLUMN FOOTING SCHEDULE

(FOOTING ON 3.0 TSF SOIL) Fc' = 5000KSI

MARK	SIZE	DEPTH	REINFORCEMENT				REMARKS
			BOTT. SHORT	BOTT. LONG	TOP SHORT	TOP LONG	
3F5.07.5	7'-6" x 5'-0"	2'-0"	7-#7	7-#7	---	---	---
3F6.010.0	6'-0" x 10'-0"	2'-0"	9-#7	8-#7	---	---	---
3F7.0	7'-0" x 7'-0"	2'-0"	7-#7	7-#7	---	---	---
3F7.0x10.0	7'-0" x 10'-0"	2'-0"	8-#8	8-#8	---	---	---
3F7.0x11.0	7'-0" x 11'-0"	2'-0"	10-#7	8-#8	---	---	---
3F7.0x12.0	7'-0" x 12'-0"	2'-6"	10-#8	13-#7	---	---	---
3F7.5	7'-6" x 7'-6"	2'-0"	9-#7	9-#7	---	---	---
3F7.5x11.0	7'-6" x 11'-0"	2'-6"	11-#7	9-#8	---	---	---
3F7.25x11.0	7'-3" x 11'-0"	2'-0"	10-#7	9-#8	---	---	---
3F8.5	8'-6" x 8'-6"	2'-0"	9-#7	9-#7	---	---	---
3F9.0	9'-0" x 9'-0"	2'-0"	8-#8	8-#8	---	---	---
3F9.5	9'-6" x 9'-6"	2'-0"	10-#8	10-#8	---	---	---
3F9.5x24.0	9'-6" x 24'-0"	3'-6"	22-#9	16-#10	---	---	---
3F10.0	10'-0" x 10'-0"	3'-6"	11-#8	11-#8	---	---	---
3F10.0x18.5	10'-0" x 18'-6"	3'-3"	19-#9	14-#10	---	---	---
3F10.5	10'-6" x 10'-6"	2'-0"	12-#8	12-#8	---	---	---
3F11.0	11'-0" x 11'-0"	2'-6"	14-#8	14-#8	---	---	---
3F11.0x27.0	11'-0" x 27'-0"	2'-9"	14-#8	11-#10	11-#6	11-#8	---
3F11.5	11'-6" x 11'-6"	2'-6"	12-#9	12-#9	---	---	---
3F12.0	12'-0" x 12'-0"	2'-6"	13-#9	13-#9	---	---	---
3F12.5	12'-6" x 12'-6"	2'-6"	15-#9	15-#9	---	---	---
3F13.25	13'-3" x 13'-3"	2'-9"	14-#10	14-#10	---	---	---
3F14.0	14'-0" x 14'-0"	3'-6"	15-#9	15-#9	---	---	---
3F14.0x30.0	14'-0" x 30'-0"	3'-0"	15-#9	12-#8	14-#6	22-#10	---
3F15.0x45.0	15'-0" x 45'-0"	3'-6"	16-#9	16-#10	15-#6	24-#10	---

NOTES:

1. ALL REBARS TO HAVE STD. 90° HOOKS EACH END.

GRADE BEAM SCHEDULE

MARK	SIZE		BOTTOM REINFORCING	TOP REINFORCING			FACE BARS	STIRRUPS ALONG BEAM			REMARKS
	W	D		CONT.	ADD'L BARS WEST OR NORTH END	ADD'L BARS EAST OR SOUTH END	NUMBER AND SIZE AT EACH FACE	SIZE	TYPE	SPACING	
GB-1	18	30	4-#9	2-#9	2-#9	2-#9	2-#5	#4	3	10@6" O.C. BAL. @12	-
GB-2	22	30	4-#9	2-#9	2-#9	2-#9	2-#5	#4	3	10@6" O.C. BAL. @12	-
GB-3	18	48	6-#10	4-#10	2-#10	2-#10	3-#5	#4	4	12@6" O.C. BAL. @12	* 4 BARS AT MOST BOTTOM AND TOP LAYERS
GB-4	18	30 OR 42	4-#9	4-#9			2-#5	#4	4	8@8" O.C. BAL. @12	TIES @8" O.C. AT CANTILEVER

NOTES:

1. GRADE BEAMS ALONG PERIMETER OF BUILDING TO BE PLACED MONOLITHIC WITH FOOTINGS.

REBAR EMBEDMENT AND SPLICE LENGTH

(BASED ON ACI 318-19, SECTION 12.2.2)

PROPERTIES: f'c = 5000 psi; Fy = 60000 psi; AGGREGATE: NORMAL; COATING: UNCOATED; WEIGHT; λ = 1; β = 1

BAR SIZE	BAR DIA. (IN.)	COMPRESSION		TENSION							
		EMBEDMENT LENGTH	LAP SPLICE LENGTH	EMBEDMENT LENGTH				LAP SPLICE LENGTH (CLASS B)			
				CASE I		CASE II		CASE I		CASE II	
				TOP BARS	OTHER BARS	TOP BARS	OTHER BARS	TOP BARS	OTHER BARS	TOP BARS	OTHER BARS
#3	0.375	8	12	17	13	25	19	22	17	32	25
#4	0.500	9	15	22	17	33	25	29	22	43	33
#5	0.625	12	19	28	21	41	32	36	28	54	41
#6	0.750	14	23	33	25	50	38	43	33	65	50
#7	0.875	16	27	48	37	72	56	63	48	94	72
#8	1.000	18	30	55	42	83	64	72	55	108	83
#9	1.128	21	34	62	48	93	72	81	62	121	93
#10	1.270	23	39	70	54	105	81	91	70	137	105
#11	1.410	26	43	78	60	117	90	101	78	152	117

NOTES:

CASE I FOR BEAMS AND COLUMNS, CONCRETE COVER >=db, c TO c BAR SPACING >=2db AND WITH STIRRUPS OR TIES THROUGHOUT L(d) NOT LESS THAN THE CODE MINIMUM.
FOR OTHER ELEMENTS, CONCRETE COVER>=db AND c TO c BAR SPACING >=3db.

CASE II FOR BEAMS AND COLUMNS, CONCRETE COVER <db AND c TO c BAR SPACING <2db.
FOR OTHER ELEMENTS, CONCRETE COVER<db OR c TO c BAR SPACING <3db.

1. USE COMPRESSION SPLICE LENGTH AT ALL COLUMN SPLICE LOCATIONS NOT SPECIFICALLY DETAILED AND UNLESS INDICATED OTHERWISE ON THE PLANS OR DETAILS. USE TENSION SPLICE FOR ALL OTHER CASES.
2. THE STANDARD SPLICE (0.0005 x Fy x D) IS USED FOR COMPRESSION ON SPLICES AND THE CLASS B SPLICE IS USED FOR TENSION SPLICES.
3. TOP BARS ARE HORIZONTAL BARS PLACED SO THAT MORE THAN 12 INCHES OF CONCRETE IS CAST IN THE MEMBER BELOW THE REBAR.
4. FOR CONCRETE DESIGNED STRENGTH f'c=3,000 psi, TENSION EMBEDMENT AND SPLICE VALUES SHALL BE INCREASED BY 18% FOR #6 BARS AND HEAVIER. TABULATED VALUE SHALL BE UTILIZED FOR COMPRESSION AND TENSION BAR SIZE #5 AND LIGHTER.
5. TABULATED VALUE ABOVE MUST BE MULTIPLIED WITH THE FOLLOWING FACTORS:
   β = 1.5 FOR EPOXY COATED BARS WITH COVER < 3db, OR CLEAR SPACING <6db.
   β = 1.2 FOR OTHER COVER AND CLEAR SPACING CONDITIONS OF EPOXY COATED BARS.
   λ = 1.3 FOR LIGHT WEIGHT CONCRETE.
   αβ = 1.7 MAXIMUM.
6. LCE LENGTH OF COMPRESSION EMBEDMENT.
   LCS LENGTH OF COMPRESSION SPLICE.
7. LTE LENGTH OF TENSION EMBEDMENT.
   LTS LENGTH OF TENSION SPLICE.
8. xdb LENGTH OF EMBEDMENT OR SPLICE IN BAR Ø.

5/28/2025 9:04:03 PM

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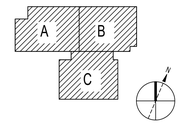
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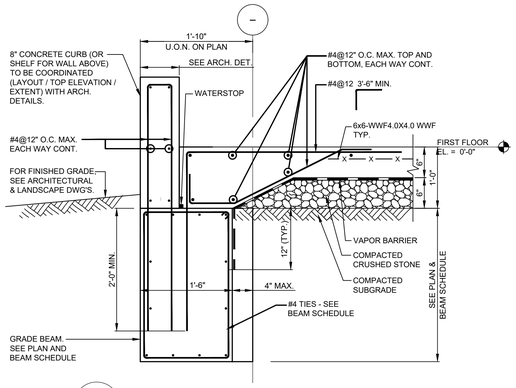
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FOUNDATION TABLES & SCHEDULES

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Sheet Number

FO204

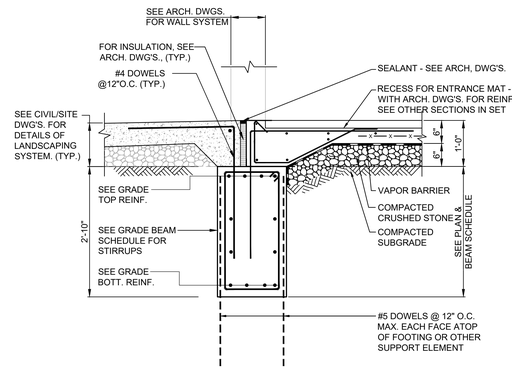


1 FO300 SECTION
SCALE: 1"=1'-0"

0 1 2 SCALE IN FEET

NOTES:

1. FOR GRADE BEAM SCHEDULE, DIMENSIONS, AND REINFORCEMENT, SEE DRAWING FO204.
2. COORDINATE EDGE OF GRADE BEAM, SLAB ON GRADE, CURB LAYOUT / DIMENSIONS WITH ARCHITECTURAL DRAWING / DETAILS.
3. DO NOT PROVIDE CURB WHERE IT IS NOT CALLED OUT ON ARCHITECTURAL DETAILS.
4. SLAB ON GRADE HAUNCH AND MINIMUM REINFORCEMENT SHOWN IS TYPICAL ALONG ALL SLAB EDGES U.O.N.
5. INFORMATION ON ONE SECTION APPLES TO ANY OTHER SIMILAR SECTION IN THE SET.

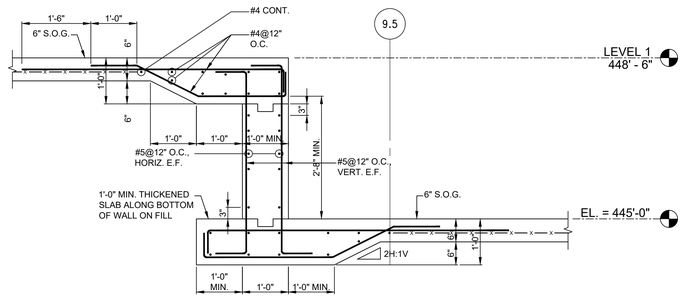


2 FO300 VESTIBULE - SECTION
SCALE:3/4"=1'-0"

0 1 2 3 SCALE IN FEET

NOTE:

1. FOR ADDITIONAL INFORMATION, SEE OTHER SECTIONS ON THE SET.

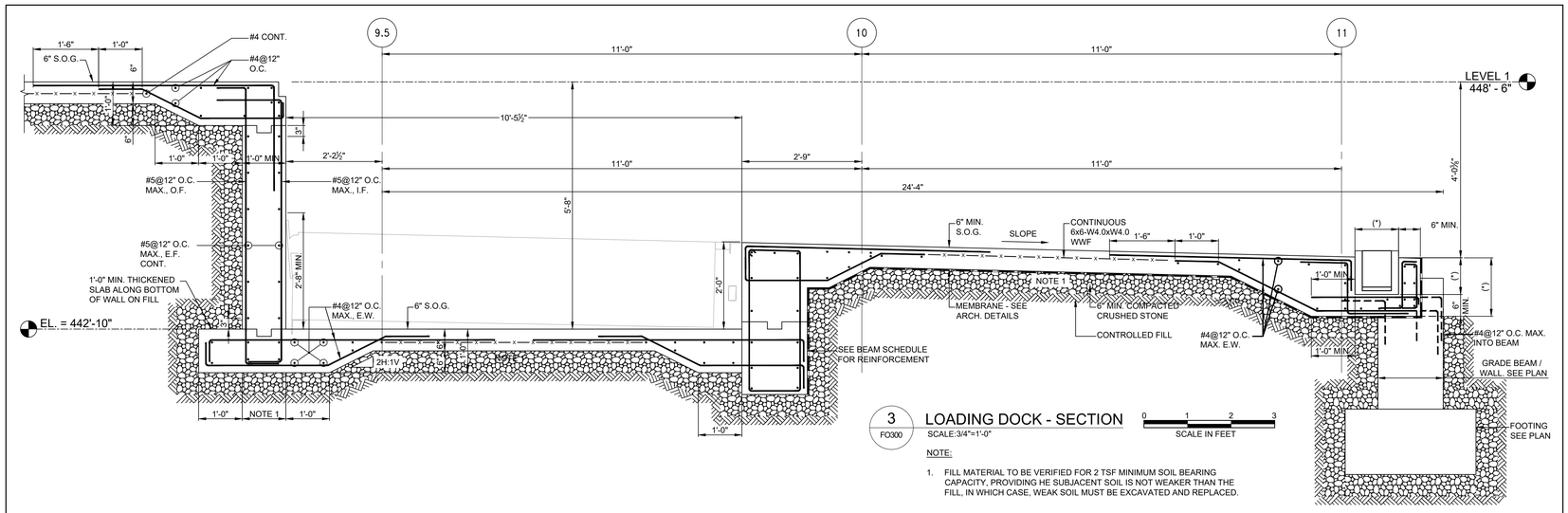


4 FO300 SECTION
SCALE:3/4"=1'-0"

0 1 2 3 SCALE IN FEET

NOTE:

1. FILL MATERIAL TO BE VERIFIED FOR 2 TSF MINIMUM SOIL BEARING CAPACITY, PROVIDING HE SUBJACENT SOIL IS NOT WEAKER THAN THE FILL, IN WHICH CASE, WEAK SOIL MUST BE EXCAVATED AND REPLACED.

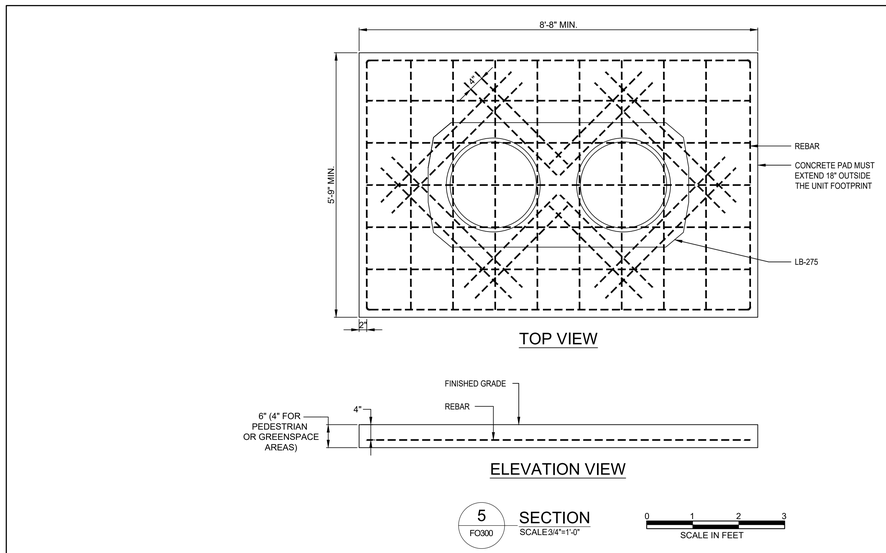


3 FO300 LOADING DOCK - SECTION
SCALE:3/4"=1'-0"

0 1 2 3 SCALE IN FEET

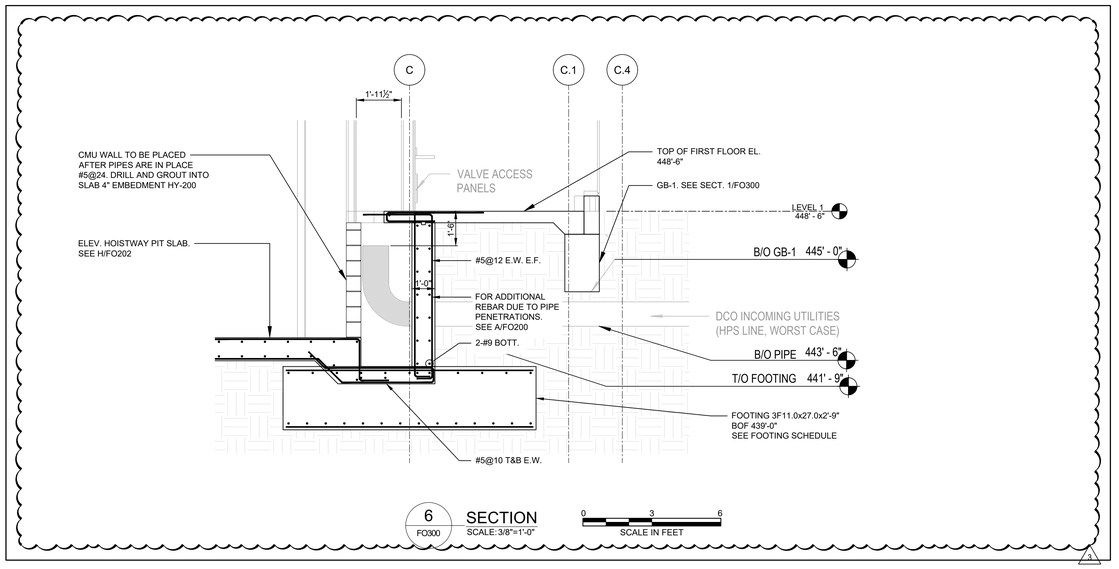
NOTE:

1. FILL MATERIAL TO BE VERIFIED FOR 2 TSF MINIMUM SOIL BEARING CAPACITY, PROVIDING HE SUBJACENT SOIL IS NOT WEAKER THAN THE FILL, IN WHICH CASE, WEAK SOIL MUST BE EXCAVATED AND REPLACED.



5 FO300 SECTION
SCALE:3/4"=1'-0"

0 1 2 3 SCALE IN FEET



6 FO300 SECTION
SCALE: 3/8"=1'-0"

0 3 6 SCALE IN FEET

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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In Association with

Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

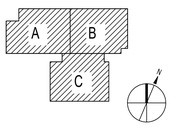
Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan



Professional Seals

NOT FOR CONSTRUCTION

No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

Sheet Title

FOUNDATION SECTIONS - SHEET NO. 1

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

FO300

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SHOP DRAWINGS AND SUBMITTALS

1. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR THE ARCHITECT'S APPROVAL PRIOR TO COMMENCEMENT OF WORK. SUCH DRAWINGS SHALL INCLUDE ERECTION PLANS, WORK PROCEDURE, SEQUENCE, AND DETAILS INTO WHICH ALL FIELD CONDITIONS HAVE BEEN INCORPORATED.
2. SHOP DRAWINGS WILL BE REVIEWED FOR COMPLIANCE WITH CONTRACT DOCUMENTS, CONSTRUCTION METHODS, DIMENSIONING AND OTHER TRADE REQUIREMENTS BY THE CONTRACTOR PRIOR TO SUBMITTAL TO THE PROJECT ENGINEER. DRAWINGS WITHOUT CONTRACTOR'S APPROVAL STAMP SHALL BE RETURNED WITHOUT ENGINEER'S REVIEW.
3. IN CASE OF A CONFLICT, INFORMATION PRESENTED ON STRUCTURAL DRAWINGS SHALL TAKE PRECEDENCE OVER THAT WITHIN SHOP DRAWINGS, UNLESS SPECIFICALLY ADDRESSED BY THE ENGINEER IN WRITING.
4. THROUGH THE PROCESS OF A CURSORY REVIEW, ENGINEER ASSUMES NO RESPONSIBILITY FOR DIMENSIONS, QUANTITIES, ERRORS OR OMISSIONS. ANY ERRORS OR OMISSIONS IRRESPECTIVE OF ENGINEER'S COMMENTS OR DURATION OF THE REVIEW SHALL BE THE RESPONSIBILITY OF AND MUST BE CORRECTED BY THE CONTRACTOR AT NO ADDITIONAL SERVICE CHARGE EVEN IF SUCH WORK WAS DONE IN ACCORDANCE WITH THE SHOP DRAWINGS.
5. THE ENGINEER RESERVES TEN WORKING DAYS FOR SHOP DRAWING REVIEW TIME (FROM THE DATE OF RECEIPT). IN CASES WHERE THE VOLUME OF SUBMITTED SHOP DRAWINGS IS VIEWED AS EXCESSIVE, THE ENGINEER RESERVES THE RIGHT TO NOTIFY THE AUTHORITY, ARCHITECT, AND THE CONTRACTOR OF THE ADDITIONAL TIME REQUIRED TO PERFORM A QUALITY REVIEW, NUMBER OF SETS WITHIN EACH INDIVIDUAL SHOP DRAWING SUBMITTAL SHALL BE LIMITED TO TWO FOR STRUCTURAL REVIEW,
6. REPRODUCTION OF ANY PORTION OF THE STRUCTURAL CONTRACT DRAWINGS FOR RESUBMITTAL AS SHOP DRAWINGS IS PROHIBITED. SHOP DRAWINGS PRODUCED IN SUCH A MANNER WILL BE REJECTED AND RETURNED.
7. ON FIRST SUBMITTAL, CLEARLY FLAG AND CLOUD ALL DIFFERENCES FROM THE CONTRACT DOCUMENTS. ON RESUBMITTALS, FLAG AND CLOUD ALL CHANGES AND ADDITIONS TO PREVIOUS SUBMITTAL; ONLY CLOUDED ITEMS WILL BE REVIEWED FOR RESUBMITTED SHOP DRAWINGS.
8. IN ADDITION TO THE ABOVE, THE STRUCTURAL ENGINEER'S REVIEW OF DELEGATED/ SPECIALTY ENGINEER SUBMITTAL IS LIMITED TO VERIFYING THAT THE SPECIFIED STRUCTURAL SUBMITTAL HAS BEEN FURNISHED, SIGNED AND SEALED BY THE DELEGATED/SPECIALTY ENGINEER AND THAT THE DELEGATED/SPECIALTY ENGINEER HAS UNDERSTOOD THE DESIGN INTENT AND USED THE SPECIFIED STRUCTURAL CRITERIA. REVIEW OF CALCULATIONS WILL BE MADE. THE DELEGATED/SPECIALTY ENGINEER IS SOLELY RESPONSIBLE FOR HIS/HER DESIGN, INCLUDING BUT NOT LIMITED TO THE ACCURACY OF HIS/HER CALCULATIONS AND COMPLIANCE WITH THE APPLICABLE CODES AND STANDARDS. DELEGATED DESIGN ITEMS ARE BUT NOT LIMITED TO, STAIR DESIGN, LADDER DESIGN, MASONRY LINTELS/BOND BEAMS, LOOSE LINTELS, LIGHTWEIGHT COLD FORM STEEL FRAMING, DECORATIVE RAW CAST ALUMINUM GRATE PANELS FOR A LIVE LOAD OF 100PSF AT BRIDGE, LIGHT POLES, FLAG POLES, BOLLARDS.
9. THE GENERAL CONTRACTOR OR CONSTRUCTION MANAGER SHALL SUBMIT STRUCTURAL SHOP DRAWINGS TO THE ARCHITECT AFTER THE GENERAL CONTRACTOR OR CONSTRUCTION MANAGER HAS REVIEWED AND NOTED ON THESE SUBMITTALS THAT THEY ARE IN CONFORMANCE WITH CONTRACT REQUIREMENTS. THE STRUCTURAL ENGINEER, UPON RECEIPT OF THESE SUBMITTALS FROM THE ARCHITECT, WILL REVIEW AND APPROVE OR TAKE OTHER APPROPRIATE ACTION UPON AND RETURN TO THE ARCHITECT FOR FINAL DISPOSITION.
10. CHANGES OR NON-CONFORMANCE TO CONTRACT REQUIREMENTS SHALL BE FLAGGED ON SUBMITTALS.
11. SUBMITTALS SHALL NOT BE USED AS A SUBSTITUTE FOR REQUESTS OR APPROVALS OF SUBSTITUTIONS OR OTHER CHANGES OR PROCEDURES REQUIRED BY THE CONSTRUCTION CONTRACT.
12. PRIOR TO SUBMITTING SHOP DRAWINGS, THE GENERAL CONTRACTOR OR CONSTRUCTION MANAGER SHALL SUBMIT A SHOP DRAWING SUBMITTAL SCHEDULE FOR THE APPROVAL OF THE STRUCTURAL ENGINEER AND THE ARCHITECT. THE SCHEDULE SHALL INCLUDE THE DATES WHEN SHOP DRAWINGS ARE TO BE SUBMITTED TO THE ARCHITECT AND THE NUMBER OF DRAWINGS AND TYPE OF DETAILS (PLANS, SCHEDULES, BEAMS, COLUMNS, ETC.) THAT WILL BE SUBMITTED ON EACH SUBMISSION DATE.
13. THE STRUCTURAL ENGINEER'S REVIEW OF, APPROVAL OF, OR OTHER ACTION UPON THE SHOP DRAWINGS IS ONLY FOR THE LIMITED PURPOSE OF CHECKING FOR CONFORMANCE WITH THE DESIGN INTENT AND INFORMATION EXPRESSED IN CONTRACT DOCUMENTS PREPARED BY THE STRUCTURAL ENGINEER.
14. THE STRUCTURAL ENGINEER'S REVIEWS SHALL NOT INCLUDE THE ACCURACY OR COMPLETENESS OF DETAILS SUCH AS WEIGHTS, GAUGES, FABRICATION OR ERECTION PROCESS, CONSTRUCTION MEANS OR METHODS, COORDINATION OF THE WORK WITH OTHER TRADES OR CONSTRUCTION SAFETY PRECAUTIONS, ALL OF WHICH ARE THE SOLE RESPONSIBILITY OF THE CONSTRUCTION MANAGER OR GENERAL CONTRACTOR.
15. THE STRUCTURAL ENGINEER'S REVIEW OF A SPECIFIC ITEM SHALL NOT EXTEND TO A REVIEW OF AN ASSEMBLY OF WHICH THE ITEM IS A COMPONENT.
16. THE STRUCTURAL ENGINEER SHALL NOT REVIEW SUBMISSIONS WHICH ARE PARTIALLY COMPLETE.
17. NO WORK MAY COMMENCE UNTIL ALL RELEVANT SHOP DRAWINGS HAVE BEEN REVIEWED AND FINAL "APPROVAL WITH NO EXCEPTIONS" HAS BEEN GRANTED BY THE ARCHITECT.
18. THE USE OF THE "REQUEST FOR INFORMATION" (RFI) PROCESS IS STRICTLY A FORM OF COMMUNICATION BETWEEN GENERAL CONTRACTOR OR CONSTRUCTION MANAGER AND THE DESIGN TEAM AND ITS SOLE PURPOSE IS TO RESOLVE MINOR ISSUES AND SHALL NOT BE USED TO PRE-PREPARE SHOP DRAWINGS.
19. STRUCTURAL STEEL SHOP DRAWINGS SHALL BE PREPARED UNDER THE SUPERVISION OF A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF NEW JERSEY WHO IS EXPERIENCED IN THE DETAILING OF STRUCTURAL STEEL AND HAS A THOROUGH WORKING KNOWLEDGE OF THE REQUIREMENTS, SUGGESTIONS, EXAMPLES AND COMMENTARIES OF THE AISC MANUAL OF STEEL CONSTRUCTION, ALLOWABLE STRESS DESIGN SPECIFICATIONS FOR STRUCTURAL STEEL BUILDINGS, THE SPECIFICATION FOR STRUCTURAL JOINTS USING ASTM A 325 OR A 490 BOLTS AND THE AMERICAN WELDING SOCIETY (AWS) D1.1 "STRUCTURAL WELDING CODE-STEEL".
20. STRUCTURAL STEEL PIECE DRAWINGS SHALL NOT BE SUBMITTED UNTIL ERECTION PLANS AND TYPICAL CONNECTION DETAIL DRAWINGS (GENERALLY REFERRED TO AS JOB STANDARDS), HAVE BEEN REVIEWED AND APPROVED BY THE STRUCTURAL ENGINEER AND ARCHITECT.
21. IF THE STRUCTURAL ENGINEER OF RECORD SO REQUESTS, THE CONSTRUCTION MANAGER AND/OR THE GENERAL CONTRACTOR SHALL SUBMIT CALCULATIONS FOR ANY OR ALL CONNECTIONS OR JOB STANDARDS SHOWN ON SHOP DRAWINGS. THESE CALCULATIONS SHALL BE SIGNED AND SEALED BY THE PROFESSIONAL ENGINEER, LICENSED IN THE STATE OF NEW JERSEY, SUPERVISING THE PREPARATION OF SHOP DRAWINGS.
22. SHOP DRAWINGS FOR CONCRETE WORK SHALL BE PREPARED UNDER THE SUPERVISION OF AN EXPERIENCED DETAILER FOR CONCRETE STRUCTURES, WHO HAS A THOROUGH WORKING KNOWLEDGE OF THE REQUIREMENTS, SUGGESTIONS, EXAMPLES AND COMMENTARIES OF ACI 318 -BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE, ACI 315-DETAILS AND DETAILING OF CONCRETE REINFORCEMENT AND THE CONCRETE REINFORCING STEEL INSTITUTE (CRSI) "MANUAL OF STANDARD PRACTICE".
23. SHOP DRAWINGS FOR CONCRETE WORK SHALL INCLUDE BUT NOT BE LIMITED TO BENDING DETAILS, LOCATION AND LENGTH OF ALL LAPS AND VERTICAL AND HORIZONTAL LOCATION OF ALL REINFORCEMENT (BARS AND WELDED WIRE FABRIC AND REINFORCEMENT) INCLUDING THE REINFORCEMENT IN SLABS CAST ON GRADE.
24. MANUFACTURER OF THERMAL BREAK ATTACHMENTS TO PROVIDE SIGNED AND SEALED CALCULATIONS SHOWING MAXIMUM CAPACITY OF CONNECTION FOR GRAVITY AND LATERAL LOADS. (4)

LIGHTWEIGHT COLD FORMED STEEL FRAMING

1. ALL LIGHT WEIGHT STEEL FRAMING WORK SHALL BE IN CONFORMANCE WITH THE SPECIFICATION SECTION 05 40 00, AND AISI "SPECIFICATION FOR THE DESIGN OF COLD FORMED STEEL WITH STRUCTURAL MEMBERS" AS WELL AS ANSI A42.4 "THE METAL LATH ASSOCIATION SPECIFICATION FOR METAL LATHING AND FURRING".
2. ALL LIGHTWEIGHT STEEL FRAMING AND COMPONENTS TO BE MANUFACTURED BY AN APPROVED MANUFACTURER COMPETENT & EXPERIENCED IN THE MANUFACTURE & INSTALLATION OF COLD FORMED STEEL. SEE SPECIFICATIONS FOR LIST OF APPROVED MANUFACTURERS.
3. INSTALL ALL METAL FRAMING IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS AND RECOMMENDATION UNLESS OTHERWISE NOTED.
4. CONTRACTOR TO SUBMIT SHOP DWGS. & CALCULATIONS SIGNED AND SEALED BY A P.E. LICENSED IN THE STATE OF NEW JERSEY PRIOR TO FABRICATION UNLESS OTHERWISE DIRECTED BY THE OWNER. LICENSED ENGINEER TO DESIGN AND DETAIL ALL CONNECTIONS AND MEMBER SIZES WITH THEIR PHYSICAL PROPERTIES.
5. CONNECTIONS SHALL BE BY WELDING, RIVETING, BOLTING, OR OTHER APPROVED FASTENING DEVICES OR METHODS PROVIDING POSITIVE ATTACHMENT AND RESISTANCE TO LOOSENING. FASTENERS SHALL BE OF COMPATIBLE MATERIAL.
6. CONTRACTOR TO VERIFY ALL DIMENSIONS, ELEVATIONS AND CONDITIONS PRIOR TO PLACING ORDER FOR FABRICATION AND ANY DISCREPANCIES SHOULD BE REPORTED IMMEDIATELY TO THE ARCHITECT/ENGINEER OF RECORD.
7. STEEL GRADES TO BE Fy = 33 KSI (MIN.). IF REQ'D USE Fy=55KSI
8. ALL COMPONENTS TO BE ZINC COATED (G90 GALVANIZED) IN ACCORDANCE WITH ASTM A-525.
9. ALL SCREWS SHALL BE H.W.H STANDARD SELF DRILLING SCREWS U.O.N ON DWGS. #10-16 FOR GAGES 20-16 #12-14 FOR GAGES 12-14 #12-24 WITH DRILL-IT POINT FOR CONNECTIONS TO STRUCTURAL STEEL. (U.O.N)
10. ALL SCREWS SHALL HAVE AN EDGE DISTANCE OF ½" (MIN) U.O.N. AND BE SPACED 1" (MIN.) ON CENTER U.O.N.
11. ALL POWDER ACTUATED FASTENERS (P.A.F.) SHALL BE A MIN. OF 0.177" DIA. & ARE TO BE SIZED BY THE COLD FORMED ENGINEER UNLESS OTHERWISE NOTED ON THE DRAWINGS, PROVIDE AS PER MANUFACTURERS GUIDELINES THE FOLLOWING EDGE DISTANCE AND FASTENER SPACINGS:

	CONCRETE	STEEL
EDGE DISTANCE	3"	1/2"
FASTENER SPACING	4"	1 1/2"
PENETRATION	1 7/16"	FULL

SPECIAL INSPECTIONS AND TESTING NOTES

SPECIAL INSPECTIONS (IBC 2021, NJ EDITION)	
SPECIAL INSPECTIONS REQUIRED IN ACCORDANCE WITH CHAPTER 17 AND THE APPLICABLE SECTIONS OF THE IBC 2021, NJ EDITION ARE LISTED IN THE FOLLOWING TABLES: THE CONTRACTOR MUST NOTIFY THE ARCHITECT OR ENGINEER FOR SPECIAL INSPECTIONS AT LEAST 72 HOURS BEFORE THE SPECIFIC WORK COMMENCES. THE FOLLOWING SPECIAL INSPECTIONS ARE TO BE COMPLETED:	
STRUCTURAL STEEL - WELDING	BC 1704.3.1
STRUCTURAL STEEL - BOLTING	BC 1704.3.2, BC 1704.3.2
STEEL FRAME JOINT DETAILS	BC 1704.3.2
CONCRETE CONSTRUCTION	BC 1704.4

SPECIAL INSPECTIONS SHALL BE IN ACCORDANCE WITH THE APPLICABLE BUILDING CODE SECTIONS. SIGNED COPIES OF ALL TESTS AND INSPECTIONS REPORTS SHALL BE FILED WITH THE DEPARTMENT OF BUILDINGS THROUGH THE APPLICANT.

1. G.C. SHALL PROVIDE TO THE TESTING AGENCY THE FOLLOWING: A FULL SET OF THE MOST CURRENT STRUCTURAL DRAWINGS AND GENERAL NOTES.
   - 1.1. SUFFICIENT NOTICE, AS AGREED AT THE START OF THE PROJECT, PRIOR TO THE WORK TO PERFORM TESTING WITHOUT DELAYING THE WORK.
   - 1.2. FULL EASY ACCESS TO ALL MATERIALS AND COMPONENTS TO BE TESTED.
2. THE APPROVED SPECIAL INSPECTION AGENCY SHALL SUBMIT RESULTS OF ALL TESTS OR INSPECTIONS TO THE OWNER AND ARCHITECT. THE TESTING AGENCY WILL BE RESPONSIBLE FOR CONDUCTING AND INTERPRETING THE TESTS AND WILL PREPARE REPORTS WHICH STATE WHETHER OR NOT THE RESULTS COMPLY WITH THE CONTRACT DOCUMENTS. REPORTS SHALL SUMMARIZE THE TYPE OF TEST OR INSPECTION, THE LOCATION OR COMPONENT TESTED OR INSPECTED, AND RECOMMEND ANY REMEDIAL MEASURES REQUIRED. THE REPORT SHALL ALSO NOTE ANY OTHER DEVIATIONS FROM THE CONTRACT DOCUMENTS.
3. MINIMUM QUALIFICATIONS FOR SPECIAL INSPECTOR:
   - 3.1. MEETS THE REQUIREMENTS OF N.J.A.C. 5:23-5.19G & IS APPROVED BY THE N.J.D.C.A.
4. THE FOLLOWING ITEMS0 OF WORK, AS APPROPRIATE, SHALL BE SUBJECT TO SPECIAL INSPECTION:
   - 4.1. STEEL CONSTRUCTION (BC TABLE 1704.3)
     - 4.1.1. HIGH STRENGTH BOLTING BC 1704.3.3
     - 4.1.2. WELDING BC1704.3.1
     - 4.1.3. STEEL FRAME JOINT DETAILS BC 1704.3.2
   - 4.2. CONCRETE CONSTRUCTION (BC 1704.4)
     - 4.2.1. REINFORCING STEEL BC 1913.4
     - 4.2.2. REINFORCING STEEL WELDING
     - 4.2.3. ANCHOR BOLTS BC 1911.5 & 1912.1
     - 4.2.4. INSTALLED ANCHOR BOLTS BC 1912.1
     - 4.2.5. DESIGN MIX BC 1904.2.2., 1913.2 & 1913.3
     - 4.2.6. FRESH CONCRETE SLUMP, AIR, STRENGTH & TEMP. TESTING BC 1913.10
     - 4.2.7. CONCRETE & SHOTCRETE PLACEMENT BC 1913.6, 1913.7 & 1913.8
     - 4.2.8. CONCRETE CURING BC 1913.9
     - 4.2.9. PRESTRESSED CONCRETE
     - 4.2.10. ERECTION OF PRECAST CONCRETE
     - 4.2.11. IN-SITU CONCRETE STRENGTH & REMOVAL OF FORMS & SHORES
     - 4.2.12. FORMWORK
5. THE OWNER WILL RETAIN AN INDEPENDENT TESTING AGENCY TO CARRY OUT THE SPECIAL INSPECTIONS AND TESTING. SEE NOTES BELOW FOR ADDITIONAL TESTS, ETC. REQUIRED FOR WELDING AND CONCRETE.
6. THE SPECIAL INSPECTOR IS TO PROVIDE A REPORT TO THE EOR FOR REVIEW CERTIFYING THAT THE NEW BACK FILL USED FOR BEARING IS SUITABLE FOR THE BEARING VALUE OF 2500psf PER SECTION 1803.5.8 OF THE NJ IBC 2021

SUPERSTRUCTURE ABBREVIATIONS AND SYMBOLS.

a. <. . . > INDICATES NUMBER OF SHEAR CONNECTORS.
b. [. . .] INDICATES CAMBER IN INCHES.
c. MC OR ► INDICATES MOMENT CONNECTION DESIGNED FOR FULL CAPACITY OF LARGEST MEMBER. SEE DETAILS.
d. INDICATES DIRECTION OF DECK SPAN.
e. INDICATES DROP OF SLAB.
f. INDICATES LIGHTWEIGHT CONCRETE FILL. (FOR EXTENT SEE ARCH DWG).
g. BP INDICATES BEARING PLATE SEE TYPICAL DETAILS ON FO200 SERIES.
h. P.J.P. PARTIAL JOINT PENETRATION.
i. INDICATES BEAM PENETRATION IN WEB.
j. N.F.P. INDICATES NO FIREPROOFING.
k. INDICATES COLUMN ABOVE (STARTS AT THIS LEVEL).
l. INDICATES COLUMN BELOW (STOPS AT THIS LEVEL).
m. (P) INDICATES POST ABOVE OR BELOW.
n. (H) INDICATES HANGER ABOVE OR BELOW.
o. CANT. INDICATES CANTILEVER BEAM WITH MC AT THE COLUMN. BACK-UP BEAM ALSO TO RECEIVE MC AT THE SAME COLUMN.
p. STRUCTURAL STEEL. CENTER LINE AND BOTH FLANGES SHOWN.
q. INDICATES BEARING WALL BLOCK.
r. E.P. INDICATES EMBEDDED PLATE.
r. INDICATES SLAB DEPRESSION.

ABBREVIATION LIST

ACI	AMERICAN CONCRETE INSTITUTE
ADD'L	ADDITIONAL
ADJ	ADJACENT
AESS	ARCHITECTURALLY EXPOSED STRUCTURAL STEEL
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
ARCH	ARCHITECTURAL
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AWS	AMERICAN WELDING SOCIETY
BLDG	BUILDING
BRG	BEARING
BS	BOTH SIDES
CANT	CANTILEVER
CL	CENTERLINE
COL	COLUMN
CM	CONSTRUCTION MANAGER
CONC	CONCRETE
CONT	CONTINUOUS
CY	CUBIC YARDS
DEMO	DEMOLITION
DTL	DETAIL
DIA	DIAMETER
DIM	DIMENSION
DL	DEAD LOAD
DO	DITTO
DWG	DRAWING
EA	EACH
EF	EACH FACE
EL	ELEVATION
EOS	EDGE OF SLAB
EQ	EQUAL (SPACING)
ES	EACH SIDE
EW	EACH WAY
EXIST	EXISTING
', FT	FEET
FF	FINISH FLOOR
FIN	FINISHED
FLG	FLANGE
GA	GAGE OR GAUGE
GALV	GALVANIZED
H, HORIZ	HORIZONTAL
", IN	INCH
K	KIP = 1000 LBS
KSF	KIPS PER SQUARE FOOT
KSI	KIPS PER SQUARE INCH
LL	LIVE LOAD
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LW	LONG WAY OR LIGHT WEIGHT CONCRETE
MAX	MAXIMUM
MECH	MECHANICAL
MIN	MINIMUM
MISC	MISCELLANEOUS
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OPNG	OPENING
OP.WT	OPERATING WEIGHT
PCF	POUNDS PER CUBIC FOOT
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
REINF	REINFORCED
REQ'D	REQUIRED
REV	REVISION
SF	SQUARE FEET OR STEPPED FOOTING
SIM	SIMILAR TO,NOT EXACTLY THE SAME; BUT INTENT IS THE SAME
SJ	SAW CUT CONTROL JOINT
SPEC	SPECIFICATION
SQ.FT	SQUARE FOOT
SQ.IN	SQUARE INCH
SS	STAINLESS STEEL
STD	STANDARD
STIFF	STIFFENER
SW	SHORT WAY
SYM	SYMMETRICAL
TBD	TO BE DETERMINED
THK	THICK
TOC	TOP OF CONCRETE
TOS	TOP OF SLAB
T/S	TOP OF STEEL
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
V, VERT	VERTICAL
VIF	VERIFY IN FIELD SOLID AT SPACING NOTED
W/	WITH
W/O	WITHOUT
WP	WORKING POINT
WWF	WELDED WIRE FABRIC
WWR	WELDED WIRE REINFORCEMENT

LATERAL FORCE CRITERIA & LOADING SCHEDULE

EARTHQUAKE DESIGN DATA		
DESIGN CRITERIA		REFERENCE
SEISMIC IMPORTANCE FACTOR	I_E = 1.25	ASCE 7 TABLE 1.5-2
RISK CATEGORY	III	ASCE 7 TABLE 1.5-1 IBC TABLE 1604.5
MAPPED SPECTRAL RESPONSE ACCELERATION AT SHORT PERIODS MAPPED SPECTRAL RESPONSE ACCELERATION AT 1 SECOND PERIODS	S_S= 0.289g S_1= 0.06g	IBC 1613.3
SITE CLASS	C	IBC 1613.3
DESIGN SPECTRAL RESPONSE ACCELERATIONS	S_{DS} = (2/3) (S_{MS} = 0.302g) S_{D1} = (2/3) (S_{M1} = 0.096g)	IBC 1613.3 ASCE 7-10 SECTION 14.4.4
SEISMIC DESIGN CATEGORY	B	IBC 1613.3.5 ASCE 7-16 TABLE 11.6-1 & 11.6-2
BASIC SEISMIC FORCE RESISTING SYSTEM	STEEL SYSTEM NOT SPECIFICALLY DETAILED FOR SEISMIC RESISTANCE	ASCE 7 TABLE 12.2-1
RESPONSE MODIFICATION FACTOR	R= 3	ASCE 7 TABLE 12.2-1
SEISMIC RESPONSE COEFFICIENT	C_S = S_{DS} /(R/I_E)=	ASCE 7 SECTION 12.8.1.1
DESIGN BASE SHEAR	V= CsW= T=	ASCE 7 SECTION 12.8.1
ANALYSIS PROCEDURE USED	EQUIVALENT LATERAL FORCE	ASCE 7 SECTION 12.8
LIQUEFACTION	NOT APPLICABLE	GEOTECH REPORT

WIND DESIGN DATA		
DESIGN CRITERIA		REFERENCE
BASIC WIND SPEED	125 MPH	ASCE7-16; 26.5.1
WIND IMPORTANCE FACTOR (Iw)	1.00	ASCE7-16; TABLE 1.5-2
WIND EXPOSURE	CATEGORY B	ASCE7-16; 26.7
INTERNAL PRESSURE COEFFICIENT	GC pi=±0.18 ENCLOSED	ASCE 7 ASCE7-16; 26.11.1 26.13-1
COMPONENTS AND CLADDING	SEE TABLE	ASCE 7-16; 30 (*), (**)
OCCUPANCY CATEGORY	III	ASCE7-16; TABLE 1.5-1
DIRECTIONALITY FACTOR	Kd = 0.85	ASCE7-16; TABLE 26.6-1

(*) WIND PRESSURES TO ALSO BE DETERMINED BY DELEGATED DESIGN ENGINEER
(**) STRUCTURE MAY BE IN WIND-BORNE DEBRIS REGION. EXTERIOR CURTAIN WALL / BLDG. ENVELOPE TO MEET MISSILE IMPACT REQUIREMENTS, IF REQ'D.

ROOF SNOW LOADS		
DESIGN CRITERIA		REFERENCE
GROUND SNOW LOAD	Pg=25 PSF	ASCE 7-16 SECTION 7.2
FLAT ROOF SNOW LOAD	Pf=22 PSF	ASCE 7-16 SECTION 7.3
SNOW EXPOSURE FACTOR (MAIN ROOF)	1.0	ASCE 7-16; 7.3.1
SNOW LOAD IMPORTANCE (Is)	1.1	ASCE 7-16; 7.3.3
THERMAL FACTOR	1.0	ASCE 7-16; 7.3.2
OCCUPANCY CATEGORY	III	ASCE7-16; TABLE 1.5-1

LOADING SCHEDULE							
FLOOR \ LOAD	SLAB (PSF)	FILL & FINISHES (PSF)	CEILING & HANG. (PSF)	PARTITION (PSF)	TOTAL D . L (PSF)	TOTAL L . L (PSF)	REMARKS
MECH PENTHOUSE FLOOR	48	50	15	-	113	75	
FLAT ROOF	44	20	10	-	74	42	+ SNOW DRIFT
FLAT ROOF + EQUIPMENT	44	20	10	-	74	100	LL INCLUDES EQUIPMENT WEIGHT
CUBE ROOF W/VEG	44	80	10	-	150	45	GT-4 INSTA GREEN
LABORATORIES/CLASSROOMS	78	5	10	12	105	60	
UPPER CORRIDORS/EXITS/LOBBIES	78	5	10	12	105	80	
TOILETS	78	15	10	12	115	60	
1ST FLR CORRIDORS/EXITS/LOBBIES	75	5	-	12	93	100	
OFFICES	78	5	10	12	105	50	
CUBE ROOF PA SPACE	44	25	10	-	79	100	
DOAS PLATFORM					20	60	300 LBS CONCENTRATED LOAD

(4)

COMPONENTS AND CLADDING DIAGRAM

COMPONENTS AND CLADDING															
LOCATION	ROOF - 10 SF AREA			WALL - 10 SF AREA		ROOF - 50 SF AREA			WALL - 50SF AREA		ROOF - 100 SF AREA			WALL - 100 SF AREA	
	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5
POSITIVE PRESSURE				34.76	34.76				32.01	32.01				29.93	29.93
NEGATIVE PRESSURE	-50.85	-79.81	-108.78	-34.76	-63.72	-44.23	-70.55	-96.86	-32.92	-56.39	-41.38	-66.55	-91.73	-31.54	-50.85

NOTE: DESIGN OF THE METAL DECK ATTACHMENT / WELD PER COMPONENTS AND CLADDING SHOWN ABOVE. CALCULATIONS TO BE SIGNED AND SEALED BY A P.E. IN THE STATE OF N.J.

MONTCLAIR STATE UNIVERSITY

Project
Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For
Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Parsippany, NJ 07054

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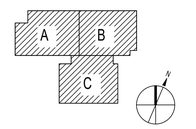
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Key Plan



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Sheet Title

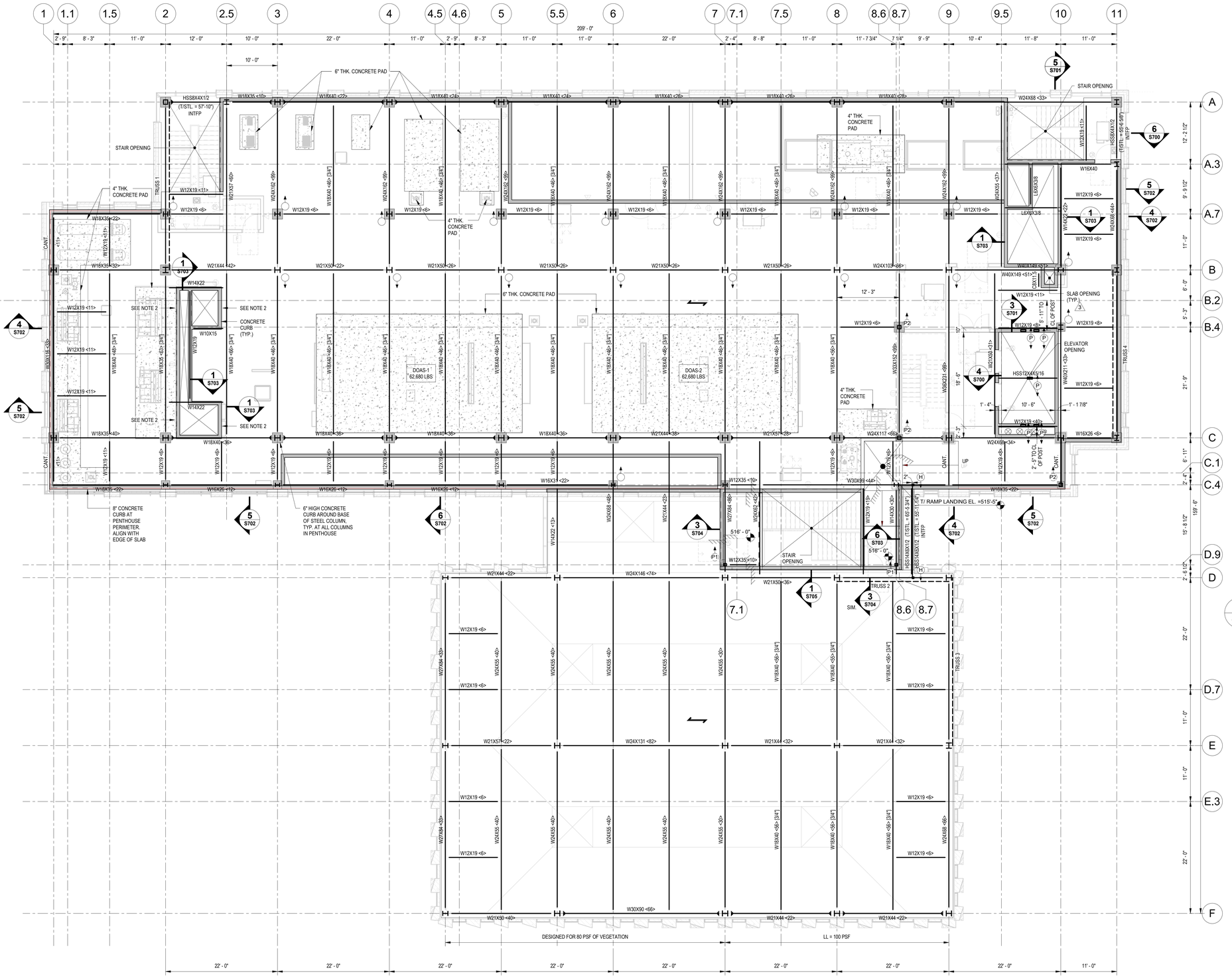
GENERAL NOTES - SHEET NO. 2

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Sheet Number

S002

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1 PENTHOUSE FRAMING PLAN
S105 SCALE : 1/8" = 1'-0"

NOTES:

1. TOP OF SLAB SHALL BE EL = 66'-0" (514.5') U.O.N. SLAB SHALL BE 3 1/4" (4 1/2") LIGHTWEIGHT CONCRETE OVER 3"-18 GAGE GALVANIZED METAL DECK REINFORCED WITH 6x6-W2.9xW2.9 WWF. THE PROJECT HAS BEEN DESIGNED IN ACCORDANCE WITH THE PROPERTIES OF CMC-USDECK fy = 40 ksi, MAXIMUM UNSHORED 2 SPAN CONDITION = 13.78 FEET FOR A 6 1/4" LIGHTWEIGHT (115 pcf) COMPOSITE SLAB. BEAMS ARE SPRAY FIREPROOFED. METAL DECK DOES NOT RECEIVE SPRAY ON FIREPROOFING.
2. FOR REINFORCEMENT, SEE TYPICAL DETAILS ON S400 SERIES. ALL OPENINGS NOTED SHALL HAVE 2-#5 T&B ALL AROUND AS SHOWN ON TYPICAL DETAIL AS WELL AS ADDITIONAL REINFORCEMENT SHOWN ON PLAN. METAL DECK FOR OPENINGS INDICATED IS NOT TO BE CUT BUT TO BE BLOCKED OUT FOR COMPLETE POUR DECK TO BE CUT IN MIN OF 7 DAYS AFTER POUR.
3. FOR SUPERSTRUCTURE SECTIONS SEE 700 SERIES DRAWINGS.
4. FOR SUPERSTRUCTURE TYPICAL DETAILS SEE 600 SERIES DRAWINGS.
5. FOR GENERAL NOTES AND LEGEND SEE DRAWINGS S001 & S002.
6. FOR COLUMN SCHEDULE AND TRUSS DETAILS SEE 400 & 500 SERIES DRAWINGS.
7. FOR EXTENT AND DEPTH OF DEPRESSION SEE ARCH. DRAWINGS.
8. U.O.N. ON PLAN R-15k FOR W10x15, W12x16, & W12x19 BEAMS.
9. CANT. INDICATES CANTILEVERS SIZE IS THE SAME SIZE AS THE BACK SPAN.
10. ALL BEAMS UNDER CONCRETE AND METAL DECK ARE COMPOSITE AND RECEIVE ONE 3/4" STUD @ 1'-0" O.C. U.O.N. ON PLAN THUS <...>.
11. FOR SLAB EDGE AND OPENINGS LOCATION SEE ARCHITECTURAL DRAWINGS. ALL BEAMS ARE LOCATED 1/2 FLANGE +/" BACK FROM SLAB EDGE U.O.N. ON PLAN.
12. U.O.N. ALL BEAMS ARE EQUALLY SPACED IN A BAY.
13. PROVIDE 3/8" FULL DEPTH BEAM STIFFENERS (B.S.) WHERE STRINGER ATTACHES OR BEARS ON BEAM.
14. ALL BEAMS FRAMING INTO A SPANDREL BEAM MUST HAVE A FULL DEPTH CONNECTION WITH A 3/8" STIFFENER ON THE OUTSIDE.
15. CONTRACTOR TO COORDINATE BEAM OPENINGS LOCATIONS AND QUANTITIES AS REQUIRED PER FULL BUILDING SYSTEMS COORDINATION. GC & CONTRACTOR RESPONSIBLE TO PLACE OPENINGS TO ALLOW SYSTEMS DESIGNED TO FALL WITHIN THE LIMITS OF WALLS, CEILINGS, FLOORS, ETC.
16. GC TO PROVIDE ADDITIONAL HSS12x4X5/16 5'-0" BELOW TOP OF SLAB ON EACH FLOOR IF REQUIRED BY ELEVATOR MANUFACTURER.
17. ALL STAIRS TO BE SUPPORTED BY BEAMS PROVIDED. ANY SLAB EXTENDING INTO THE STAIR OPENING BEYOND THE BEAM FLANGE IS TO BE SUPPORTED AND DETAILED BY THE STAIR MANUFACTURER AS PART OF THE STAIRS. ANY ADDITIONAL STEEL NOT SHOWN ON THE DRAWINGS TO CREATE A FULLY FUNCTIONAL STAIRS IS TO BE PROVIDED BY STAIR MANUFACTURER AT NO ADDITIONAL COST TO THE WNER. STAIR MANUFACTURER TO COORDINATE WITH A DRAWINGS AS WELL AS STRUCTURAL STEEL FABRICATOR.
18. ALL LINTELS MUST BE COORDINATED WITH ARCHITECTURAL DRAWINGS PRIOR TO SUBMITTING SHOP DRAWINGS. ANY DISCREPANCIES MUST BE BROUGHT TO THE ATTENTION OF THE AOR AND EOR.
19. (P) INDICATES HSS12X4X1/2
20. (P1) INDICATES HSS6X6X1/2
21. (P2) INDICATES HSS8X8X3/8
22. (H) INDICATES HSS4X4X3/8 HANGER
23. ALL HSS MUST HAVE MIN 1/4" END CAPS.
24. INDICATES MOMENT CONNECTION FOR MOMENT FRAME
25. INTFP INDICATES INTUMESCENT FIREPROOFING
26. INDICATES SLAB ORIENTATION
27. ALL CONCRETE PADS MUST BE LIGHT WEIGHT CONCRETE.

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t +1 212 741 1200 www.hok.com

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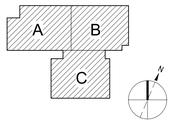
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Key Plan



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Sheet Title

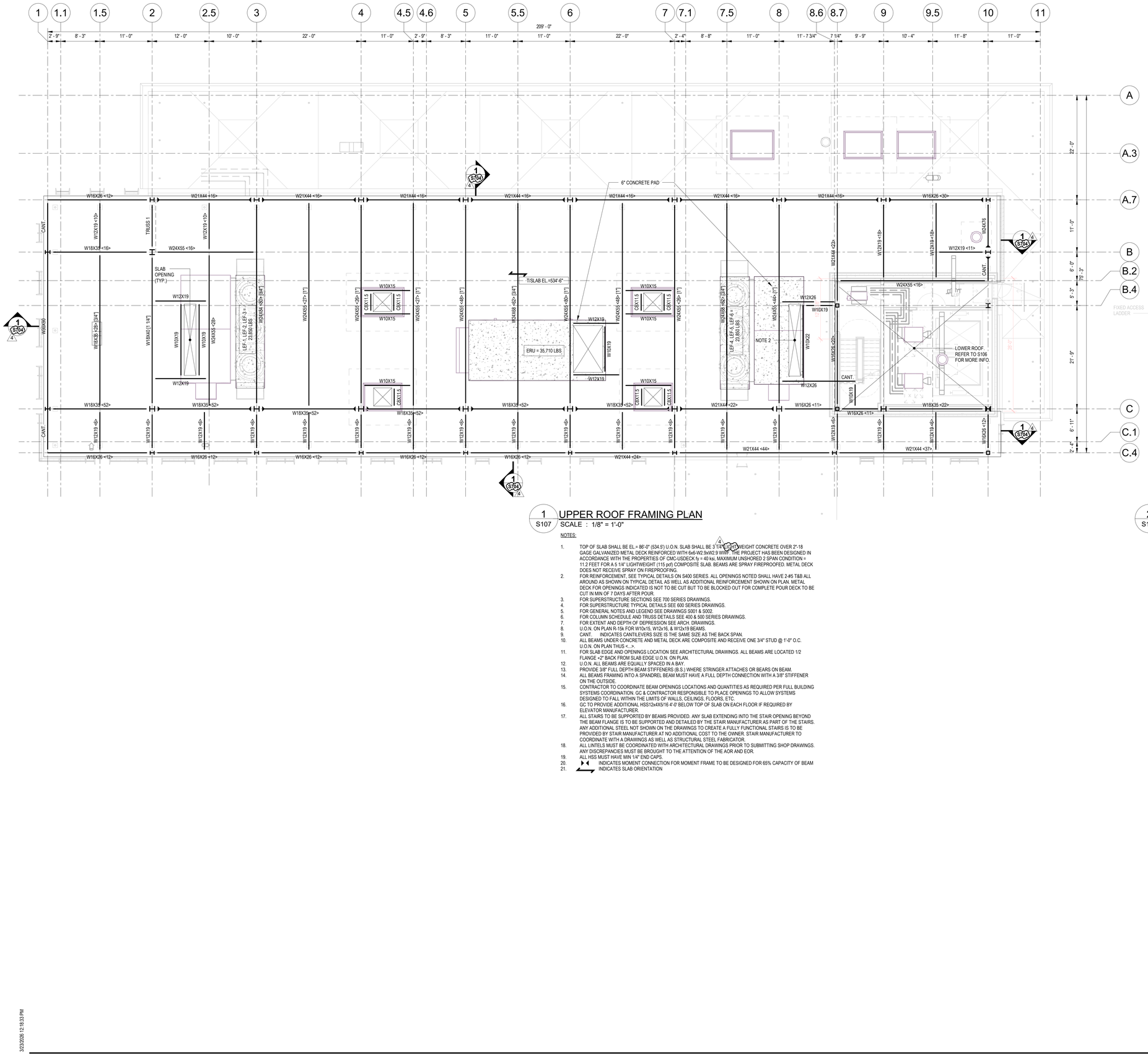
PENTHOUSE FRAMING PLAN

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Sheet Number

S105

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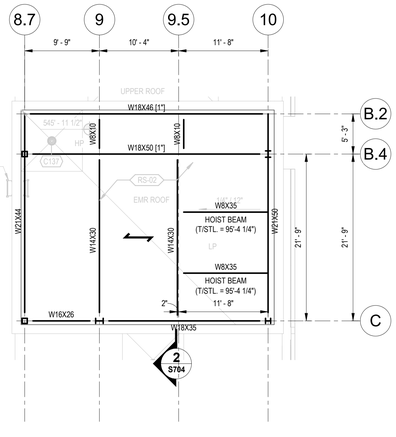


1 UPPER ROOF FRAMING PLAN

S107 SCALE : 1/8" = 1'-0"

NOTES:

1. TOP OF SLAB SHALL BE EL = 86'-0" (534.5') U.O.N. SLAB SHALL BE 3 1/4" LIGHTWEIGHT CONCRETE OVER 2"-18 GAGE GALVANIZED METAL DECK REINFORCED WITH 6x6-W2.9xW2.9 WWF. THE PROJECT HAS BEEN DESIGNED IN ACCORDANCE WITH THE PROPERTIES OF CMC-USDECK fy = 40 ksi, MAXIMUM UNSHORED 2 SPAN CONDITION = 11.2 FEET FOR A 5 1/4" LIGHTWEIGHT (115 pcf) COMPOSITE SLAB. BEAMS ARE SPRAY FIREPROOFED. METAL DECK DOES NOT RECEIVE SPRAY ON FIREPROOFING.
2. FOR REINFORCEMENT, SEE TYPICAL DETAILS ON S400 SERIES. ALL OPENINGS NOTED SHALL HAVE 2-#5 T&B ALL AROUND AS SHOWN ON TYPICAL DETAIL AS WELL AS ADDITIONAL REINFORCEMENT SHOWN ON PLAN. METAL DECK FOR OPENINGS INDICATED IS NOT TO BE CUT BUT TO BE BLOCKED OUT FOR COMPLETE POUR DECK TO BE CUT IN MIN OF 7 DAYS AFTER POUR.
3. FOR SUPERSTRUCTURE SECTIONS SEE 700 SERIES DRAWINGS.
4. FOR SUPERSTRUCTURE TYPICAL DETAILS SEE 600 SERIES DRAWINGS.
5. FOR GENERAL NOTES AND LEGEND SEE DRAWINGS S001 & S002.
6. FOR COLUMN SCHEDULE AND TRUSS DETAILS SEE 400 & 500 SERIES DRAWINGS.
7. FOR EXTENT AND DEPTH OF DEPRESSION SEE ARCH. DRAWINGS.
8. U.O.N. ON PLAN R-15k FOR W10x15, W12x16, & W12x19 BEAMS.
9. CANT. INDICATES CANTILEVERS SIZE IS THE SAME SIZE AS THE BACK SPAN.
10. ALL BEAMS UNDER CONCRETE AND METAL DECK ARE COMPOSITE AND RECEIVE ONE 3/4" STUD @ 1'-0" O.C. U.O.N. ON PLAN THUS <...>.
11. FOR SLAB EDGE AND OPENINGS LOCATION SEE ARCHITECTURAL DRAWINGS. ALL BEAMS ARE LOCATED 1/2 FLANGE +2" BACK FROM SLAB EDGE U.O.N. ON PLAN.
12. U.O.N. ALL BEAMS ARE EQUALLY SPACED IN A BAY.
13. PROVIDE 3/8" FULL DEPTH BEAM STIFFENERS (B.S.) WHERE STRINGER ATTACHES OR BEARS ON BEAM.
14. ALL BEAMS FRAMING INTO A SPANDREL BEAM MUST HAVE A FULL DEPTH CONNECTION WITH A 3/8" STIFFENER ON THE OUTSIDE.
15. CONTRACTOR TO COORDINATE BEAM OPENINGS LOCATIONS AND QUANTITIES AS REQUIRED PER FULL BUILDING SYSTEMS COORDINATION. GC & CONTRACTOR RESPONSIBLE TO PLACE OPENINGS TO ALLOW SYSTEMS DESIGNED TO FALL WITHIN THE LIMITS OF WALLS, CEILINGS, FLOORS, ETC.
16. GC TO PROVIDE ADDITIONAL HSS12x4X5/16 4'-0" BELOW TOP OF SLAB ON EACH FLOOR IF REQUIRED BY ELEVATOR MANUFACTURER.
17. ALL STAIRS TO BE SUPPORTED BY BEAMS PROVIDED. ANY SLAB EXTENDING INTO THE STAIR OPENING BEYOND THE BEAM FLANGE IS TO BE SUPPORTED AND DETAILED BY THE STAIR MANUFACTURER AS PART OF THE STAIRS. ANY ADDITIONAL STEEL NOT SHOWN ON THE DRAWINGS TO CREATE A FULLY FUNCTIONAL STAIRS IS TO BE PROVIDED BY STAIR MANUFACTURER AT NO ADDITIONAL COST TO THE OWNER. STAIR MANUFACTURER TO COORDINATE WITH A DRAWINGS AS WELL AS STRUCTURAL STEEL FABRICATOR.
18. ALL LINTELS MUST BE COORDINATED WITH ARCHITECTURAL DRAWINGS PRIOR TO SUBMITTING SHOP DRAWINGS. ANY DISCREPANCIES MUST BE BROUGHT TO THE ATTENTION OF THE AOR AND EOR.
19. ALL HSS MUST HAVE MIN 1/4" END CAPS.
20. INDICATES MOMENT CONNECTION FOR MOMENT FRAME TO BE DESIGNED FOR 65% CAPACITY OF BEAM
21. INDICATES SLAB ORIENTATION



2 EMR ROOF FRAMING PLAN

S107 SCALE : 1/8" = 1'-0"

NOTES:

1. TOP OF SLAB SHALL BE EL = 97'-3" (545.25') U.O.N. SLAB SHALL BE 3"-18 GAGE GALVANIZED METAL DECK REINFORCED WITH 6x6-W2.9xW2.9 WWF. THE PROJECT HAS BEEN DESIGNED IN ACCORDANCE WITH THE PROPERTIES OF CMC-USDECK fy = 40 ksi, MAXIMUM UNSHORED 2 SPAN CONDITION = 13.78 FEET FOR A 3" NORMAL WEIGHT (115 pcf) COMPOSITE SLAB.
2. FOR REINFORCEMENT, SEE TYPICAL DETAILS ON S400 SERIES. ALL OPENINGS NOTED SHALL HAVE 2-#5 T&B ALL AROUND AS SHOWN ON TYPICAL DETAIL AS WELL AS ADDITIONAL REINFORCEMENT SHOWN ON PLAN. METAL DECK FOR OPENINGS INDICATED IS NOT TO BE CUT BUT TO BE BLOCKED OUT FOR COMPLETE POUR DECK TO BE CUT IN MIN OF 7 DAYS AFTER POUR.
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7. FOR EXTENT AND DEPTH OF DEPRESSION SEE ARCH. DRAWINGS.
8. U.O.N. ON PLAN R-15k FOR W10x15, W12x16, & W12x19 BEAMS.
9. CANT. INDICATES CANTILEVERS SIZE IS THE SAME SIZE AS THE BACK SPAN.
10. ALL BEAMS UNDER CONCRETE AND METAL DECK ARE COMPOSITE AND RECEIVE ONE 3/4" STUD @ 1'-0" O.C. U.O.N. ON PLAN THUS <...>.
11. FOR SLAB EDGE AND OPENINGS LOCATION SEE ARCHITECTURAL DRAWINGS. ALL BEAMS ARE LOCATED 1/2 FLANGE +2" BACK FROM SLAB EDGE U.O.N. ON PLAN.
12. U.O.N. ALL BEAMS ARE EQUALLY SPACED IN A BAY.
13. PROVIDE 3/8" FULL DEPTH BEAM STIFFENERS (B.S.) WHERE STRINGER ATTACHES OR BEARS ON BEAM.
14. ALL BEAMS FRAMING INTO A SPANDREL BEAM MUST HAVE A FULL DEPTH CONNECTION WITH A 3/8" STIFFENER ON THE OUTSIDE.
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16. GC TO PROVIDE ADDITIONAL HSS12x4X5/16 4'-0" BELOW TOP OF SLAB ON EACH FLOOR IF REQUIRED BY ELEVATOR MANUFACTURER.
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19. ALL HSS MUST HAVE MIN 1/4" END CAPS.
20. INDICATES MOMENT CONNECTION FOR MOMENT FRAME
21. INDICATES SLAB ORIENTATION

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MONTCLAIR STATE UNIVERSITY

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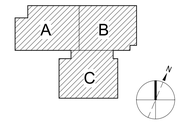
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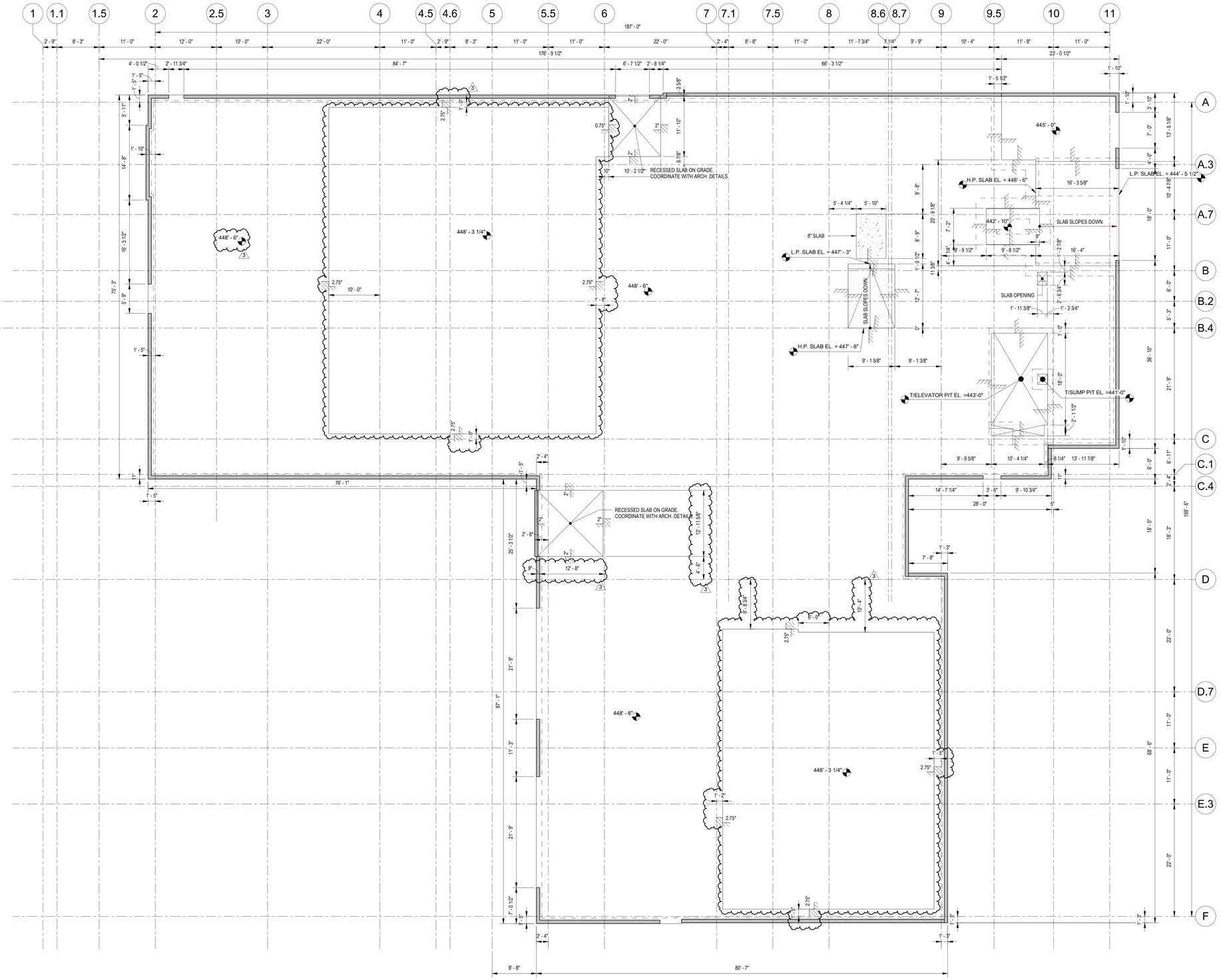
Sheet Title

UPPER ROOF & EMR FRAMING PLANS

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Sheet Number

S107



1 S201 GROUND FLOOR SLAB EDGE PLAN
SCALE : 1/8" = 1'-0"

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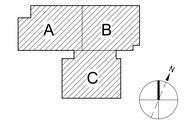
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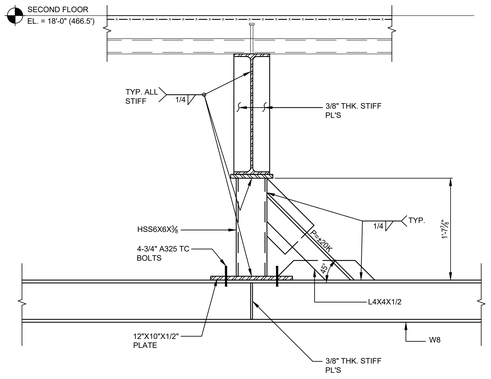
Sheet Title

GROUND FLOOR SLAB EDGE PLAN

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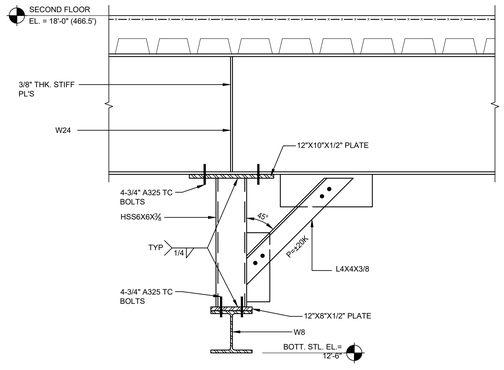
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S201



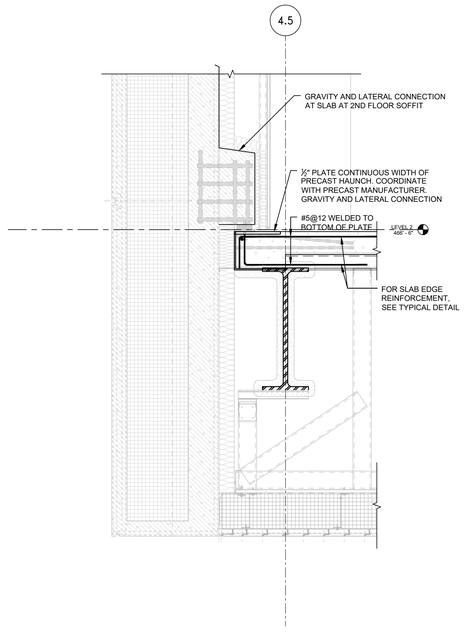
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SCALE: 1"=1'-0"

0 1 2
SCALE IN FEET



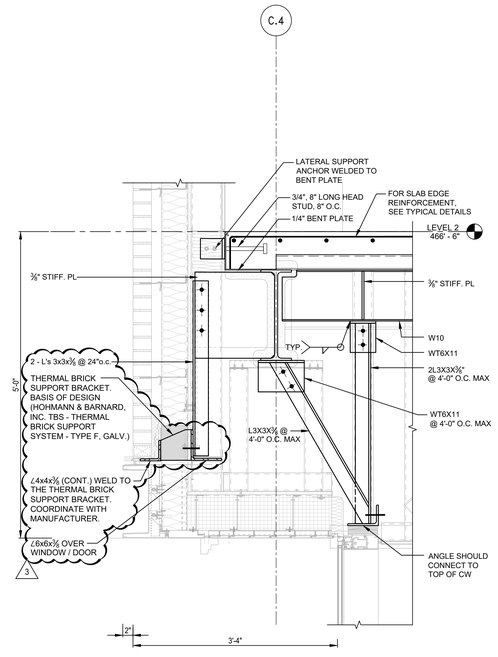
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SCALE: 1"=1'-0"

0 1 2
SCALE IN FEET



3 S700 SECTION
SCALE: 1"=1'-0"

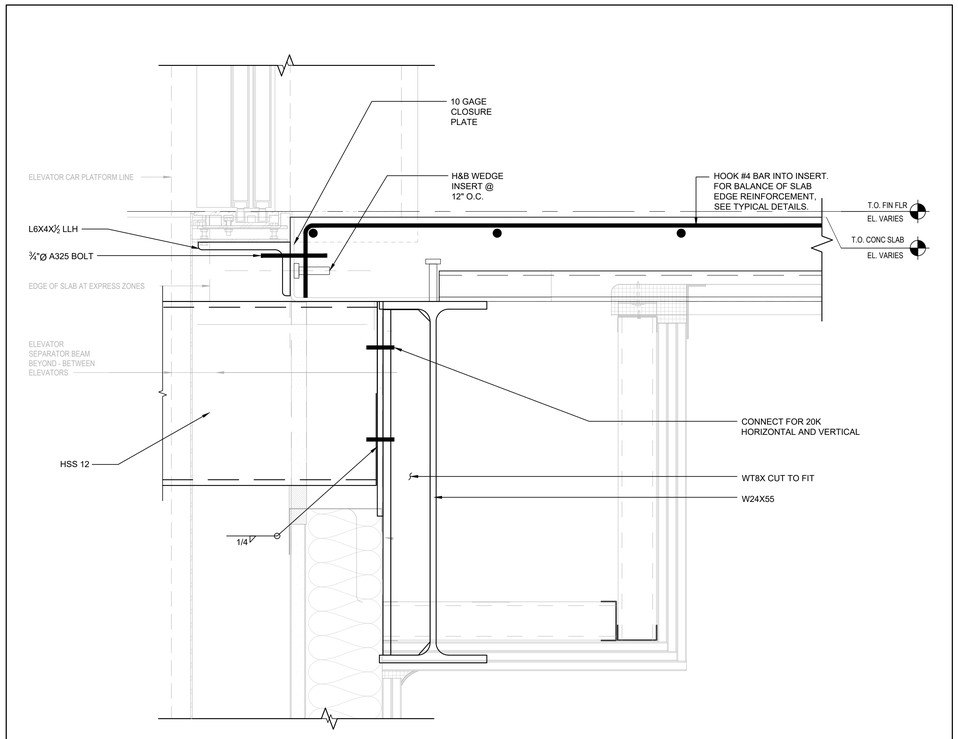
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SCALE IN FEET



5 S700 SECTION
SCALE: 1"=1'-0"

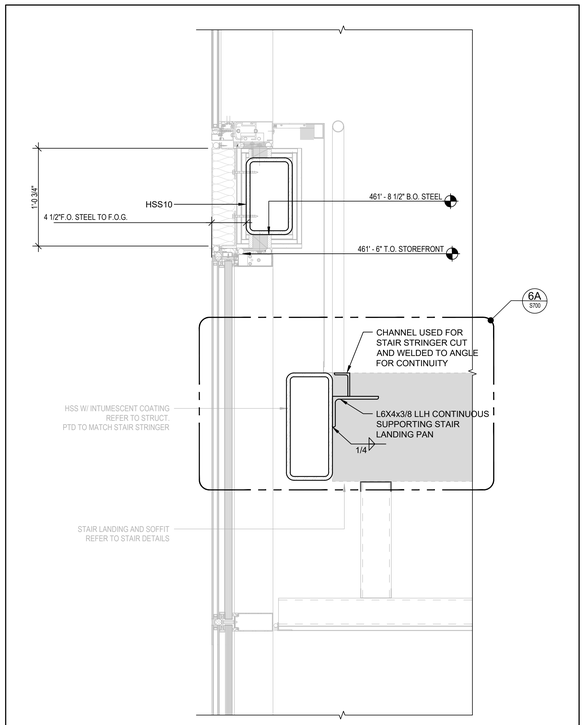
0 1 2
SCALE IN FEET

NOTE:
ALL BOLTS ARE ⅞"Ø A325 TC.



4 S700 SECTION
SCALE: 3"=1'-0"

0 .25 .5 1
SCALE IN FEET

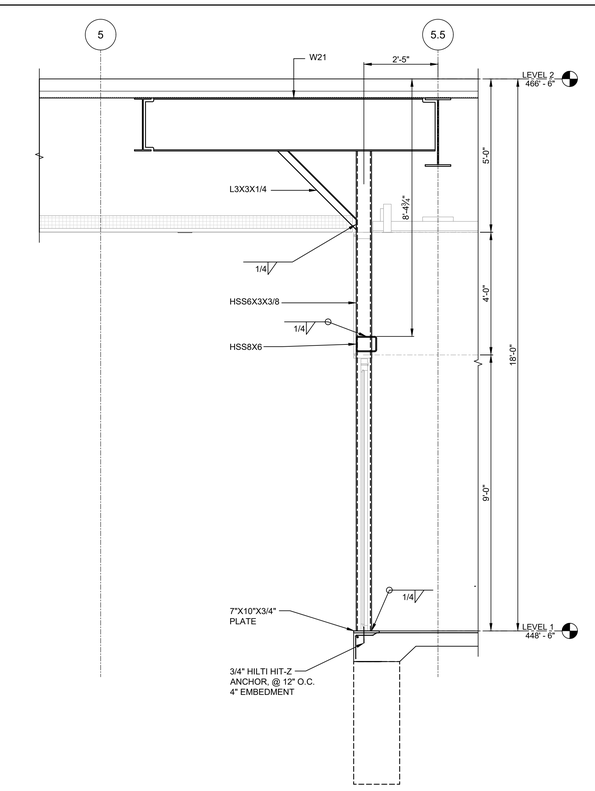


6/6A S700 SECTION
SCALE: 1 1/2"=1'-0"

0 .5 1 2
SCALE IN FEET

NOTE:

1. STAIRS TO BE DESIGNED TO BEAR ON HSS AT MID LANDING, NO HANGERS.



7 S700 SECTION
SCALE: 1"=1'-0"

0 1 2
SCALE IN FEET

S:\2025\25146\STRM\

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building

1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University

1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Parsippany, NJ 07054

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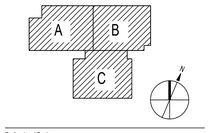
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Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan



Professional Seals

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No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

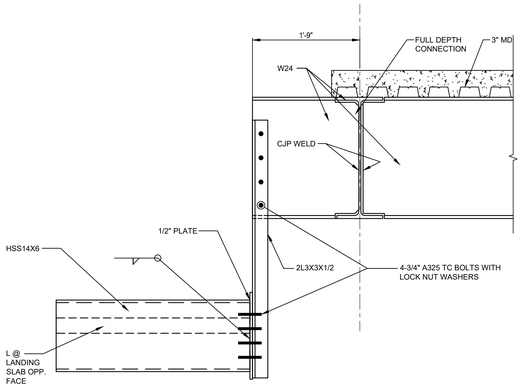
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SUPERSTRUCTURE SECTIONS - SHEET NO. 1

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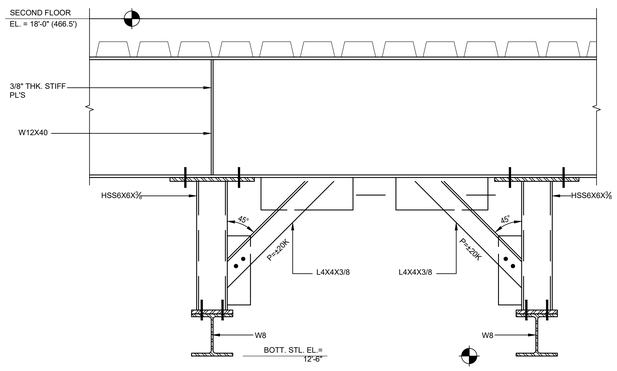
Sheet Number

S700



1 S701 SECTION
SCALE: 1"=1'-0"

0 1 2
SCALE IN FEET

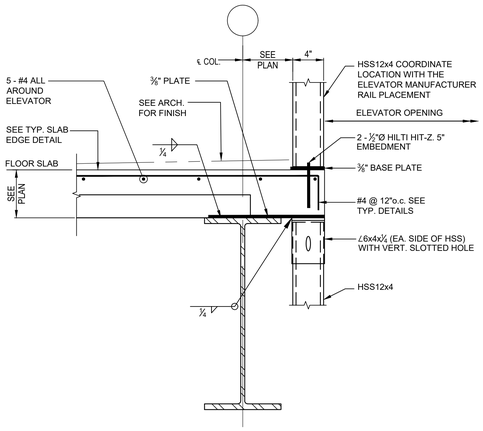


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SCALE: 1"=1'-0"

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SCALE IN FEET

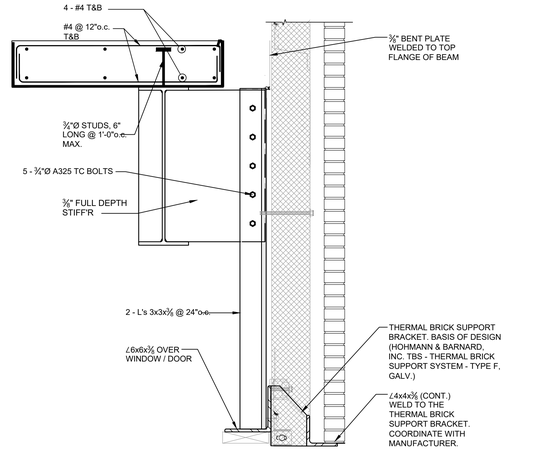
NOTE:

1. FOR BAL INFORMATION SEE SECT 2/S700



3 S701 SECTION
SCALE: 1-1/2"=1'-0"

0 .5 1 2
SCALE IN FEET

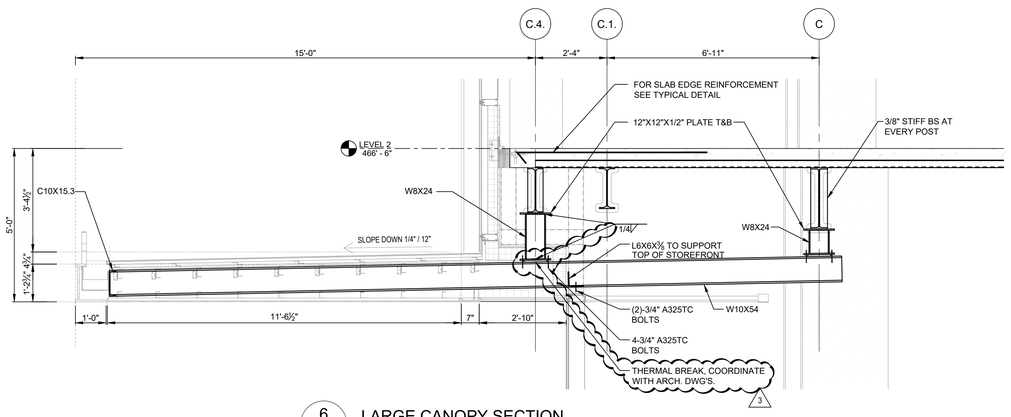


5 S701 SECTION
SCALE: 1-1/2"=1'-0"

0 .5 1 2
SCALE IN FEET

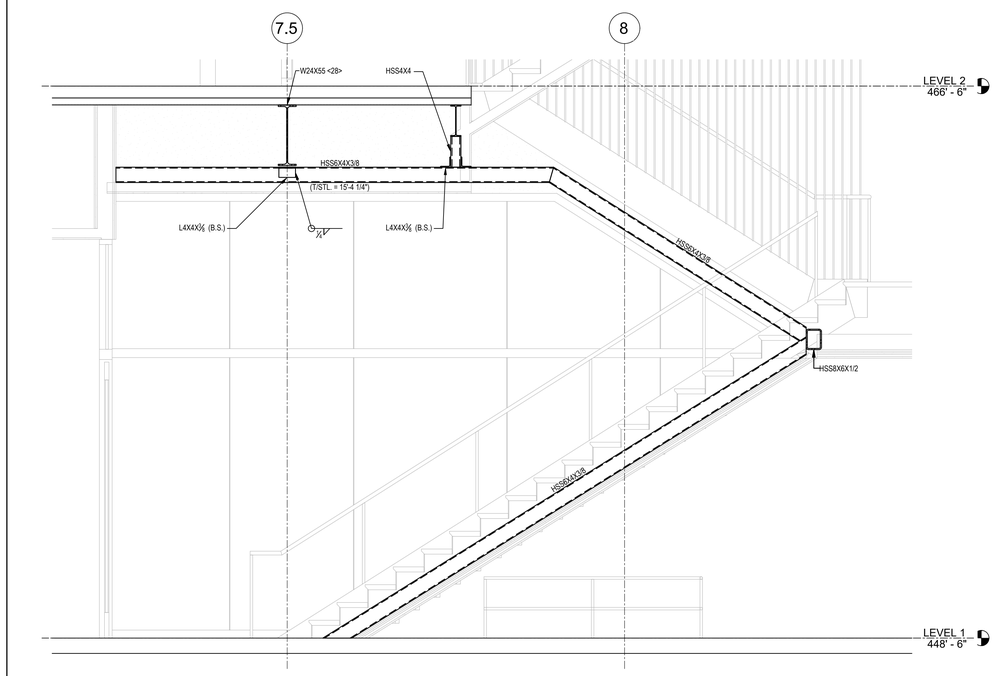
NOTE:

1. SEE ARCHITECTURAL DRAWING FOR BOTTOM OF ANGLE ELEVATION.



6 S701 LARGE CANOPY SECTION
SCALE: 1/2"=1'-0"

0 2 4
SCALE IN FEET

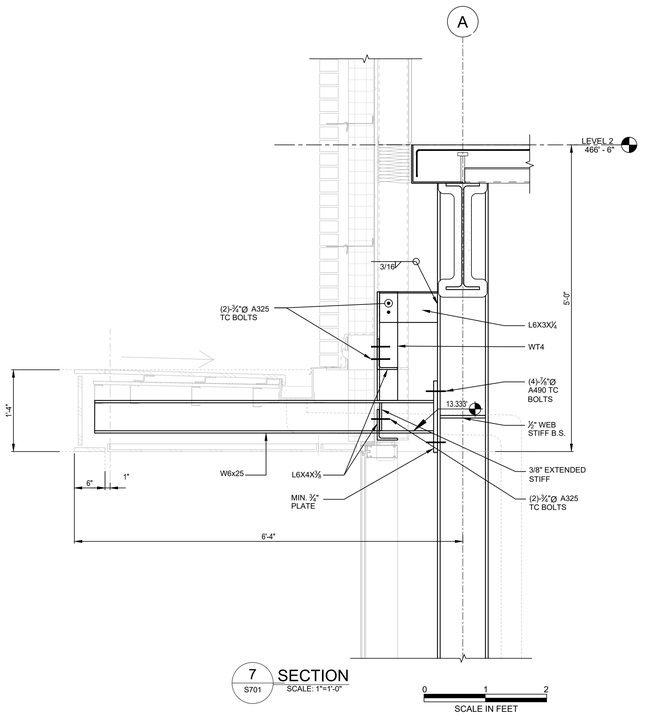


4 S701 SECTION
SCALE: 1/2"=1'-0"

0 2 4
SCALE IN FEET

NOTE:

1. HSS6X4 HAVE BEEN DESIGNED TO CARRY THE WEIGHT OF THE GLASS ONLY.



7 S701 SECTION
SCALE: 1"=1'-0"

0 1 2
SCALE IN FEET

5/28/2025 9:04:03 PM

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building
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Prepared For

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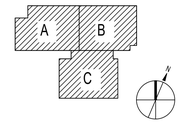
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Key Plan



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1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

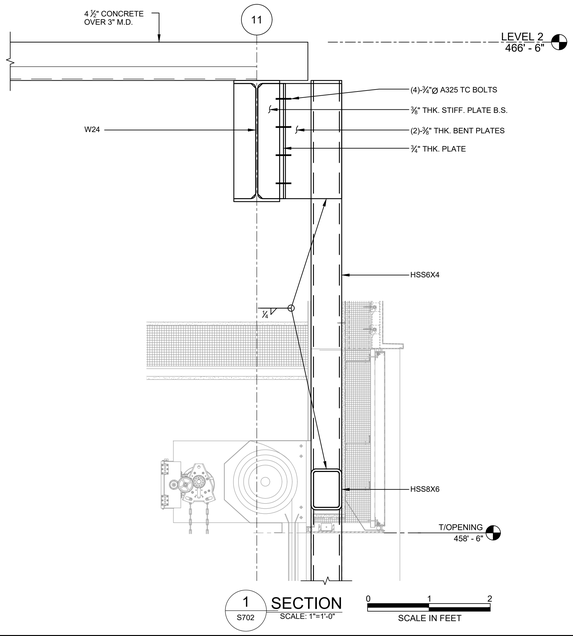
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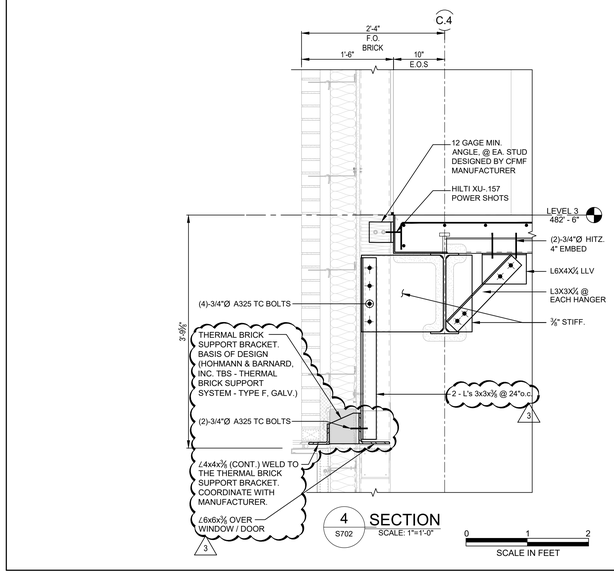
SUPERSTRUCTURE SECTIONS - SHEET NO. 2

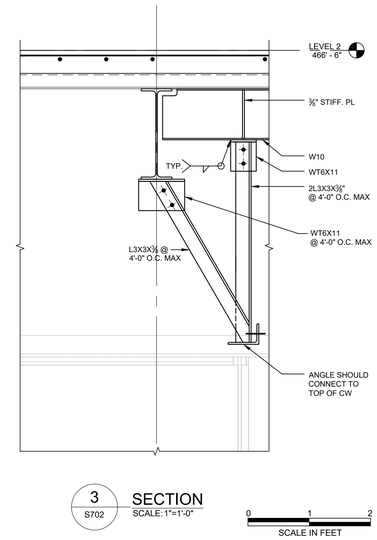
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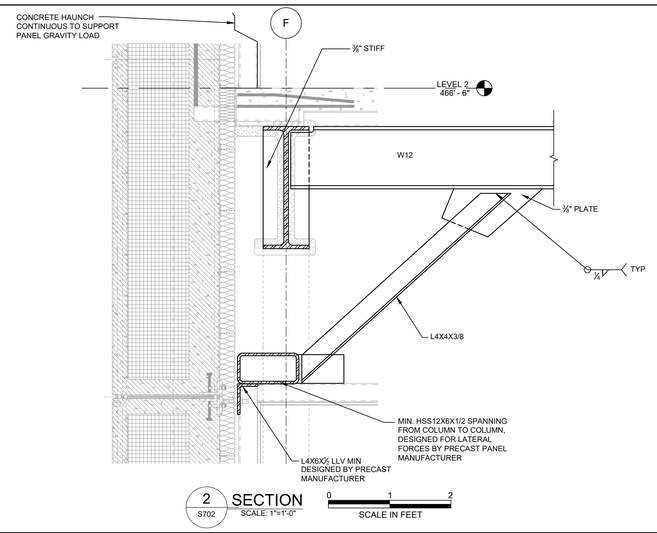
Sheet Number

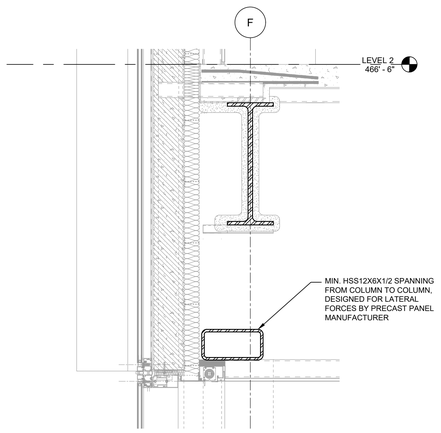
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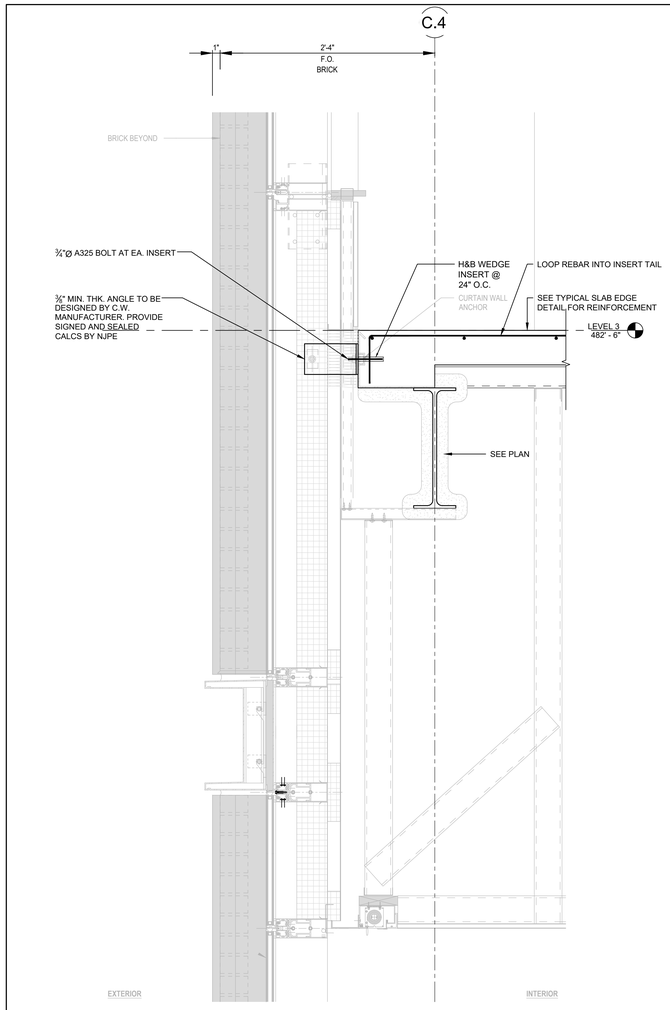


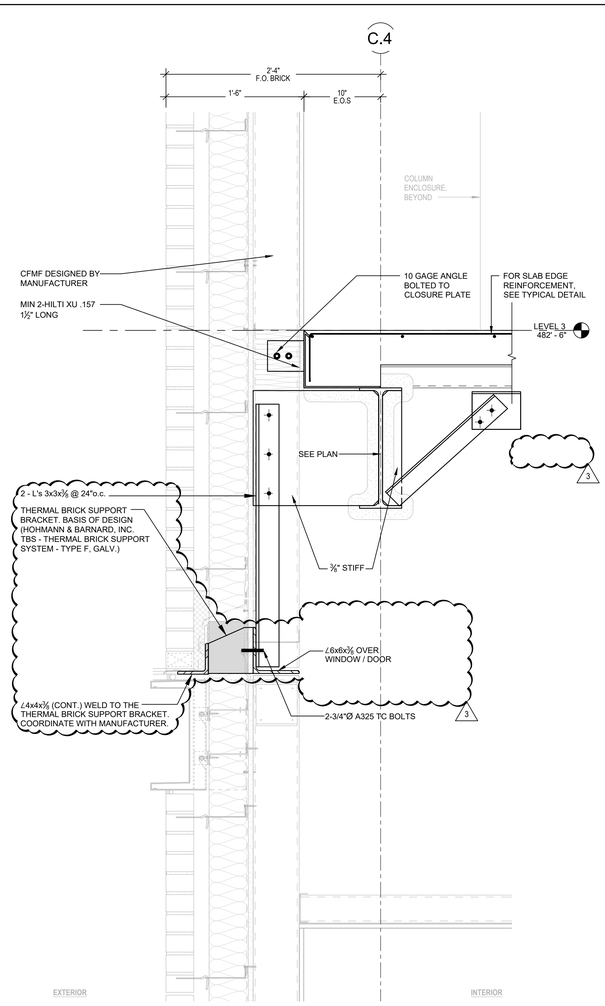












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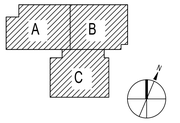
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Princeton, NJ 08540

Shen Milsom & Wilke LLC
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Key Plan



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No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

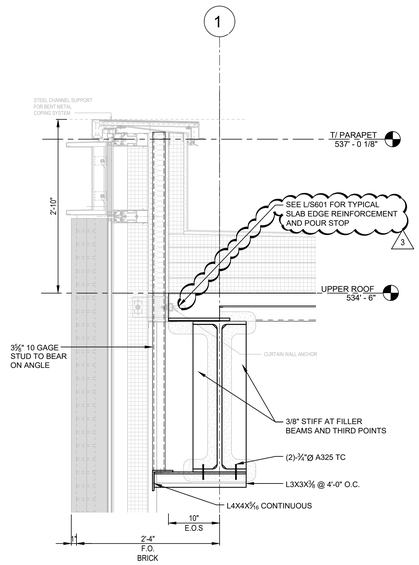
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SUPERSTRUCTURE SECTIONS - SHEET NO. 3

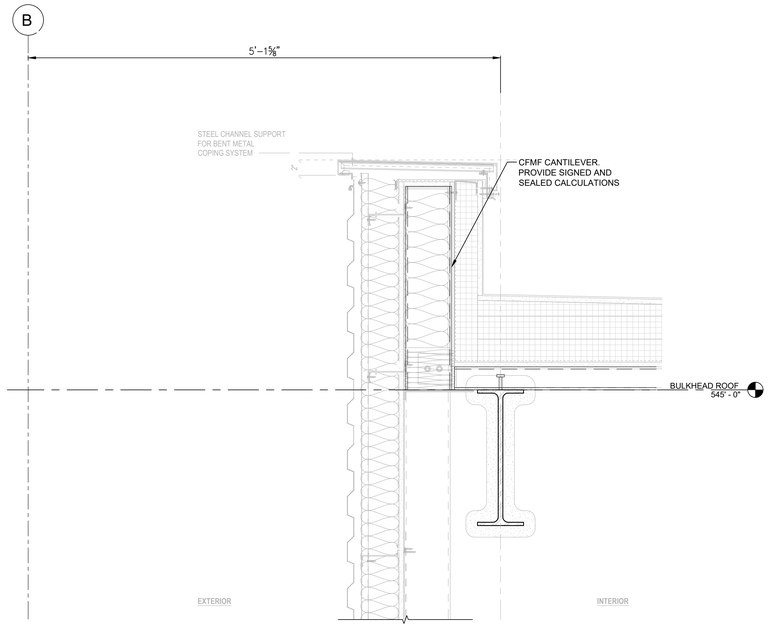
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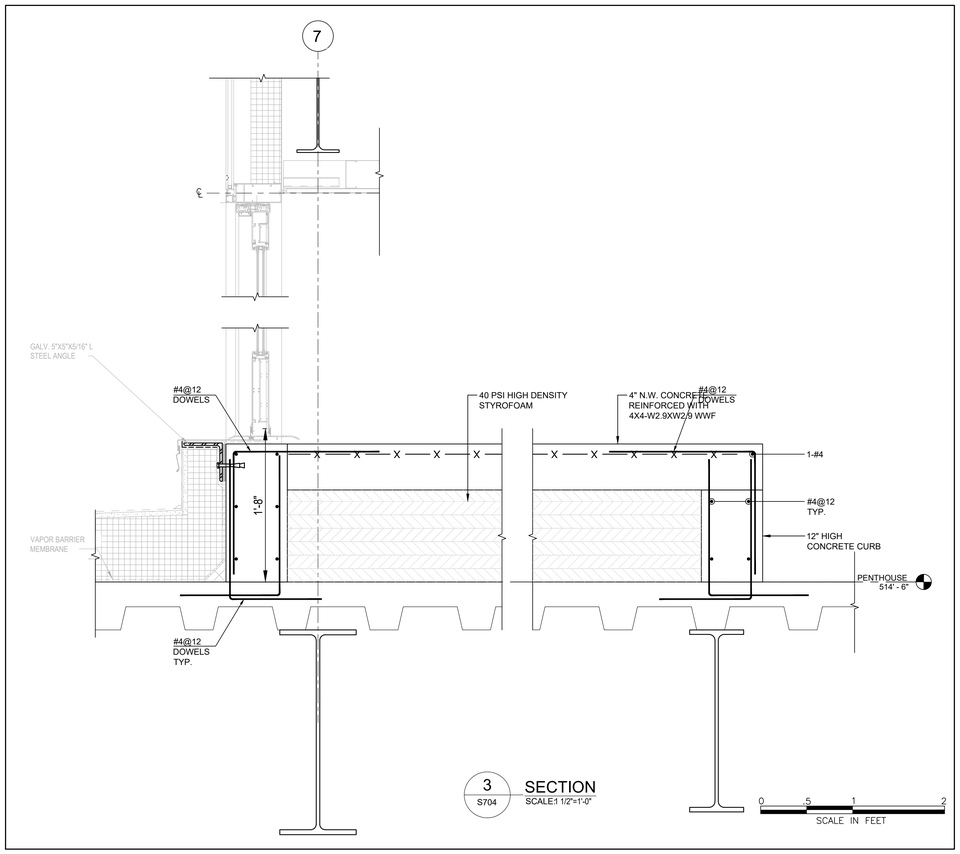
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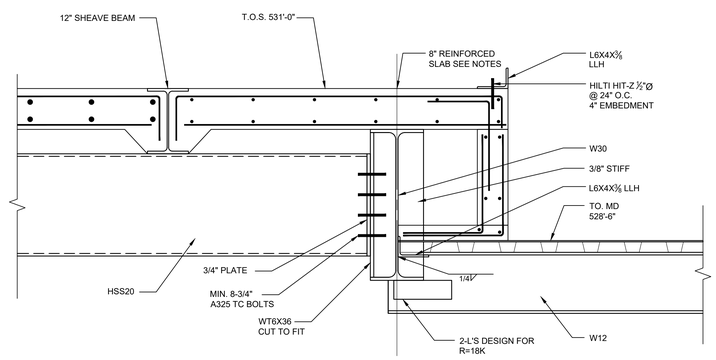
1 S704 SECTION CW PARAPET
SCALE: 1"=1'-0"
0 1 2
SCALE IN FEET



2 S704 SECTION
SCALE:1 1/2"=1'-0"
0 .5 1 2
SCALE IN FEET



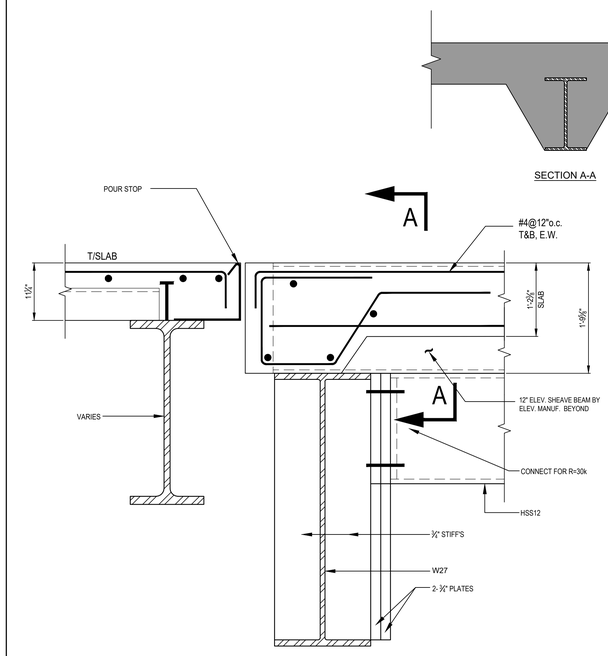
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SCALE IN FEET



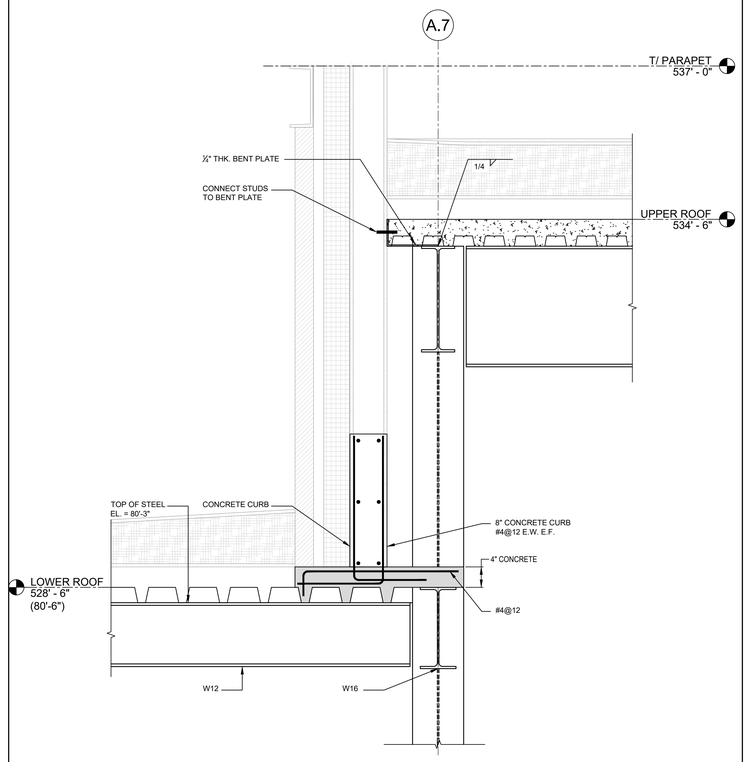
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SCALE IN FEET

NOTE:

REF. A632



5 S704 SECTION
SCALE: 1"=1'-0"
0 1 2
SCALE IN FEET



6 S704 SECTION
SCALE: 1"=1'-0"
0 1 2
SCALE IN FEET

S:\2021\2021.59\A&E\SHM\

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Prepared For

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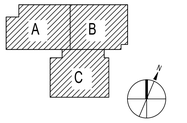
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1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

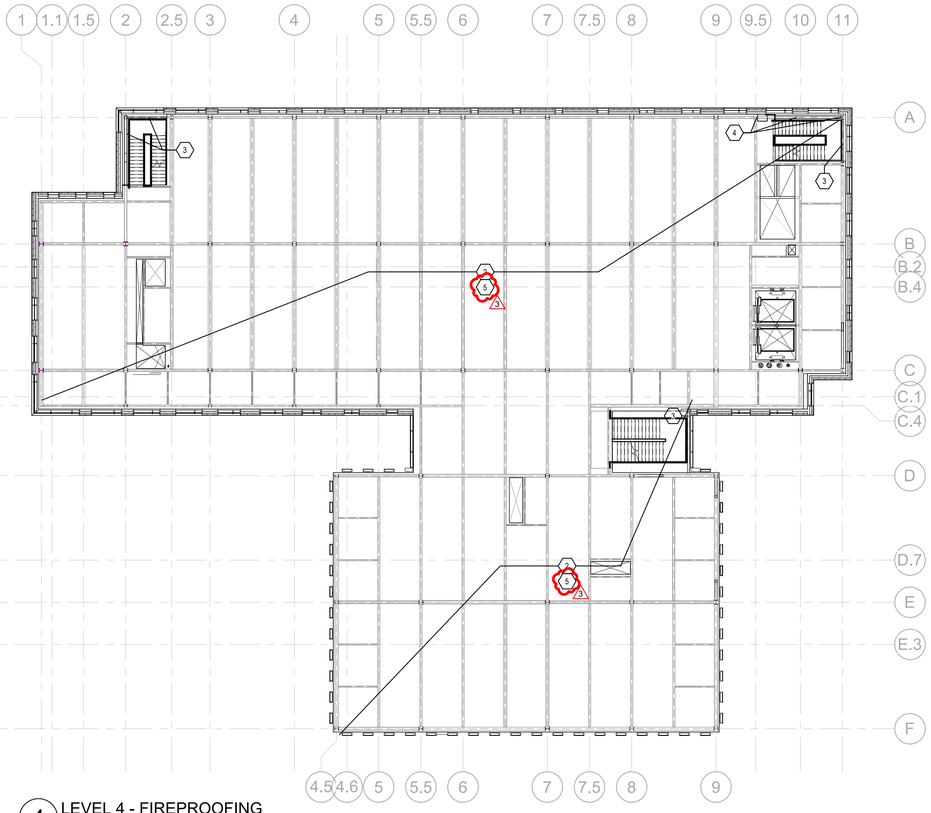
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SUPERSTRUCTURE SECTIONS - SHEET NO. 5

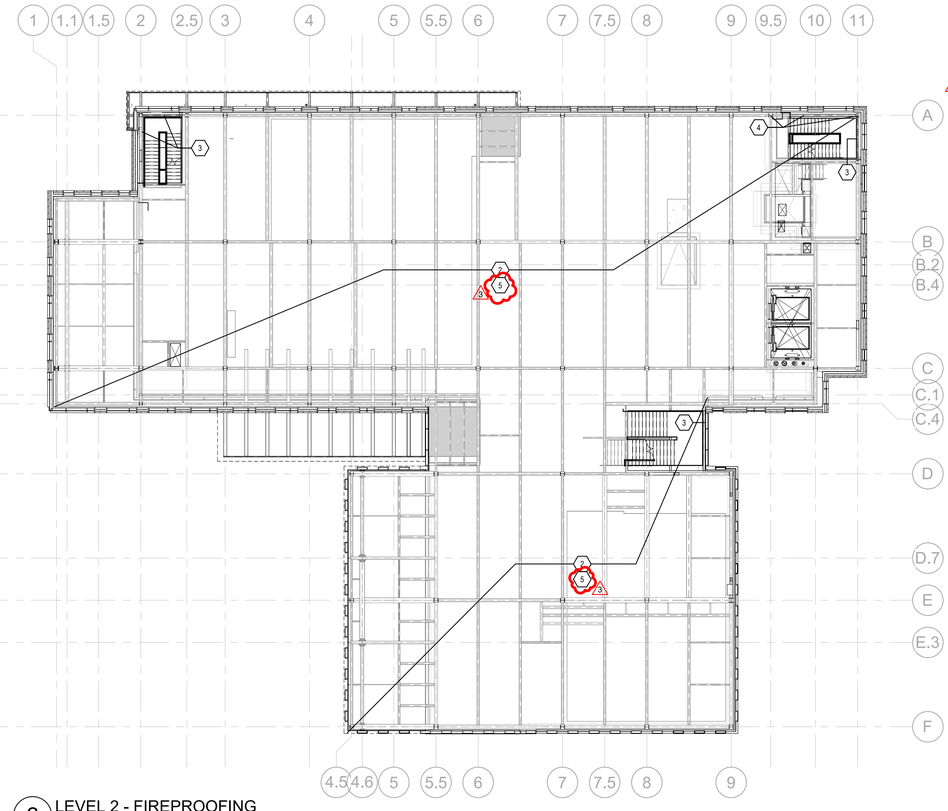
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Sheet Number

S704



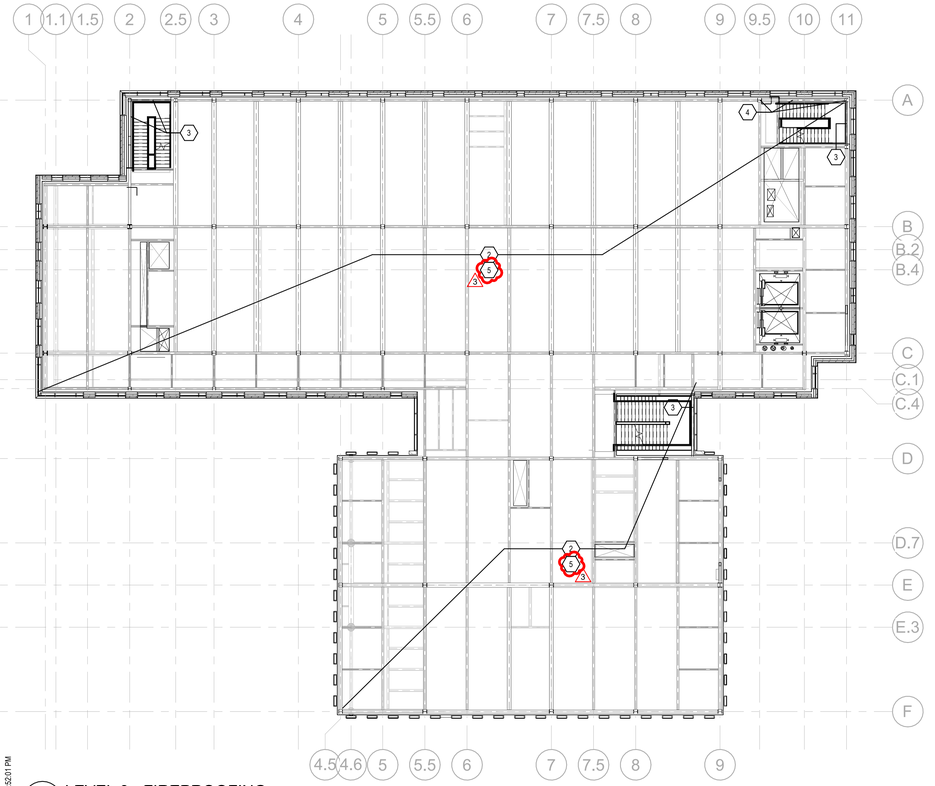
4 LEVEL 4 - FIREPROOFING
1/16" = 1'-0"



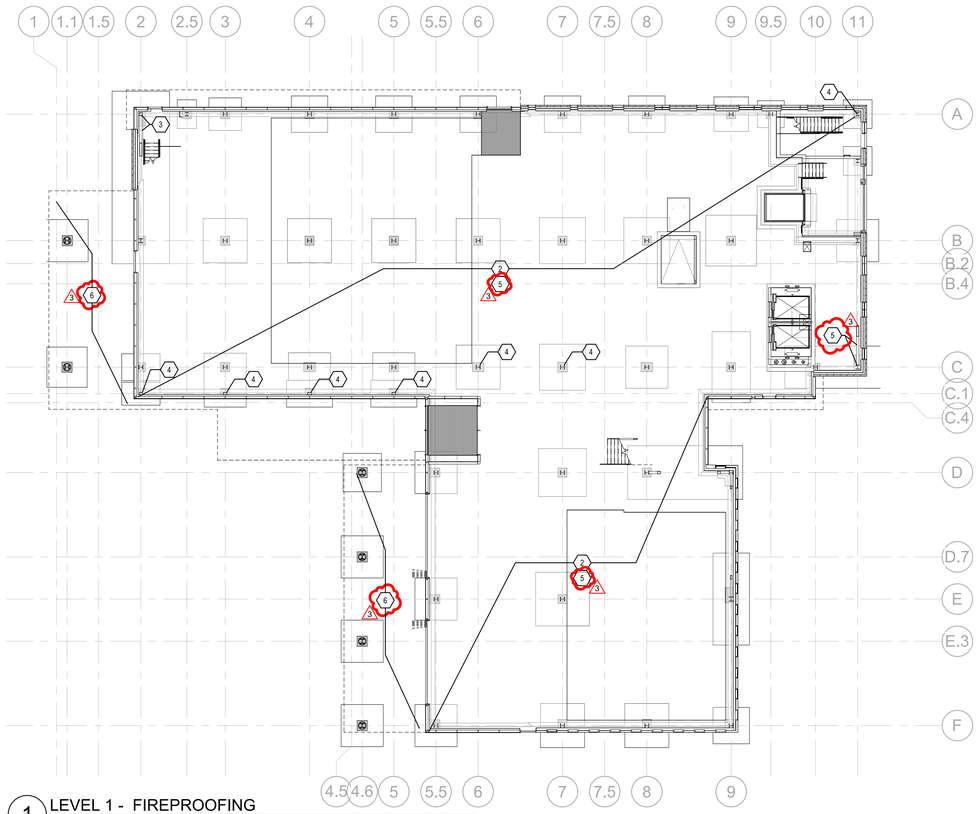
2 LEVEL 2 - FIREPROOFING
1/16" = 1'-0"

FIRE PROTECTION PLAN KEYNOTE LEGEND

1. PROVIDE 1-HR. RATED ROOF CONSTRUCTION AT EXPOSED SECONDARY STRUCTURAL MEMBERS AND METAL DECKING WITH SFRM FP-02.
2. PROVIDE 2-HR RATED CONSTRUCTION AT CONCEALED PRIMARY STRUCTURAL STEEL BEAMS, STEEL COLUMNS, AND STEEL LATERAL BRACING WITH SFRM FP-01. REFER TO STRUCTURAL DRAWINGS FOR STEEL MEMBER SIZES, BEAMS SIZES AND SLAB THICKNESS.
3. PROVIDE 2-HR. RATED INTUMESCENT COATING AT STEEL TUBE WITH IFP-02.
4. PROVIDE 2-HR. RATED INTUMESCENT COATING AT STEEL COLUMN OR BEAM WITH IFP-02.
5. PROVIDE 2-HR RATED CONSTRUCTION AT EXPOSED PRIMARY STRUCTURAL STEEL BEAMS, COLUMNS, AND LATERAL BRACING WITH SFRM FP-02. REFER TO RCPS FOR OPEN CEILING LOCATIONS. PROVIDE FP-02 AT ALL EXPOSED STRUCTURAL STEEL COLUMNS UNLESS OTHERWISE NOTED.
6. PROVIDE 2-HR RATED CONSTRUCTION AT EXTERIOR PRIMARY STRUCTURAL STEEL AT SOFFITS WITH CEMENTITIOUS SFRM FP-03



3 LEVEL 3 - FIREPROOFING
1/16" = 1'-0"



1 LEVEL 1 - FIREPROOFING
1/16" = 1'-0"

3/23/2026 11:52:01 PM

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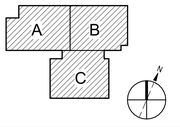
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3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

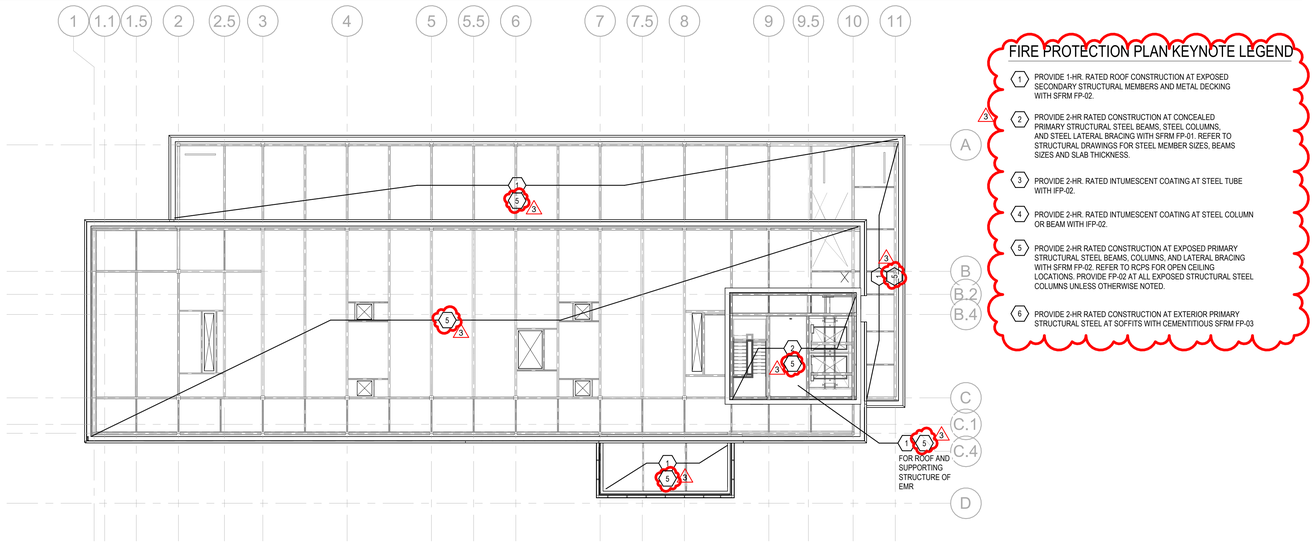
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FIRE PROTECTION PLANS - L1-L4

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Sheet Number

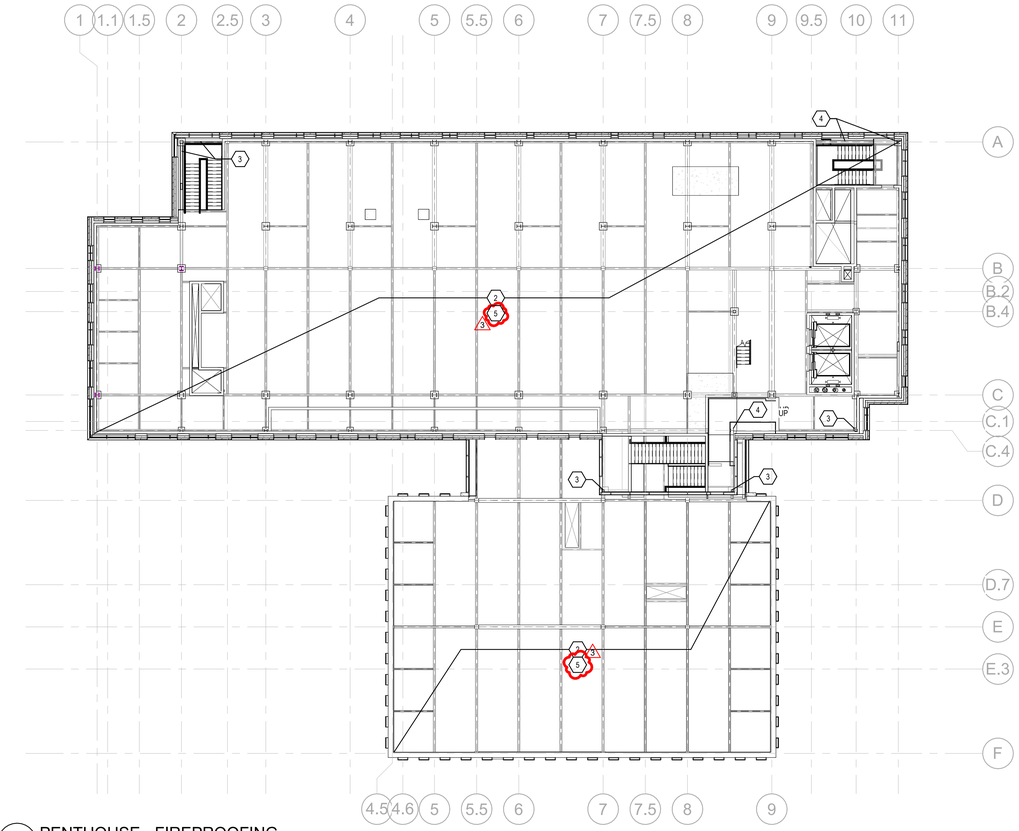
A021



FIRE PROTECTION PLAN KEYNOTE LEGEND

1. PROVIDE 1-HR. RATED ROOF CONSTRUCTION AT EXPOSED SECONDARY STRUCTURAL MEMBERS AND METAL DECKING WITH SFRM FP-02.
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3. PROVIDE 2-HR. RATED INTUMESCENT COATING AT STEEL TUBE WITH IFP-02.
4. PROVIDE 2-HR. RATED INTUMESCENT COATING AT STEEL COLUMN OR BEAM WITH IFP-02.
5. PROVIDE 2-HR RATED CONSTRUCTION AT EXPOSED PRIMARY STRUCTURAL STEEL BEAMS, COLUMNS, AND LATERAL BRACING WITH SFRM FP-02. REFER TO RCPS FOR OPEN CEILING LOCATIONS. PROVIDE FP-02 AT ALL EXPOSED STRUCTURAL STEEL COLUMNS UNLESS OTHERWISE NOTED.
6. PROVIDE 2-HR RATED CONSTRUCTION AT EXTERIOR PRIMARY STRUCTURAL STEEL AT SOFFITS WITH CEMENTITIOUS SFRM FP-03

2 ROOF - FIREPROOFING
1/16" = 1'-0"



1 PENTHOUSE - FIREPROOFING
1/16" = 1'-0"

3/23/2026 11:51:45 PM

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1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
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Jersey City, NJ 07302

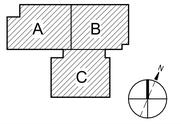
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Iselin, NJ 08830

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MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

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IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan



Professional Seals

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No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

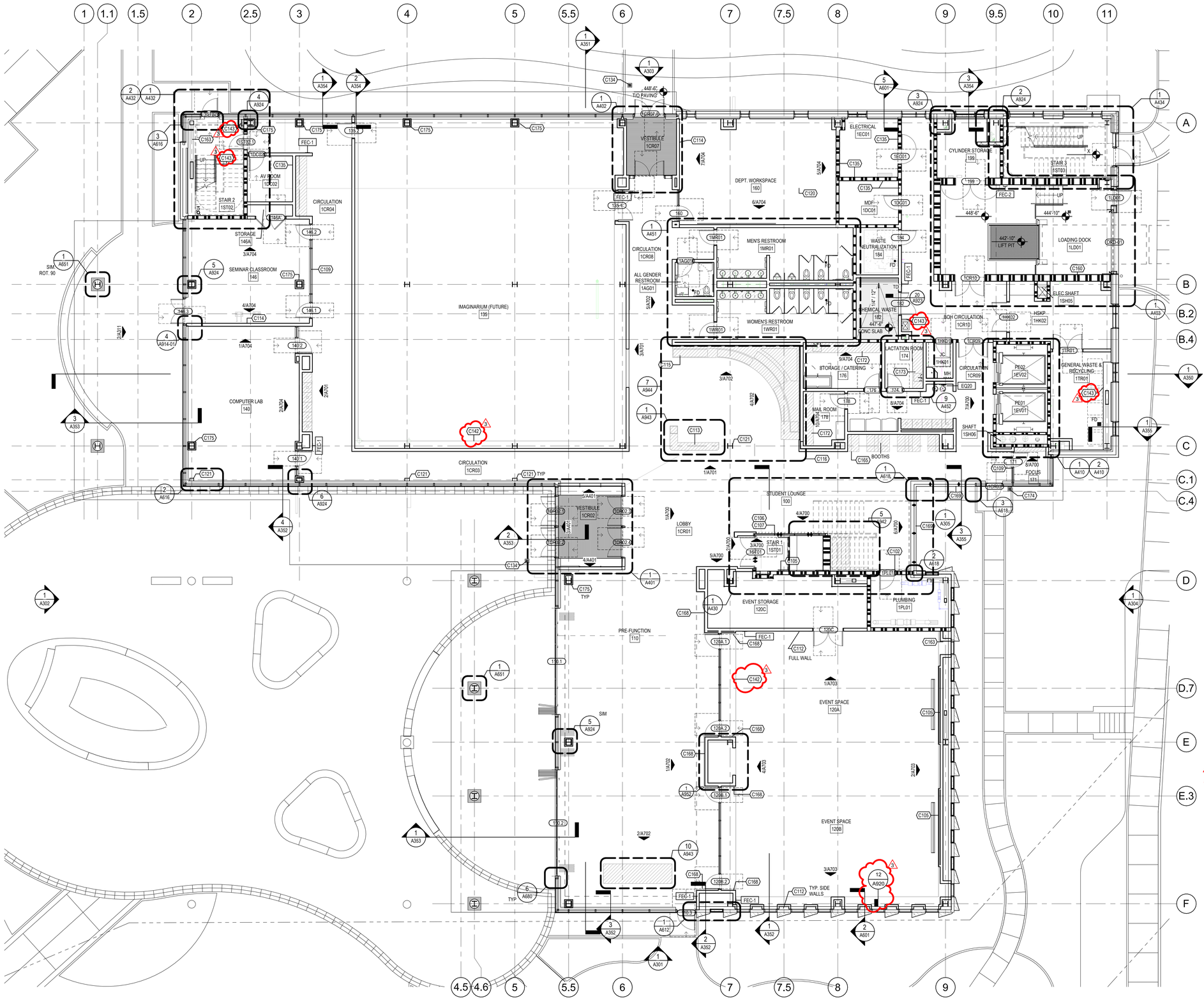
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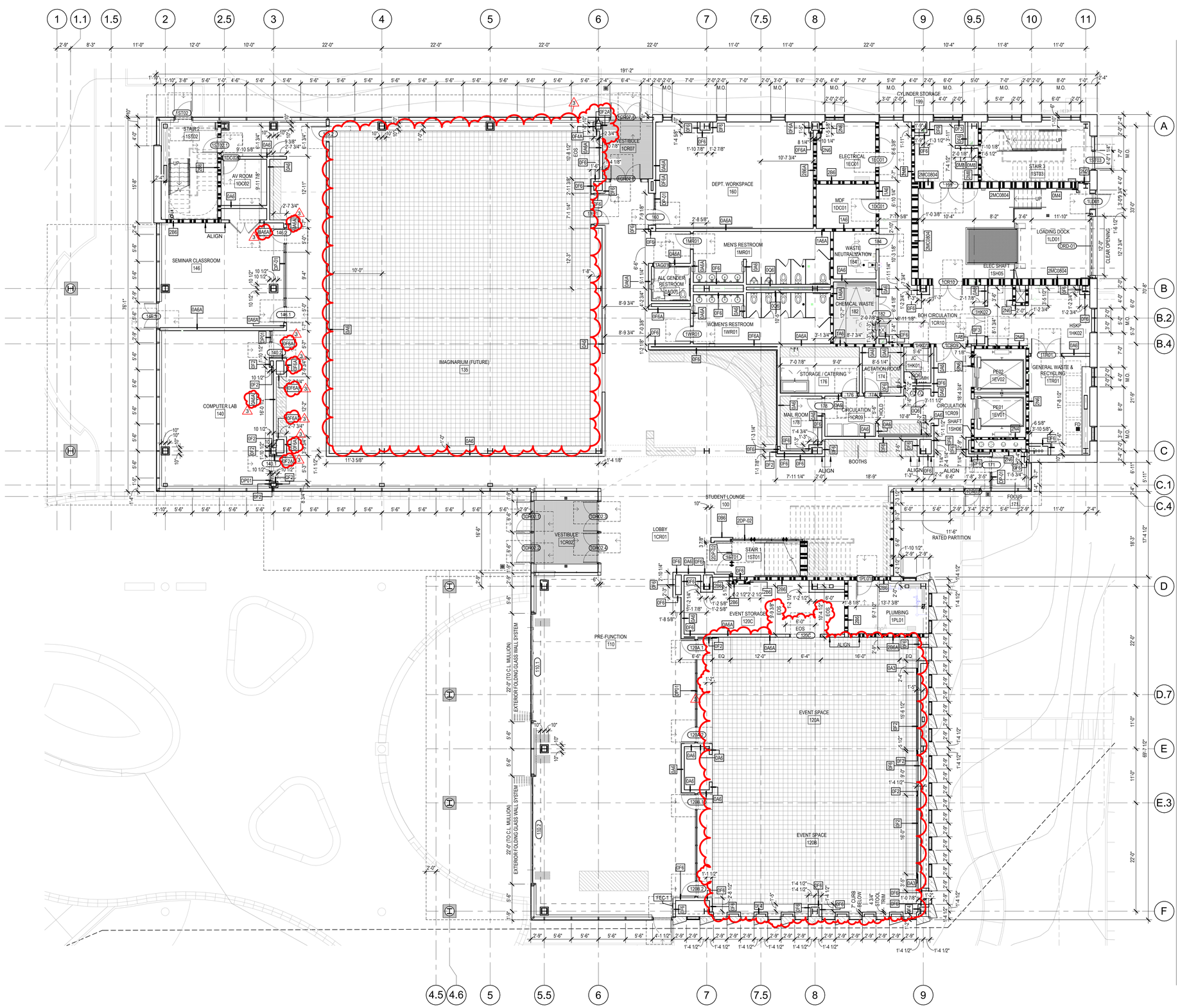
FIRE PROTECTION PLANS - PENTHOUSE AND ROOF

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Sheet Number

A022


VESTIBULE 1CR07
DEPT. WORKSPACE 160
ELECTRICAL 1EC01
CYLINDER STORAGE 199
STAIR 3 1ST03
LOADING DOCK 1LD01
MEN'S RESTROOM 1MR01
WASTE NEUTRALIZATION 154
CIRCULATION 1CR08
ALL GENDER RESTROOM 1AG01
WOMEN'S RESTROOM 1WR01
CHEMICAL WASTE 182
CONC SLAB
BOH CIRCULATION 1CR1D
HSKP 1HK02
LACTATION ROOM 174
STORAGE / CATERING 176
CIRCULATION 1CR09
GENERAL WASTE & RECYCLING 1TR01
PE02 1EV02
PE01 1EV01
FOCUS 171
MAIL ROOM 178
SHAFT 1SH06
BOOTHS
CIRCULATION 1CR03
STUDENT LOUNGE 100
VESTIBULE 1CR02
LOBBY 1CR01
STAIR 1 1ST01
EVENT STORAGE 120C
PLUMBING 1PL01
PRE-FUNCTION T10
FULL WALL
EVENT SPACE 120A
EVENT SPACE 120B
TYP. SIDE WALLS
STAIR 2 1ST02
AV ROOM 1DC02
CIRCULATION 1CR04
STORAGE 146A
SEMINAR CLASSROOM 146
IMAGINARIUM (FUTURE) 135
COMPUTER LAB 140
SIM ROT. 90
T/O PAVING
SIM
TYP
FEC-1
FEC-2
MDF / IDF 1DC01
1EC01
1TR01
1HK02
1HN01
1CR10
1LD01
1SH05
1SH06
1ST03
1AG01
1MR01
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1CR1D
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1CR10
1HN02
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1CR01
1ST01
1ST02
1DC02
1CR04
1CR03
1CR07
1CR08
1EV02
1EV01
1PL01
1DC01
1LD01
442'-10" LIFT PIT
444'-10"
448'-6"
447'-6"
20
182
184
160
199
135
135.1
135.2
130.1
130.2
130.3
120A.1
120A.2
120B.1
120B.2
120C
146.1
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1 DIMENSION PLAN - LEVEL 1
1/8" = 1'-0"

GENERAL NOTES

1. ALL PARTITIONS TO BE TYPE **0A6A** ON LEVEL 1 AND **0A4A** ON LEVELS 2-4, UON.
2. ALL PARTITIONS IN CORRIDORS AND PUBLIC AREAS TO HAVE IMPACT/ABUSE RESISTANT GWB
3. ALL FIRE RATED PARTITION AND ACOUSTIC PARTITION PROPERTIES TO BE CONTINUOUS.
4. PROVIDE 3/4" FIRE-RETARDANT PLYWOOD BACKER BOARD AT TELECOM/ELECTRICAL ROOMS, TYP.
5. PROVIDE PARTITION REINFORCING (16 GA SHEET METAL) FOR THE FOLLOWING ITEMS:
   - ART WALLS AND ENVIRONMENTAL GRAPHIC
   - AV EQUIPMENT
   - UPPER WALL CABINETS
   - WALL SHELVING
   - TOILET ROOM ACCESSORIES AND COMPARTMENT PARTITIONS
   - UPPER FURNITURE STORAGE
6. PROVIDE FURRING AT ALL EXPOSED CORE WALLS.
7. ALL DIMENSIONS TO THE EXTERIOR WALLS ARE TO THE FACE OF GYP BD FURRING, UON.
8. ALL WOOD TO BE FIRE TREATED IN ACCORDANCE WITH APPLICABLE BUILDING CODES.
9. PROVIDE AND INSTALL FIRE EXTINGUISHER CABINET(S) IN ACCORDANCE WITH ALL APPLICABLE CODE REQUIREMENTS. VERIFY LOCAL SIGNAGE REQUIREMENTS. CABINET DOOR TO BE PAINTED TO MATCH ADJACENT WALL.
10. PROVIDE PARTN TYPE 0A4A , UON ABOVE DEMOUNTABLE AND ALL GLASS PARTITIONS TO SLAB ABOVE. PROVIDE PARTN TYPE 2B4A ABOVE FIRE RATED GLASS PARTITION.
11. PROVIDE WATERPROOF FLOOR MEMBRANE AT TOILET ROOMS; LAP 4" AFF AT PERIMETER WALLS.
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14. FIRE SAFE PENETRATIONS AT RATED PARTITIONS PER APPLICABLE UL ASSEMBLY.
15. DIMENSIONS NOTED "CLEAR" OR "CLR" OR "HOLD" MUST BE ACCURATELY MAINTAINED AND SHALL NOT VARY MORE THAN +/- 1/8" WITHOUT WRITTEN CONSENT FROM THE ARCHITECT.

CONSTRUCTION PLAN LEGEND

CG	CORNER GUARD, SEE FINISH PLANS	FE	FIRE EXTINGUISHER
WP	WALL PROTECTION, SEE FINISH PLANS	FEC	FIRE EXTINGUISHER CABINET
ALIGN	INDICATES ALIGNMENT OF FINISH SURFACES		MILLWORK
	ROUND FLOOR DRAIN		FIXED CASEWORK (LAB)
	SQUARE FLOOR DRAIN		1 HR FIRE RATED CONSTRUCTION (Fire Rating = 1)
	TRENCH DRAIN		2 HR FIRE RATED CONSTRUCTION (Fire Rating = 2)
	MOP HOLDER		1 HR RATED GLAZED FIRE BARRIER (Fire Rating = 1-GL)
			2 HR RATED GLAZED FIRE BARRIER (Fire Rating = 2-GL)

MONTCLAIR STATE UNIVERSITY

Project
Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For
Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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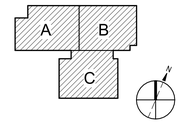
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Project No: 24.07023.00

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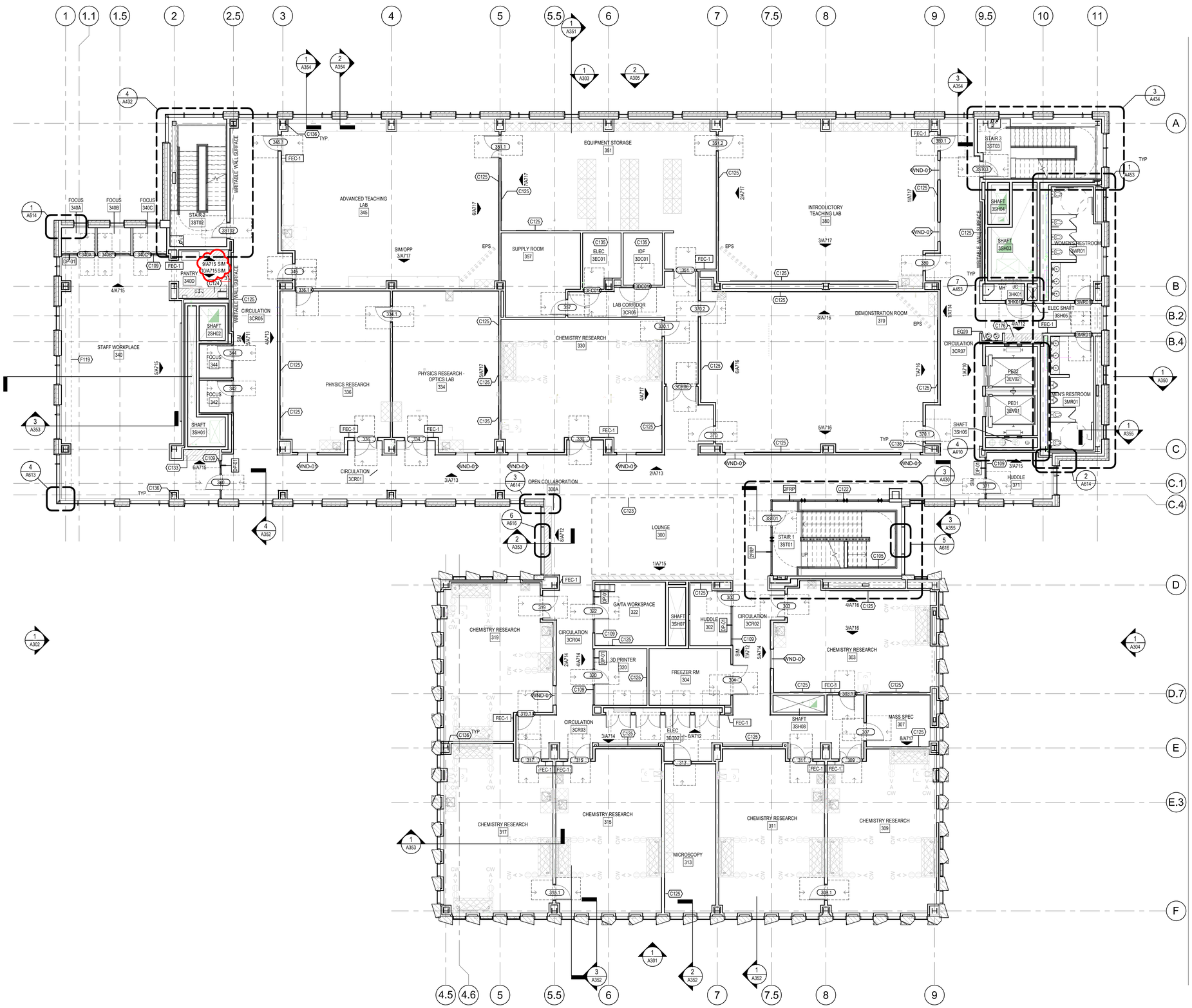
DIMENSION PLAN - LEVEL 01

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Sheet Number

A101D

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1 FLOOR PLAN - LEVEL 3
1/8" = 1'-0"

GENERAL NOTES

1. ALL PARTITIONS TO BE TYPE **0A6A** ON LEVEL 1 AND **0A4A** ON LEVELS 2-4, UON.
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3. ALL FIRE RATED PARTITION AND ACOUSTIC PARTITION PROPERTIES TO BE CONTINUOUS.
4. PROVIDE 3/4" FIRE-RETARDANT PLYWOOD BACKER BOARD AT TELECOM/ELECTRICAL ROOMS, TYP.
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9. PROVIDE AND INSTALL FIRE EXTINGUISHER CABINET(S) IN ACCORDANCE WITH ALL APPLICABLE CODE REQUIREMENTS. VERIFY LOCAL SIGNAGE REQUIREMENTS. CABINET DOOR TO BE PAINTED TO MATCH ADJACENT WALL.
10. PROVIDE PARTN TYPE 0A4A , UON ABOVE DEMOUNTABLE AND ALL GLASS PARTITIONS TO SLAB ABOVE. PROVIDE PARTN TYPE 2B4A ABOVE FIRE RATED GLASS PARTITION.
11. PROVIDE WATERPROOF FLOOR MEMBRANE AT TOILET ROOMS; LAP 4" AFF AT PERIMETER WALLS.
12. VERIFY PARTITION LAYOUT WITH ARCHITECT PRIOR TO PROCEEDING WITH CONSTRUCTION.
13. WHERE FURRED PARTITIONS EXCEED MAXIMUM HEIGHT, BRACE TO ADJACENT STRUCTURE.
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CONSTRUCTION PLAN LEGEND

CG — CORNER GUARD, SEE FINISH PLANS	FE — FIRE EXTINGUISHER
WP — WALL PROTECTION, SEE FINISH PLANS	FEC — FIRE EXTINGUISHER CABINET
ALIGN — INDICATES ALIGNMENT OF FINISH SURFACES	MILLWORK
ROUND FLOOR DRAIN	FIXED CASEWORK (LAB)
SQUARE FLOOR DRAIN	1 HR FIRE RATED CONSTRUCTION (Fire Rating = 1)
TRENCH DRAIN	2 HR FIRE RATED CONSTRUCTION (Fire Rating = 2)
MOP HOLDER	1 HR RATED GLAZED FIRE BARRIER (Fire Rating = 1-GL)
	2 HR RATED GLAZED FIRE BARRIER (Fire Rating = 2-GL)

KEYNOTE LEGEND

C105	PROVIDE LEVEL 5 FINISH, INCLUDING PRIMER AND PAINT, AT GWB IN PREPARATION FOR APPLIED GRAPHICS, DRY ERASE PAINT, OR SPECIALTY FINISH. TO BE HAND TROWELLED AND SANDED LEVEL 5 FINISH TO ELIMINATE APPEARANCE AND SHADOWING OF METAL STUDS TELEGRAPHING TO PARTITION FACE. SPRAY-APPLIED OR ROLLER-APPLIED LEVEL 5 COMPOUND WILL NOT BE ACCEPTED.
C109	LOW IRON ALUMINUM FRAMED INTERIOR GLAZING SYSTEM (DP01) BOD: WILSON PARTITION 500 SERIES WITH 4IN. ALUMINUM SHOE AND 2IN. SNAP ON TRIM. LEVEL 1 ASSEMBLIES TO BE 13FT. H WITH 9FT DOORS AND TRANSOM ABOVE. LEVEL 2-3 ASSEMBLIES TO BE 9FT 6IN WITH FULL HEIGHT DOORS. BUTT GLAZED SEAMS TYP AT ALL JOINTS. ALL GLAZING TO BE PROVIDED WITH CUSTOM GRAPHIC FILMS 48IN. PROVIDE ALSO HEAVY GAUGE MTL STUD FRAMING AND LATERAL BRACING ABOVE PARTITION.
C122	2 HR FIRE RATED GLASS ENCLOSURE WITH 90 MIN FIRED RESISTANCE RATED GLASS DOORS AND HARDWARE AT 9FT 6IN OVERALL HEIGHT WITH DOUBLE SWING DOOR ON AUTOMATIC HOLD OPEN ON LEVEL 1 AND SINGLE SWING ON UPPER LEVELS. EXTENTS OF GLASS TO BE FULL HEIGHT TO LEVEL WITH ALL NECESSARY HARDWARE. GLASS PANELS TO BE BUTT JOINED WITH RATED SEALANT AT TYPICAL VERTICAL JOINTS TO MINIMIZE VERTICAL MULLIONS; BOD: MCGRORY GLASS.
C123	LARGE FORMAT INTERACTIVE MEDIA SCREEN WITH LED ARRAY TOUCH SCREENS.
C124	PANTRY LOCATION TO CONSIST OF PLASTIC LAMINATE BASE CABINET MILLWORK, SOLID SURFACE QUARTZ COUNTERTOP, CERAMIC TILE BACKSPLASH. PROVIDE ALSO (3) VALVE BOXES AND DRAINS FOR PLUMBED APPLIANCES. SEE ALSO - ACCESSORY EQUIPMENT AND FIXTURE SCHEDULES ON A400. AT PANTRY PROVIDE ONE EACH OF FOLLOWING - EQ01, EQ03, EQ04, PF01, PF02, PF03
C125	WRITEABLE GLASS BOARD AS NOTED IN FINISH PLAN, SEE I SERIES FOR TYPE.
C133	PLASTIC LAMINATE MILLWORK, BASE CABINETS WITH STORAGE AND PULL OUT DUAL WASTE/RECYCLE RECEPTACLE. COUNTERTOP WITH BACKSPLASH AND BACKSPLASH MOUNTED POWER RECEPTACLES. WALL STORAGE CABINET AND ADJUSTABLE MAL SLOTS WITH 20 UNITS. PROVIDE ALSO CABINET DOWNLIGHT AND CABINET UPLIGHT PER RCP
C135	3/4IN FIRE RETARDANT PLYWOOD. TYPICAL AT TELECOM AND ELECTRICAL ROOMS.
C136	COLUMN SPLICE AT 4'-0" AFF. TYPICAL THROUGHOUT FLOOR. REFER TO DETAIL 1/A924 AND STRUCTURAL DRSWINGS.
C176	TYP. WASTE, RECYCLE, COMPOST, E-WASTE COLLECTION AREA. PROVIDE SOLID SURFACE COUNTER WITH 4IN BACKSPLASH. PLASTIC LAMINATE BASE CABIENTS WITH INTEGRAL TOE KICK, WASTE RECEPTACLES WITHIN AND STAINLESS STEEL SQUARE TRASH GROMMETS AT TOP.
F119	OPEN-TO-ABOVE CEILING TO BE FULLY PAINTED. TO INCLUDE ALL STRUCTURE, CONDUIT, JUNCTION BOXES, DUCTWORK, CABLE TRAYS, AND SIMILAR ITEMS OR SYSTEMS. SEE ALSO GENERAL OPEN CEILING NOTES AT SHEET A002 AND A201-A205 FOR ADDITIONAL CEILING NOTES.

MONTCLAIR STATE UNIVERSITY

Project
Interdisciplinary Science Building
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Montclair, New Jersey

Prepared For
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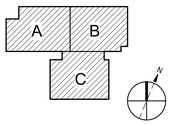
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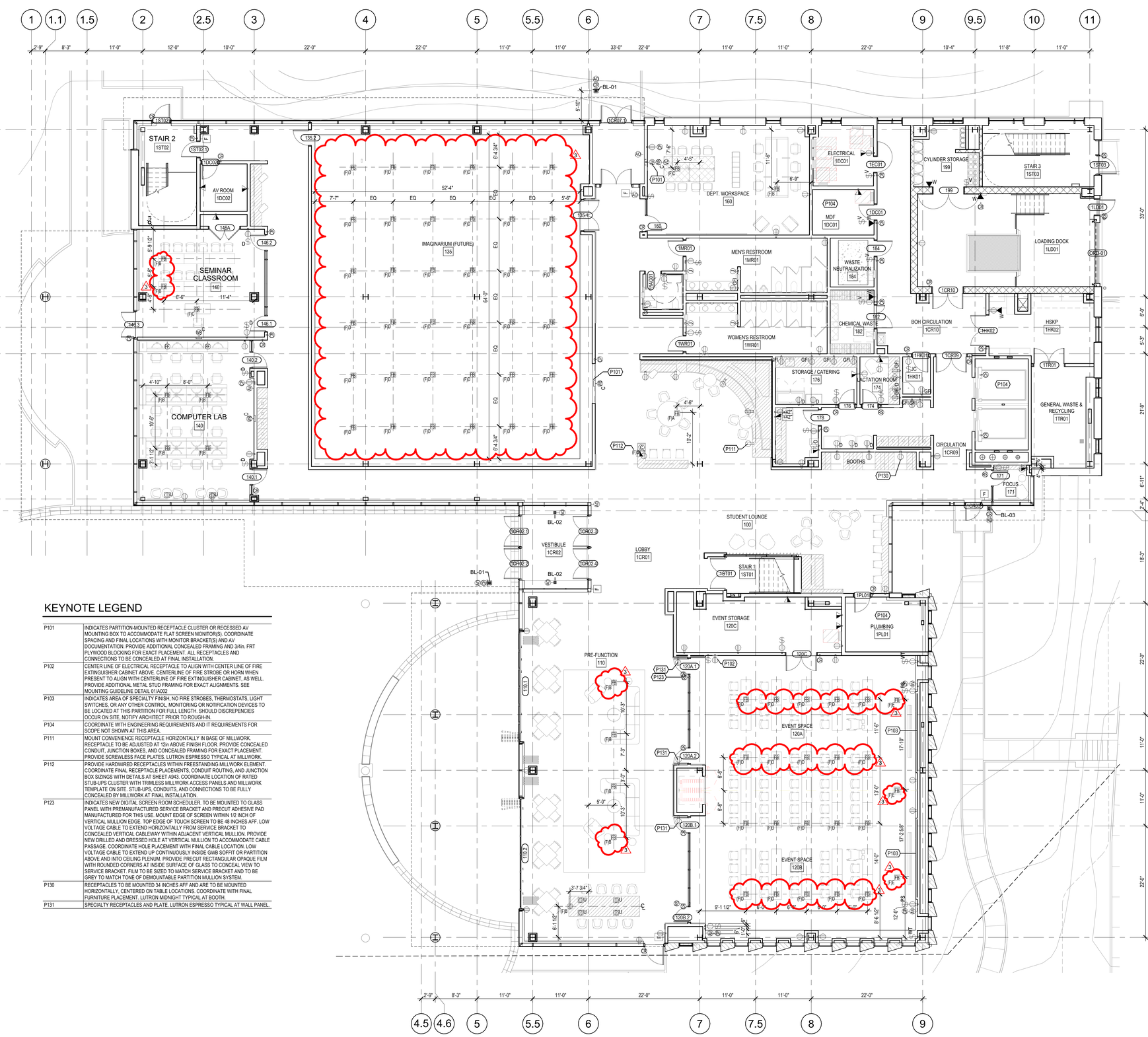
Project No: 24.07023.00

Sheet Title
FLOOR PLAN - LEVEL 03

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Sheet Number
A103

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1 POWER DATA PLAN - LEVEL 1
1/8" = 1'-0"

KEYNOTE LEGEND

P101	INDICATES PARTITION-MOUNTED RECEPTACLE CLUSTER OR RECESSED AV MOUNTING BOX TO ACCOMMODATE FLAT SCREEN MONITOR(S). COORDINATE SPACING AND FINAL LOCATIONS WITH MONITOR BRACKET(S) AND AV DOCUMENTATION. PROVIDE ADDITIONAL CONCEALED FRAMING AND 3/4in. FRT PLYWOOD BLOCKING FOR EXACT PLACEMENT. ALL RECEPTACLES AND CONNECTIONS TO BE CONCEALED AT FINAL INSTALLATION.
P102	CENTER LINE OF ELECTRICAL RECEPTACLE TO ALIGN WITH CENTER LINE OF FIRE EXTINGUISHER CABINET ABOVE. CENTERLINE OF FIRE STROBE OR HORN WHEN PRESENT TO ALIGN WITH CENTERLINE OF FIRE EXTINGUISHER CABINET, AS WELL. PROVIDE ADDITIONAL METAL STUD FRAMING FOR EXACT ALIGNMENTS. SEE MOUNTING GUIDELINE DETAIL 01/A002
P103	INDICATES AREA OF SPECIALTY FINISH, NO FIRE STROBES, THERMOSTATS, LIGHT SWITCHES, OR ANY OTHER CONTROL. MONITORING OR NOTIFICATION DEVICES TO BE LOCATED AT THIS PARTITION FOR FULL LENGTH. SHOULD DISCREPENCIES OCCUR ON SITE, NOTIFY ARCHITECT PRIOR TO ROUGH-IN.
P104	COORDINATE WITH ENGINEERING REQUIREMENTS AND IT REQUIREMENTS FOR SCOPE NOT SHOWN AT THIS AREA.
P111	MOUNT CONVENIENCE RECEPTACLE HORIZONTALLY IN BASE OF MILLWORK. RECEPTACLE TO BE ADJUSTED AT 12in ABOVE FINISH FLOOR. PROVIDE CONCEALED CONDUIT, JUNCTION BOXES, AND CONCEALED FRAMING FOR EXACT PLACEMENT. PROVIDE SCREWLESS FACE PLATES. LUTRON ESPRESSO TYPICAL AT MILLWORK.
P112	PROVIDE HARDWIRED RECEPTACLES WITHIN FREESTANDING MILLWORK ELEMENT. COORDINATE FINAL RECEPTACLE PLACEMENTS, CONDUIT ROUTING, AND JUNCTION BOX SIZINGS WITH DETAILS AT SHEET A943. COORDINATE LOCATION OF RATED STUB-UPS CLUSTER WITH TRIMLESS MILLWORK ACCESS PANELS AND MILLWORK TEMPLATE ON SITE. STUB-UPS, CONDUITS, AND CONNECTIONS TO BE FULLY CONCEALED BY MILLWORK AT FINAL INSTALLATION.
P123	INDICATES NEW DIGITAL SCREEN ROOM SCHEDULER. TO BE MOUNTED TO GLASS PANEL WITH PREMANUFACTURED SERVICE BRACKET AND PRECUT ADHESIVE PAD MANUFACTURED FOR THIS USE. MOUNT EDGE OF SCREEN WITHIN 1/2 INCH OF VERTICAL MULLION EDGE. TOP EDGE OF TOUCH SCREEN TO BE 48 INCHES AFF. LOW VOLTAGE CABLE TO EXTEND HORIZONTALLY FROM SERVICE BRACKET TO CONCEALED VERTICAL CABLEWAY WITHIN ADJACENT VERTICAL MULLION. PROVIDE NEW DRILLED AND DRESSED HOLE AT VERTICAL MULLION TO ACCOMMODATE CABLE PASSAGE. COORDINATE HOLE PLACEMENT WITH FINAL CABLE LOCATION. LOW VOLTAGE CABLE TO EXTEND UP CONTINUOUSLY INSIDE GWB SOFFIT OR PARTITION ABOVE AND INTO CEILING PLENUM. PROVIDE PRECUT RECTANGULAR OPAQUE FILM WITH ROUNDED CORNERS AT INSIDE SURFACE OF GLASS TO CONCEAL VIEW TO SERVICE BRACKET. FILM TO BE SIZED TO MATCH SERVICE BRACKET AND TO BE GREY TO MATCH TONE OF DEMOUNTABLE PARTITION MULLION SYSTEM.
P130	RECEPTACLES TO BE MOUNTED 34 INCHES AFF AND ARE TO BE MOUNTED HORIZONTALLY, CENTERED ON TABLE LOCATIONS. COORDINATE WITH FINAL FURNITURE PLACEMENT. LUTRON MIDNIGHT TYPICAL AT BOOTH.
P131	SPECIALTY RECEPTACLES AND PLATE. LUTRON ESPRESSO TYPICAL AT WALL PANEL.

POWER AND DATA PLAN LEGEND

WALL MOUNTED DEVICES

- SIMPLEX
- DUPLEX
- U — USB DUPLEX
- D — DEDICATED DUPLEX
- GFI — GROUND-FAULT CIRCUIT INTERRUPTER DUPLEX
- QUADRAPLEX
- SPECIAL POWER
- FP — FURNITURE FEED POWER
- FD — FURNITURE FEED TELE / DATA
- FV — FURNITURE FEED AUDIOVISUAL
- JUNCTION BOX
- 48L 42 — PLUG MOLD, INDICATING HEIGHT
- POWER / DATA RACEWAY
- PD — POWER / DATA SERVICE POLE
- TELE / DATA
- W — WALL PHONE
- TV — COAX CABLE TV
- LIGHTING TIME CLOCK
- RS — ROOM SCHEDULER
- OS — OCCUPANCY SENSOR / MOTION DETECTOR
- AV — AUDIOVISUAL CONNECTION
- VC — AV CAMERA
- VS — AV SPEAKER
- CP — CONTROL PANEL (AV / LIGHTING / SHADES)
- T — THERMOSTAT
- CO — CARBON MONOXIDE DETECTOR
- WB — AV RECESSED WALL BOX
- SC — SECURITY CAMERA
- ELH — ELECTRIC DOOR HARDWARE LOCATION
- CR — SECURITY CARD READER
- RX — REQUEST TO EXIT BUTTON
- DH — ELECTROMAGNETIC DOOR HOLD OPEN
- MS — MOTION SENSOR
- IC — INTERCOM STATION CONNECTION
- AO — AUTO OPERATOR
- RD — REMOTE DOOR RELEASE
- DB — DISTRESS BUTTON
- KB — KNOX BOX

LIFE SAFETY DEVICES - WALL MOUNTED

- F — FIRE ALARM PULL STATION, 42" AFF
- FS — FIRE ALARM STROBE / HORN, 80" AFF
- FIREMAN PHONE JACK
- FW — FIREWARDEN STATION

POWER / DATA / AV FOR CEILING AV EQUIP

- PP — POWER, DATA AND AV CONNECTIONS FOR CEILING MOUNTED PROJECTOR
- PS — POWER, DATA AND AV CONNECTIONS FOR CEILING MOUNTED PROJECTOR SCREEN
- PC — POWER, DATA AND AV CONNECTIONS FOR CEILING MOUNTED CONFIDENCE MONITOR

FURNITURE MOUNTED DEVICES

- FURNITURE DUPLEX
- U — FURNITURE USB DUPLEX
- FURNITURE QUADRAPLEX
- FURNITURE TELE / DATA
- AV — FURNITURE AV CONNECTION
- M — FURNITURE MICROPHONE

LABORATORY DEVICES

- PEDESTAL TABLE BOX (DUPLEX/BLANK ON FRONT BLANK/BLANK ON BACK)
- PEDESTAL TABLE BOX (DUPLEX/DUPLEX ON FRONT, BLANK/BLANK ON BACK)
- PEDESTAL TABLE BOX (DUPLEX/BLANK ON FRONT + DUPLEX/BLANK ON BACK)
- PEDESTAL TABLE BOX (DUPLEX/DUPLEX ON FRONT, DUPLEX/DUPLEX ON BACK)
- SPECIAL POWER RECEPTACLE ON GENERATOR AND/OR UPS
- DUPLEX POWER RECEPTACLE ON GENERATOR AND/OR UPS
- SPLIT BOX WITH DUPLEX POWER AND DATA, REFER TO DIV. 26
- DUAL CHANNEL RACEWAY. REFER TO PLANS FOR SINGLE CHANNEL RACEWAY LOCATIONS. REFER TO QL001 FOR MOUNTING HEIGHTS
- CEILING SERVICE PANEL. REFER TO QL SHEETS
- OVERHEAD SERVICE CARRIER WITH RACEWAY
- DATA JACK, REFER TO TELECOM PLANS
- QUADRAPLEX POWER OUTLET ON GENERATOR AND/OR UPS

WALL SWITCH / CONTROL

A — INDICATES TYPE AS OUTLINED BELOW
INDICATES SWITCH

TYPE 3W:	3-WAY CONTROL
TYPE 4W:	4-WAY CONTROL
TYPE D:	DIMMING
TYPE MP:	MOTORIZED PARTITION
TYPE O:	OVERRIDE
TYPE OS:	OCCUPANCY SENSOR
TYPE PL:	PROJECTOR LIFT
TYPE PS:	PROJECTION SCREEN
TYPE SC:	SCENE CONTROL
TYPE V:	VARIABLE SPEED CONTROL
TYPE VS:	VACANCY SENSOR
TYPE WT:	WINDOW TREATMENT

FLUSH OR SEMI-RECESSED POKE-THRU AT FLOOR

PT — INDICATES PREMANUFACTURED POKE-THRU
(F)AS — S WHEN PRESENT INDICATES SEMI-RECESSED
INDICATES TYPE AS OUTLINED BELOW

TYPE A:
TYPE B:
TYPE C: AV
TYPE D: AV

*(F)" WHEN PRESENT INDICATES POKE-THRU IS SERVING FURNITURE. COORDINATE WITH SPECIFIC FURNITURE REQUIREMENTS FOR EXACT PLACEMENT.

FURNITURE WHIP POKE-THRU AT FLOOR

FW — INDICATES PREMANUFACTURED POKE-THRU
A — INDICATES TYPE AS OUTLINED BELOW

TYPE A: **POWER ONLY**
TYPE B: **POWER AND DATA**
TYPE C: **POWER, DATA, AND AV**
TYPE D: **DATA ONLY**

COORDINATE WITH SPECIFIC FURNITURE REQUIREMENTS FOR EXACT PLACEMENT. WHIPS TO BE PROVIDED BY SEPARATE FURNITURE VENDOR. TO BE HARDWIRED BY CONTRACTOR.

FLUSH BOX RECESSED AT FLOOR

FB — INDICATES FLUSH FLOOR BOX
(F)A — INDICATES TYPE AS OUTLINED BELOW

TYPE A:
TYPE B:
TYPE C: AV
TYPE D: AV (ACCESS FLOOR SYS)
TYPE E: AV (ACCESS FLOOR SYS)

*(F)" WHEN PRESENT INDICATES FLOOR BOX IS SERVING FURNITURE AND IS TO BE COORDINATED WITH SPECIFIC FURNITURE REQUIREMENTS FOR EXACT PLACEMENT.

FLOOR STUB-UPS FOR CONDUIT

C — INDICATES FIRE SEALED FLOOR CORE WITH CONDUIT / STUB-UP(S)
(F)A — INDICATES TYPE AS OUTLINED BELOW. PROVIDE SEPARATE CONDUITS FOR EACH SERVICE TYPE.

TYPE A: **POWER**
TYPE B: **POWER AND DATA**
TYPE C: **POWER, DATA, AND AV**

*(F)" WHEN PRESENT INDICATES STUB-UPS ARE SERVING FURNITURE AND IS TO BE COORDINATED WITH SPECIFIC FURNITURE REQUIREMENTS AND TABLETOP HATCHES FOR EXACT PLACEMENT. PROVIDE ADDITIONAL CONCEALED CONDUIT RUNS AND CABLES U.O.N.

TABLE OR MILLWORK MOUNTED DEVICES

NOTE: DEVICES MAY BE WITHIN A TABLETOP HATCH, INSIDE A DRAWER, OR EDGE-MOUNTED AT TABLE LIP. COORD WITH FURNITURE OR MILLWORK CONFIGURATION

TT — INDICATES "TABLETOP" DEVICE CLUSTER
A — INDICATES TYPE AS OUTLINED BELOW

TYPE A: USB
TYPE B: USB
TYPE C: USB AV

AV RECESSED WALL BOX

WB — INDICATES TYPE AS OUTLINED BELOW
A — INDICATES RECESSED COLLECTOR WALL BOX FOR AV INSTALLATION

TYPE A:
TYPE B:
TYPE C: AV

MILLWORK

FIXED CASEWORK (LAB)

MONTCLAIR STATE UNIVERSITY

Project
Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For
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1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

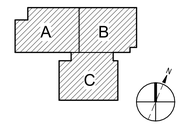
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Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

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A/V Engineer
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Key Plan



Professional Seals

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2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

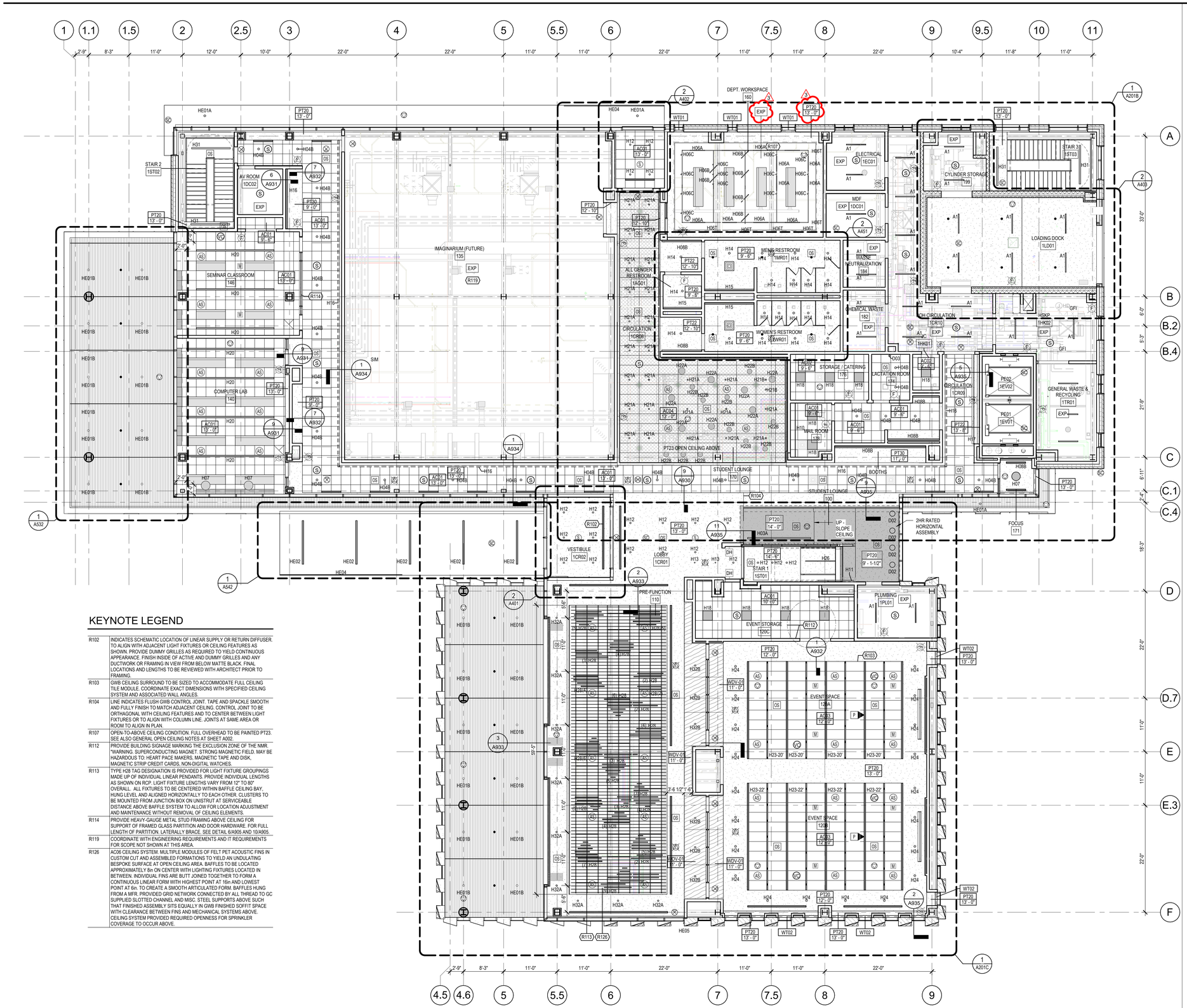
Project No: 24.07023.00

Sheet Title
POWER DATA PLAN - LEVEL 1

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Sheet Number
A151

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KEYNOTE LEGEND

R102	INDICATES SCHEMATIC LOCATION OF LINEAR SUPPLY OR RETURN DIFFUSER. TO ALIGN WITH ADJACENT LIGHT FIXTURES OR CEILING FEATURES AS SHOWN. PROVIDE DUMMY GRILLES AS REQUIRED TO YIELD CONTINUOUS APPEARANCE. FINISH INSIDE OF ACTIVE AND DUMMY GRILLES AND ANY DUCTWORK OR FRAMING IN VIEW FROM BELOW MATTE BLACK. FINAL LOCATIONS AND LENGTHS TO BE REVIEWED WITH ARCHITECT PRIOR TO FRAMING.
R103	GWB CEILING SURROUND TO BE SIZED TO ACCOMMODATE FULL CEILING TILE MODULE. COORDINATE EXACT DIMENSIONS WITH SPECIFIED CEILING SYSTEM AND ASSOCIATED WALL ANGLES.
R104	LINE INDICATES FLUSH GWB CONTROL JOINT. TAPE AND SPACKLE SMOOTH AND FULLY FINISH TO MATCH ADJACENT CEILING. CONTROL JOINT TO BE ORTHAGONAL WITH CEILING FEATURES AND TO CENTER BETWEEN LIGHT FIXTURES OR TO ALIGN WITH COLUMN LINE. JOINTS AT SAME AREA OR ROOM TO ALIGN IN PLAN.
R107	OPEN-TO-ABOVE CEILING CONDITION. FULL OVERHEAD TO BE PAINTED PT23. SEE ALSO GENERAL OPEN CEILING NOTES AT SHEET A002.
R112	PROVIDE BUILDING SIGNAGE MARKING THE EXCLUSION ZONE OF THE NMR. "WARNING. SUPERCONDUCTING MAGNET. STRONG MAGNETIC FIELD. MAY BE HAZARDOUS TO: HEART PACE MAKERS, MAGNETIC TAPE AND DISK, MAGNETIC STRIP CREDIT CARDS, NON-DIGITAL WATCHES.
R113	TYPE H28 TAG DESIGNATION IS PROVIDED FOR LIGHT FIXTURE GROUPINGS MADE UP OF INDIVIDUAL LINEAR PENDANTS. PROVIDE INDIVIDUAL LENGTHS AS SHOWN ON RCP. LIGHT FIXTURE LENGTHS VARY FROM 12" TO 80' OVERALL. ALL FIXTURES TO BE CENTERED WITHIN BAFFLE CEILING BAY, HUNG LEVEL AND ALIGNED HORIZONTALLY TO EACH OTHER. CLUSTERS TO BE MOUNTED FROM JUNCTION BOX ON UNISTRUT AT SERVICEABLE DISTANCE ABOVE BAFFLE SYSTEM TO ALLOW FOR LOCATION ADJUSTMENT AND MAINTENANCE WITHOUT REMOVAL OF CEILING ELEMENTS.
R114	PROVIDE HEAVY-GAUGE METAL STUD FRAMING ABOVE CEILING FOR SUPPORT OF FRAMED GLASS PARTITION AND DOOR HARDWARE. FOR FULL LENGTH OF PARTITION. LATERALLY BRACE. SEE DETAIL 6/A905 AND 10/A905.
R119	COORDINATE WITH ENGINEERING REQUIREMENTS AND IT REQUIREMENTS FOR SCOPE NOT SHOWN AT THIS AREA.
R126	AC06 CEILING SYSTEM. MULTIPLE MODULES OF FELT PET ACOUSTIC FINS IN CUSTOM CUT AND ASSEMBLED FORMATIONS TO YIELD AN UNDULATING BESPOKE SURFACE AT OPEN CEILING AREA. BAFFLES TO BE LOCATED APPROXIMATELY 8in ON CENTER WITH LIGHTING FIXTURES LOCATED IN BETWEEN. INDIVIDUAL FINS ARE BUTT JOINED TOGETHER TO FORM A CONTINUOUS LINEAR FORM WITH HIGHEST POINT AT 16in AND LOWEST POINT AT 6in. TO CREATE A SMOOTH ARTICULATED FORM. BAFFLES HUNG FROM A MFR. PROVIDED GRID NETWORK CONNECTED BY ALL THREAD TO GC SUPPLIED SLOTTED CHANNEL AND MISC. STEEL SUPPORTS ABOVE SUCH THAT FINISHED ASSEMBLY SITS EQUALLY IN GWB FINISHED SOFFIT SPACE WITH CLEARANCE BETWEEN FINS AND MECHANICAL SYSTEMS ABOVE. CEILING SYSTEM PROVIDED REQUIRED OPENNESS FOR SPRINKLER COVERAGE TO OCCUR ABOVE.

1 REFLECTED CEILING PLAN - LEVEL 1
1/8" = 1'-0"

RCP LEGEND

MATERIALS

- 2' x 2' GRID AND TILE SYSTEM - SEE SPECIFICATIONS
- 2' x 4' GRID AND TILE SYSTEM - SEE SPECIFICATIONS
- GYPSUM BOARD CEILING AS INDICATED ON PLAN - SEE FINISH PLAN FOR PAINT SPECIFICATIONS
- ACOUSTIC BAFFLE CEILING SYSTEM
- DECORATIVE METAL MESH CEILING

ANNOTATIONS

- XX## — FINISHED CEILING MATERIAL CODE. SEE FINISH SCHEDULE
- 8' - 6" — FINISHED CEILING HEIGHT AS INDICATED ON PLAN UON.

SECURITY

- SC — SECURITY CAMERA

CEILING FIXTURES

- 2' x 2' RECESSED LIGHT
- 2' x 4' RECESSED LIGHT
- RECESSED LINEAR
- RECESSED DOWNLIGHT
- RECESSED WALL WASH DOWNLIGHT
- CEILING MTD SEMI RECESS WALLWASH
- LARGE PENDANT
- PENDANT
- CEILING SURFACE MOUNTED STRIP LIGHT
- WALL SCONCE
- PENDANT MTD DIRECT / INDIRECT
- UNDER CABINET
- UPLIGHT STRIP
- ROLLER SHADE, SINGLE
- ROLLER SHADE, DOUBLE
- HVAC CHILLED BEAM
- HVAC SQUARE DIFFUSER
- HVAC LINEAR DIFFUSER, SUPPLY/RETURN
- CEILING MOUNTED RADIANT PANEL
- CEILING ACCESS PANEL
- CSP-X — CEILING SERVICE PANEL - REFER TO QL SHEETS

POWER & TELEDATA

- VC — CEILING MOUNTED AV CAMERA
- OS — OCCUPANCY SENSOR
- AS — AUDIO SPEAKER
- P — PROJECTOR
- M — MICROPHONE
- WIRELESS ACCESS POINT
- EPS — PROJECTION SCREEN - ELECTRONIC

LIFE SAFETY

- EXIT SIGN, ARROW INDICATES PATH OF TRAVEL
- S — SMOKE DETECTOR
- (F) — LIFE SAFETY SPEAKER STROBE
- (F) — LIFE SAFETY STROBE
- SPRINKLER

LABORATORY

- CEILING SERVICE PANEL, REFER TO QL SHEETS FOR TYPES
- SAFETY SHOWER
- PIPE CHASE, CEILING PENETRATION COLLAR
- OVERHEAD SERVICE CARRIER
- LASER CURTAIN
- POINT EXHAUST, REFER TO DIV. 23
- SNORKEL, EXHAUST CONNECTION BY DIV. 23

GENERAL RCP NOTES

1. ALL STROBES SHALL BE LOCATED @ +80" AFF UON. SEE ENGINEER'S DRAWINGS FOR SPECIFICATIONS.
2. ALL STROBES TO ALIGN VERTICALLY WITH RECEPTACLE BELOW WHERE OCCURS.
3. ALL UNDER CABINET LIGHTING TO HAVE AN INDEPENDENT SWITCH AT EACH LOCATION WHERE NOTED.
4. ARCHITECT TO REVIEW ALL LIGHT/ CEILING FIXTURE LOCATIONS PRIOR TO INSTALLATION DURING SHOP DRAWINGS.
5. ARCHITECT TO REVIEW LOCATIONS OF ALL SLOT DIFFUSERS, SPRINKLERS, SMOKE DETECTORS, ETC. IN GYP BD CEILINGS PRIOR TO INSTALLATION DURING SHOP DRAWINGS.
6. REFLECTED CEILING PLANS INDICATE:
   A. GENERAL TYPE AND SPECIFIC LOCATION OF LIGHT FIXTURES OF SIGNAL & EQUIPMENT DEVICES.
7. ELECTRICAL ENGINEERING DRAWINGS INDICATE:
   A. CIRCUITING AND WIRING OF LIGHT FIXTURES AND SWITCHES.
   B. LIFE SAFETY EQUIPMENT.
   C. LOCATION OF REQUIRED EMERGENCY LIGHT FIXTURES.
   D. LIGHT FIXTURE SPECIFICATIONS.
8. MECHANICAL ENGINEERING DRAWINGS INDICATE:
   A. DUCTS, AIR MOVEMENT REQUIREMENTS AND SIZES OF GRILLES AND REGISTERS.
9. FIRE PROTECTION DRAWINGS INDICATE:
   A. LAYOUT, LOCATION AND SIZE OF SPRINKLER LINES.
   B. PRESSURE REQUIREMENTS.
   C. SPRINKLER HEAD SPECIFICATIONS.
   D. LOCATION OF FIRE PROTECTION RISERS AND WALL HYDRANTS.
10. WHERE ACOUSTICAL CEILING PANELS ARE REQUIRED TO BE CUT, CUT THE PANELS TO MAINTAIN A SHARP AND NEAT EDGE. DO NOT USE TILE FRAGMENTS LESS THAN 6 INCHES IN EITHER DIRECTION UNLESS OTHERWISE SHOWN.
11. CENTER CEILING DEVICES IN ACOUSTIC CEILING TILES IN BOTH DIRECTIONS, UNLESS OTHERWISE NOTED. DEVICES, INCLUDING BUT NOT LIMITED TO LIGHT FIXTURES, SPEAKERS, SPRINKLERS, FIRE STROBES, EXIT SIGNS, SMOKE DETECTORS, OCCUPANCY SENSORS AND OTHER DEVICES ARE SHOWN FOR ROUGH LOCATION INFORMATION ONLY.
12. ALL ACOUSTIC CEILING TILES, SOUND ATTENUATING BLANKET, HVAC INSULATION AND BUILDING INSULATION TO BE OF FM APPROVED CLASS 1 MATERIALS OR NONCOMBUSTIBLE MATERIALS.

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Project
Interdisciplinary Science Building
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Montclair, New Jersey

Prepared For
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1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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300 Kimball Drive, 4th floor
Parsippany, NJ 07054

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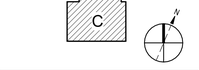
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Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

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100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
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Key Plan



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1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

Sheet Title

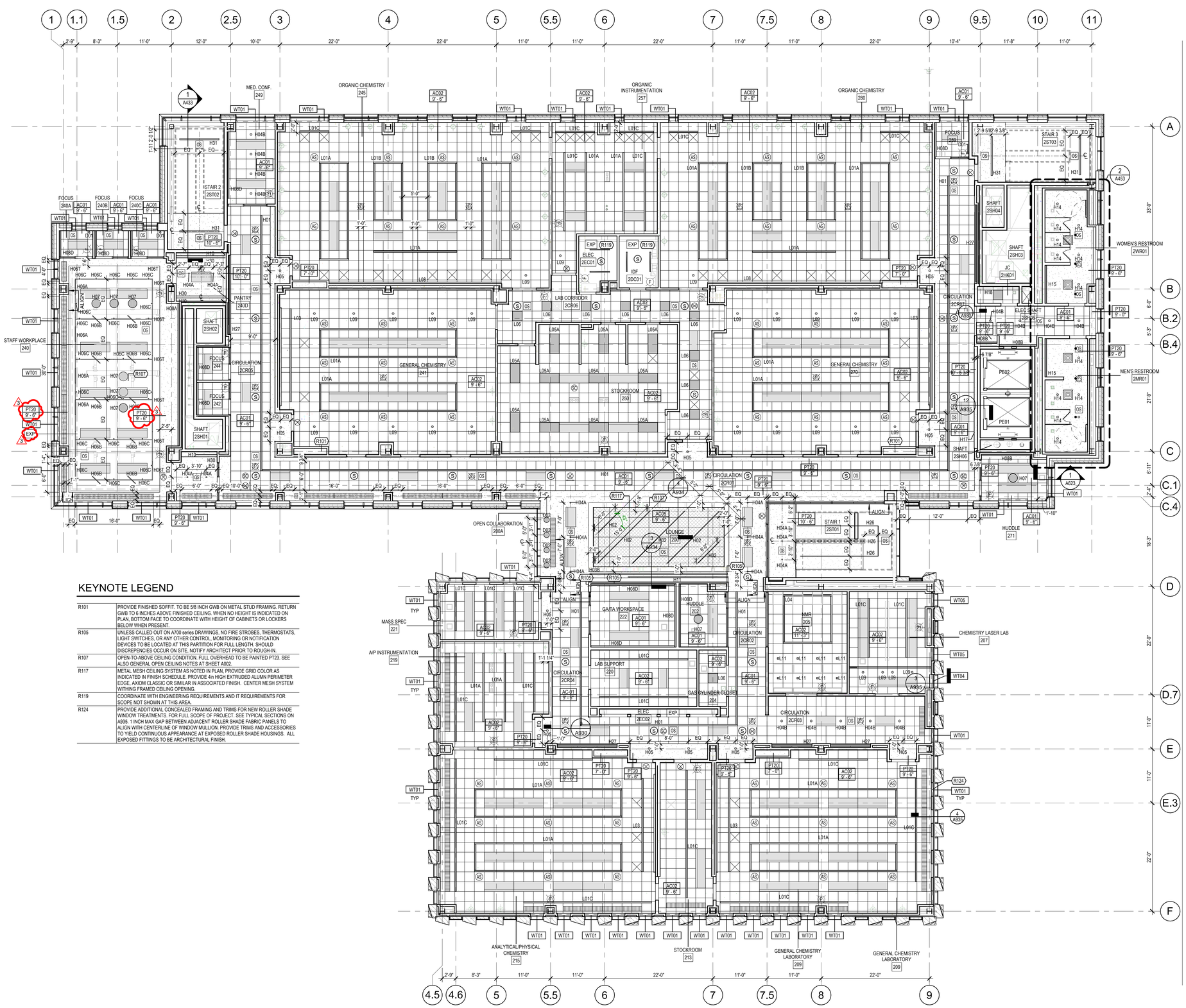
REFLECTED CEILING PLAN - LEVEL 01

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

A201

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1 REFLECTED CEILING PLAN - LEVEL 2
1/8" = 1'-0"

KEYNOTE LEGEND

R101	PROVIDE FINISHED SOFFIT. TO BE 5/8 INCH GWB ON METAL STUD FRAMING. RETURN GWB TO 6 INCHES ABOVE FINISHED CEILING. WHEN NO HEIGHT IS INDICATED ON PLAN, BOTTOM FACE TO COORDINATE WITH HEIGHT OF CABINETS OR LOCKERS BELOW WHEN PRESENT.
R105	UNLESS CALLED OUT ON A700 series DRAWINGS, NO FIRE STROBES, THERMOSTATS, LIGHT SWITCHES, OR ANY OTHER CONTROL, MONITORING OR NOTIFICATION DEVICES TO BE LOCATED AT THIS PARTITION FOR FULL LENGTH. SHOULD DISCREPENCIES OCCUR ON SITE, NOTIFY ARCHITECT PRIOR TO ROUGH-IN.
R107	OPEN-TO-ABOVE CEILING CONDITION. FULL OVERHEAD TO BE PAINTED PT23. SEE ALSO GENERAL OPEN CEILING NOTES AT SHEET A002.
R117	METAL MESH CEILING SYSTEM AS NOTED IN PLAN, PROVIDE GRID COLOR AS INDICATED IN FINISH SCHEDULE. PROVIDE 4in HIGH EXTRUDED ALUMN PERIMETER EDGE, AXIOM CLASSIC OR SIMILAR IN ASSOCIATED FINISH. CENTER MESH SYSTEM WITHING FRAMED CEILING OPENING.
R119	COORDINATE WITH ENGINEERING REQUIREMENTS AND IT REQUIREMENTS FOR SCOPE NOT SHOWN AT THIS AREA.
R124	PROVIDE ADDITIONAL CONCEALED FRAMING AND TRIMS FOR NEW ROLLER SHADE WINDOW TREATMENTS. FOR FULL SCOPE OF PROJECT. SEE TYPICAL SECTIONS ON A935. 1 INCH MAX GAP BETWEEN ADJACENT ROLLER SHADE FABRIC PANELS TO ALIGN WITH CENTERLINE OF WINDOW MULLION. PROVIDE TRIMS AND ACCESSORIES TO YIELD CONTINUOUS APPEARANCE AT EXPOSED ROLLER SHADE HOUSINGS. ALL EXPOSED FITTINGS TO BE ARCHITECTURAL FINISH.

RCP LEGEND

MATERIALS

- 2' x 2' GRID AND TILE SYSTEM - SEE SPECIFICATIONS
- 2' x 4' GRID AND TILE SYSTEM - SEE SPECIFICATIONS
- GYPSUM BOARD CEILING AS INDICATED ON PLAN - SEE FINISH PLAN FOR PAINT SPECIFICATIONS
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ANNOTATIONS

- XX## — FINISHED CEILING MATERIAL CODE. SEE FINISH SCHEDULE
- 8' - 6" — FINISHED CEILING HEIGHT AS INDICATED ON PLAN UON.

SECURITY

- SC — SECURITY CAMERA

CEILING FIXTURES

- 2' x 2' RECESSED LIGHT
- 2' x 4' RECESSED LIGHT
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- RECESSED DOWNLIGHT
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- CEILING MTD SEMI RECESS WALLWASH
- LARGE PENDANT
- PENDANT
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POWER & TELEDATA

- VC — CEILING MOUNTED AV CAMERA
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HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Parsippany, NJ 07054

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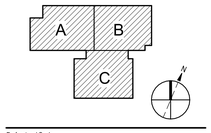
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Structural Engineer
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Project No: 24.07023.00

Sheet Title

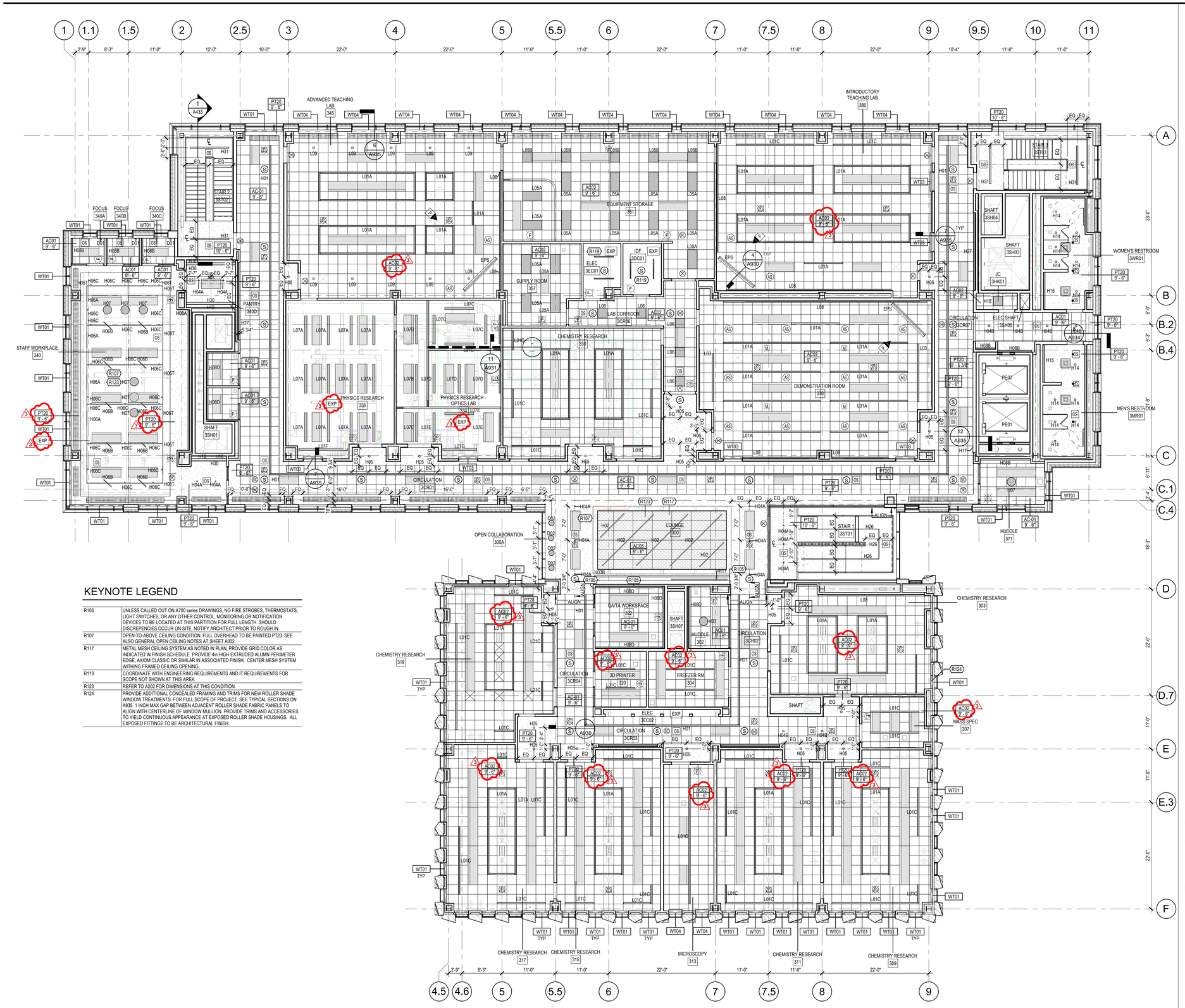
REFLECTED CEILING PLAN - LEVEL 02

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Sheet Number

A202

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1 CEILING PLAN - LEVEL 03
1/8" = 1'-0"

KEYNOTE LEGEND

R105	UNLESS CALLED OUT ON A700 series DRAWINGS, NO FIRE STROBES, THERMOSTATS, LIGHT SWITCHES, OR ANY OTHER CONTROL, MONITORING OR NOTIFICATION DEVICES TO BE LOCATED AT THIS PARTITION FOR FULL LENGTH. SHOULD DISCREPENCIES OCCUR ON SITE, NOTIFY ARCHITECT PRIOR TO ROUGH-IN.
R107	OPEN-TO-ABOVE CEILING CONDITION. FULL OVERHEAD TO BE PAINTED PT23. SEE ALSO GENERAL OPEN CEILING NOTES AT SHEET A002.
R117	METAL MESH CEILING SYSTEM AS NOTED IN PLAN, PROVIDE GRID COLOR AS INDICATED IN FINISH SCHEDULE. PROVIDE 4in HIGH EXTRUDED ALUMN PERIMETER EDGE, AXIOM CLASSIC OR SIMILAR IN ASSOCIATED FINISH. CENTER MESH SYSTEM WITHING FRAMED CEILING OPENING.
R119	COORDINATE WITH ENGINEERING REQUIREMENTS AND IT REQUIREMENTS FOR SCOPE NOT SHOWN AT THIS AREA.
R123	REFER TO A202 FOR DIMENSIONS AT THIS CONDITION.
R124	PROVIDE ADDITIONAL CONCEALED FRAMING AND TRIMS FOR NEW ROLLER SHADE WINDOW TREATMENTS. FOR FULL SCOPE OF PROJECT. SEE TYPICAL SECTIONS ON A935. 1 INCH MAX GAP BETWEEN ADJACENT ROLLER SHADE FABRIC PANELS TO ALIGN WITH CENTERLINE OF WINDOW MULLION. PROVIDE TRIMS AND ACCESSORIES TO YIELD CONTINUOUS APPEARANCE AT EXPOSED ROLLER SHADE HOUSINGS. ALL EXPOSED FITTINGS TO BE ARCHITECTURAL FINISH.

RCP LEGEND

MATERIALS

- 2' x 2' GRID AND TILE SYSTEM - SEE SPECIFICATIONS
- 2' x 4' GRID AND TILE SYSTEM - SEE SPECIFICATIONS
- GYPSUM BOARD CEILING AS INDICATED ON PLAN - SEE FINISH PLAN FOR PAINT SPECIFICATIONS
- ACOUSTIC BAFFLE CEILING SYSTEM
- DECORATIVE METAL MESH CEILING

ANNOTATIONS

- XX## — FINISHED CEILING MATERIAL CODE. SEE FINISH SCHEDULE
- 8' - 6" — FINISHED CEILING HEIGHT AS INDICATED ON PLAN UON.

SECURITY

- SC — SECURITY CAMERA

CEILING FIXTURES

- 2' x 2' RECESSED LIGHT
- 2' x 4' RECESSED LIGHT
- RECESSED LINEAR
- RECESSED DOWNLIGHT
- RECESSED WALL WASH DOWNLIGHT
- CEILING MTD SEMI RECESS WALLWASH
- LARGE PENDANT
- PENDANT
- CEILING SURFACE MOUNTED STRIP LIGHT
- WALL SCONCE
- PENDANT MTD DIRECT / INDIRECT
- UNDER CABINET
- UPLIGHT STRIP
- ROLLER SHADE, SINGLE
- ROLLER SHADE, DOUBLE
- HVAC CHILLED BEAM
- HVAC SQUARE DIFFUSER
- HVAC LINEAR DIFFUSER, SUPPLY/RETURN
- CEILING MOUNTED RADIANT PANEL
- CEILING ACCESS PANEL
- CSP-X — CEILING SERVICE PANEL - REFER TO QL SHEETS

POWER & TELEDATA

- CM — CEILING MOUNTED AV CAMERA
- OS — OCCUPANCY SENSOR
- AS — AUDIO SPEAKER
- P — PROJECTOR
- M — MICROPHONE
- WAP — WIRELESS ACCESS POINT
- EPS — PROJECTION SCREEN - ELECTRONIC

LIFE SAFETY

- EXIT SIGN, ARROW INDICATES PATH OF TRAVEL
- S — SMOKE DETECTOR
- SS — LIFE SAFETY SPEAKER STROBE
- S — LIFE SAFETY STROBE
- SPRINKLER

LABORATORY

- CEILING SERVICE PANEL, REFER TO QL SHEETS FOR TYPES
- SAFETY SHOWER
- PIPE CHASE, CEILING PENETRATION COLLAR
- OVERHEAD SERVICE CARRIER
- LASER CURTAIN
- POINT EXHAUST, REFER TO DIV. 23
- SNORKEL, EXHAUST CONNECTION BY DIV. 23

GENERAL RCP NOTES

1. ALL STROBES SHALL BE LOCATED @ +80" AFF UON. SEE ENGINEER'S DRAWINGS FOR SPECIFICATIONS.
2. ALL STROBES TO ALIGN VERTICALLY WITH RECEPTACLE BELOW WHERE OCCURS.
3. ALL UNDER CABINET LIGHTING TO HAVE AN INDEPENDENT SWITCH AT EACH LOCATION WHERE NOTED.
4. ARCHITECT TO REVIEW ALL LIGHT/ CEILING FIXTURE LOCATIONS PRIOR TO INSTALLATION DURING SHOP DRAWINGS.
5. ARCHITECT TO REVIEW LOCATIONS OF ALL SLOT DIFFUSERS, SPRINKLERS, SMOKE DETECTORS, ETC. IN GYP BD CEILINGS PRIOR TO INSTALLATION DURING SHOP DRAWINGS.
6. REFLECTED CEILING PLANS INDICATE:
   A. GENERAL TYPE AND SPECIFIC LOCATION OF LIGHT FIXTURES OF SIGNAL & EQUIPMENT DEVICES.
7. ELECTRICAL ENGINEERING DRAWINGS INDICATE:
   A. CIRCUITING AND WIRING OF LIGHT FIXTURES AND SWITCHES.
   B. LIFE SAFETY EQUIPMENT.
   C. LOCATION OF REQUIRED EMERGENCY LIGHT FIXTURES.
   D. LIGHT FIXTURE SPECIFICATIONS.
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10. WHERE ACOUSTICAL CEILING PANELS ARE REQUIRED TO BE CUT, CUT THE PANELS TO MAINTAIN A SHARP AND NEAT EDGE. DO NOT USE TILE FRAGMENTS LESS THAN 6 INCHES IN EITHER DIRECTION UNLESS OTHERWISE SHOWN.
11. CENTER CEILING DEVICES IN ACOUSTIC CEILING TILES IN BOTH DIRECTIONS, UNLESS OTHERWISE NOTED. DEVICES, INCLUDING BUT NOT LIMITED TO LIGHT FIXTURES, SPEAKERS, SPRINKLERS, FIRE STROBES, EXIT SIGNS, SMOKE DETECTORS, OCCUPANCY SENSORS AND OTHER DEVICES ARE SHOWN FOR ROUGH LOCATION INFORMATION ONLY.
12. ALL ACOUSTIC CEILING TILES, SOUND ATTENUATING BLANKET, HVAC INSULATION AND BUILDING INSULATION TO BE OF FM APPROVED CLASS 1 MATERIALS OR NONCOMBUSTIBLE MATERIALS.

MONTCLAIR STATE UNIVERSITY

Project
Interdisciplinary Science Building
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Prepared For
Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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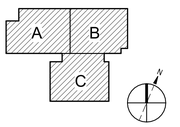
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Key Plan



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2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

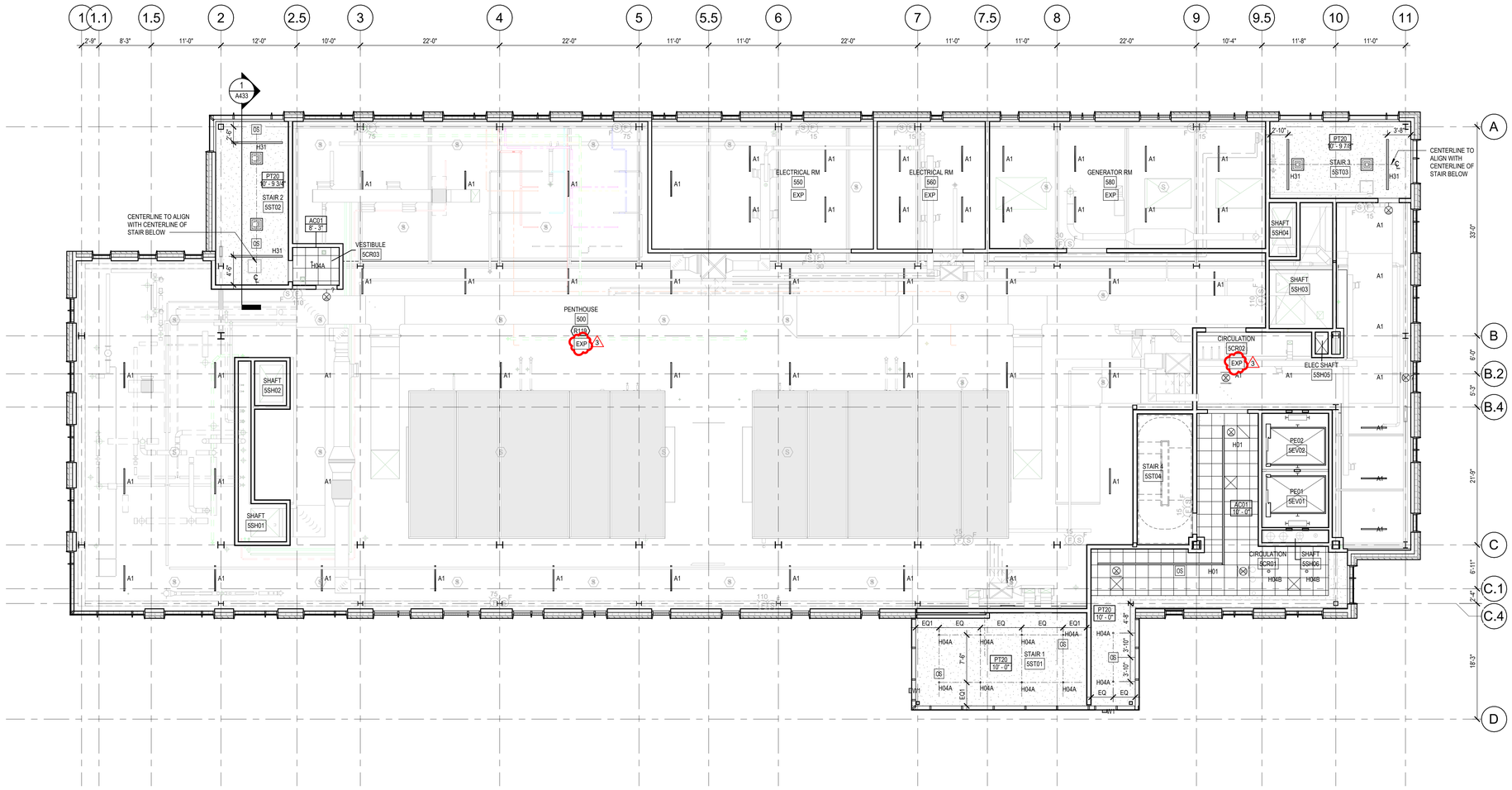
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Sheet Title
REFLECTED CEILING PLAN - LEVEL 03

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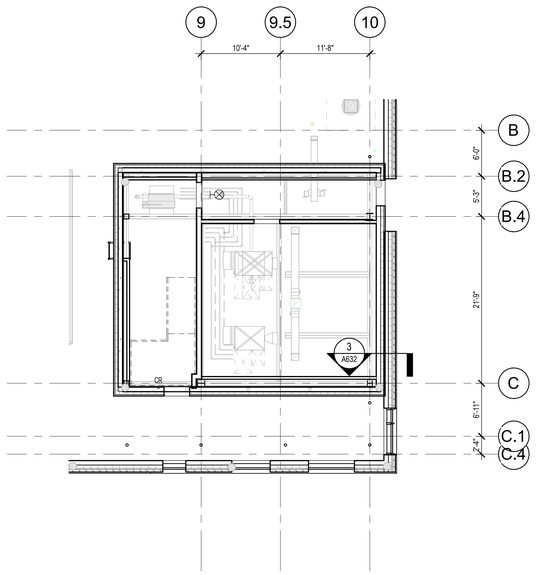
Sheet Number
A203

3/24/2026 12:12:03 AM



1 CEILING PLAN - PENTHOUSE

1/8" = 1'-0"



2 CEILING PLAN - EMR

1/8" = 1'-0"

3/24/2026 12:14:50 AM

RCP LEGEND

MATERIALS

- 2' x 2' GRID AND TILE SYSTEM - SEE SPECIFICATIONS
- 2' x 4' GRID AND TILE SYSTEM - SEE SPECIFICATIONS
- GYPSUM BOARD CEILING AS INDICATED ON PLAN - SEE FINISH PLAN FOR PAINT SPECIFICATIONS
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- VC — CEILING MOUNTED AV CAMERA
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- EXIT SIGN, ARROW INDICATES PATH OF TRAVEL
- S — SMOKE DETECTOR
- SF — LIFE SAFETY SPEAKER STROBE
- F — LIFE SAFETY STROBE
- SPRINKLER

LABORATORY

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- SAFETY SHOWER
- PIPE CHASE, CEILING PENETRATION COLLAR
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- POINT EXHAUST, REFER TO DIV. 23
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KEYNOTE LEGEND

R119	COORDINATE WITH ENGINEERING REQUIREMENTS AND IT REQUIREMENTS FOR SCOPE NOT SHOWN AT THIS AREA.

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building

1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University

1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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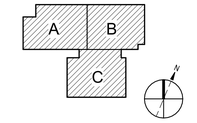
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Princeton, NJ 08540

Shen Milsom & Wilke LLC
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Key Plan



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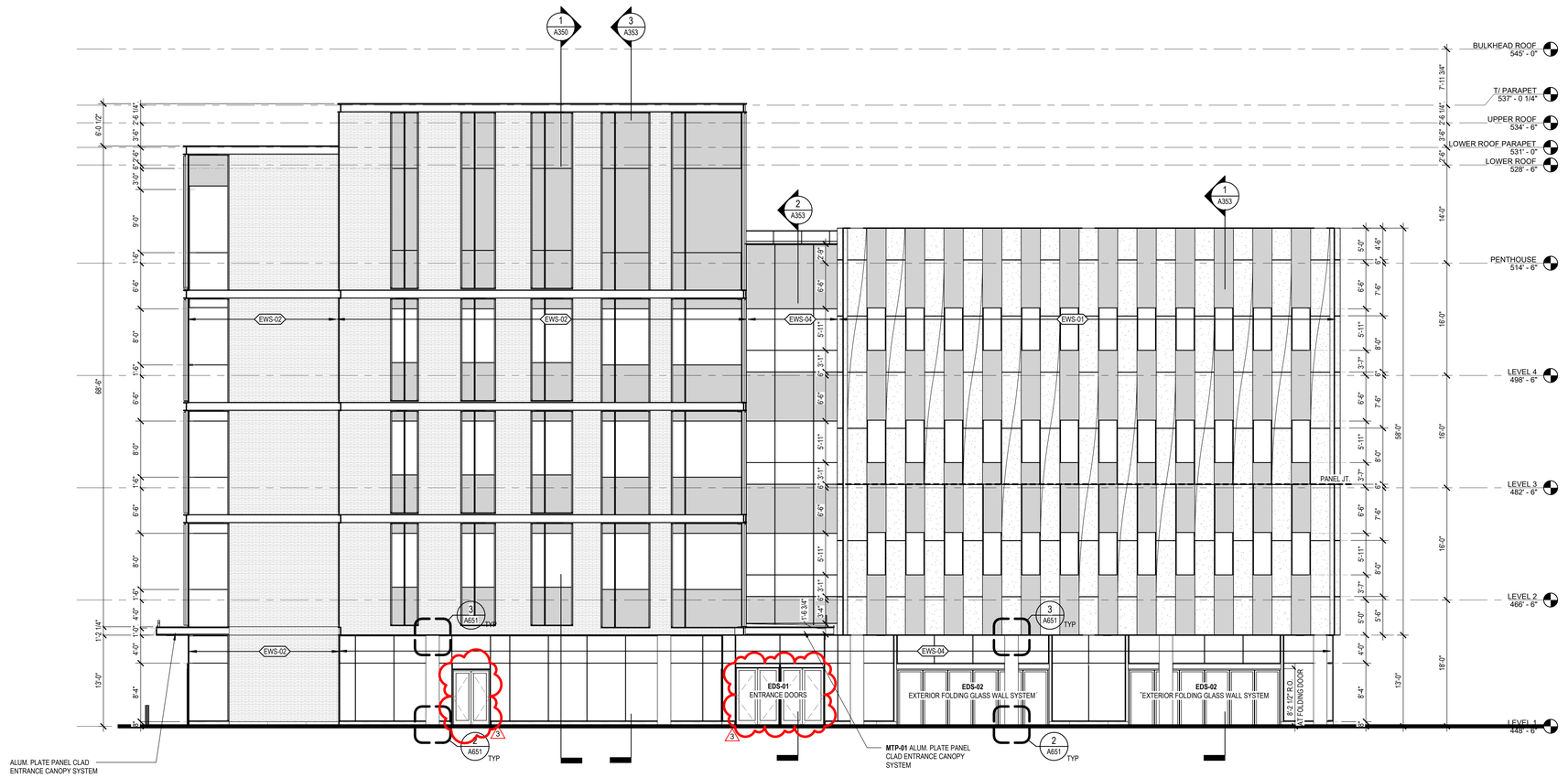
Sheet Title

REFLECTED CEILING PLAN - LEVEL PENTHOUSE

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

A205



1 BUILDING ELEVATION - WEST
1/8" = 1'-0"

EXTERIOR WALL SYSTEM TYPES	
EWS-01	MONOLITHIC PRECAST WALL PANELS WITH PRE-INSTALLED GLAZING AND FIELD INSTALLED GLAZING INFILL PANELS
EWS-02	BRICK CAVITY WALL SYSTEM WITH INFILL GLAZING UNITS - TYPICAL BRICK MIX
EWS-03	BRICK CAVITY WALL SYSTEM WITH INFILL GLAZING UNITS - ACCENT BRICK
EWS-04	STOREFRONT / CURTAIN WALL GLAZING SYSTEM
EWS-05	CORRUGATED ALUMINUM PANEL RAIN SCREEN
EWS-06	1-HOUR FIRE-RATED STOREFRONT SYSTEM WITH 60-MIN. FIRE-RATED VISION AND SPANDREL GLAZING

BUILDING ELEVATIONS LEGEND

- VISION GLAZING IGU
- SPANDREL GLAZING IGU
- VISION GLAZING IGU WITH PRIVACY FRIT
- ARCHITECTURAL PRE-CAST CONCRETE
- BRICK VENEER CAVITY WALL
- GRANITE STONE VENEER
- CORRUGATED METAL PANEL RAINSCREEN
- ALUM. PLATE PANEL
- ARCHITECTURAL STORM LOUVER, GLAZED INTO CURTAINWALL UNIT

3/23/2026 11:24:05 PM

MONTCLAIR STATE UNIVERSITY

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Prepared For

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HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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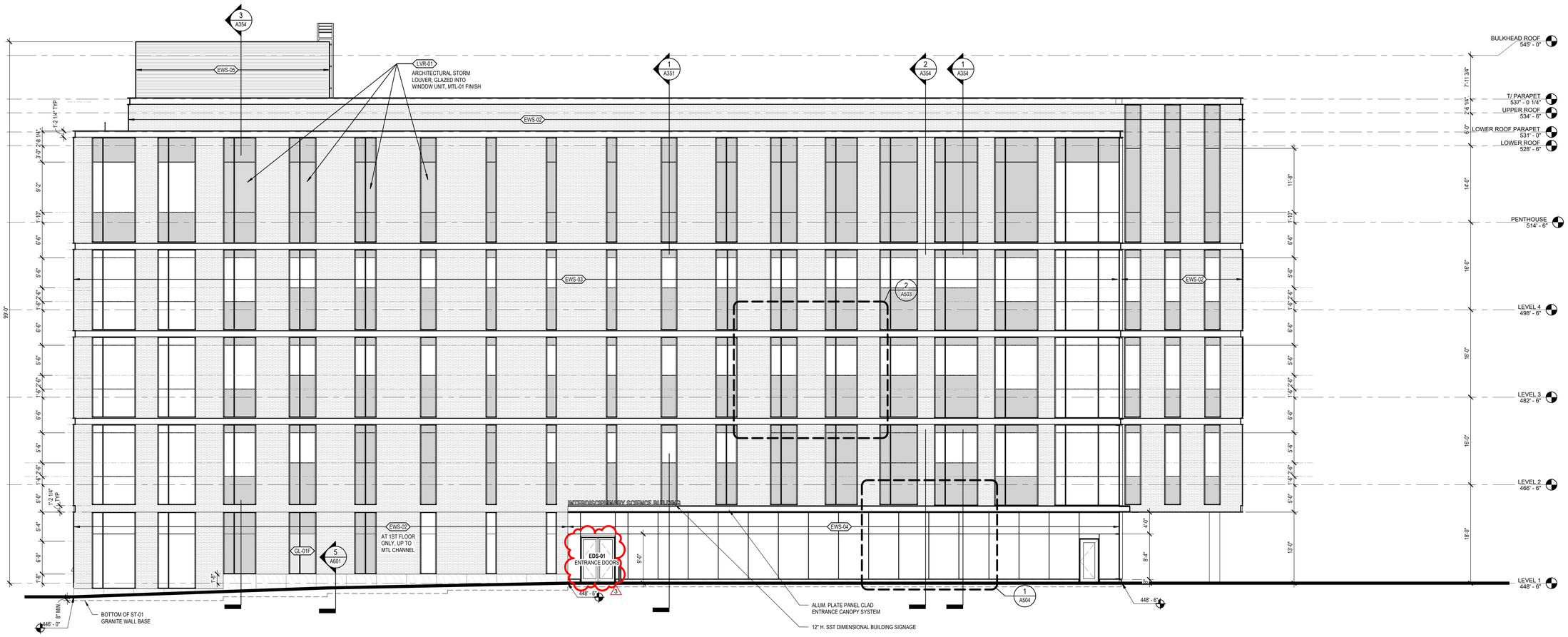
Sheet Title

EXTERIOR ELEVATIONS - WEST

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

A302



1 BUILDING ELEVATION - NORTH
1/8" = 1'-0"

EXTERIOR WALL SYSTEM TYPES	
EWS-01	MONOLITHIC PRECAST WALL PANELS WITH PRE-INSTALLED GLAZING AND FIELD INSTALLED GLAZING INFILL PANELS
EWS-02	BRICK CAVITY WALL SYSTEM WITH INFILL GLAZING UNITS - TYPICAL BRICK MIX
EWS-03	BRICK CAVITY WALL SYSTEM WITH INFILL GLAZING UNITS - ACCENT BRICK
EWS-04	STOREFRONT / CURTAIN WALL GLAZING SYSTEM
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BUILDING ELEVATIONS LEGEND

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- SPANDREL GLAZING IGU
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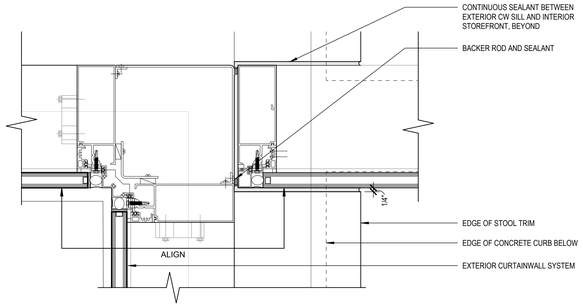
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EXTERIOR ELEVATIONS - NORTH

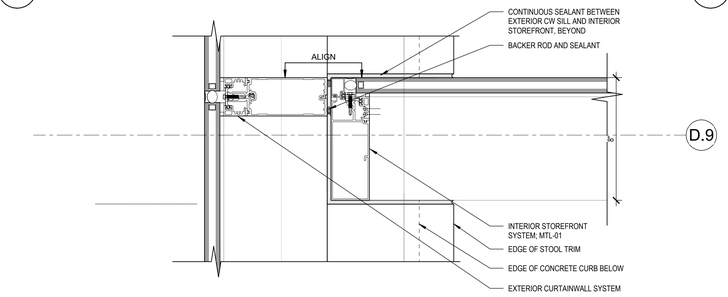
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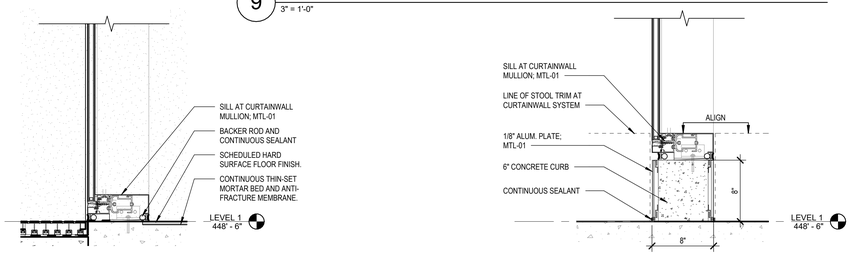
A303



10 ENLARGED PLAN - MAIN ENTRANCE WEST - CORNER AT CW
3" = 1'-0"

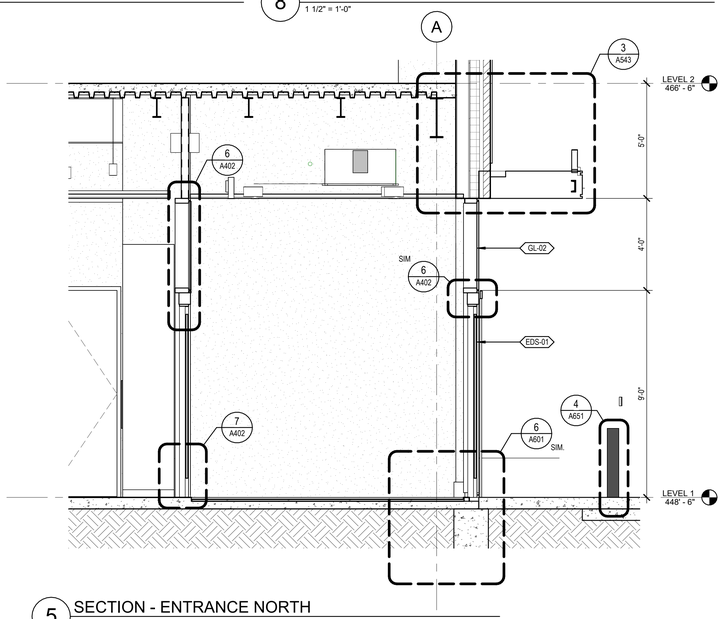


9 ENLARGED PLAN - MAIN ENTRANCE WEST - PERP. INT. AT CW
3" = 1'-0"

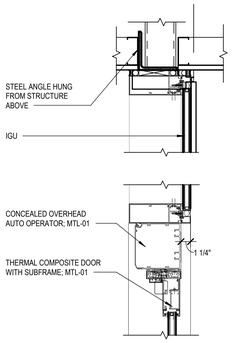


11 SECTION - SILL DETAIL AT NORTH VESTIBULE CURTAINWALL
1 1/2" = 1'-0"

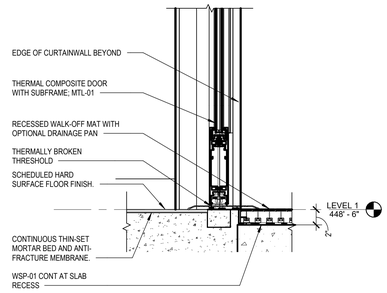
8 SECTION - SILL DETAIL AT WEST VESTIBULE CURTAINWALL
1 1/2" = 1'-0"



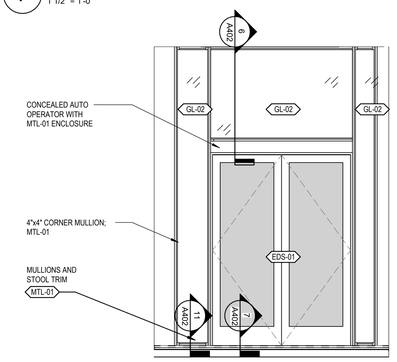
5 SECTION - ENTRANCE NORTH
3/8" = 1'-0"



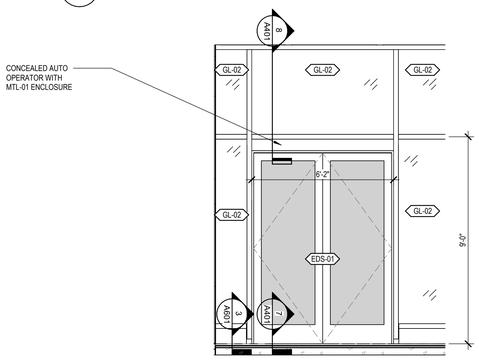
6 SECTION - ENTRANCE NORTH - INTERIOR DOOR HEAD DETAIL
1 1/2" = 1'-0"



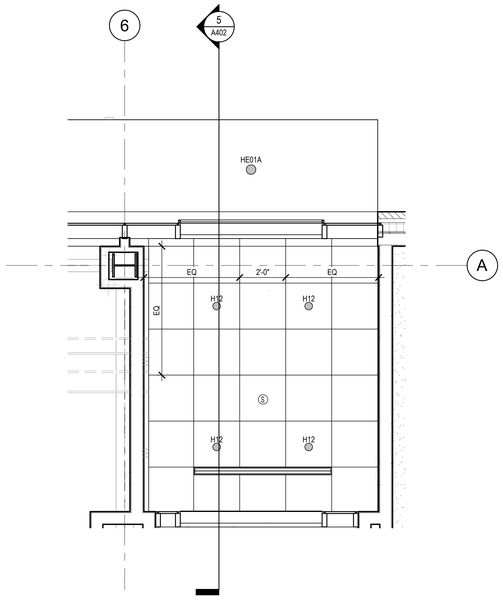
7 SECTION - ENTRANCE NORTH - INTERIOR DOOR SILL DETAIL
1 1/2" = 1'-0"



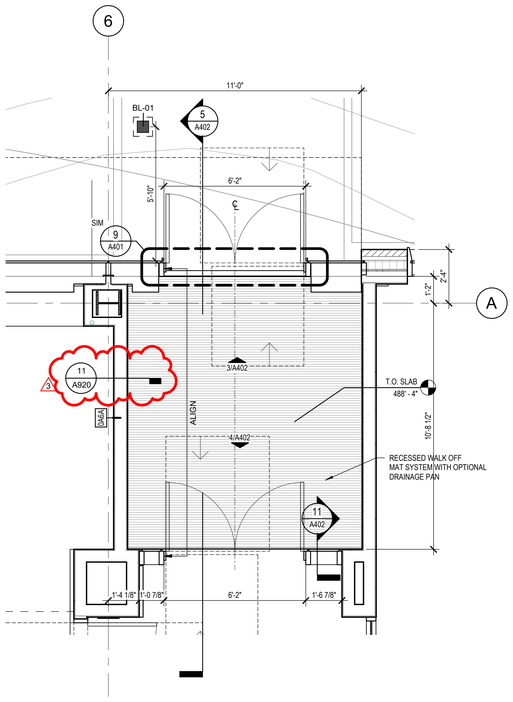
4 ELEVATION - ENTRANCE NORTH - SOUTH
3/8" = 1'-0"



3 ELEVATION - ENTRANCE NORTH - NORTH
3/8" = 1'-0"



2 ENLARGED RCP - ENTRANCE NORTH
3/8" = 1'-0"



1 ENLARGED PLAN - ENTRANCE NORTH
3/8" = 1'-0"

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MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building

1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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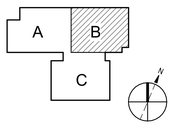
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3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

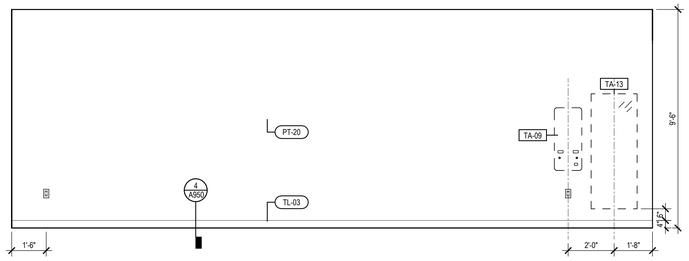
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ENLARGED VIEWS - ENTRANCE NORTH

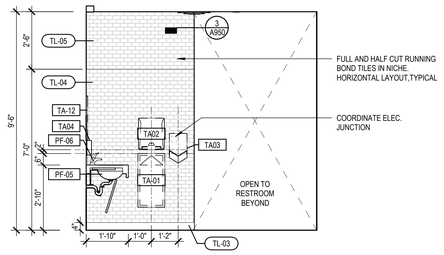
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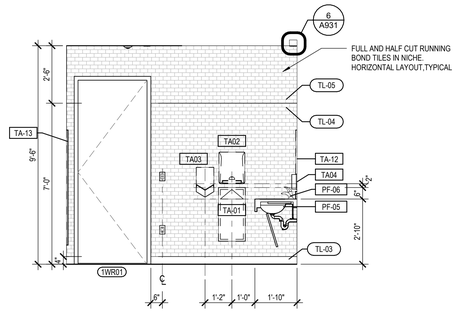
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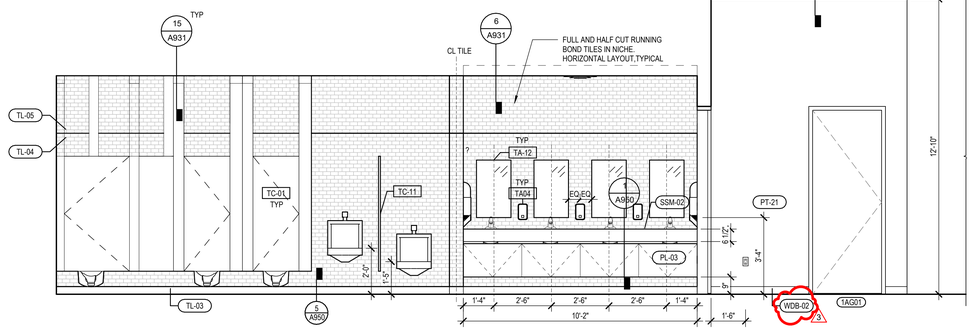
7 ELEVATION - WOMEN'S RESTROOM - SOUTH
3/8" = 1'-0"



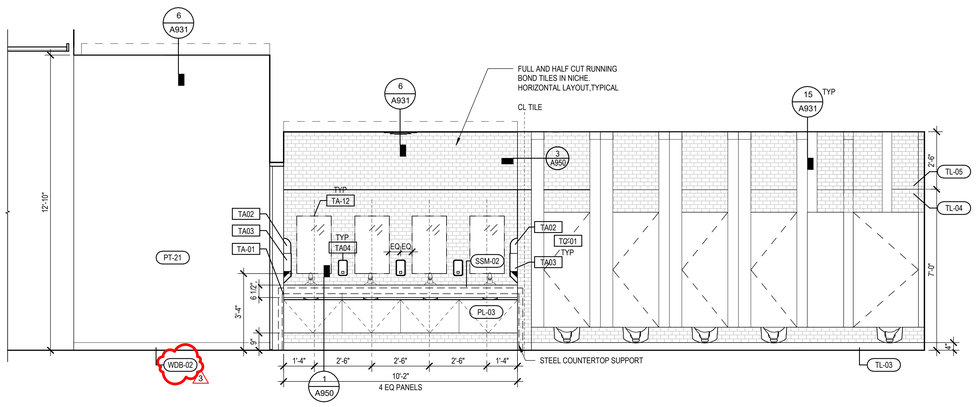
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3/8" = 1'-0"



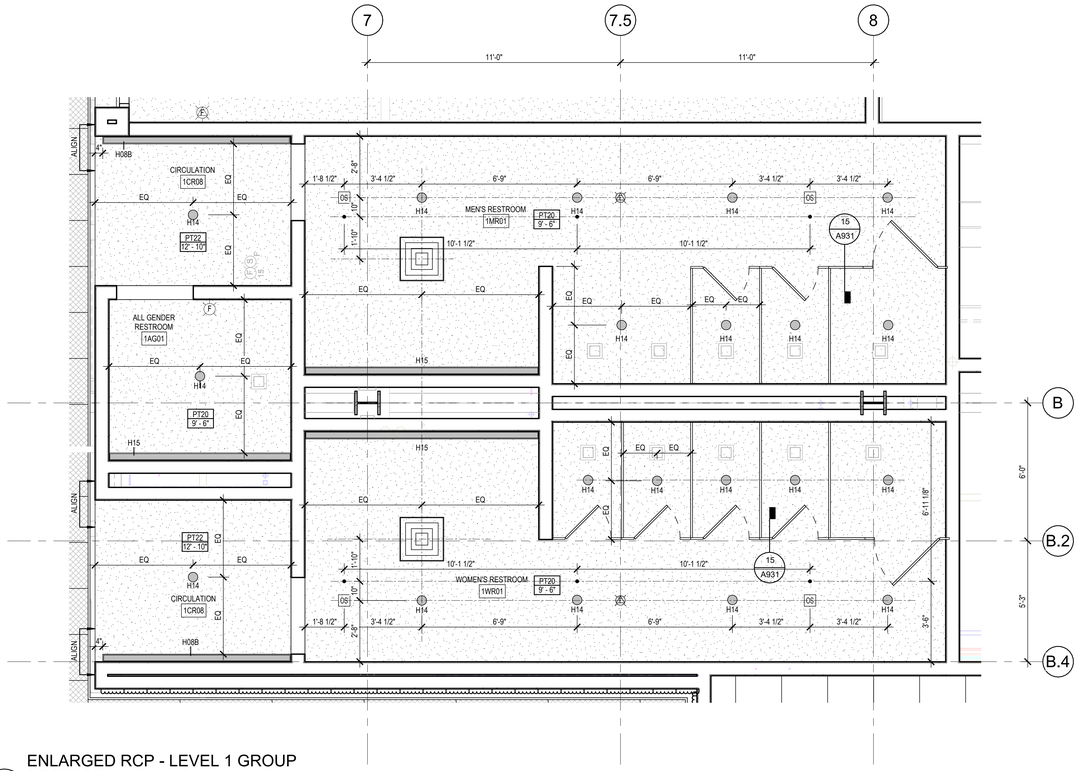
5 ELEVATION - WOMEN'S RESTROOM WEST
3/8" = 1'-0"



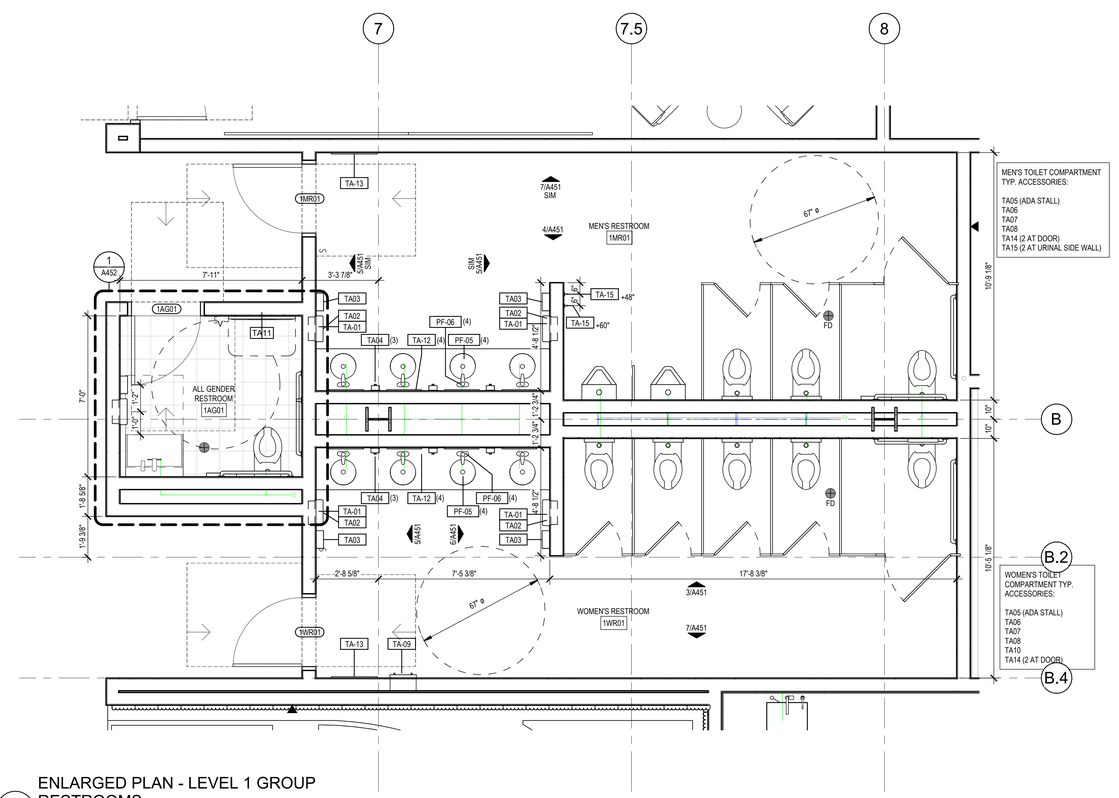
4 ELEVATION - MEN'S RESTROOM - SOUTH
3/8" = 1'-0"



3 ELEVATION - WOMEN'S RESTROOM - NORTH
3/8" = 1'-0"



2 ENLARGED RCP - LEVEL 1 GROUP RESTROOMS
3/8" = 1'-0"



1 ENLARGED PLAN - LEVEL 1 GROUP RESTROOMS
3/8" = 1'-0"

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Sheet Title
ENLARGED VIEWS - TOILET ROOMS LEVEL 1

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Sheet Number
A451

EXTERIOR MATERIAL AND PRODUCT SCHEDULE

Code	Component Description	Spec Sections	BOD Manufacturer	BOD Product	Extended Description			Color
AB-01	HIGH-BUILD AIR BARRIER, VAPOR RETARDING	072720Membrane Air Barriers	GCP APPLIED TECHNOLOGIES	PERM-A-BARRIER LIQUID	FLUID APPLIED IMPERMEABLE AIR AND VAPOR			
AB-03	SHEET MEMBRANE AIR BARRIER, VAPOR RETARDING	072720Membrane Air Barriers	GCP APPLIED TECHNOLOGIES	PERM-A-BARRIER WALL MEMBRANE	SHEET IMPERMEABLE AIR AND VAPOR BARRIER			
BRK-01	BRICK - FIELD BRICK	042000Unit Masonry 042613 Masonry Veneer	GLEN GERY	Custom mix of (3) colors / textures	Custom gray brick mix to be selected by architect. Weathered horizontal joints. Norman size: 11-5/8" X 3-5/8" X 2-1/4"	40% Stone 40% Urban 20% Steel Gray (Hanley Plant)	WIRECUT FINISH	Norman 11-5/8" X 3-5/8" X 2-1/4"
BRK-02	BRICK - ACCENT BRICK	042000Unit Masonry 042613 Masonry Veneer	GLEN GERY	Match BRK-01	Brick size, mix and mortar to match BRK-01. 50% of BRK-02 is to be solid brick (not cored) and installed at an angle with max. 1-1/2" projection. See EWS-03 wall system drawings	40% Stone 40% Urban 20% Steel Gray (Hanley Plant)	WIRECUT FINISH	Norman 11-5/8" X 3-5/8" X 2-1/4"
CMU-01	CONCRETE MASONRY UNIT	042000Unit Masonry			TYPE MC Cavity Wall at Loading Dock.			8"x8"x16" 4"x8"x16"
EDS-01	ENTRANCE DOOR SYSTEM - SWING DOOR	084113Aluminum-Framed Entrances and Storefronts	OLDCASTLE	MS375TC (medium stile)	Thermal Composite Door and subframe within EWS-04 storefront system. Medium stiles (3-3/4") with 10" bottom rail. Full height ladder pull at entrance doors, 24" high ladder pull at other locations where indicated. GL-02 glass lites.	MTL-01 Panel and Frame SST Hardware		
EDS-02	ENTRANCE DOOR SYSTEM - FOLDING GLASS WALL SYSTEM	084113Aluminum-Framed Entrances and Storefronts	NANAWALL	NW-640	Exterior thermally broken folding glass wall system. GL-02 glass lites.	MTL-01 Panel and Frame SST Hardware		
EWS-01	MONOLITHIC PRE-CAST SYSTEM WITH VERTICAL INFILL GLAZING	084000Exterior Enclosure System Requirements						
EWS-02	BRICK CAVITY WALL SYSTEM WITH INFILL GLAZING UNITS AND PLATE ALUM TRIM - TYPE A	084000Exterior Enclosure System Requirements						
EWS-03	BRICK CAVITY WALL SYSTEM WITH INFILL GLAZING UNITS AND PLATE ALUM TRIM - TYPE B	084000Exterior Enclosure System Requirements						
EWS-04	STOREFRONT AND CURTAIN WALL GLAZING SYSTEM	084000Exterior Enclosure System Requirements	OLDCASTLE	Reliance 8" deep cassette system				
EWS-05	CORRUGATED METAL PANEL RAINSCREEN	084000Exterior Enclosure System Requirements						
EWS-06	1-HOUR RATED EXTERIOR STOREFRONT SYSTEM	084000Exterior Enclosure System Requirements 084426 Fire-Rated Silicone Glazed Steel Curtain Walls	PILKINGTON PYROSTOP (TGP)	Fireframes - SG Curtainwall Series (60-Minute Fire-Rated)	1-hour rated exterior glass wall system with 1-hour rated vision and spandrel glazing IGU's. GL-02 and GL-02S IGU outboard lites GL-03 60-minute glass	MTL-01 framing		
FL-01	STAINLESS STEEL FLASHING	076200Flashing and Trim						
FL-02	ALUMINUM COUNTERFLASHING	076200Flashing and Trim						
FL-03	SILICONE FLASHING	076200Flashing and Trim						
FL-04	PMMA FLASHING	076200Flashing and Trim						
⚠ CP-03	EXPOSED ABUSE-RESISTANT CEMENTITIOUS SFRM	078100Applied Fire Protection	GCP APPLIED TECHNOLOGIES	MONOKOTE Z146	STEEL FIREPROOFING - EXTERIOR			
GL-01	EXTERIOR GLASS - VISION (TYP)	088000Glazing	VIRACON	1" VZRE24-65 IGU	4 SIDED SSG WITH LOW-E COATING AND BIRD-FRIENDLY FRIT ON #2 SURFACE 1/4" OptiWhite VRE-65 #2 1/2" - Argon 1/4"OptiWhite VZE-SC#3			
GL-01S	EXTERIOR GLASS - SPANDREL (TYP)	088000Glazing	VIRACON	1" VRE24-65 Spandrel IGU	4 SIDED SSG WITH LOW-E COATING AND BIRD-FRIENDLY FRIT ON #2 SURFACE, LOW-E COATING ON #3 SURFACE, SPANDREL FRIT ON #4 SURFACE 1/4" OptiWhite VRE-65 #2 1/2" - Argon 1/4"OptiWhite V954 GRAY Spandrel #4	GRAY OPAQUE FRIT - COLOR TO BE SELECTED BY ARCHITECT		
GL-01F	EXTERIOR GLASS - WITH PRIVACY FRIT ON #3 SURFACE	088000Glazing	VIRACON	1" VRE24-65 with privacy frit	4 SIDED SSG WITH LOW-E COATING AND BIRD-FRIENDLY FRIT ON #2 SURFACE 1/4" OptiWhite VRE-65 #2 1/2" - Argon 1/4"OptiWhite with 100% V1093 SIM SANDBLAST #3	GRAY TRANSLUCENT FRIT - COLOR TO BE SELECTED BY ARCHITECT		
GL-02	EXTERIOR GLASS - VISION (AT GROUND FLOOR)	088000Glazing	VIRACON	1" VE24-2M IGU	4 SIDED SSG WITH LOW-E COATING AND BIRD-FRIENDLY FRIT ON #2 SURFACE, SPANDREL FRIT ON #4 SURFACE 1/4"OptiWhite VE-2M #2 1/2" - Argon 1/4" OptiWhite			
GL-02S	EXTERIOR GLASS - SPANDREL (AT GROUND FLOOR)	088000Glazing	VIRACON	1" VE24-2M Spandrel IGU	4 SIDED SSG WITH LOW-E COATING AND BIRD-FRIENDLY FRIT ON #2 SURFACE, SPANDREL FRIT ON #4 SURFACE 1/4"OptiWhite VE-2M #2 1/2" - Argon 1/4" OptiWhite V954 GRAY Spandrel #4			
GL-03	EXTERIOR GLASS - 60-MINUTE FIRE-RATED VISION GLASS	088000Glazing	TGP	PILKINGSTON PYROSTOP 60-101 (60 MIN. FIRE RATING)	7/8" THICKNESS USED AT EWS-06. 1-HOUR LOW IRON RATED GLASS WITH GL-01 OR GL-01S IGU OUTBOARD LITE			
INS-01A	XPS INSULATION	072100Thermal Insulation	OWENS CORNING	FOAMULAR INSUL-DRAIN	ASTM C578 Type IV, 25 psi compressive strength			
INS-02D	POLY ISOCYANURATE INSULATION	072100Thermal Insulation	CARLISLE SYNTEC	INSULBASE / INSULBASE NH				
INS-03A	MINERAL WOOL BOARD INSULATION	072100Thermal Insulation	ROCKWOOL	CURTAINROCK	Mineral wool insulation for use at backpans in curtain wall			
INS-03B	MINERAL WOOL BOARD, FOIL FACED	072100Thermal Insulation	OWENS CORNING	THERMAFIBER FIRESPAN 90	R 4.3 per inch mineral wool insulation			
INS-03C	MINERAL WOOL BOARD,UNFACED	072100Thermal Insulation	OWENS CORNING	THERMAFIBER RAINBARRIER HD	R 4.2 per inch mineral wool insulation			
INS-03E	MINERAL WOOL BOARD with SMART VAPOR RETARDER	072100Thermal Insulation	ROCKWOOL	SMARTROCK	R 4.2 per inch mineral wool insulation			
INS-08	CELLULAR GLASS INSULATION	072100 Thermal Insulation	OWENS CORNING	FOAMGLAS T4+	R3.44 per inch			
LVR-01	FIXED LOUVER - ARCHITECTURAL	089119Fixed Louvers	C-S	RS-4700	ARCHITECTURAL STORM LOUVER, MTL-01 FINISH	MTL-01		
MTL-01	EXTERIOR METAL FINISH	074213Formed Metal Wall Panels 074216Metal Plate Wall Panels 084413 Structural Sealant Glazed Curtain Walls	PPG	DURANAR - SUNSTORM	TYPICAL FINISH COATING FOR ALL EXTERIOR METAL ON FACADE, EXTERIOR TRIM, CANOPY, EXTERIOR DOOR FRAMES AND PANELS	GRAY VELVET (UC126244F)		
MTP-01	METAL PANEL - EXTERIOR	074216Metal Plate Wall Panels	Metalwerks		1/4" alum. plate at wall base and canopy roof. 1/8" plate at other locations. Profiles as indicated on dwgs. For use at exterior canopies, metal channel, exterior wall trim and copings.	MTL-01		
MTP-03	METAL PANEL - EXTERIOR WALL	074213Formed Metal Wall Panels	MORIN	MX-1	.050 ALUMINUM - CORRUGATED METAL WALL PANEL WITH CONCEALED FASTENERS	MTL-01		
PC-01	PRECAST CONCRETE	034500Precast Architectural Concrete	HIGH CONCRETE GROUP UNIVERSAL CONCRETE	MONOLITHIC PRECAST PANELS, CUSTOM SHAPE AND CONCRETE MIX	EWS-01 PANELS	BOD: PCI #107	LIGHT ACID ETCH	Varies. See EWS-01 drawings
RS-01	TPO SINGLE PLY ROOFING OVER CONCRETE AND METAL DECK	075423Thermoplastic Polyolefin (TPO) Roofing	Carlisle SyTec Incorporated	Sure-Weld Extra Fleece Backed TPO Membrane with Octguard XT	A 60-mil TPO (thermoplastic polyolefin) system, fully adhered over cover board sheathing, semi-rigid tapered insulation, semi-rigid insulation, vapor barrier over cast-in-place concrete. System R value of 30; U value of 0.033.	WHITE		
RS-02	TPO SINGLE PLY ROOFING OVER METAL DECK AND SHEATHING	075423Thermoplastic Polyolefin (TPO) Roofing	Carlisle SyTec Incorporated	Sure-Weld Extra Fleece Backed TPO Membrane with Octguard XT	A 60-mil TPO (thermoplastic polyolefin) system, fully adhered over cover board sheathing, semi-rigid tapered insulation, semi-rigid insulation, vapor barrier over cast-in-place concrete. System R value of 30; U value of 0.033.	WHITE		
SE-01	STRUCTURAL SILICONE SEALANT	079200Joint Sealants	DOW CORNING COPORATION	DOWSIL 983	CURTAIN WALL STRUCTURAL SILICONE SEALANT	BLACK		
SE-02	STRUCTURAL SILICONE SEALANT	079200Joint Sealants	DOW CORNING COPORATION	DOWSIL 790, 791, OR 795	SILCONE WEATHER JOINT SEALANT - @GLASS-TO-GLASS			
SSM-05	SOLID SURFACE MATERIAL	064000Architectural Woodwork	CORIAN	SOLID SURFACE	3/4" THICKNESS INTERIOR WINDOW SILL	DESIGNER WHITE	HONED	
SP-01	EXTERIOR SOFFIT PANEL SYSTEM- WOOD	064000Architectural Woodwork	RULON (ALT: ARMSTRONG)	LINEAR CLOSED EXTERIOR SOFFIT	1" THICK CUSTOM SOFFIT SYSTEM - QUARTER CUT WITH APRICOT FINISH 4" WIDE X 8'-3" LONG PLANKS	ASH - QUARTER SAWN	APRICOT FINISH	4" O.C. PLANKS
ST-01	STONE - EXTERIOR GRANITE WALL BASE	044000Exterior Dimension Stonework	SWENSON STONE	JET MIST - THERMAL FINISH	2" thick stone wall base at EWS-01, EWS-02, EWS-03	JET MIST	THERMAL	
WPS-01	POSITIVE SIDE WATERPROOFING	071326 Self Adhering Sheet Waterproofing	GCP APPLIED TECHNOLOGIES	BITUTHENE 4000	POSITIVE SIDE WATERPROOFING			
WPS-02	BLIND SIDE WATERPROOFING	071326 Self Adhering Sheet Waterproofing	GCP APPLIED TECHNOLOGIES	PREPRUFE 160 VERTICAL; PREPRUFE 300 HORIZONTAL	BLIND SIDE WATERPROOFING			

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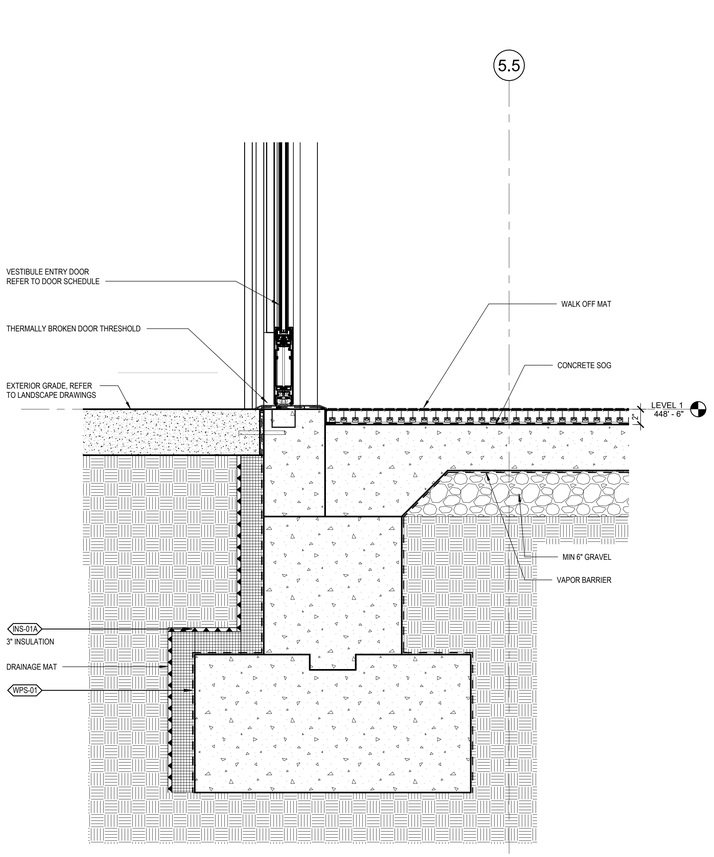
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EXTERIOR MATERIAL SCHEDULE

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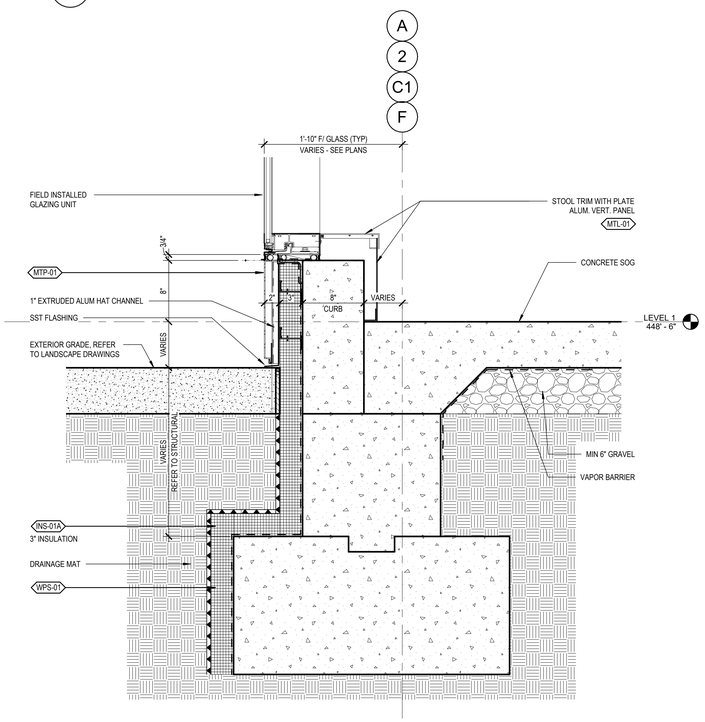
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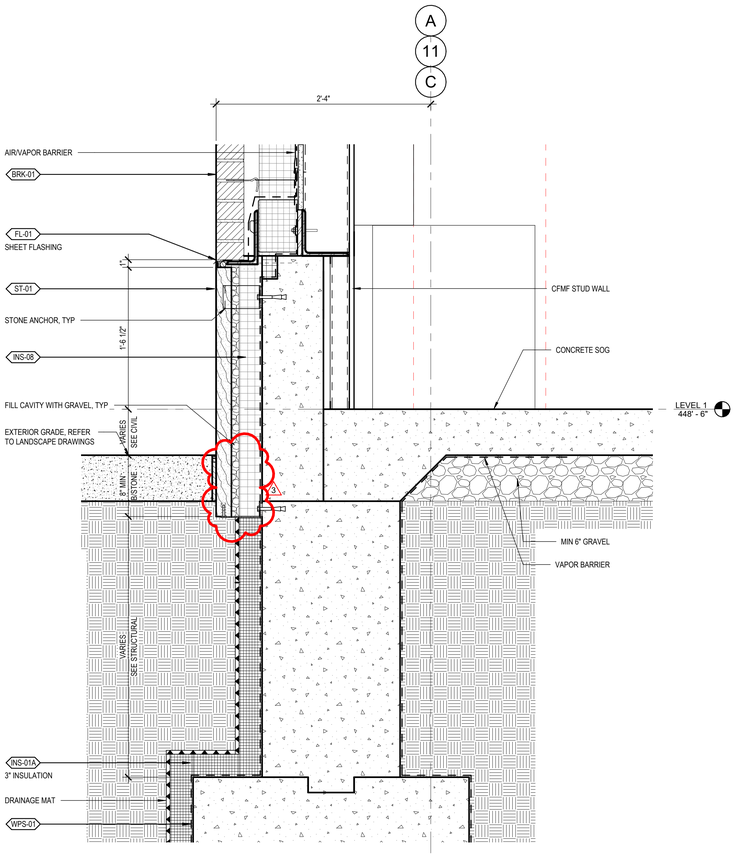
6 FOUNDATION DETAIL - EWS-04 @ VESTIBULE

1 1/2" = 1'-0"



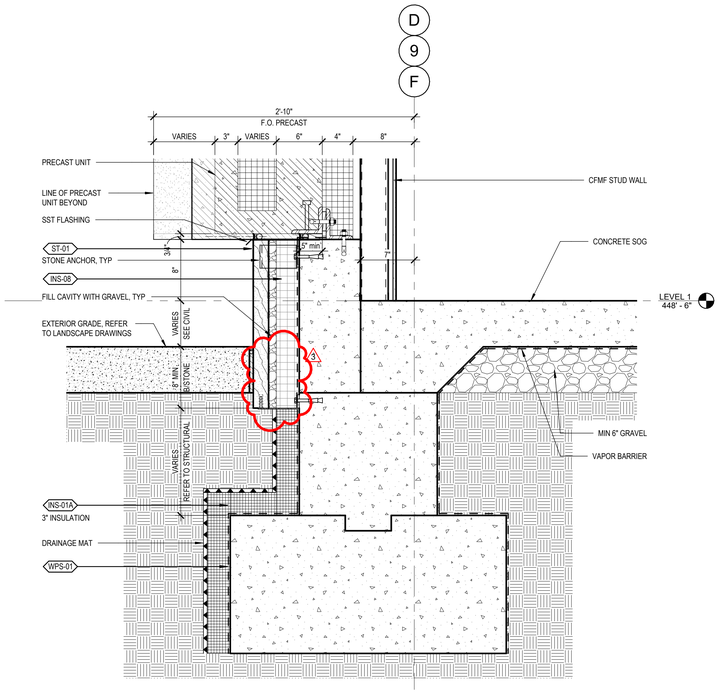
3 FOUNDATION DETAIL - EWS-04

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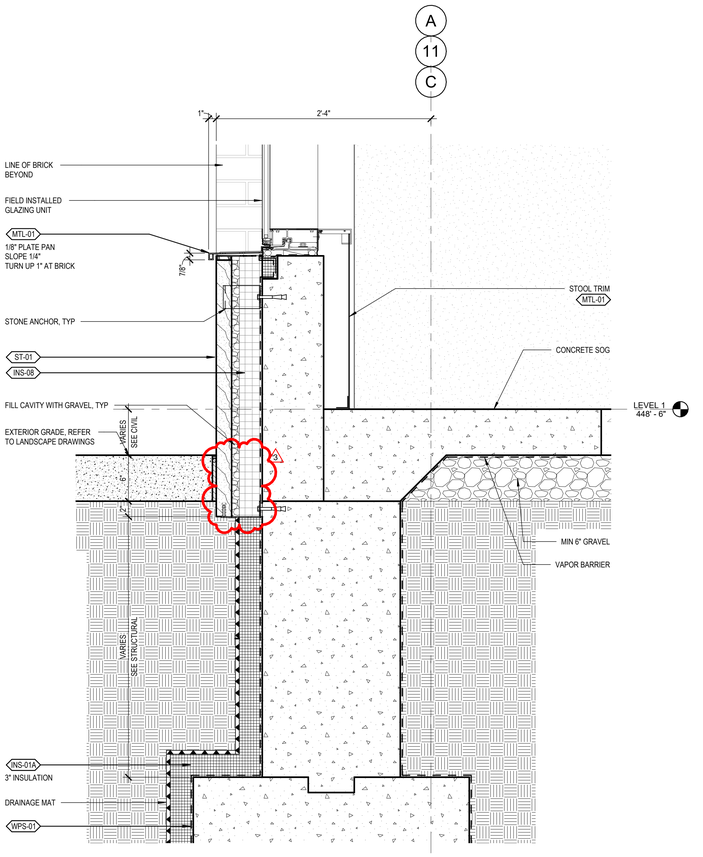
5 FOUNDATION DETAIL - EWS-03 @ BRICK

1 1/2" = 1'-0"



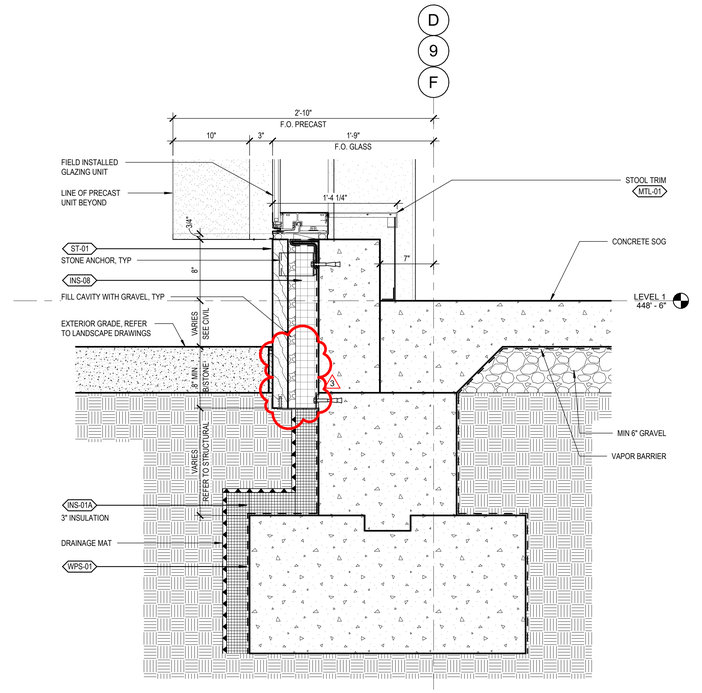
2 FOUNDATION DETAIL - EWS-01 @ PRECAST

1 1/2" = 1'-0"



4 FOUNDATION DETAIL - EWS-03 @ GLASS

1 1/2" = 1'-0"



1 FOUNDATION DETAIL - EWS-01 @ GLASS

1 1/2" = 1'-0"

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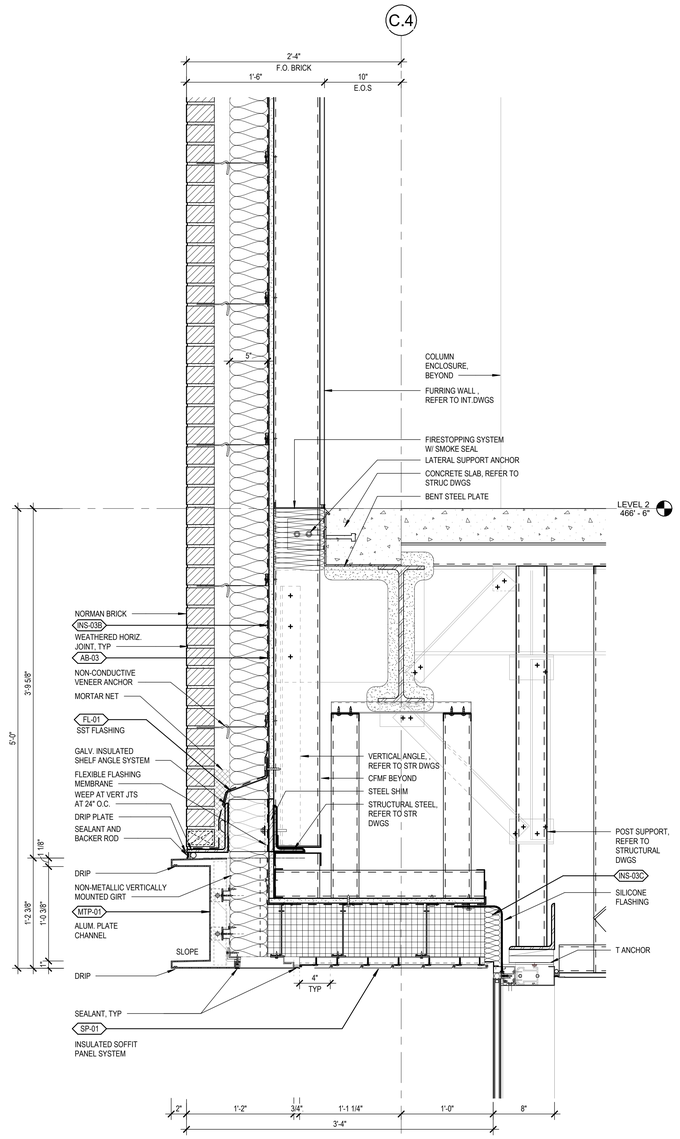
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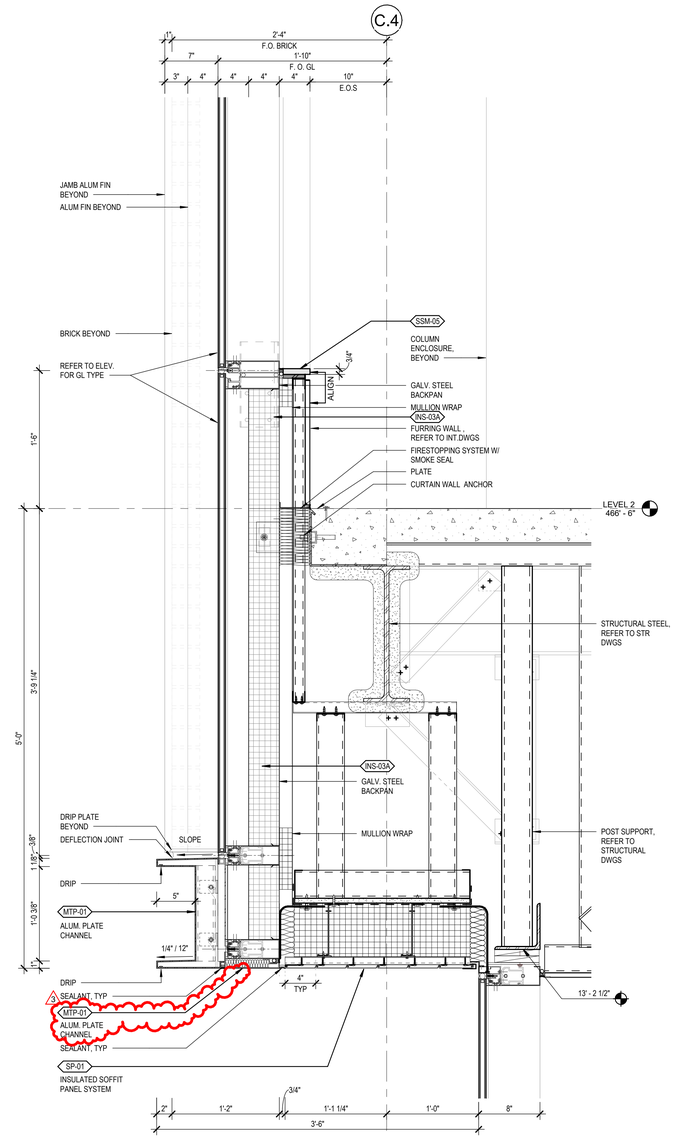
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A601



2 SECTION DETAIL - EWS-02/03 @ CAVITY WALL TO SOFFIT
1 1/2" = 1'-0"



1 SECTION DETAIL - EWS-02/03 GLAZING @ CURTAIN WALL TO SOFFIT
1 1/2" = 1'-0"

3/23/2026 11:24:37 PM

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
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Shen Milsom & Wilke LLC
A/V Engineer
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New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan

Professional Seals

NOT FOR CONSTRUCTION

No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

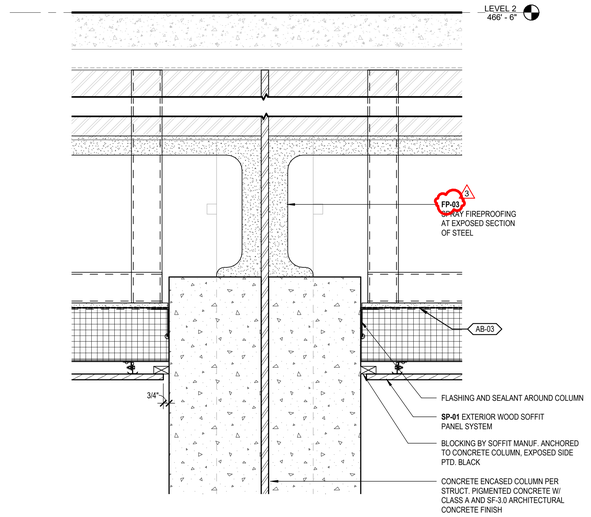
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EXTERIOR WALL TYPE EWS-02/03 EXTERIOR SECTION DETAILS

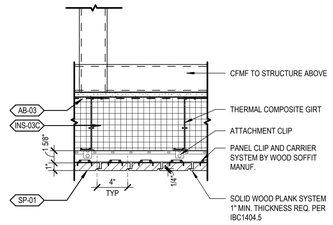
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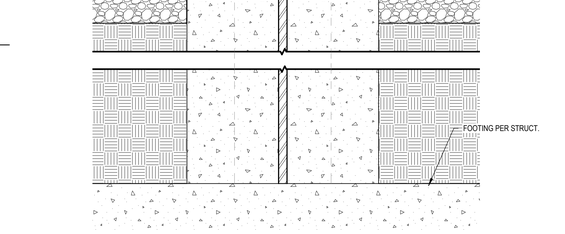
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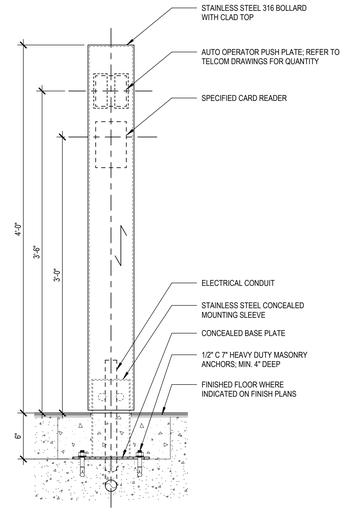
3 EXTERIOR SECTION DETAIL - EXTERIOR COLUMN ENCLOSURE HEAD
1 1/2" = 1'-0"



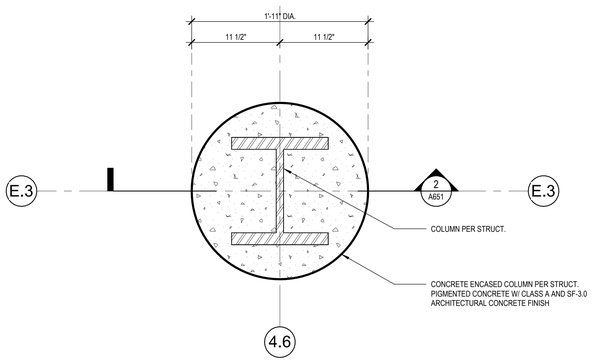
5 SP-01 WOOD SOFFIT DETAILS
1 1/2" = 1'-0"



2 EXTERIOR SECTION DETAIL - EXTERIOR COLUMN ENCLOSURE BASE
1 1/2" = 1'-0"



4 TYPICAL BOLLARD AT VESTIBULES
1 1/2" = 1'-0"



1 PLAN DETAIL - EXTERIOR INSULATED COLUMN (TYP)
1 1/2" = 1'-0"

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3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

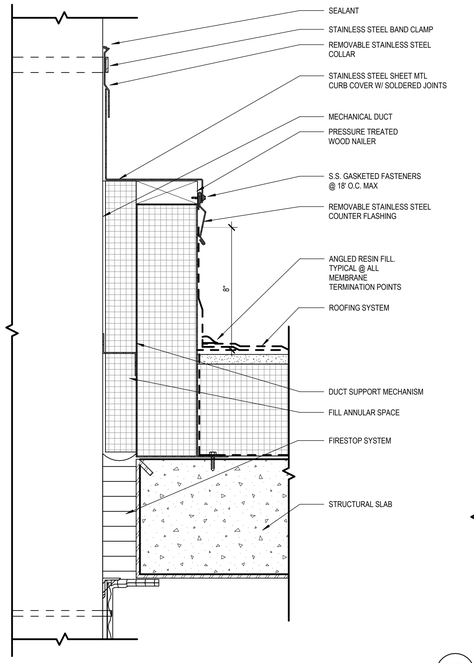
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EXTERIOR DETAILS - MISC.

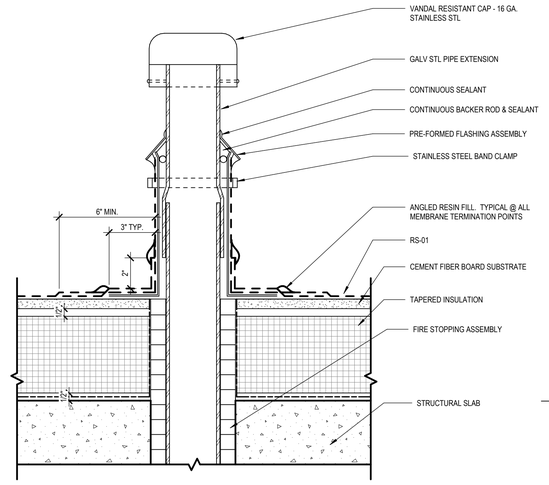
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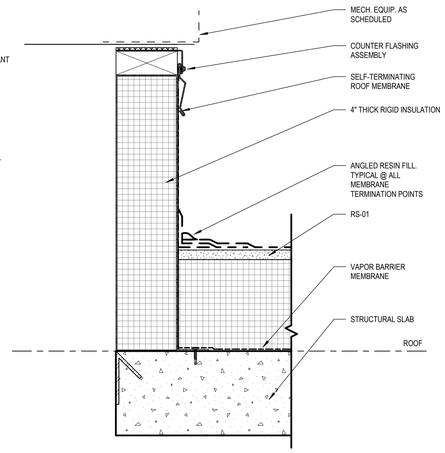
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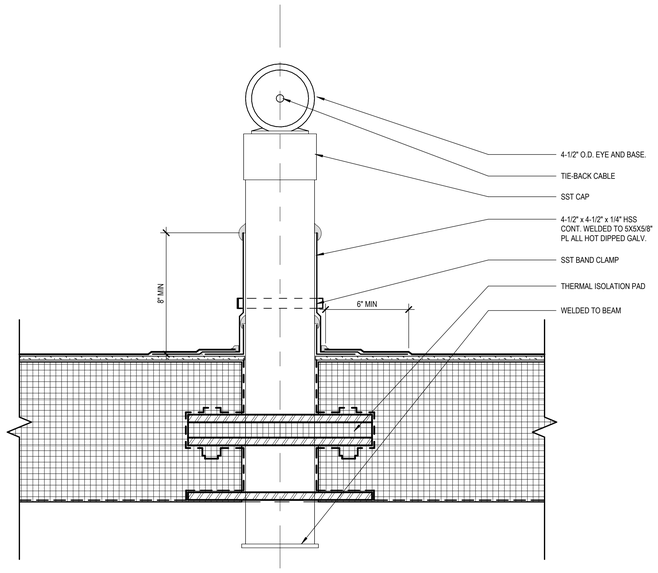
8 EXHAUST RISER PENETRATION
3" = 1'-0"



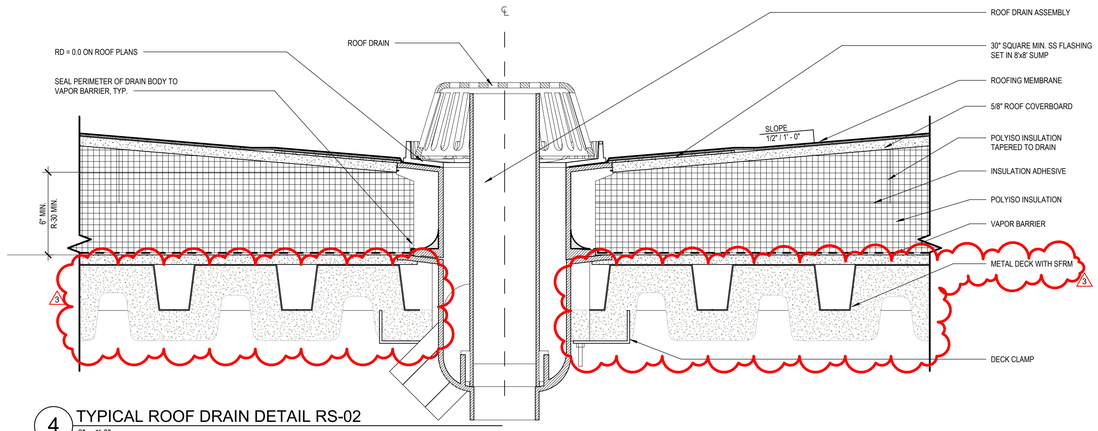
7 ROOF VENT FLASHING
3" = 1'-0"



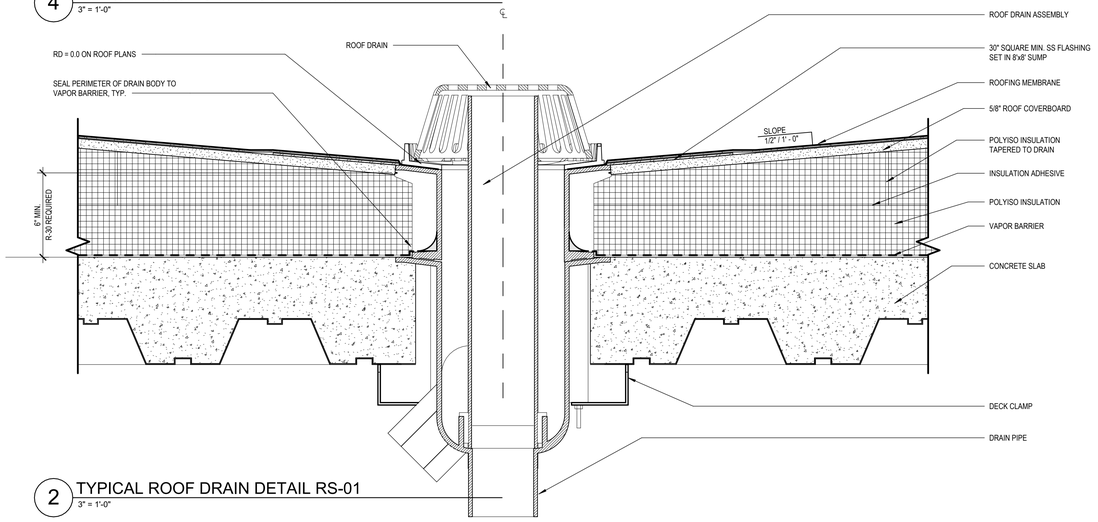
6 ROOF CURB AT MECHANICAL PENETRATION
3" = 1'-0"



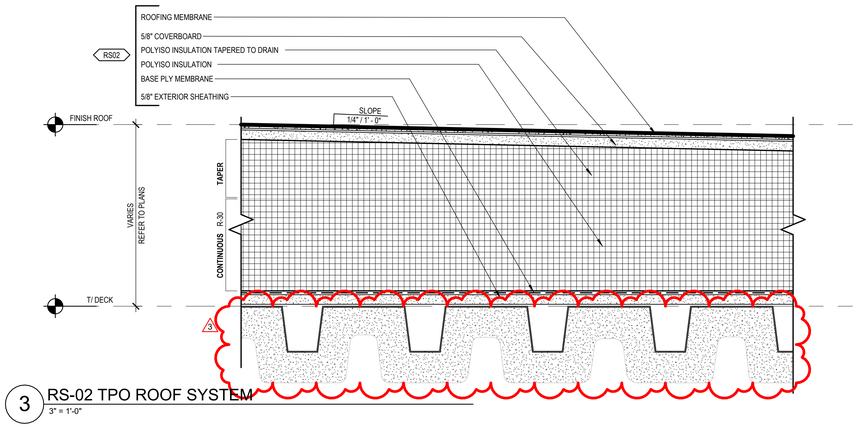
5 ROOFING DETAIL - FALL ARREST ANCHOR
3" = 1'-0"



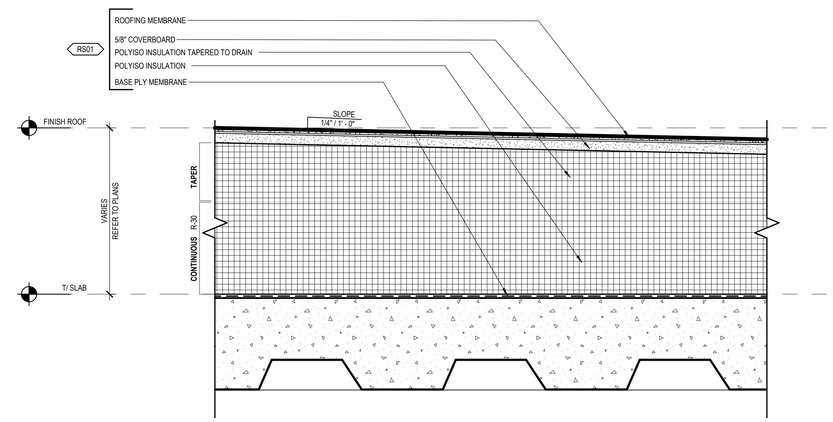
4 TYPICAL ROOF DRAIN DETAIL RS-02
3" = 1'-0"



2 TYPICAL ROOF DRAIN DETAIL RS-01
3" = 1'-0"



3 RS-02 TPO ROOF SYSTEM
3" = 1'-0"



1 RS-01 TPO ROOF SYSTEM
3" = 1'-0"

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Key Plan

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3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

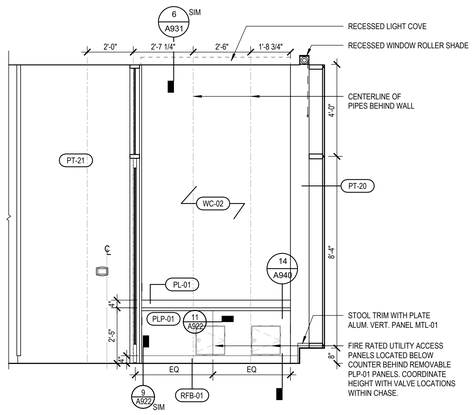
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ROOFING DETAILS

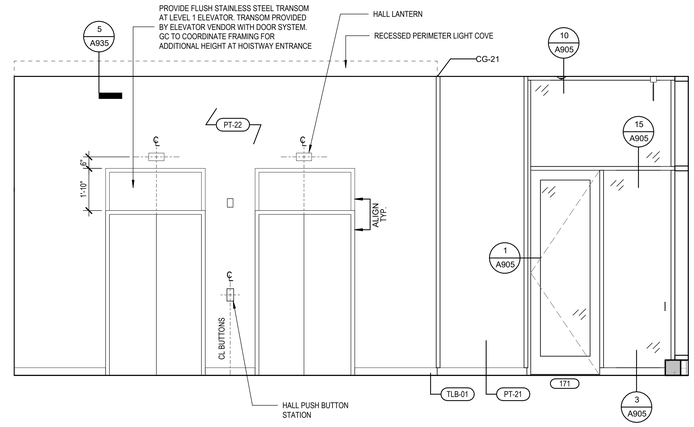
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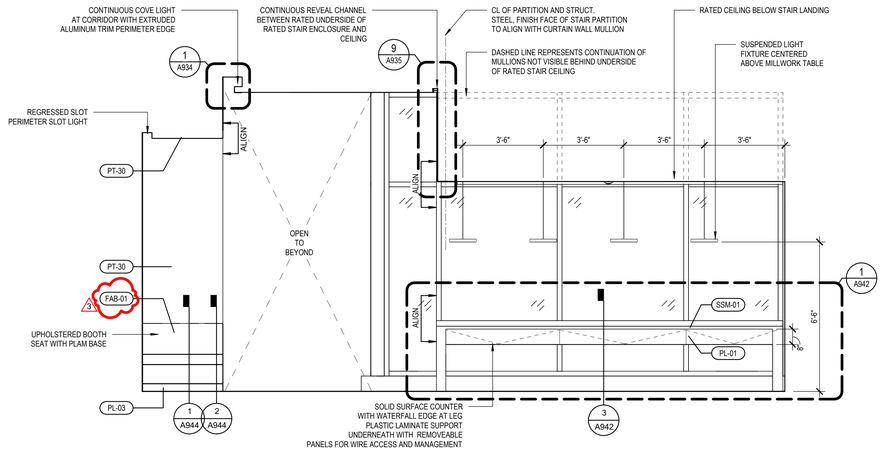
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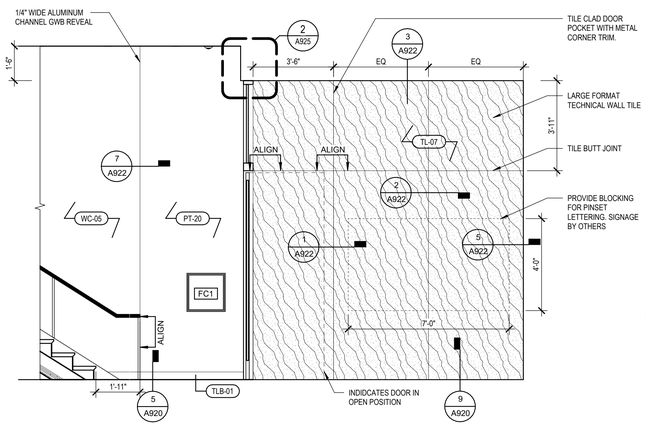
8 INTERIOR ELEVATION - PHONE
3/8" = 1'-0"



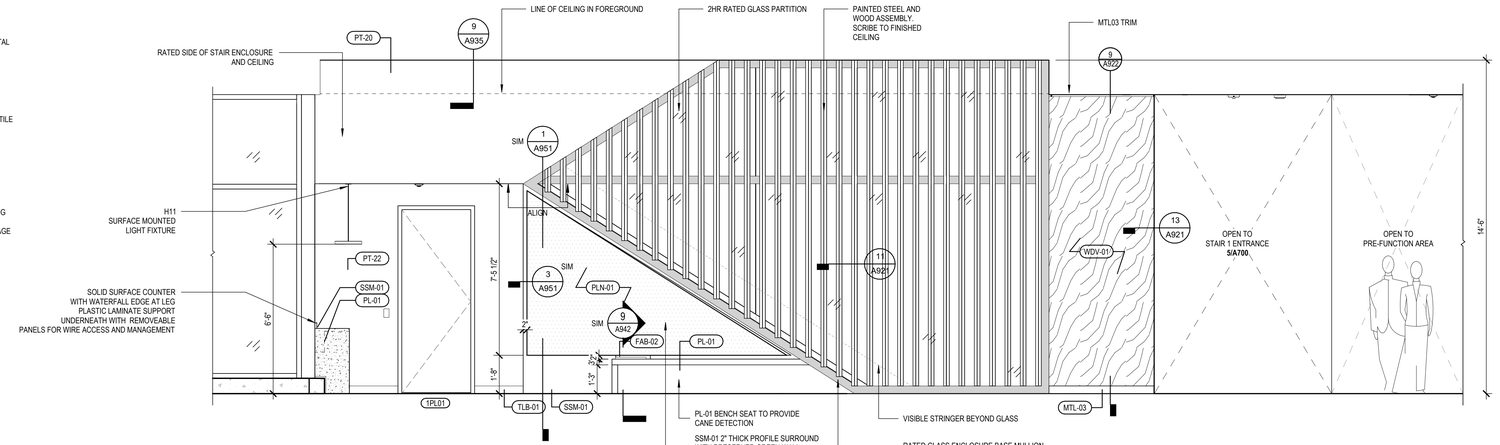
7 INTERIOR ELEVATION - L1 ELEVATOR
3/8" = 1'-0"



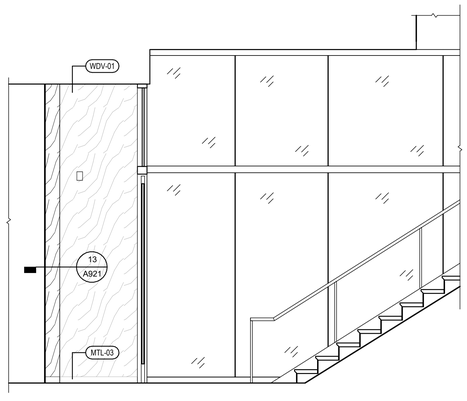
6 INTERIOR ELEVATION - LOUNGE EAST
3/8" = 1'-0"



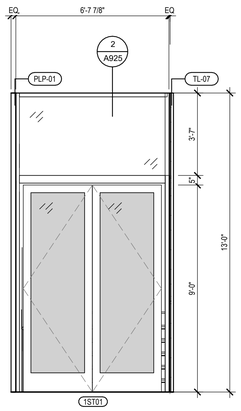
5 INTERIOR ELEVATION - STAIR 1
3/8" = 1'-0"



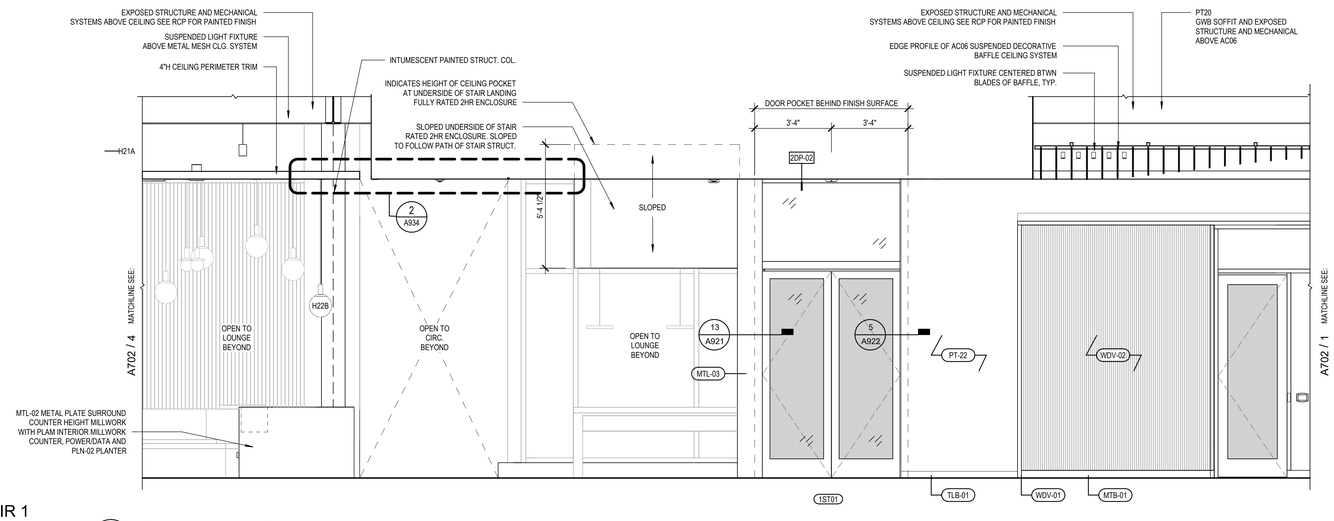
4 INTERIOR ELEVATION - LOUNGE SOUTH
3/8" = 1'-0"



3 L1 STAIR 1 - NORTH DOOR POCKET
3/8" = 1'-0"



INTERIOR ELEVATION - STAIR 1 ENTRANCE
3/8" = 1'-0"



1 LOBBY ENTRANCE
3/8" = 1'-0"

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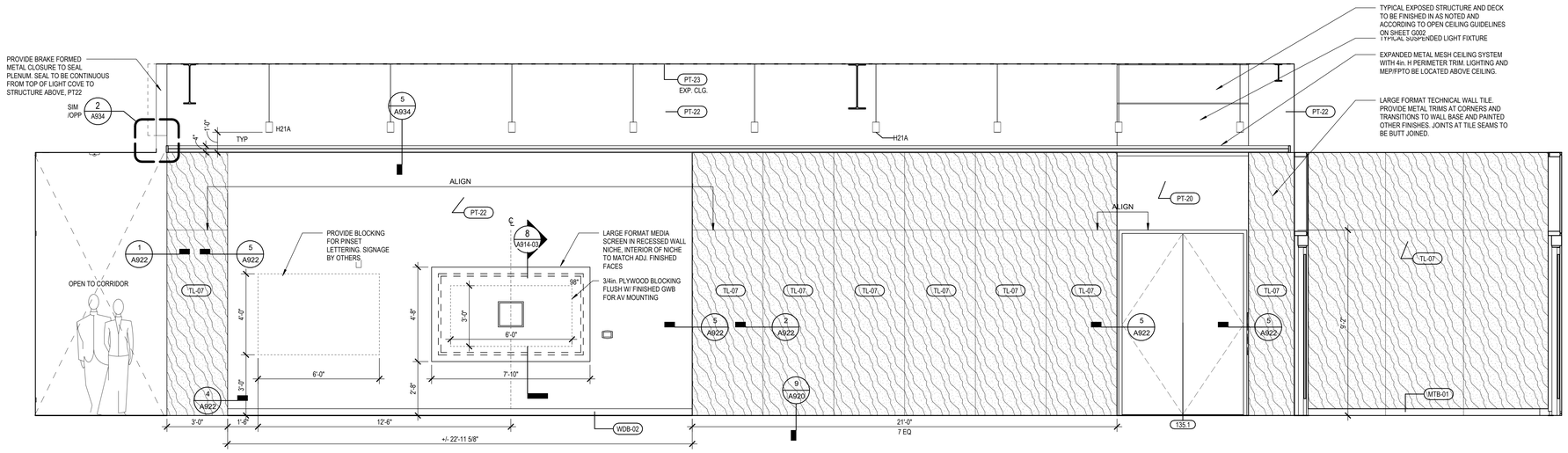
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INTERIOR ELEVATIONS - MAIN LOBBY/ELEVATOR LOBBY - L1

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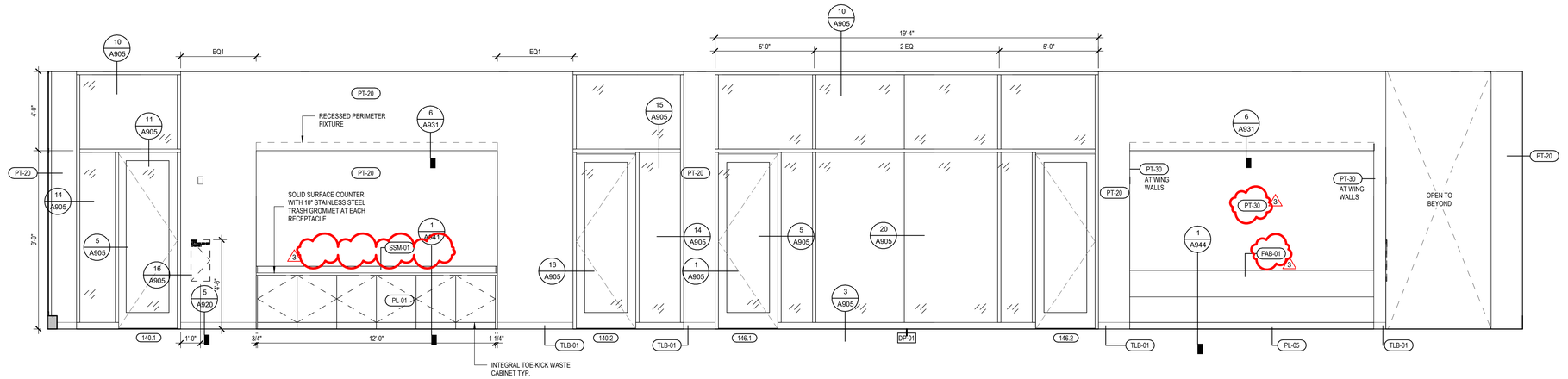
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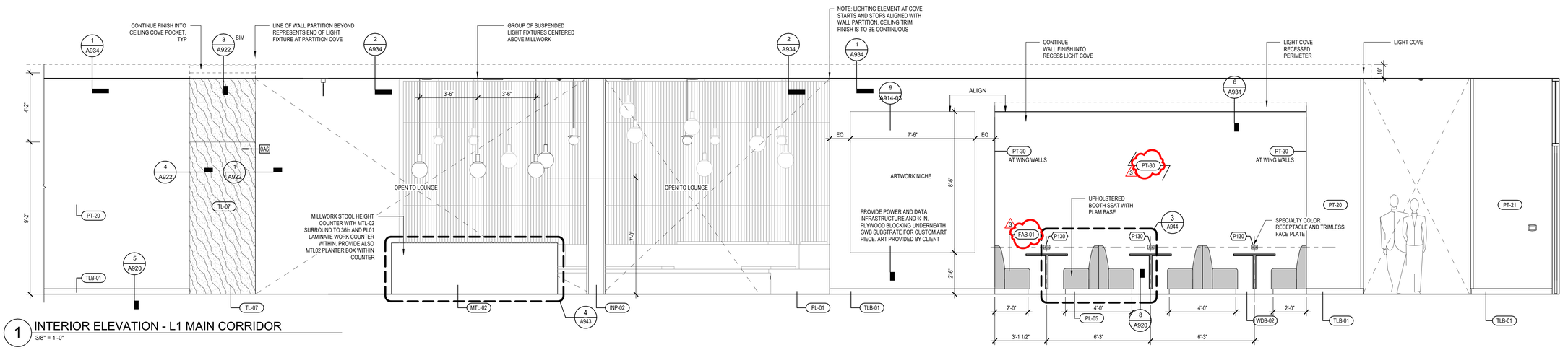
3 INTERIOR ELEVATION - EMERGING TECH GALLERY WEST

3/8" = 1'-0"



2 INTERIOR ELEVATION - COMPUTER LAB CORRIDOR

3/8" = 1'-0"



1 INTERIOR ELEVATION - L1 MAIN CORRIDOR

3/8" = 1'-0"

3/23/2026 11:24:53 PM

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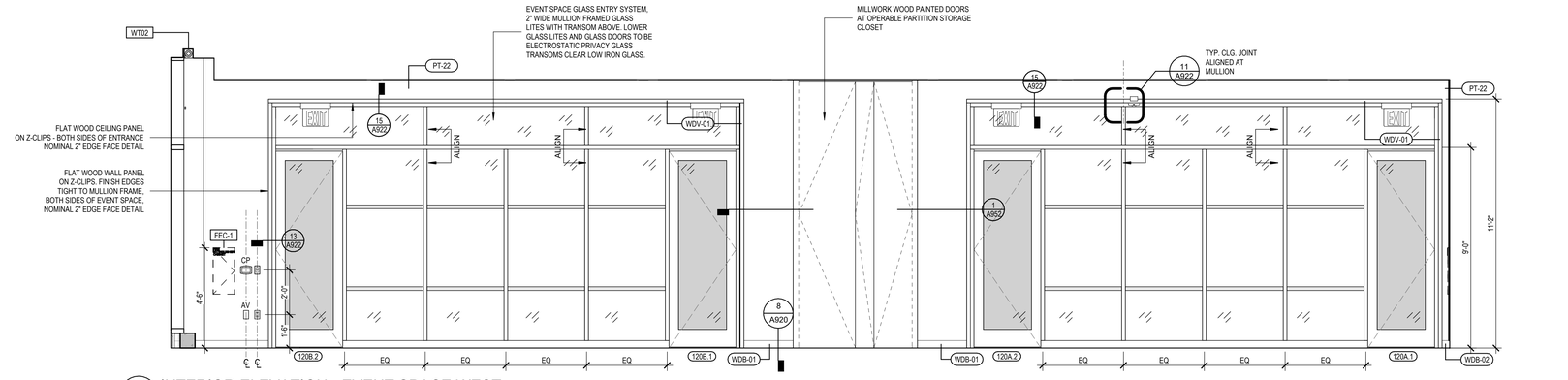
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INTERIOR ELEVATIONS - MAIN CORRIDORS - L1

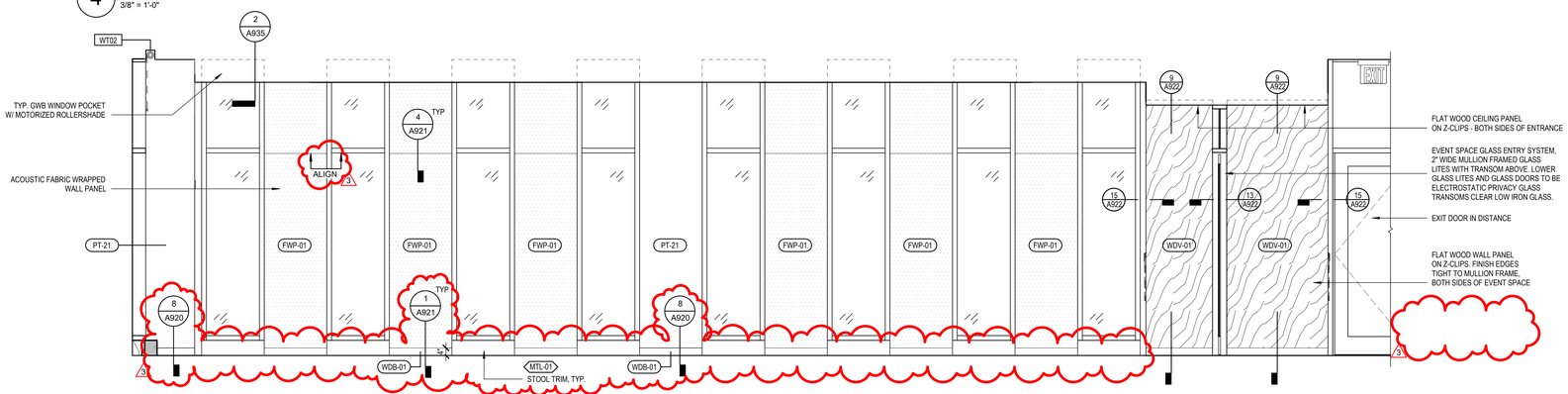
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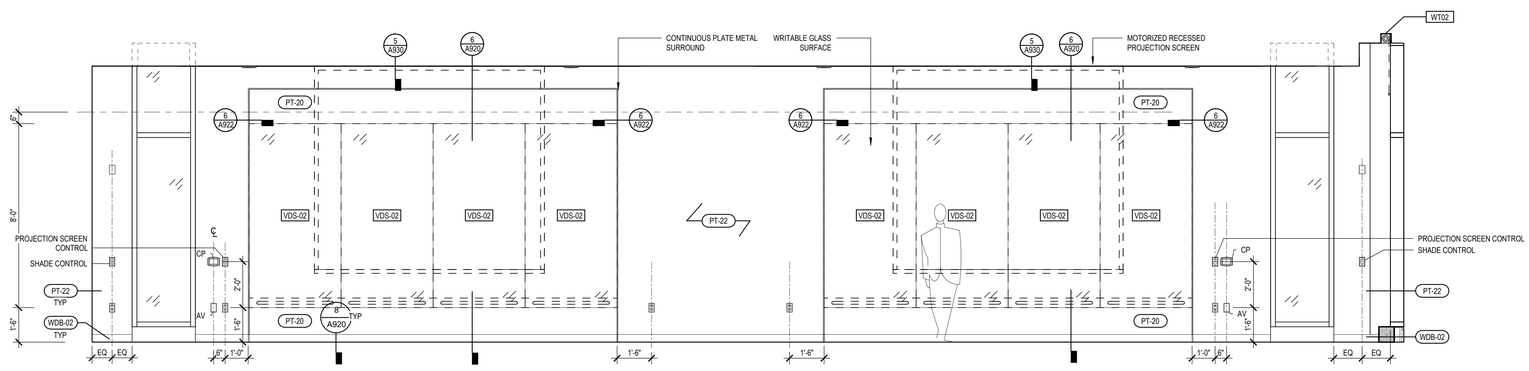
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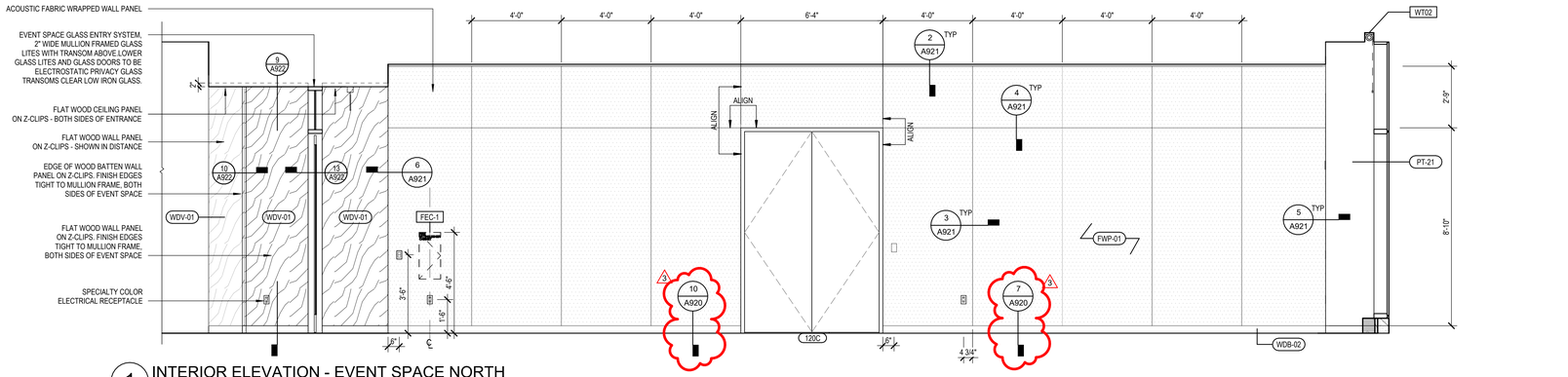
4 INTERIOR ELEVATION - EVENT SPACE WEST
3/8" = 1'-0"



3 INTERIOR ELEVATION - EVENT SPACE SOUTH
3/8" = 1'-0"



2 INTERIOR ELEVATION - EVENT SPACE EAST
3/8" = 1'-0"



1 INTERIOR ELEVATION - EVENT SPACE NORTH
3/8" = 1'-0"

3/23/2026 11:24:57 PM

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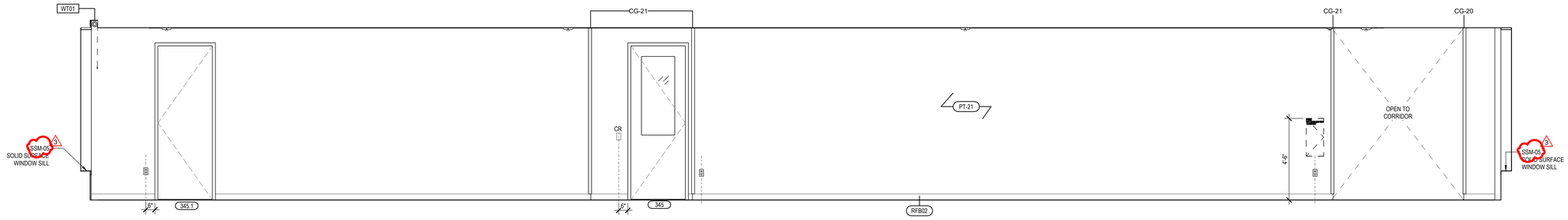
Sheet Title

INTERIOR ELEVATIONS - PREFUNCTION/EVENT SPACE

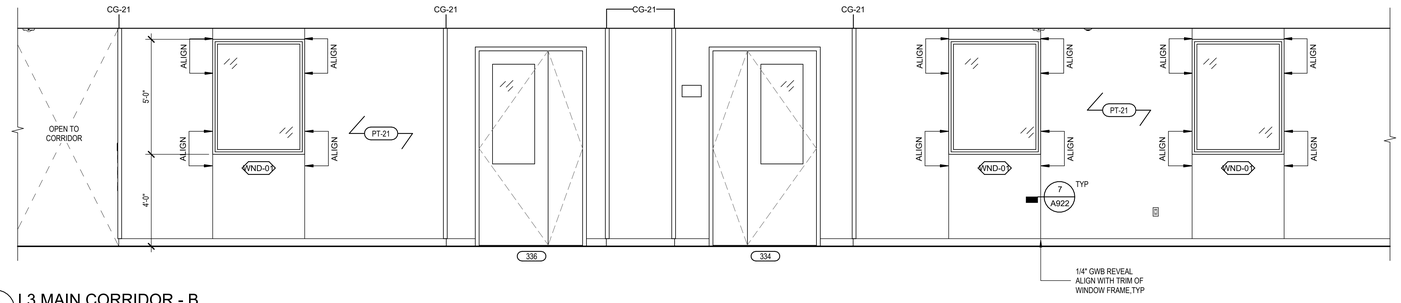
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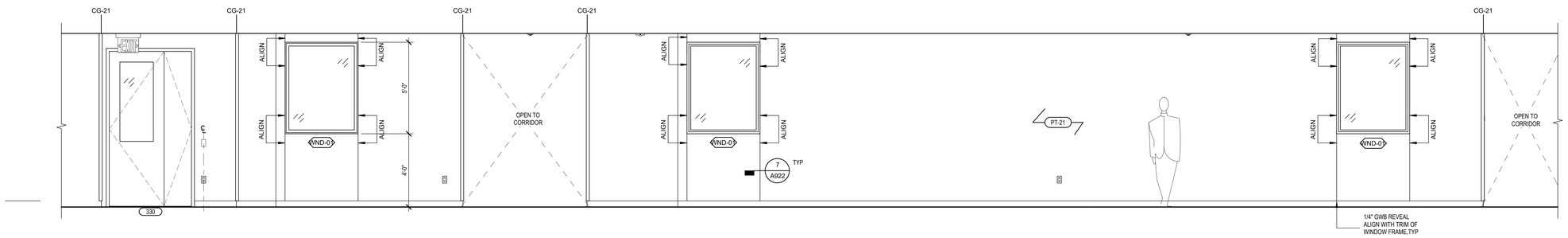
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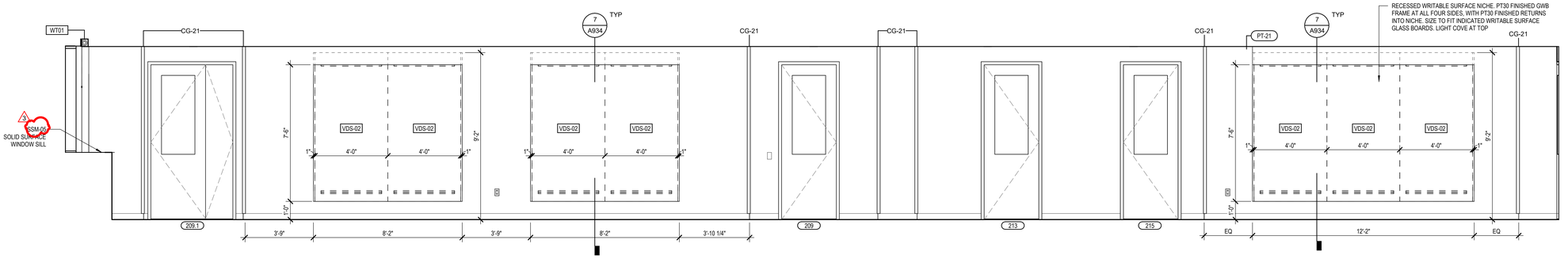
4 INTERIOR ELEVATION - L3 NW CORRIDOR EAST
3/8" = 1'-0"



3 L3 MAIN CORRIDOR - B
3/8" = 1'-0"



2 L3 MAIN CORRIDOR - A
3/8" = 1'-0"



1 L2 - SOUTH CORRIDOR
3/8" = 1'-0"

3/23/2026 11:25:00 PM

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Parsippany, NJ 07054

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Landscape
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Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan

Professional Seals

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No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

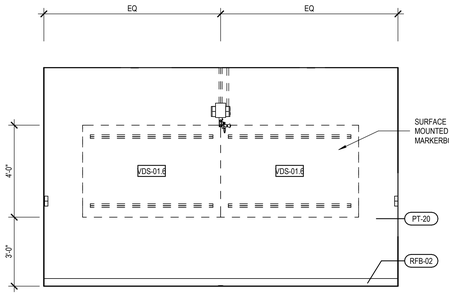
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INTERIOR ELEVATIONS - MAIN CORRIDORS - L3

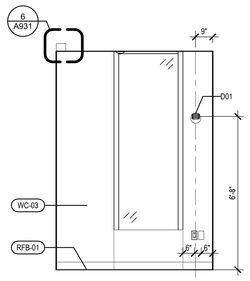
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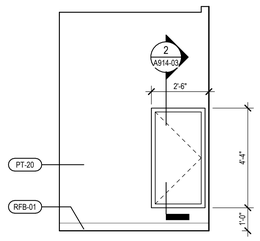
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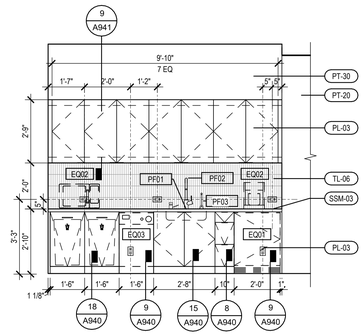
13 ELEVATION - CHEM LASER LAB - NORTH
3/8" = 1'-0"



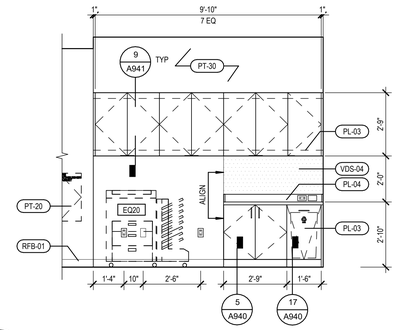
12 FOCUS ROOM TYPICAL WINDOW WALL
3/8" = 1'-0"



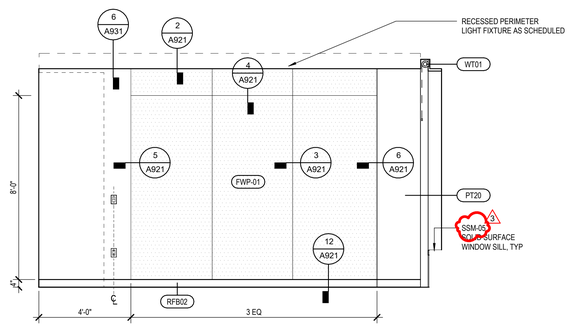
11 ELEVATION-CORRIDOR FOCUS ROOM
3/8" = 1'-0"



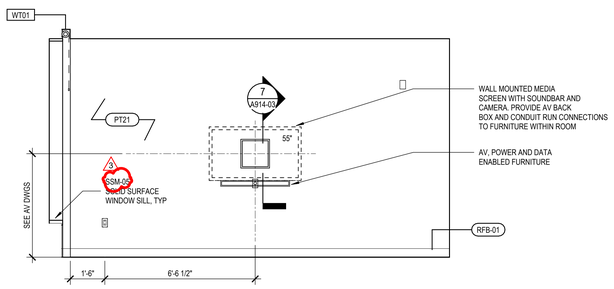
10 INTERIOR ELEVATION - FACULTY PANTRY
3/8" = 1'-0"



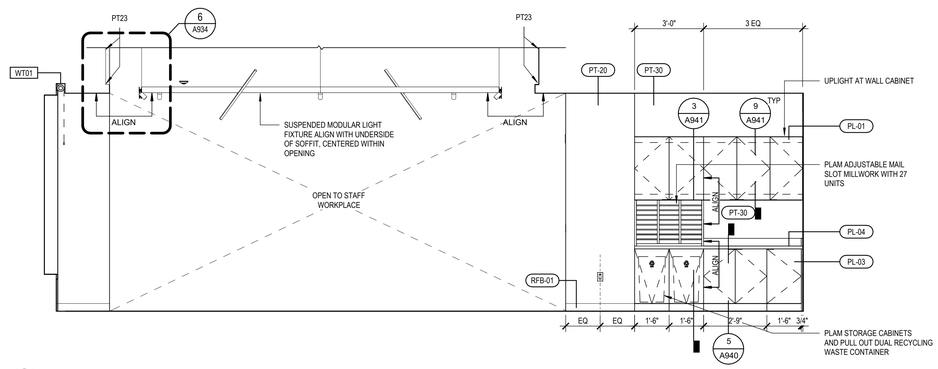
9 INTERIOR ELEVATION - FACULTY COPY
3/8" = 1'-0"



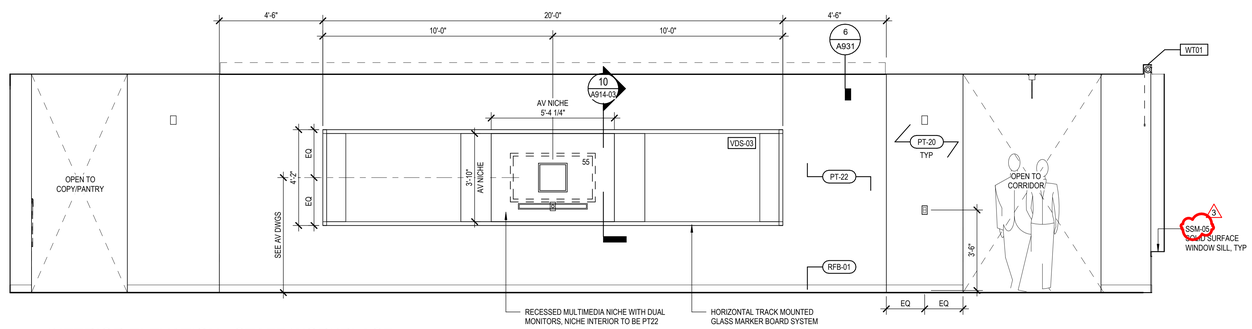
8 INTERIOR ELEVATION - MED. CONF. WEST
3/8" = 1'-0"



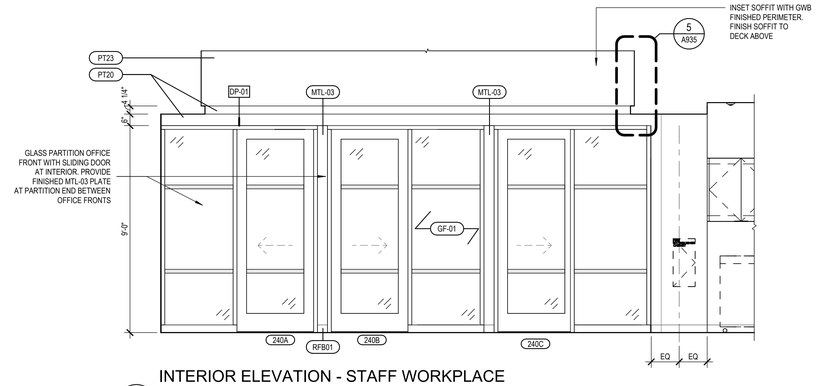
7 INTERIOR ELEVATION - MED. CONF. EAST
3/8" = 1'-0"



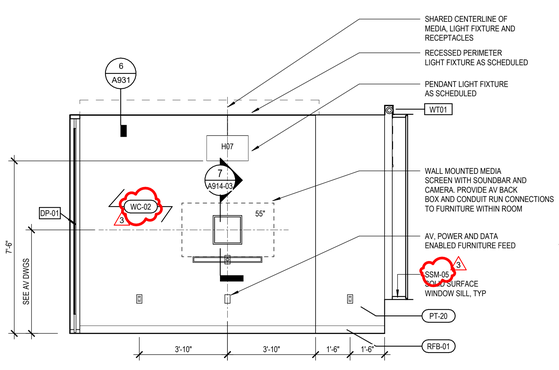
6 INTERIOR ELEVATION - FACULTY ALCOVE
3/8" = 1'-0"



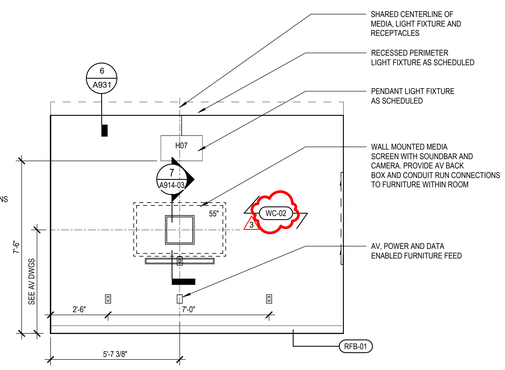
5 INTERIOR ELEVATION - STAFF WORKPLACE EAST
3/8" = 1'-0"



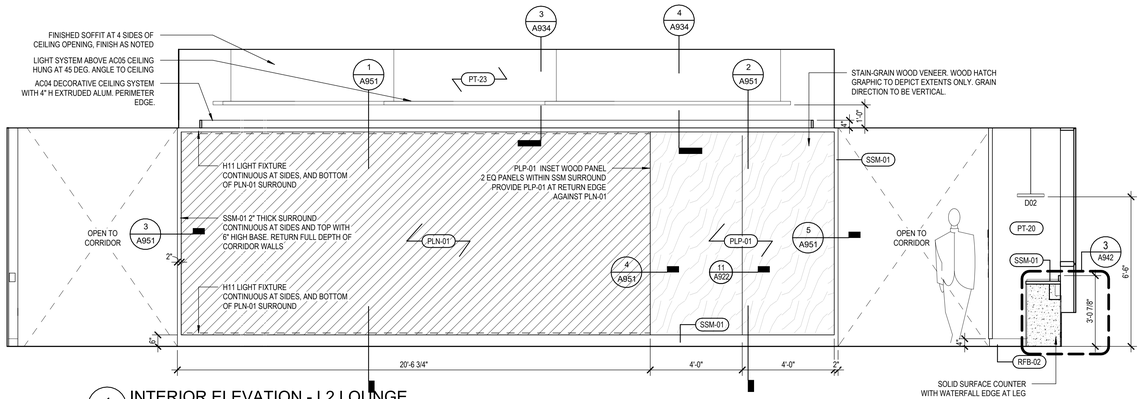
4 INTERIOR ELEVATION - STAFF WORKPLACE NORTH
3/8" = 1'-0"



3 INTERIOR ELEVATION - L2 HUDDLE 2
3/8" = 1'-0"



2 INTERIOR ELEVATION - L2 HUDDLE 1
3/8" = 1'-0"



1 INTERIOR ELEVATION - L2 LOUNGE
3/8" = 1'-0"

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Clifton, NJ 07013

Key Plan

Professional Seals

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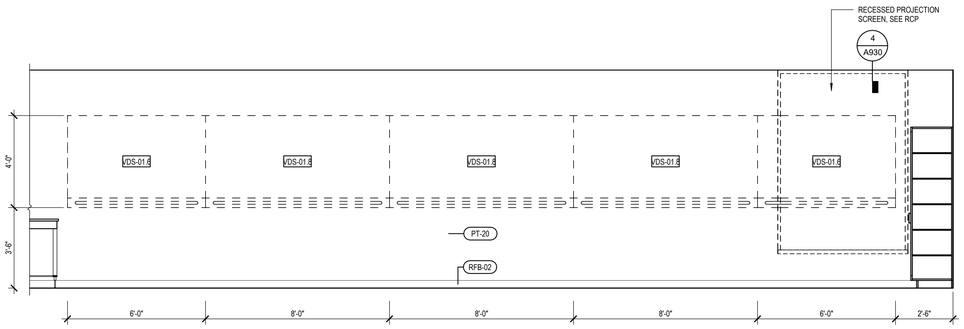
No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

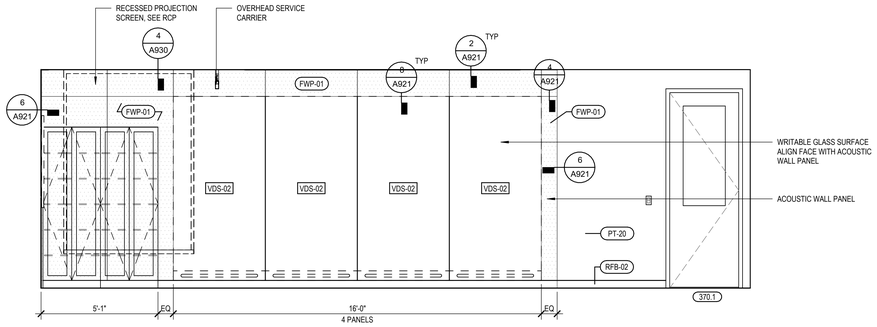
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INTERIOR ELEVATIONS - LEVEL 2

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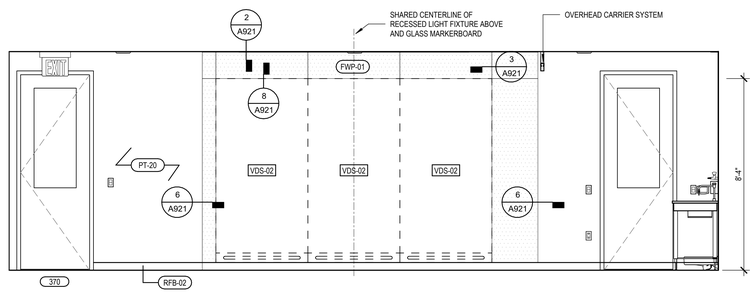
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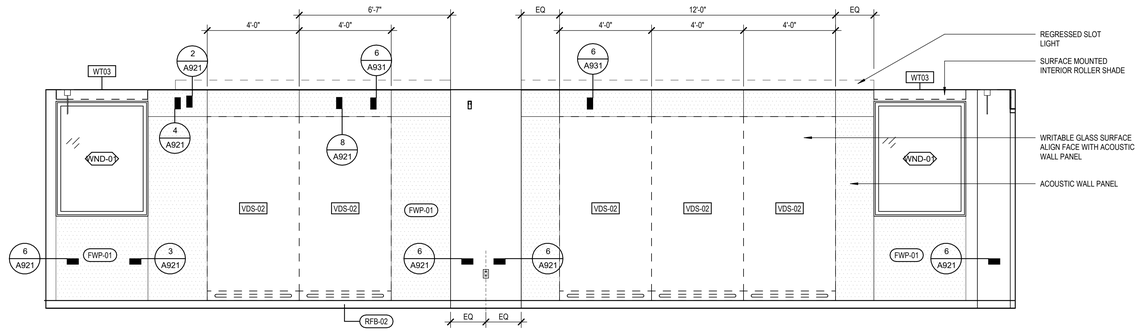
8 ELEVATION - DEMONSTRATION ROOM 370 -NORTH
3/8" = 1'-0"



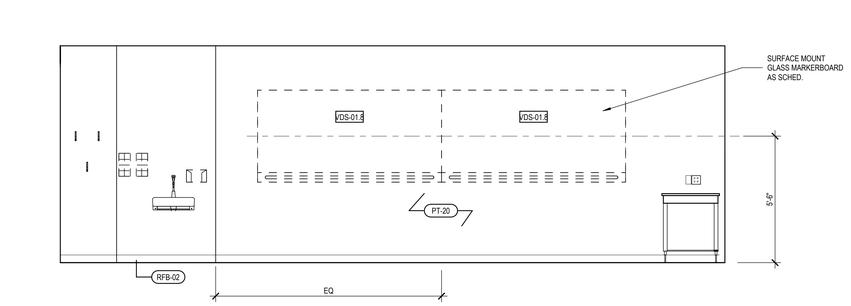
7 ELEVATION - DEMONSTRATION ROOM 370 -EAST
3/8" = 1'-0"



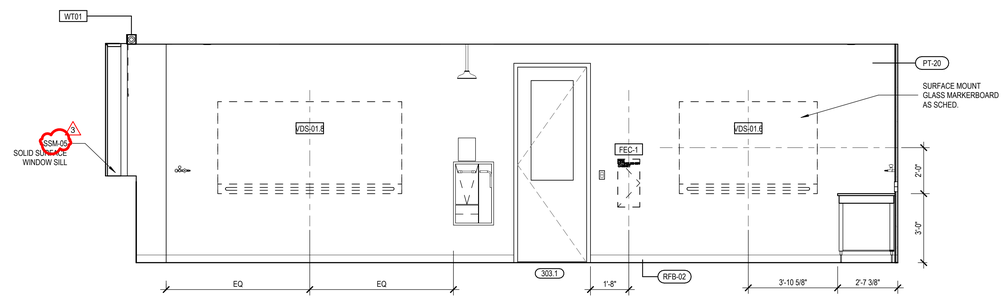
6 ELEVATION - DEMONSTRATION ROOM 370 - WEST
3/8" = 1'-0"



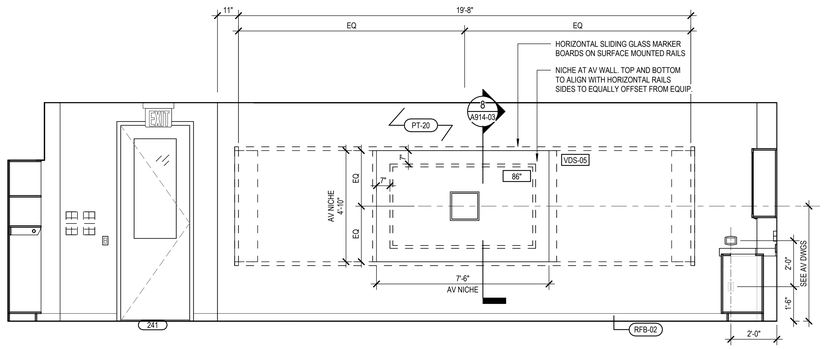
5 ELEVATION - DEMONSTRATION ROOM 370 - SOUTH
3/8" = 1'-0"



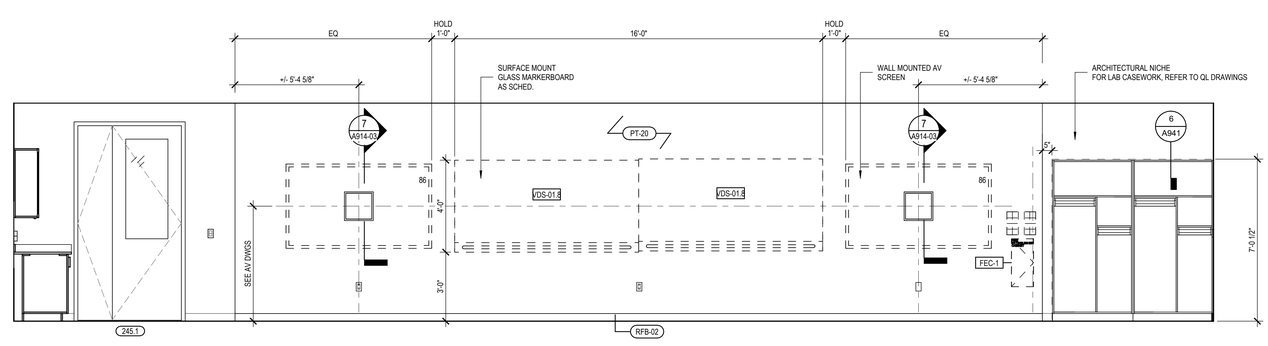
4 INTERIOR ELEVATION - CHEMISTRY RESEARCH NORTH
3/8" = 1'-0"



3 INTERIOR ELEVATION - CHEMISTRY RESEARCH SOUTH
3/8" = 1'-0"



2 ELEVATION - GENERAL CHEMISTRY 241 - WEST
3/8" = 1'-0"



1 ELEVATION - ORGANIC CHEM CLASSROOM 245 - SOUTH
3/8" = 1'-0"

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MONTCLAIR STATE UNIVERSITY

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Structural Engineer
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MEPFP Engineer
100 Overlook Center, 2nd Floor
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Key Plan

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No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

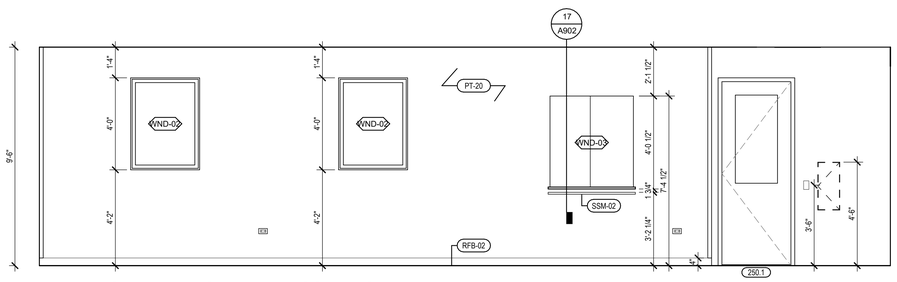
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INTERIOR ELEVATIONS - LEVEL 2/3

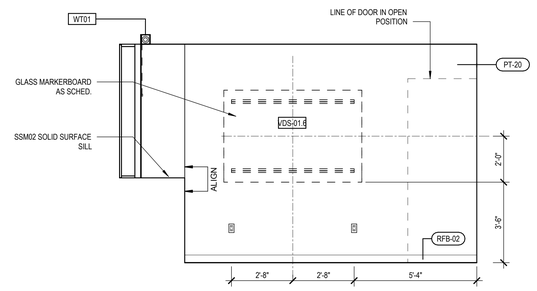
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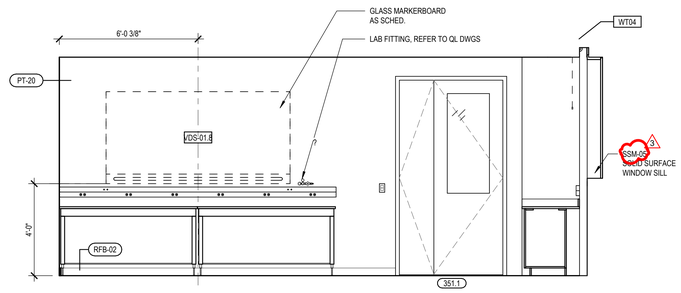
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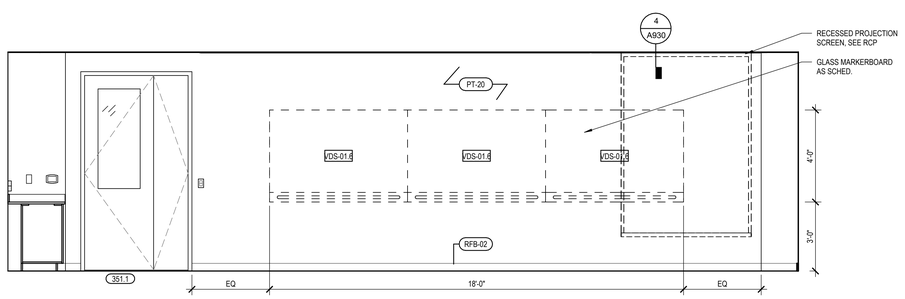
9 INTERIOR ELEVATION - L2 LAB CORRIDOR SOUTH
3/8" = 1'-0"



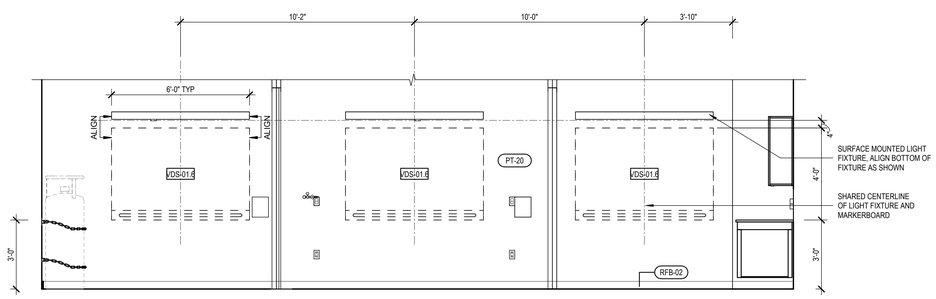
8 ELEVATION - MASS SPEC 307 - SOUTH
3/8" = 1'-0"



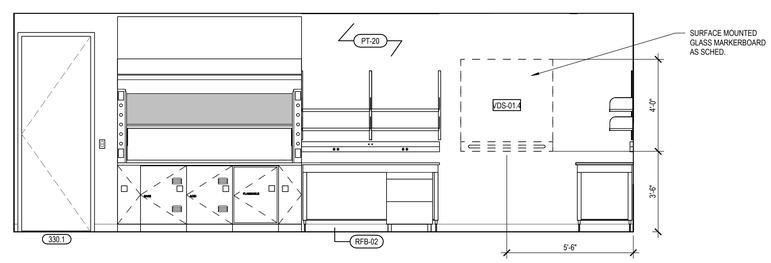
7 ELEVATION - EQUIPMENT STORAGE 351 - WEST
3/8" = 1'-0"



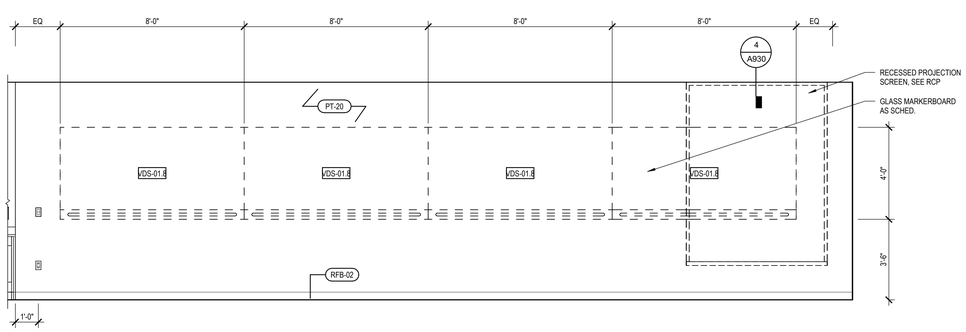
6 ELEVATION - ADVANCED TEACHING LAB 345 - EAST
3/8" = 1'-0"



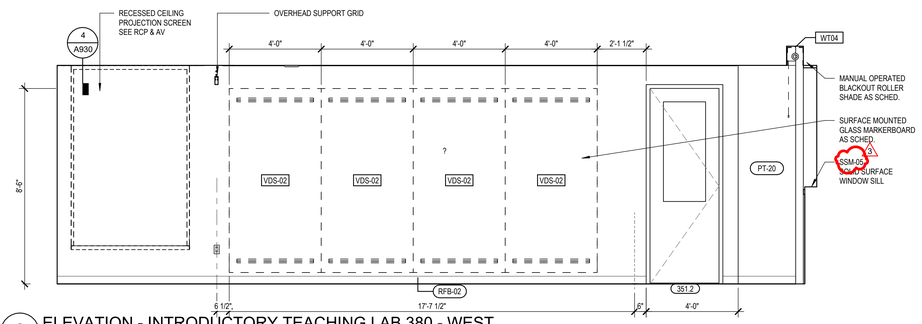
5 ELEVATION - PHYSICS RESEARCH - OPTICS LAB 334 -EAST
3/8" = 1'-0"



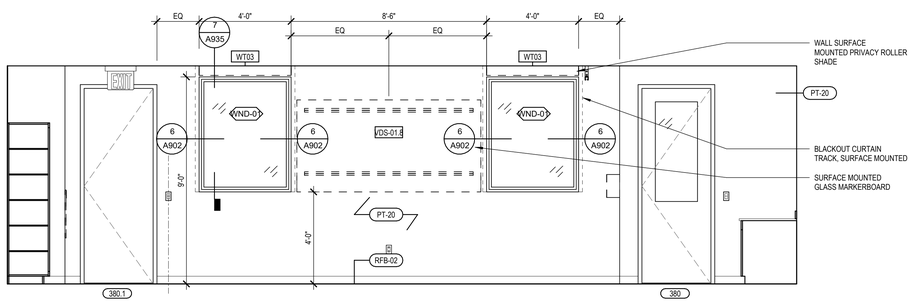
4 ELEVATION - CHEMISTRY RESEARCH 330 - EAST
3/8" = 1'-0"



3 ELEVATION - INTRODUCTORY TEACHING LAB 380 -SOUTH
3/8" = 1'-0"



2 ELEVATION - INTRODUCTORY TEACHING LAB 380 - WEST
3/8" = 1'-0"



1 ELEVATION - INTRODUCTORY TEACHING LAB 380 -EAST
3/8" = 1'-0"

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MONTCLAIR STATE UNIVERSITY

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2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

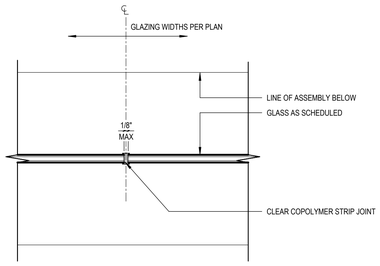
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INTERIOR ELEVATIONS - LEVEL 2/3

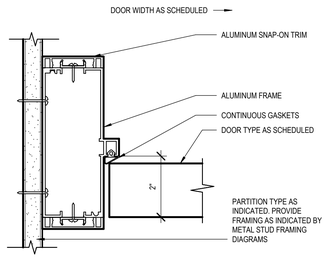
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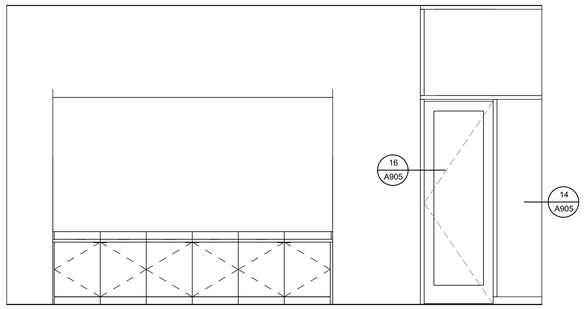
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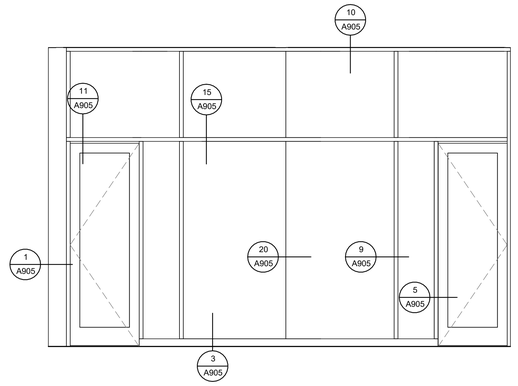


20 ALUMINUM PARTITION - BUTT JOINT
6" = 1'-0"

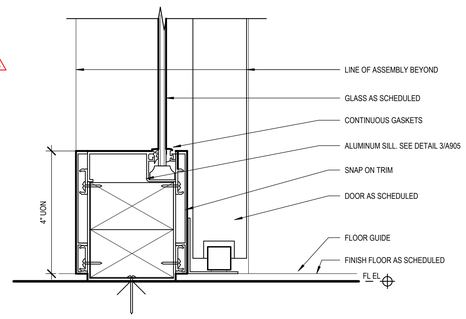


16 ALUMINUM JAMB DETAIL - STARTER
6" = 1'-0"

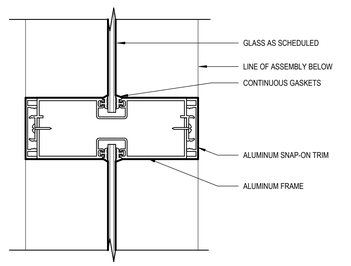




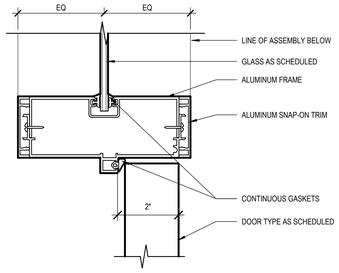
4 ALUM INT STOREFRONT PTN TYP. DETAILS
3/8" = 1'-0"



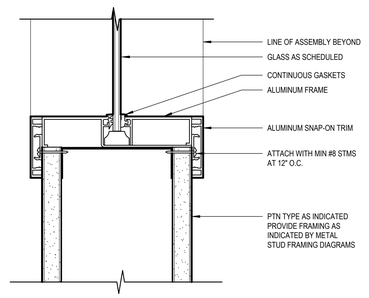
19 ALUMINUM SILL DETAIL - SLIDING DOOR
6" = 1'-0"



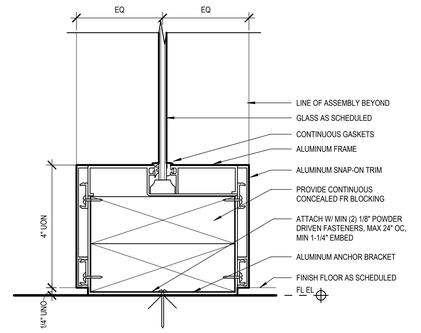
15 ALUMINUM MULLION - BORROWED LITE
6" = 1'-0"



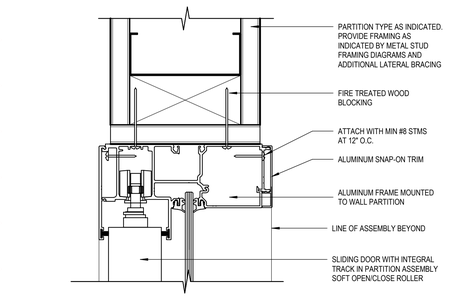
11 ALUMINUM HEAD DETAIL - BORROWED LITE
6" = 1'-0"



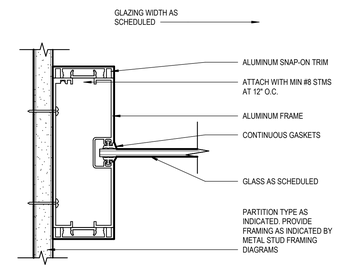
7 ALUMINUM SILL DETAIL - BORROWED LITE
6" = 1'-0"



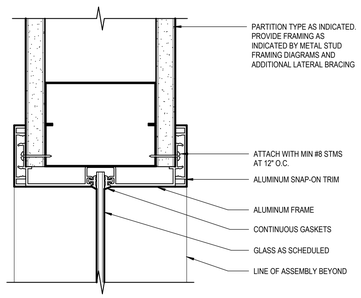
3 ALUMINUM SILL DETAIL - BORROWED LITE
6" = 1'-0"



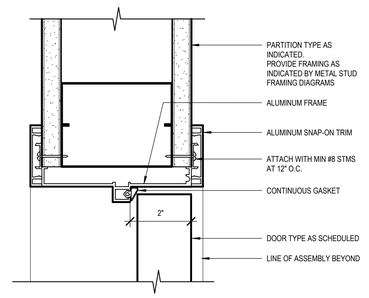
18 ALUMINUM SLIDING HEAD DETAIL
6" = 1'-0"



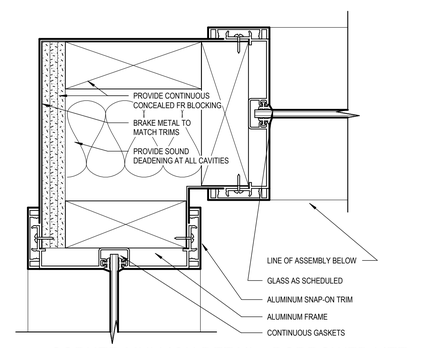
14 ALUMINUM BORROWED LITE STARTER DETAIL
6" = 1'-0"



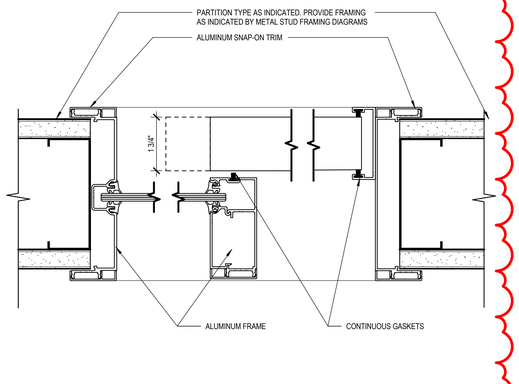
10 ALUMINUM HEAD DETAIL BORROWED LITE
6" = 1'-0"



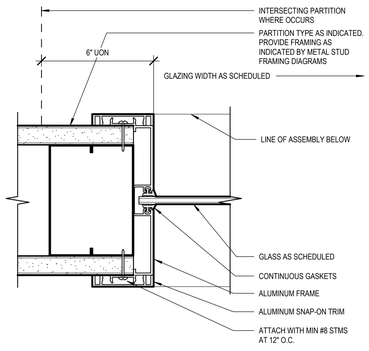
6 ALUMINUM HEAD DETAIL
6" = 1'-0"



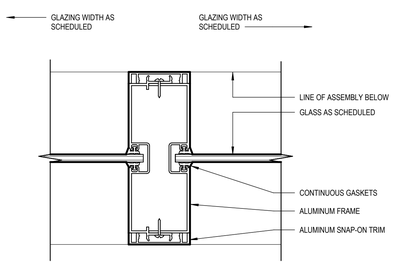
CORNER MULLION DETAIL - BORROWED LITE FRAME
6" = 1'-0"



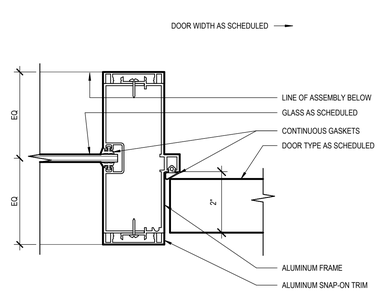
17 ALUMINUM SLIDING JAMB DETAIL
6" = 1'-0"



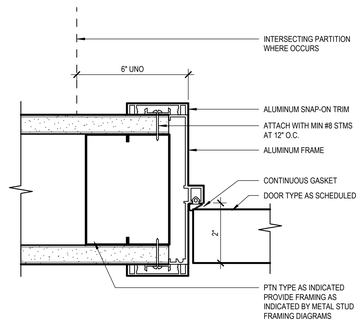
13 ALUMINUM JAMB DETAIL - BORROWED LITE
6" = 1'-0"



9 ALUMINUM MULLION - BORROWED LITE
6" = 1'-0"



5 ALUMINUM JAMB DETAIL - BORROWED LITE
6" = 1'-0"



1 ALUMINUM JAMB DETAIL
6" = 1'-0"

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building
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Prepared For

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5 Bryant Park
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New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Key Plan

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No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

Sheet Title

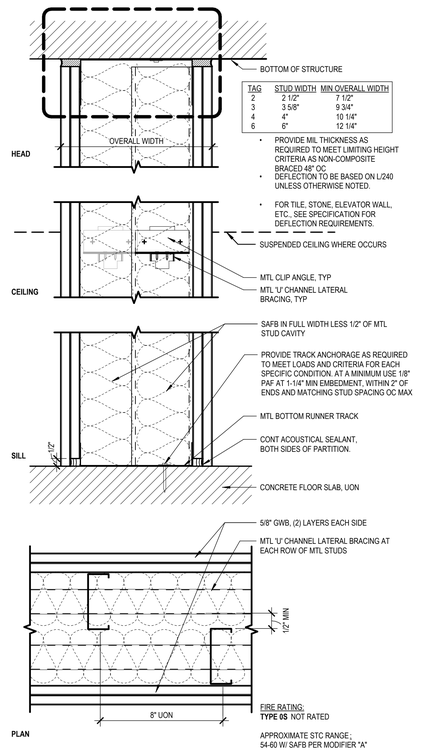
AL FRAME, 2" FACE, GWB PARTITION DETAILS

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

A905

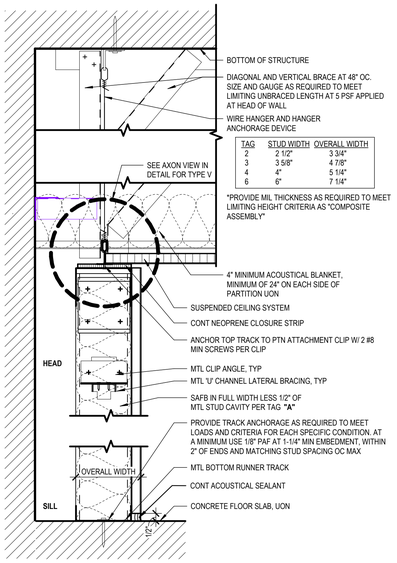
Plotted: 3/20/2026



TAG	STUD WIDTH	MIN OVERALL WIDTH
2	2 1/2"	7 1/2"
3	3 5/8"	9 3/4"
4	4"	10 1/4"
6	6"	12 1/4"

- PROVIDE MIL THICKNESS AS REQUIRED TO MEET LIMITING HEIGHT CRITERIA AS NON-COMPOSITE BRACED 48" OC
- DEFLECTION TO BE BASED ON L/240 UNLESS OTHERWISE NOTED.
- FOR TILE, STONE, ELEVATOR WALL, ETC., SEE SPECIFICATION FOR DEFLECTION REQUIREMENTS.

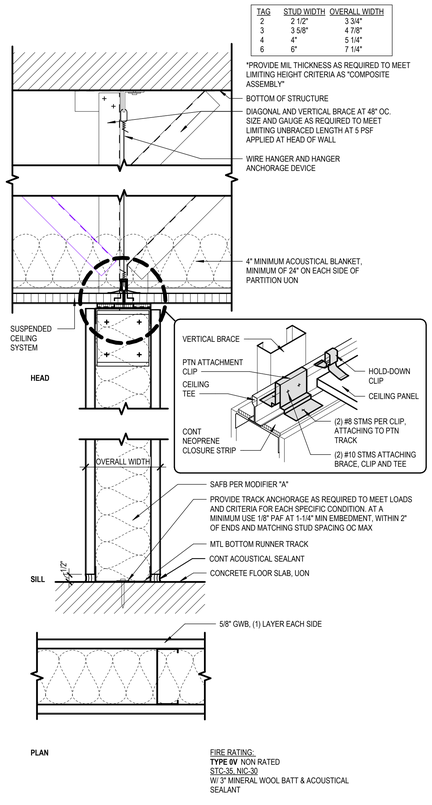
Y TYPE Y: STAGGERED: NON RATED
3" = 1'-0"



TAG	STUD WIDTH	OVERALL WIDTH
2	2 1/2"	3 3/4"
3	3 5/8"	4 7/8"
4	4"	5 1/4"
6	6"	7 1/4"

*PROVIDE MIL THICKNESS AS REQUIRED TO MEET LIMITING HEIGHT CRITERIA AS "COMPOSITE ASSEMBLY"

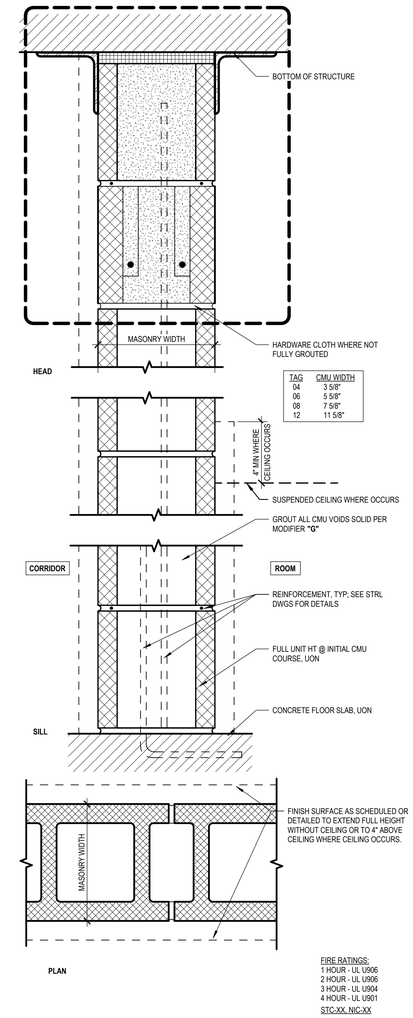
W TYPE W: CEILING HT FURRING: NON RATED
3" = 1'-0"



TAG	STUD WIDTH	OVERALL WIDTH
2	2 1/2"	3 3/4"
3	3 5/8"	4 7/8"
4	4"	5 1/4"
6	6"	7 1/4"

*PROVIDE MIL THICKNESS AS REQUIRED TO MEET LIMITING HEIGHT CRITERIA AS "COMPOSITE ASSEMBLY"

V TYPE V: CEILING HEIGHT: NON RATED
3" = 1'-0"



TAG	CMU WIDTH
04	3 5/8"
06	5 5/8"
08	7 5/8"
12	11 5/8"

M TYPE M: CMU PARTITION
3" = 1'-0"

3/23/2026 11:25:21 PM

MONTCLAIR STATE UNIVERSITY

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Key Plan

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1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

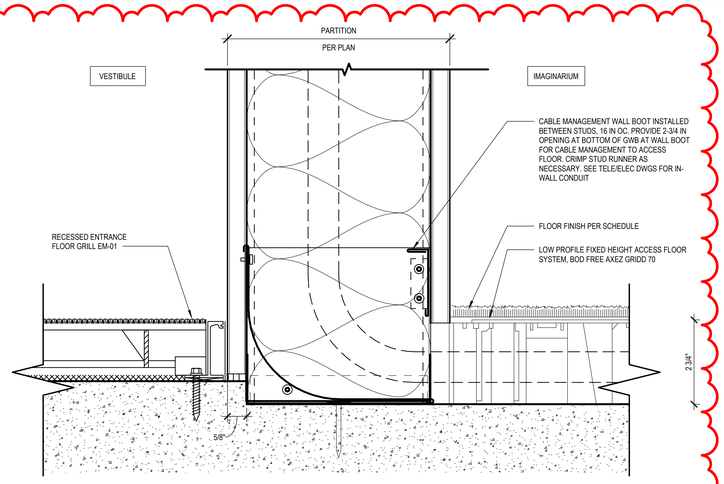
Sheet Title

INTERIOR GWB PTN AND CMU PTN TYPES

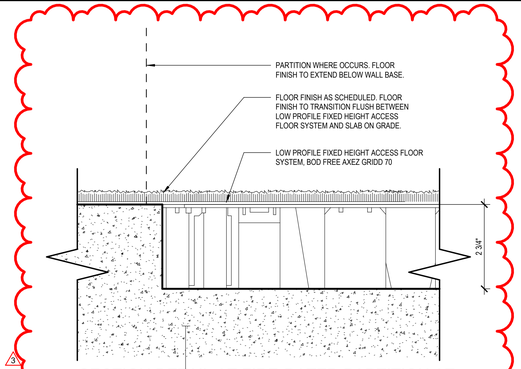
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Sheet Number

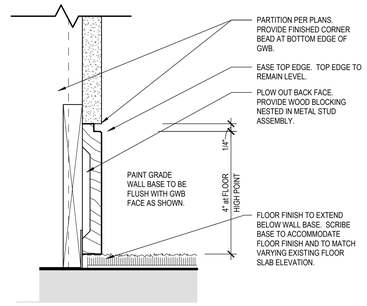
A911-03



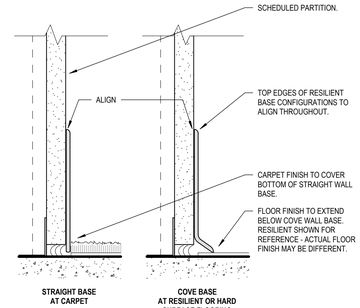
3 SECTION DETAIL AT RECESSED PARTITION AT ACCESS FLOOR RECESSED SLAB
11 6" = 1'-0"



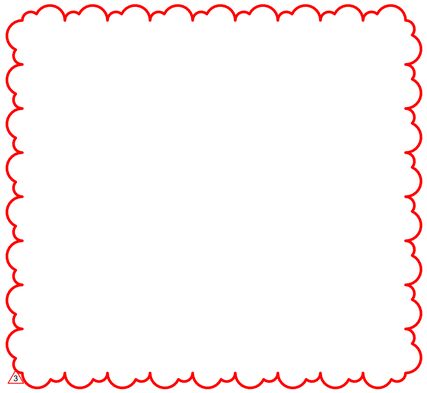
3 SECTION DETAIL AT FIRE-RATED PARTITION AT ACCESS FLOOR RECESSED SLAB
12 6" = 1'-0"



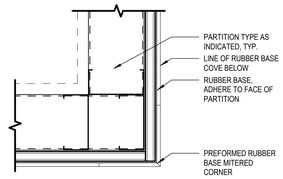
8 WOOD WALL BASE - FLUSH
6" = 1'-0"

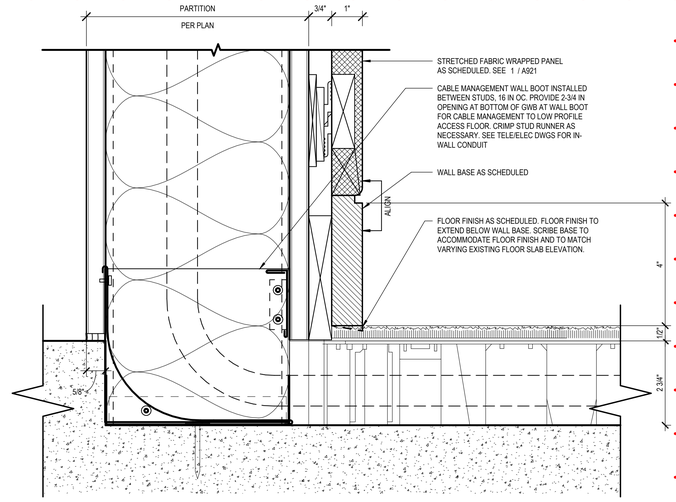


4 RESILIENT WALL BASE
6" = 1'-0"

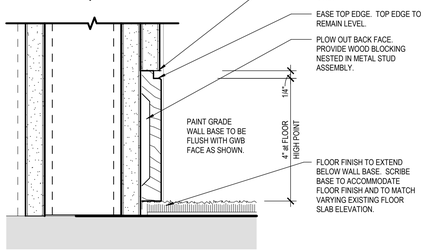


3 PLAN @ RESILIENT BASE OUTSIDE CORNER
3" = 1'-0"

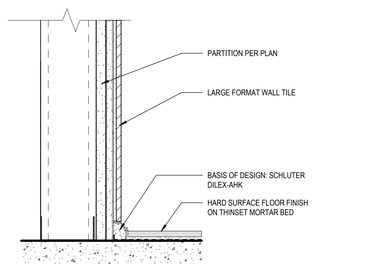




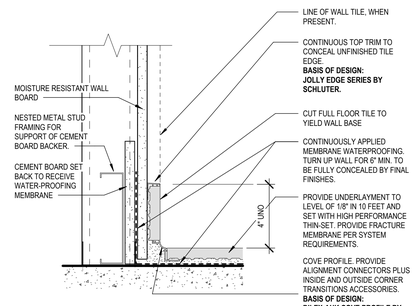
3 SECTION DETAIL AT RECESSED PARTITION AT ACCESS FLOOR RECESSED SLAB
10 6" = 1'-0"



6 SECTION AT FLUSH MARKERBOARD
6" = 1'-0"

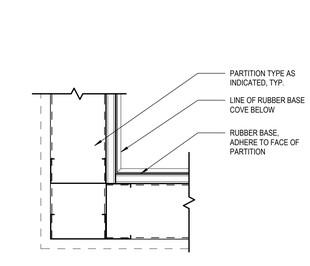


9 WALL TILE NO BASE
3" = 1'-0"

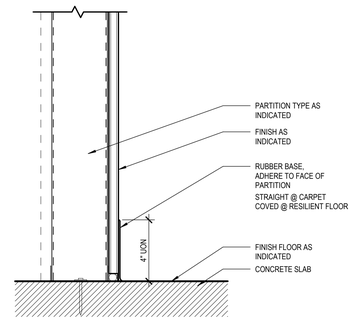


HIGH PERFORMANCE THIN SET WITH UNDERLAYMENT

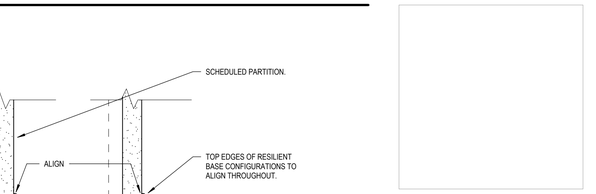
5 TILE BASE AT WATERPROOFING
3" = 1'-0"



2 PLAN @ RESILIENT BASE INSIDE CORNER
3" = 1'-0"



1 SECTION @ RESILIENT COVE BASE
3" = 1'-0"



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1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
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3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

Sheet Title

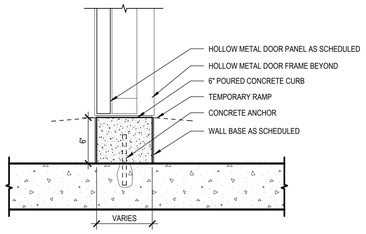
INTERIOR WALL BASE DETAILS

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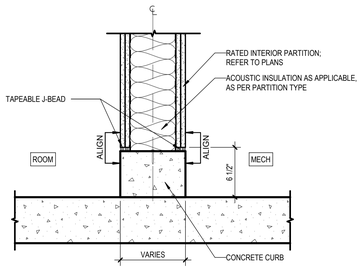
Sheet Number

A920

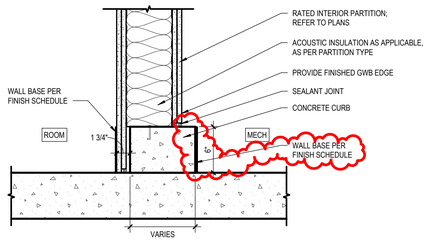
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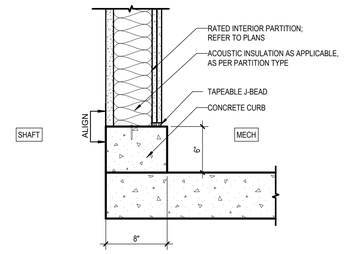
4 SECTION DETAIL - PARTITION CURB AT DOOR
1 1/2" = 1'-0"



3 SECTION DETAIL - PARTITION CURBS 2
1 1/2" = 1'-0"



2 SECTION DETAIL - PARTITION CURBS
1 1/2" = 1'-0"



1 SECTION DETAIL - SHAFT WALL CURBS
1 1/2" = 1'-0"

3/23/2026 11:25:25 PM

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Project No: 24.07023.00

Sheet Title

INTERIOR PARTITION CURB DETAILS

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Sheet Number

A927

FINISH SCHEDULE

CODE	COMPONENT DESCRIPTION	SPEC SECTION	SPECIFICATION SECTION NAME	MANUFACTURER	PRODUCT	DESCRIPTION	COLOR	FINISH	SIZE	COMMENTS
AC-01	ACOUSTICAL CEILING	95123	ACOUSTIC TILE CEILINGS	ARMSTRONG	OPTIMA TEGUARL LAY-IN 9/16 WHITE GRID; PRELUDE	HIGH NRC	WHITE		2'x2'	GENERAL
AC-02	ACOUSTICAL CEILING	95123	ACOUSTIC TILE CEILINGS	ARMSTRONG	ULTIMA HEALTHZONE SQUARE LAY-IN 15/16 WHITE GRID; PRELUDE	HIGH NRC	WHITE		2'x2'	LAB TYPICAL
AC-03	ACOUSTICAL CEILING	95123	ACOUSTIC TILE CEILINGS	ARMSTRONG	OPTIMA TEGUARL LAY-IN 9/16 WHITE GRID; PRELUDE	HIGH NRC	WHITE		2'x4'	MULTI-PURPOSE ROOM, CONFERENCE ROOM
AC-04	ACOUSTICAL CEILING	95436	SUSPENDED DECORATIVE GRIDS	PINTA	METAL MESH SQUARELINE; LARGE OPEN	NO BACKING	BLACK		2'x4'	INCLUDE MATCHING COLOR 4" PERIMETER TRIM AND 15/16 PRELUDE; LAY-IN GRID
AC-05	ACOUSTICAL CEILING	95436	SUSPENDED DECORATIVE GRIDS	PINTA	METAL MESH SQUARELINE; LARGE OPEN	NO BACKING	WHITE		2'x4'	NON-MATCHING TRIMS :I NCLUDE BLACK COLOR 4" PERIMETER TRIM AND BLACK COLOR 5/16 PRELUDE; LAY-IN GRID
AC-06	ACOUSTICAL CEILING	95436	SUSPENDED DECORATIVE GRIDS	ARKTURA	ATMOSPHERA ADAPTIVE ANALOG 3D	OPEN VARIABLE HEIGHT BAFFLE CEILING; BLACK GRID SUPPORTS; 89%-92% OPENNES IN PLAN	"SOFT SOUND" ACOUSTIC P.E.T FIN	SNOW	6'6"x11'8" TYP. MODULE, 16" FIN DEPTH	SEAMLESS BUTT JOINT BTWN MODULES
CO-20	CORNER GUARD	102600	WALL AND DOOR PROTECTION	CS GROUP	ASCO-8	SURFACE MOUNTED .063 ALUM. CORNER GUARD - ADHESIVE BACKED	POWDER COAT FINISH - MATCH PT-20	POWDER COAT ALUM.	2" X 2" X 136" - CUT IN FIELD	
CO-21	CORNER GUARD	102600	WALL AND DOOR PROTECTION	CS GROUP	ASCO-8	SURFACE MOUNTED .063 ALUM. CORNER GUARD - ADHESIVE BACKED	POWDER COAT FINISH - MATCH PT-21	POWDER COAT ALUM.	2" X 2" X 136" - CUT IN FIELD	
CPT-01	CARPET	96813	TILE CARPETING	MILLIKEN	CARPET TILE	DISSIDENT COLLECTION	DISSIDENT -CST120-122 MASONRY	QUARTER TURN	2'x2'	PREFUNCTION, LOBBY, MPR
CPT-02	CARPET	96813	TILE CARPETING	MILLIKEN	CARPET TILE	FREE FLOW COLLECTION; PATH	PTH235 GRAVEL	ASHLAR	2'x2'	CLASSROOMS, WORKPLACE
FAB-01	UPHOLSTRY	97723	UPHOLSTRY	MAHARAM	ARLO; 466598	UPHOLSTRY	014 THREAD			LOUNGE BANQUETTE SEATING
FAB-02	UPHOLSTRY	97723	UPHOLSTRY	MAHARAM	METHOD; 466579	UPHOLSTRY	024 JAM			LOUNGE MILLWORK SEATING
FWP-01	FABRIC WRAPPED PANEL	97723	FABRIC WRAPPED PANELS	DESIGNTEX	BLUR	WALL PANEL	3128-104 FLURRY		1" THK	EVENT SPACE
GF-01	GLAZING FILM	88100	GLAZING FILM	3M	DISTRACTION MARKER		DUSTED CRYSTAL			
IFP-02	INTUMESCENT FIREPROOFING	88813	INTUMESCENT FIREPROOFING				TO MATCH PT-21			
MTL-02	DECORATIVE METAL	57000	DECORATIVE METAL	TO MATCH - RAL CONTROL SAMPLE	RIMEX T22 FINISH	CUSTOM METAL FINISH	TERRACOTTA	FRP	SIZE VARIES - APPLIED TO ARCHITECTURAL & DECORATIVE STEEL SURFACES	
MTL-03	DECORATIVE METAL	57000	DECORATIVE METAL	TO MATCH - RIMEX CONTROL SAMPLE	POWDER COATED METAL	POWDER COATED METAL FINISH ON ARCHITECTURAL AND DECORATIVE SURFACES.	QUARTZ BRONZE GRANEX	MATTE	SIZE VARIES - APPLIED TO ARCHITECTURAL & DECORATIVE SURFACES	
MTB-01	DECORATIVE METAL	57000	DECORATIVE METAL BASE	TO MATCH - RIMEX CONTROL SAMPLE	POWDER COATED METAL	POWDER COATED METAL FINISH ON ARCHITECTURAL AND DECORATIVE SURFACES.	QUARTZ BRONZE GRANEX	MATTE	4" H	
PLN-01	PRESERVED PLANTINGS	129213	PRESERVED FOLIAGE	GROW-UP	PRESERVED MOSS AND FOLIAGE	DEHYDRATED AND PRESERVED MOSS AND FOLIAGE CUSTOMIZED ASSEMBLY OF 20%-30% FOLIAGE - 80% - 70% MOSS. PROVIDE MIN. 4 VARIETIES OF EACH MOSS AND FOLIAGE. WALL MOUNTED, FIRE RATED			SEE ELEV.	LEVEL 1,2,3 LOUNGE WALL
PLN-02	ARTIFICIAL PLANTINGS	129213	ARTIFICIAL FOLIAGE	GROW-UP	ARTIFICIAL POTTED PLANTINGS	ARTIFICIAL POTTED PLANTINGS OF MIN. 4 VARIETIES OF FOLIAGE IN VARYING HEIGHTS			SEE PLAN	LEVEL 1 LOUNGE SEATING
PL-01	PLASTIC LAMINATE	64200	INTERIOR ARCHITECTURAL WOODWORK	WILSONART	HPL		PASADENA OAK 7986-38	FINE VELVET FINISH		GENERAL
PL-02	PLASTIC LAMINATE	64200	INTERIOR ARCHITECTURAL WOODWORK	WILSONART	SOLICOR LAMINATE		DESIGNER WHITE, D354-60			MAIL, CATERING
PL-03	PLASTIC LAMINATE	64200	INTERIOR ARCHITECTURAL WOODWORK	NEVAMAR	HPL		FERAL FERN SV7700	TEXTURED		PANTRY, COPY
PL-04	PLASTIC LAMINATE	64200	INTERIOR ARCHITECTURAL WOODWORK	NEVAMAR	HPL		GRAY	TEXTURED		COPY
PL-05	PLASTIC LAMINATE	64200	INTERIOR ARCHITECTURAL WOODWORK	NEVAMAR	HPL		BLACK	TEXTURED		MILLWORK BASE
PLP-01	PLASTIC LAMINATE PANELS	64219	PLASTIC LAMINATE FACED WOOD PANELS	WILSONART	HPL		PASADENA OAK 7986-38	FINE VELVET FINISH		
PT-20	PAINT	99123	INTERIOR PAINTING - FIELD PAINT	SHERWIN WILLIAMS	SCUFF PRO; PRO MAR 200 ZERO VOC		ALABASTER - SW7008			
PT-21	PAINT	99123	INTERIOR PAINTING - ACCENT	SHERWIN WILLIAMS	SCUFF PRO; PRO MAR 200 ZERO VOC		CHINA DOLL - SW7517			
PT-22	PAINT	99123	INTERIOR PAINTING - ACCENT	SHERWIN WILLIAMS	SCUFF PRO; PRO MAR 200 ZERO VOC		GARRET GRAY SW 6075			
PT-23	PAINT	99123	INTERIOR PAINTING - ACCENT	SHERWIN WILLIAMS	SCUFF PRO; PRO MAR 200 ZERO VOC		DOMINO - SW6989			
PT-30	PAINT	99123	INTERIOR PAINTING - ACCENT	SHERWIN WILLIAMS	SCUFF PRO; PRO MAR 200 ZERO VOC		HUNT CLUB - SW6468			
PT-31-C	PAINT	99123	LAB - METAL CASEWORK PAINT	BY MFR	LAB CASEWORK PAINT	STANDARD MFR. COLOR	MFR. STANDARD WHITE, TBD.			
PT-32-C	PAINT	99123	LAB - METAL CASEWORK PAINT - ACCENT	BY MFR	LAB CASEWORK PAINT	CUSTOM COLOR PAINT	RAVE RED - SW6608 (TO MATCH)			
PWC-01	PLASTIC WALL PROTECTION	102600	PROTECTIVE WALL COVERING	CS GROUP	ACROVYN	WALLCOVERING 0.40" WITH TRIMS	933 MISSION WHITE		4'X10'	
RF-01	RESILIENT FLOORING	96519	RESILIENT SHEET FLOORING	GERFLOR	MIPOLAM SYMBIOZ		6041 CLAY		SHEET W/ 4" INTEGRAL COVE -W/ HEAT WELDED SEAMS	
RF-02	RESILIENT FLOORING	96519	RESILIENT SHEET FLOORING	GERFLOR	MIPOLAM AFFINITY		4463 GREIGE		SHEET W/ 4" INTEGRAL COVE -W/ HEAT WELDED SEAMS	
RF-03	RESILIENT FLOORING	96519	RESILIENT SHEET FLOORING	GERFLOR	MIPOLAM AFFINITY		4457 OLIVINE		SHEET W/ 4" INTEGRAL COVE -W/ HEAT WELDED SEAMS	
RF-04	RESILIENT FLOORING	96519	RESILIENT SHEET FLOORING	GERFLOR	MIPOLAM AFFINITY		4475 CINABRE		SHEET	SAFETY DEMARCATION ZONE
RF-05	RESILIENT FLOORING	96519	RESILIENT TILE FLOORING	BENTLEY	BALASTRAUDE	LVT; 5mm	BEAUX ARTS 802116		18" X 36", ASHLAR INSTALLATION	PANTRY/ COPY
RF-06	RESILIENT FLOORING	96519	RESILIENT TILE FLOORING	ARMSTRONG	STANDARD EXCELON	VCT FLOORING	MINT CREAM 51876		12" X 12"	ELEC, PLUMBING, HOUSEKEEPING, JC, BOH AREAS
RF-07	RESILIENT FLOORING	96536	STATIC-CONTROL RESILIENT FLOORING	ARMSTRONG FLOORING	EXCELON SDT	STATIC DISSIPATIVE TILE	MARBLE BEIGE 51950		12" X 12"	MDF, IDF
RF-08	RESILIENT FLOORING	96536	STATIC-CONTROL RESILIENT FLOORING	TARKETT	IQ GRANIT SD	STATIC DISSIPATIVE SHEET	3096948 GRAY		WELDED SHEET W/ 4" INTEGRAL COVE	NMR
RFB-01	RESILIENT FLOORING - BASE	96513	RESILIENT BASE AND ACCESSORIES	ROPPE	700 SERIES RUBBER WALL BASE		GRAY		4" STRAIGHT at CPT, 4" COVE at STANDARD RESILIENT	
RFB-02	RESILIENT FLOORING - BASE	96513	RESILIENT BASE AND ACCESSORIES	GERFLOR	INTEGRAL BASE		MATCH TO ADJACENT FLOOR RF01-RF06		4" INTEGRAL COVE - HEAT WELDED SEAMS	
RFB-03	RESILIENT FLOORING - BASE	96513	RESILIENT BASE AND ACCESSORIES	ROPPE	700 SERIES RUBBER WALL BASE		WHITE		4" STRAIGHT at LAB CASEWORK	
RFB-04	RESILIENT FLOORING - BASE	96513	RESILIENT BASE AND ACCESSORIES	ROPPE	700 SERIES RUBBER WALL BASE		BLACK		4" STRAIGHT at LAB CASEWORK	
RMX-01	MATRIX FLOORING	96723	CHEMICAL RESISTANT POURED FLOOR	STONHARD	STONTEC		SMOKEY MOUNTAIN	LG. FLAKE		
SSM-01	SOLID SURFACE MATERIAL	64023	INTERIOR ARCHITECTURAL WOODWORK	CORIAN	SOLID SURFACE		DOESKIN			L1 LOUNGE; L2-L3 COLLABORATION
SSM-02	SOLID SURFACE MATERIAL	64023	INTERIOR ARCHITECTURAL WOODWORK	CORIAN	SOLID SURFACE		CAMEO WHITE			RESTROOM VANITY; CATERING
SSM-03	SOLID SURFACE MATERIAL	64023	INTERIOR ARCHITECTURAL WOODWORK	CORIAN	QUARTZ		CONCRETE CARRARA			PANTRY; MOTHERS
SSM-05	SOLID SURFACE MATERIAL	64023	INTERIOR ARCHITECTURAL WOODWORK	CORIAN	SOLID SURFACE		DESIGNER WHITE			WINDOW SILLS
TL-01	TILING	93013	CERAMIC TILING	ATLAS CONCORDE	BOOST, STONE	PORCELAIN LARGE FORMAT; FLOOR	CLAY	R10; MATTE	48" X 48"x9mm	LOBBY, PREFUNCTION
TL-02	TILING	93013	CERAMIC TILING	ATLAS CONCORDE	WOOD LOOK	PORCELAIN; FLOOR	MEMORY OAK	CARAMEL	8" X 40" X 9mm	LOUNGE, GALLERY
TL-03	TILING	93013	CERAMIC TILING	CROSSVILLE	RETROACTIVE 2.0	PORCELAIN; FLOOR	ROASTED CHESTNUT	UPS	12"X12"	RESTROOM FLOOR
TL-04	TILING	93013	CERAMIC TILING	CROSSVILLE	RETROACTIVE 2.0	PORCELAIN; WALL	RACING GREEN - RET12	UPS	2X4 MOSAIC SHEET	RESTROOM WALL TILE
TL-05	TILING	93013	CERAMIC TILING	CROSSVILLE	RETROACTIVE 2.0	PORCELAIN; WALL	EMPRESS WHITE - RET04	UPS	2X4 MOSAIC SHEET	RESTROOM WALL TILE
TL-06	TILING	93013	CERAMIC TILING	DALTILE	COLOR WHEEL LINEAR	CERAMIC WALL	SUEDE GRAY	MATTE	1X6 TILE IN SHEET, VERTICAL INSTALL	PANTRY BACKSPLASH
TL-07	TILING	93013	LARGE FORMAT TILE	LAMINAM	IN-SIDE	TECHNICAL WALL TILE	PIETRA DI CARDOSO NERO FIAMMATO	FLAMED	1200mmX3000mm 5+mm	LOBBY
TL-08	TILING	93013	LARGE FORMAT TILE	LEA CERAMICHE	SIDE STONE	TECHNICAL WALL TILE	CLUSTER - DARK	NAT	48" X 109" X 3/8"	STUDENT LOUNGE
TLB-01	TILING	93013	CERAMIC TILING - BASE	ATLAS CONCORDE	PORCELAIN LARGE FORMAT; FLOOR	BOOST, STONE	CLAY	MATTE	4" X 48" x9mm	AT TL-01, PROVIDE SCHLUTER JOLLY CAP
VDS-01.X	VISUAL DISPLAY SURFACE	101100	VISUAL DISPLAY SURFACE	CLARIDGE	GLASS MARKERBOARD	MAGNETIC BOARD HORIZONTAL	BRILLIANT WHITE		VDS-01.4 - 48"x48" VDS-01.6 - 48"x72" VDS-01.8 - 48"x96"	
VDS-02	VISUAL DISPLAY SURFACE	101100	VISUAL DISPLAY SURFACE	CLARIDGE	GLASS MARKERBOARD	GLASS BOARD VERTICAL	BRILLIANT WHITE		48"x96"	
VDS-03	VISUAL DISPLAY SURFACE	101100	VISUAL DISPLAY SURFACE	CLARIDGE	HORIZONTAL SLIDING SYSTEM	GLASS BOARD ON HORIZONTAL RAILS	BRILLIANT WHITE		48" H x LENGTH PER PLAN	
VDS-04	VISUAL DISPLAY SURFACE	101100	VISUAL DISPLAY SURFACE	CLARIDGE	TACKWALL	TW1F EDGE WRAPPED CORK ON DURACORE	TBD		TBD	
VDS-05	VISUAL DISPLAY SURFACE	101100	VISUAL DISPLAY SURFACE	CLARIDGE	HORIZONTAL SLIDING SYSTEM	GLASS BOARD ON HORIZONTAL RAILS	BRILLIANT WHITE		60" H x LENGTH PER PLAN	
WC-01	WALL COVERING	97200	WALL COVERINGS - ACOUSTIC	DFB - SWELL	PITCH	FELT WRAPPED FLUTED PROFILE VERTICAL APPLICATION	HERO HEATHER		2" WIDE, 2" DEEP, VERTICAL	L1 LOUNGE
WC-02	WALLCOVERING	97200	WALL COVERINGS	DESIGNTEX	BLUR	WALLCOVERING; DIRECT	3128-104 FLURRY			FOCUS, HUDDLE
WC-03	WALLCOVERING	97200	WALL COVERINGS	MAHARAM	TEK-WALL THEORY	WALLCOVERING; DIRECT	300111 - 010 ABSINTHE			FOCUS
WC-04	WALLCOVERING	97200	WALL COVERINGS	CARNEGIE	RODINA	WALLCOVERING; DIRECT	8200-04			MOTHERS
WC-05	WALLCOVERING	97200	DIGITAL WALLCOVERING	WOLF GORDON	CURATED DIGITAL COLLECTION	WALLCOVERING; DIRECT	TBD	TBD		STAIR 1
WDB-01	WOOD BASE	64000	ARCHITECTURAL WOODWORK		SOLID HARDWOOD W/ PLAM FINISH		TO MATCH PL01		4"	
WDB-02	WOOD BASE	64000	ARCHITECTURAL WOODWORK		HARDWOOD		PAINTED TO MATCH WALL SURFACE		4"	
WDV-01	WOOD VENEER PANEL	64023	INTERIOR ARCHITECTURAL WOODWORK	M BOHLKE CORP.	QTR CUT TEAK VTEC	RECONSTITUTED. VENEER	MBTQC AA - MAT. # 33848			
WDV-02	WOOD BATTEN PANEL	64023	INTERIOR ARCHITECTURAL WOODWORK	M BOHLKE CORP.	QTR CUT TEAK VTEC	1-1/2" WDV-01 BATTENS ON WDV-01 PANEL	MBTQC AA - MAT. # 33848			
WT-01	WINDOW TREATMENT	122200	ROLLER SHADE (MANUAL)	MECHOSHADE	ECOVEIL 1550	3% OPEN	0701 WHITE; SHADE HOUSING TO MATCH MULLION			
WT-02	WINDOW TREATMENT	122200	ROLLER SHADE (MOTORIZED)	MECHOSHADE	ECOVEIL 1550	3% OPEN	0701 WHITE; SHADE HOUSING TO MATCH MULLION			
WT-03	WINDOW TREATMENT	122200	ROLLER SHADE (MANUAL SURFACE MOUNT)	MECHOSHADE	CLASSIC BLACKOUT 0700 SERIES	SINGLE MANUAL ROLL, SURFACE MOUNT HOUSING	0701 WHITE; SHADE HOUSING WHITE			
WT-04	WINDOW TREATMENT	122200	ROLLER SHADE (MANUAL DUAL)	MECHOSHADE	ECOVEIL 1550; CLASSIC BLACKOUT 0700 SERIES	DUAL MANUAL RECESSED	0701 WHITE; SHADE HOUSING TO MATCH MULLION			
WT-05	WINDOW TREATMENT	115333	LASER SHADE (MANUAL - INTERLOCKED)	SEE LAB EQUIPMENT & SPECIFICATIONS		SURFACE MOUNTED MANUAL	BLACK SHADE - SHADE HOUSING WHTIE			LASER LAB - REFER TO QL DRAWINGS
END										

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MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building

1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University

1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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In Association with

Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan

Professional Seals

NOT FOR CONSTRUCTION

No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

Sheet Title

FINISH SCHEDULE

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

I001

FINISH LEGEND NOTES

A. TL01 & TL02 FLOOR TILE AND WALL TRIMS. CUT TILE WALLBASE FROM FULL SIZE TILES, ALIGN VERTICAL AND HORIZONTAL JOINTS BETWEEN FLOOR AND WALL INCLUDING AT CUT FIELD TILES (PER KEYNOTE F120) FINISH WITH METAL TRIMS, BOD: SCHLUTER SYSTEMS - STAINLESS STL.
B. TL07 LARGE FORMAT TECHNICAL WALL TILE TO BE PAIRED WITH METAL TILE TRIMS, BOD: SCHLUTER SYSTEMS (QUADEC, JOLLY, ETC.) PER ELEVATION DETAILS - TRIM FINISH TO BE BLACK
C. OPEN CEILING CONDITION WITHIN ROOM AREA, SEE GENERAL NOTES SHEET G010 FOR ADDITIONAL INFORMATION ON FINISH REQUIREMENTS FOR ABOVE CEILING SYSTEMS. ALL FIREPROOFING, STRUCTURE, SOUNDPROOFING, MISC. METAL ATTACHMENTS TO BE PAINTED OUT ACCORDING TO CEILING FINISH COLOR.
D. TOILET ROOM TILE WALL FINISHES TO BE ASSEMBLED WITH TL-04 & TL05 IN RUNNING BOND PATTERN (PER MFR. MOSAIC SHEET) ALIGN VERTICAL JOINTS AT TILE TRANSITION, SEE ELEVATIONS AND RENDERED VIEW.
E. LABORATORY CASEWORK IN LABS TO BE FINISHED WITH RESILIENT 4"H STRAIGHT VINYL BASE. COLOR TO COORDINATE WITH CASEWORK FINISH. TYPICAL "WHITE" CABINETS RECEIVE "WHITE" RFB-03 AND ACCENT "RED" CABINETS RECIEVE "BLACK" RFB-04
F. REFER TO LAB SPECIFICATIONS AND FINISH LEGEND FOR INFORMATION ON FINISH COLOR FOR LAB CASEWORK. PAINTED FINISH TO BE FACTORY APPLIED WITH APPROVED STOCK AND CUSTOM COLOR COMBINATION AT LOCATIONS SHOWN ON FINISH PLANS; SEE PT-31-C & PT-32-C LOCATIONS

FINISH GROUP LEGEND

AS PER FINISH GROUP CODES CLUSTERED WITH ROOM NUMBERS AT [*I-100*] SERIES DRAWINGS

FINISH GROUP LEGEND

FINISH GROUP	FLOOR	BASE	WALL	MILLWORK OR GLAZING	CEILING	REFERENCE ELEVATIONS	LOCATION	NOTES SEE FINISH LEGEND NOTES AT SIDE
INTERDISCIPLINARY / EDUCATION								
FG-1.1	TL-01	TLB-01	PT20, TL07	GL-50, MTL-03 WDV-01	PT-20, AC01		LOBBY	NOTE: A, B
FG-1.2	TL-01, CPT-01	TLB-01, WDB-01 MTL-03	WDV-01, WDV-02 PT-20, PT-22	WDV-01	PT-20, AC-06, WDV-01		PRE-FUNCTION	NOTE: A
FG-1.3	CPT-01	WDB-02	PT-20, PT-22, FWP-01, WDV-01	VDS-02	PT-20, AC-03		EVENT SPACE	NOTE: A, C
FG-1.4	TL-02, CPT-01	WDB-02	PT-20, PT-22, PT-30, WC-03	PLP-01, SSM-01,02,03 FAB-01, PLN-01	PT-20. PT30		COLLABORATION, LOUNGE (UNDER-STAIR), BOOTHS	NOTE: A
FG-1.5	TL-02	WDB-02	PT-20,PT-22, PT-30, WC-01 TL-07	PLP-01, MTL-02 PL-01, PLN-02 FAB-02	PT-23, AC-04		STUDENT LOUNGE (LARGE)	NOTE: A, C
FG-1.6	CPT-02	RFB-01	PT-20, PT-22 FWP-01	-	AC-01		COMPUTER LAB, SEMINAR CLASSROOM	
FG-1.7	RF-06	RFB-01	PT-20	-	AC-01		STORAGE	
FG-1.8	SC-01	RFB-01	PT20, PT-21		PT-20, AC01		ROOF TOP CIRCULATION	
FG-1.9	CPT-01	RFB-01	PT-20,WC-02	PL-01, PLP-01	AC-01		FOCUS	
LABORATORY / EDUCATION								
FG-2.1	RF-01, RF-03	-	PT-20, PT-21	SSM-01, PL-01, PL-02, PLP-01 PLN-01	PT-20, PT-23,AC-05		STUDENT LOUNGE, OPEN COLLABORATION	NOTE: C
FG-2.2	RF-01, RF-02,	RFB-02, RFB-03 RFB-04	PT-20	VDS-01	AC-02		LABORATORY, INSTRUMENTATION	NOTE: E, F
FG-2.3	RF-01	RFB-02, RFB-03	PT-20	-	AC-02		EQUIPMENT STORAGE, STOCKROOM	NOTE: E, F
FG-2.4	RF-08	RF-08, RFB-03	PT-20	VDS-01	AC-02		NMR, MASS SPEC, CHEM. LASER LAB	NOTE: E, F
FG-2.5	RF-01, RF-03	RFB-02	PT-20, PT21	VDS-01	PT-20, AC-01		LAB FLOOR CIRCULATION	
FG-2.6	RF-08	RF-08,RFB-03	PT-20	VDS-01	EXP. PT20		PHYSICS RESEARCH	NOTE: C, E, F
FG-2.7	RF-01	RFB-02	PT-20, FWP-01	VDS-02,VDS-03	AC-02		DEMONSTRATION ROOM	
WORKPLACE								
FG-3.1	CPT-02	RFB-01	PT-20, PT-22 FWP-01	VDS-02,VDS-03	PT-20, PT-23		OPEN OFFICE	NOTE: C
FG-3.2	RF-03	RFB-02	WC-05, PT-20	VDS-01	AC-01		GRADUATE / TEACHING ASSISTANT	
FG-3.3	CPT-02	RFB-01	WC-02, PT-20	VDS-01	AC-01		HUDDLE	
FG-3.4	CPT-02	RFB-01	WC-02 / WC03 PT-20	-	AC-01		FOCUS	
FG-3.5	CPT-02	RFB-01	PT-20	PL-02, VDS-04	AC-01		MAIL	
FG-3.7	RF-05	RFB-01	PT-30, TL-06	PL-03, SSM-03, PL04, VDS-04	PT-20		PANTRY, COPY	
FG-3.8	CPT-02	RFB-01	FWP-01, PT-20		AC-01		CONFERENCE	
BUILDING CIRCULATION								
FG-4.1	WALK-OFF MAT / TL-01	MTB-01	PT-20, PT22, TL07		PT-20 / AC-01		VESTIBULE	
FG-4.2	SC-01	RFB-01	PT-20, WC-05		PT-20		STAIR 1	
FG-4.3	SC-01	RFB-01	PT-20		PT-20		STAIR 2,3	
FG-4.4	RESILIENT	-	STAINLESS STEEL	SS BUMPER RAIL	WOOD VENEER PANEL		ELEVATOR (STANDARD FINISHES BY MFR)	
SUPPORT SPACES								
FG-5.1	TL-03	TL-03	TL-04, TL-05 PT-20	SS-03, PL-02	PT-20		GANGED RESTROOM, NOTE D	NOTE: D
FG-5.2	TL-03	TL-03	TL-04, TL-05 PT-20	-	PT-20		GENDER NEUTRAL RESTROOM, NOTE D	NOTE: D
FG-5.3	TL-02	TL-02	PT-20, WC-04	SS-04, PL-01	AC-01		MOTHERS ROOM	
FG-5.4	RF-06	RFB-01	PT-20	SS-03, PL-02	AC-01		CATERING	
FG-5.5	RF-06	RFB-01 (6")	PT-20	PL-02	AC-02		JANITOR CLOSET	
FG-5.6	RF-06	RFB-01	PT-20	-	EXPOSED		ELECTRICAL, PLUMBING	
FG-5.7	RF-07	RFB-01	PT-20	-	EXPOSED		MDF, AV, IDF	
FG-5.8	RF-06	RFB-01	PT-20	-	EXPOSED		WASTE, HSKP STOR	
FG-5.9	SC-01	RFB-01	PT-20	-	EXPOSED		LOADING DOCK, PENTHOUSE, CYLINDER STOR	
FG -6.0	RMX-01	RMX-01	PT-20		EXPOSED		CHEMICAL WASTE	
SHELL SPACE								
FG-7.1	-	-	-	-	EXPOSED		LEVEL 4	
FG-7.2	CPT-02	-	-	-	EXPOSED		IMAGINARIUM	

MONTCLAIR STATE UNIVERSITY

Project
Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For
Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Parsippany, NJ 07054

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Project No: 24.07023.00

Sheet Title

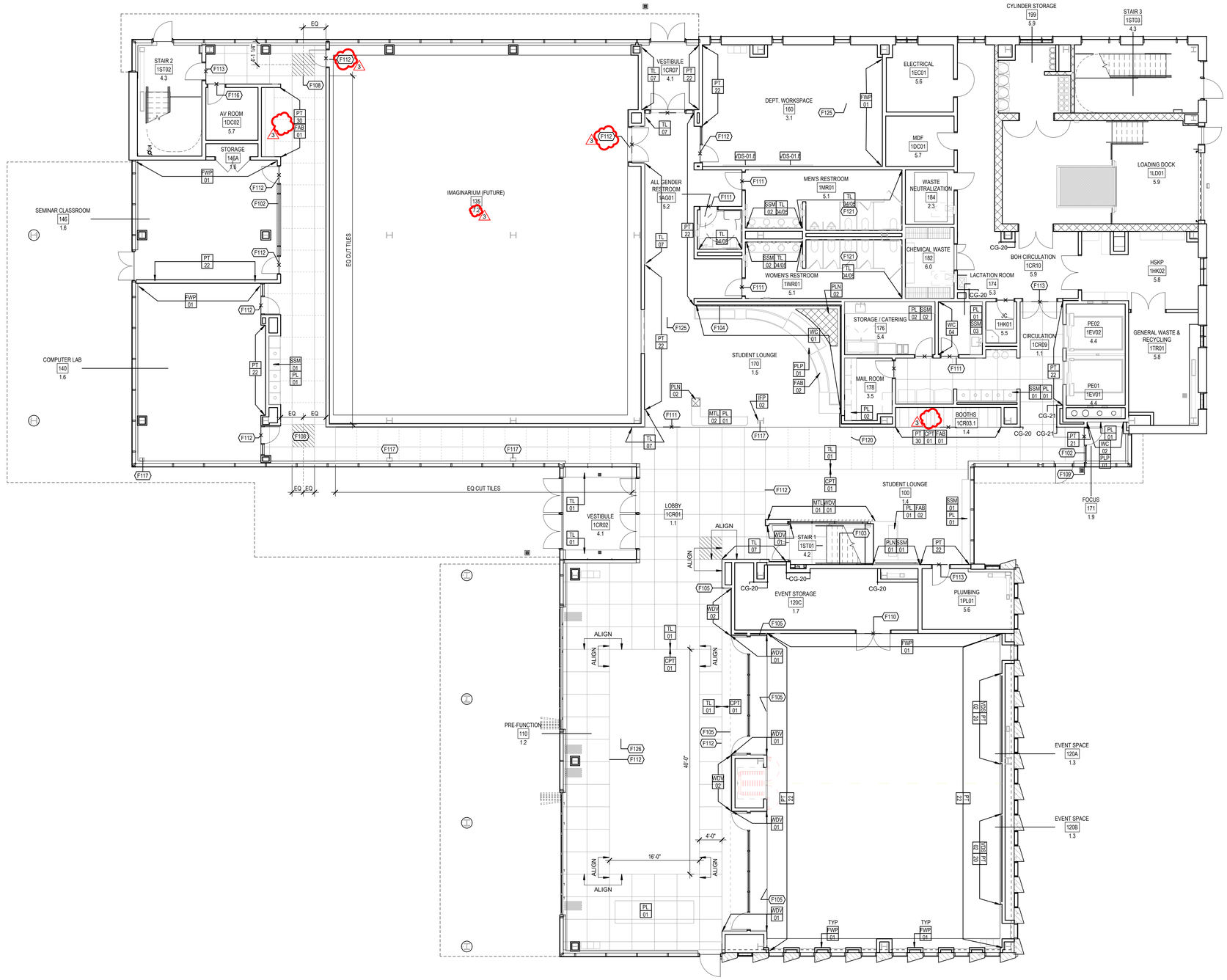
FINISH LEGEND

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

I002

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1 FINISH PLAN - LEVEL 1
1/8" = 1'-0"

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KEYNOTE LEGEND

F102	PROVIDE CUSTOM VINYL DISTRACTION GRAPHICS OR PRIVACY FILMS AT PARTITION GLASS PANELS AND DOORS THROUGHOUT. TO BE FULL HEIGHT AND WIDTH OF EACH GLASS PANEL AND DOOR. GRAPHICS TO ALIGN AND APPEAR CONTINUOUS BETWEEN PANELS. FINAL ARTWORK AND COLOR TBD.
F103	PROVIDE LEVEL 5 FINISH, INCLUDING PRIMER AND PAINT, AT GWB IN PREPARATION FOR APPLIED GRAPHICS, DRY ERASE PAINT, OR SPECIALTY FINISH. TO BE HAND TROWELLED AND SANDED LEVEL 5 FINISH TO ELIMINATE APPEARANCE AND SHADOWING OF METAL STUDS TELEGRAPHING TO PARTITION FACE. SPRAY-APPLIED OR ROLLER-APPLIED LEVEL 5 COMPOUND WILL NOT BE ACCEPTED.
F104	DIMENSIONAL FLUTED WALL PANEL MATERIAL ADHERED TO GWB PARTITION. TO EXTEND FROM CORNER-TO-CORNER.
F105	PROVIDE FULL-HEIGHT FLUSH WOOD VENEER PANELS - OR - WOOD VENEER BATTEN PANEL AS NOTED IN FINISH PLAN OR RCP. PANELS TO BE APPLIED TO WALL SURFACES AND TO UNDERSIDE OF GWB CEILING AS SHOWN IN A750 SERIES 3D VIEWS. REFER ALSO TO WOOD WALL PANEL DETAILS AT SHEET A922.
F108	INDICATES FLOOR FINISH START TILE.
F109	INDICATES TRANSITION LINE BETWEEN CARPET FLOOR FINISHES AND TILE. FLASH PATCH AS REQUIRED BELOW CARPET TO YIELD FLUSH TRANSITION. TRANSITION TO ALIGN WITH DOOR IN CLOSED POSITION. PARTITION WALL BASE FACE, CEILING SOFFIT OR FEATURE ABOVE. DETAILS AT SHEET 1/A923
F110	INDICATES TRANSITION LINE BETWEEN CARPET FLOOR FINISH TO RESILIENT FLOOR FINISH. PROVIDE CONTINUOUS VINYL REDUCER STRIP. TRANSITION TO ALIGN WITH DOOR IN CLOSED POSITION WHEN PRESENT. PARTITION WALL BASE FACE, CEILING SOFFIT OR FEATURE ABOVE. DETAILS AT SHEET 5/A923
F111	INDICATES TRANSITION BETWEEN FLOOR TILE TYPES. PROVIDE SCHLUTER DECO TRIM AT TRANSITION AND FLASH PATCH AS REQUIRED TO YIELD FLUSH TRANSITION BETWEEN TILES OF DIFFERENT THICKNESS. DETAILS AT SHEET 3/A923
F112	INDICATES TRANSITION LINE FROM FLOOR TILE FINISH TO INSET CARPET FLOOR FINISH. FLASH PATCH BELOW CARPET TO YIELD GENTLE AND FLUSH TRANSITION. PROVIDE CONTINUOUS ORNAMENTAL METAL TRANSITION EDGE. TRANSITION TO ALIGN WITH ARCHITECTURAL ELEMENTS, PARTITION WALL BASE FACE, CEILING SOFFIT OR FEATURE ABOVE. SEE TYPICAL TRANSITION DETAIL 13/A923
F113	INDICATES TRANSITION LINE FROM CONTINUOUS SEALED CONCRETE TOPPER FLOOR FINISH TO TILE FLOOR FINISH. PROVIDE SCHLUTER RENO SERIES ANGLED TRANSITION TRIM TO BE NO MORE THAN 1/4in IN HEIGHT. TRANSITION TO ALIGN WITH DOOR IN CLOSED POSITION, PARTITION WALL BASE FACE, CEILING SOFFIT OR FEATURE ABOVE. SEE TYPICAL TRANSITION DETAIL 7/A923.
F116	INDICATES TRANSITION LINE FROM THINSET TILE FLOOR TO RESILIENT. PROVIDE T-MOLD TRACK AND VINYL INSERT. TO BE FLUSH AND ALIGN WITH DOOR IN CLOSED POSITION. DETAILS AT SHEET 10/A923
F117	INTUMESCENT PAINTED EXPOSED STEEL COLUMN. SEE FINISH SCHEDULE IN 'I' SERIES FOR ADDITIONAL INFORMATION AND FINISH COLOR. PROVIDE INTUMESCENT FINISH FOR 12 INCHES ABOVE FINISH CEILING OR ARCHITECTURAL ELEMENT BEFORE TRANSITION TO SPRAY ON FIREPROOFING.
F120	TRIM FLOOR TILES ALONG PATH OF CIRCULATION TO YEILD EQUAL WIDTH APPEARANCE IN BETWEEN INDICATED HATCHED FULL SIZE FLOOR TILES AT PATTERN RE-START LOCATIONS
F121	PROVIDE FULL HEIGHT TILE AT INDICATED RESTROOM WALLS AND RETURN WALLS WITHIN NOTED AREA. TILE TO BE COMBINATION OF TL04 AND TL05 WITH TL04 TO BEGIN AT FINISH FLOOR AND EXTEND IN FULL TILE SHEETS TO APPROX. 84in AFF. TL05 TO BEGIN AT TOP OF TL04 AND CONTINUE IN FULL SHEETS TO CEILING HEIGHT. PROVIDE SHLUTER QUADEC AND JOLLY TRIMS AT TILE TERMINATIONS AND OUTSIDE CORNERS.
F125	OPEN CEILING CONDITION THROUGHOUT. FINISHED SOFFIT CEILING SURROUND PAINTED PT20 WITH 4in. HIGH PT20 PERIMETER FASCIA. WALL PARTITION ABOVE SOFFIT TO BE SET BACK FROM FINISHED PERIMETER EDGE, CONSTRUCTED CONTINOUS TO DECK AND FINISHED WITH PT23. REFER TO CEILING WORKSPACE CEILING DETAIL 5/A934 AND TO GENERAL NOTES OPEN CEILING CONDITIONS FOR ADDITIONAL INFORMATION ON LEVEL OF FINISH REQUIRED AT SYSTEMS.
F126	OPEN CEILING CONDITION THROUGHOUT. FINISHED SOFFIT CEILING SURROUND PAINTED PT20 AND CONTINUE UP TO DECK WITH SAME PT20 FINISH. REFER TO PRE-FUNCTION CEILING DETAILS 2/A933 AND 3/A933 AND TO GENERAL NOTES OPEN CEILING CONDITIONS FOR ADDITIONAL INFORMATION ON LEVEL OF FINISH REQUIRED AT SYSTEMS.

MONTCLAIR STATE UNIVERSITY

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t +1 212 741 1200 www.hok.com

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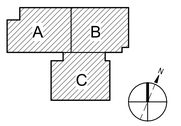
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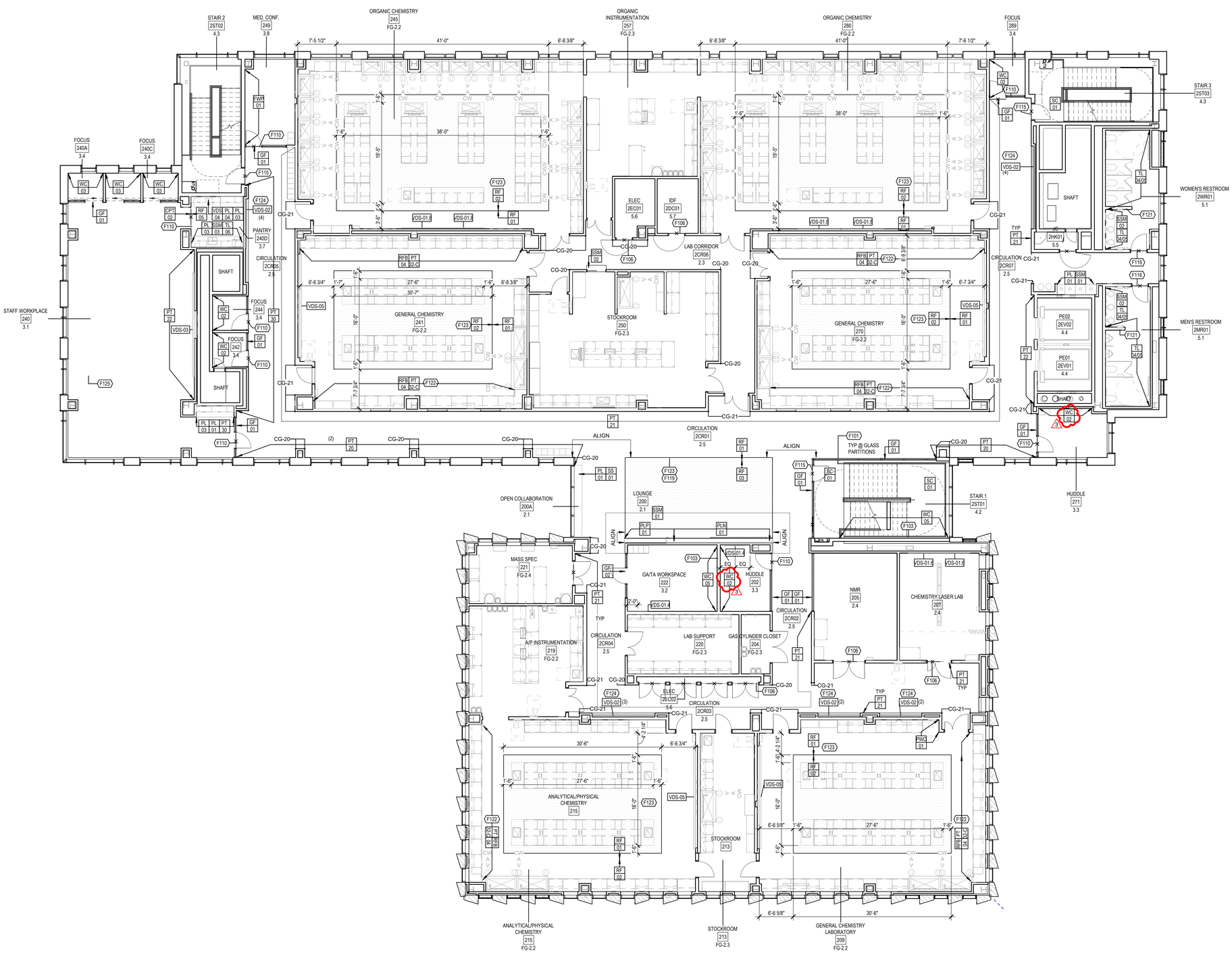
Sheet Title

FINISH PLAN - LEVEL 1

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

I101



1 FINISH PLAN - LEVEL 2
1/8" = 1'-0"

KEYNOTE LEGEND

F101	PROVIDE CUSTOM GRAPHIC FILM DISTRACTION MARKERS FOR FULL LENGTH OF SAFETY GLASS PANELS AND DOORS. FILM TO MATCH 3M DUSTED CRYSTAL. GRAPHICS TO ALIGN AND APPEAR CONTINUOUS BETWEEN PANELS. FINAL ARTWORK TBD.
F103	PROVIDE LEVEL 5 FINISH, INCLUDING PRIMER AND PAINT, AT GWB IN PREPARATION FOR APPLIED GRAPHICS. DRY ERASE PAINT, OR SPECIALTY FINISH, TO BE HAND TROWELLED AND SANDED. LEVEL 5 FINISH TO ELIMINATE APPEARANCE AND SHADOWING OF METAL STUDS TELEGRAPHING TO PARTITION FACE. SPRAY-APPLIED OR ROLLER-APPLIED LEVEL 5 COMPOUND WILL NOT BE ACCEPTED.
F106	INDICATES TRANSITION LINE BETWEEN RESILIENT FLOOR TYPES, PROVIDE STRAIGHT CLEAN CUTS. TRANSITION TO BE CENTERED ABOVE DOOR WHERE OCCURS. SEE DETAIL 2/A923.
F110	INDICATES TRANSITION LINE BETWEEN CARPET FLOOR FINISH TO RESILIENT FLOOR FINISH. PROVIDE CONTINUOUS VINYL REDUCER STRIP. TRANSITION TO ALIGN WITH DOOR IN CLOSED POSITION WHEN PRESENT, PARTITION WALL BASE FACE, CEILING SOFFIT OR FEATURE ABOVE. DETAILS AT SHEET 5/A923
F115	INDICATES TRANSITION LINE FROM SEALED CONCRETE TO RESILIENT FLOOR. TO BE FLUSH AND ALIGN WITH DOOR IN CLOSED POSITION. PROVIDE CONTINUOUS METAL TRANSITION EDGE SCHLUTER VINPRO SERIES TO COORDINATE WITH RESILIENT FLOOR THICKNESS. DETAILS AT SHEET 6/A923
F116	INDICATES TRANSITION LINE FROM THINSET TILE FLOOR TO RESILIENT. PROVIDE T-MOLD TRACK AND VINYL INSERT. TO BE FLUSH AND ALIGN WITH DOOR IN CLOSED POSITION. DETAILS AT SHEET 10/A923
F119	OPEN-TO-ABOVE CEILING TO BE FULLY PAINTED. TO INCLUDE ALL STRUCTURE, CONDUIT, JUNCTION BOXES, DUCTWORK, CABLE TRAYS, AND SIMILAR ITEMS OR SYSTEMS. SEE ALSO GENERAL OPEN CEILING NOTES AT SHEET A002 AND A201-A205 FOR ADDITIONAL CEILING NOTES.
F121	PROVIDE FULL HEIGHT TILE AT INDICATED RESTROOM WALLS AND RETURN WALLS WITHIN NOTED AREA. TILE TO BE COMBINATION OF TL04 AND TL05 WITH TL04 TO BEGIN AT FINISH FLOOR AND EXTEND IN FULL TILE SHEETS TO APPROX. 84in AFF. TL05 TO BEGIN AT TOP OF TL04 AND CONTINUE IN FULL SHEETS TO CEILING HEIGHT. PROVIDE SHLUTER QUADEC AND JOLLY TRIMS AT TILE TERMINATIONS AND OUTSIDE CORNERS.
F122	CUSTOM POWDER COATED FINISH TO BASE LAB CABIENTS, SEE FINISH SCHEDULE FOR PAINT MATCH.
F123	RESILIENT FLOOR FINISH ACCENT COLOR. PROVIDE STRAIGHT CLEAN WELDED SEAMS AT TRANSITION MAINTAINING ALIGNMENTS TO ADJACENT ARCHITECTURAL FEATURES.
F124	INSET WRITE UP WALL NICHE WITH VERTICAL GLASS MARKER BOARDS AS NOTED PER FINISH PLAN. BUTT INDIVIDUAL BOARDS TOGETHER AT VERTICAL SIDE FOR TIGHT FLUSH SEAMS BETWEEN PANELS. FINISH OF ARCHITECTURAL NICHE AS SHOWN IN CORRESPONDING ELEVATION, PAINT FINISH VARIES.
F125	OPEN CEILING CONDITION THROUGHOUT. FINISHED SOFFIT CEILING SURROUND PAINTED PT20 WITH 4in. HIGH PT20 PERIMETER FASCIA. WALL PARTITION ABOVE SOFFIT TO BE SET BACK FROM FINISHED PERIMETER EDGE. CONSTRUCTED CONTINOUS TO DECK AND FINISHED WITH PT23. REFER TO CEILING WORKSPACE CEILING DETAIL 5/A934 AND TO GENERAL NOTES OPEN CEILING CONDITIONS FOR ADDITIONAL INFORMATION ON LEVEL OF FINISH REQUIRED AT SYSTEMS.

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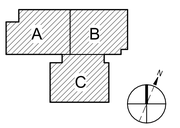
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Structural Engineer
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Iselin, NJ 08830

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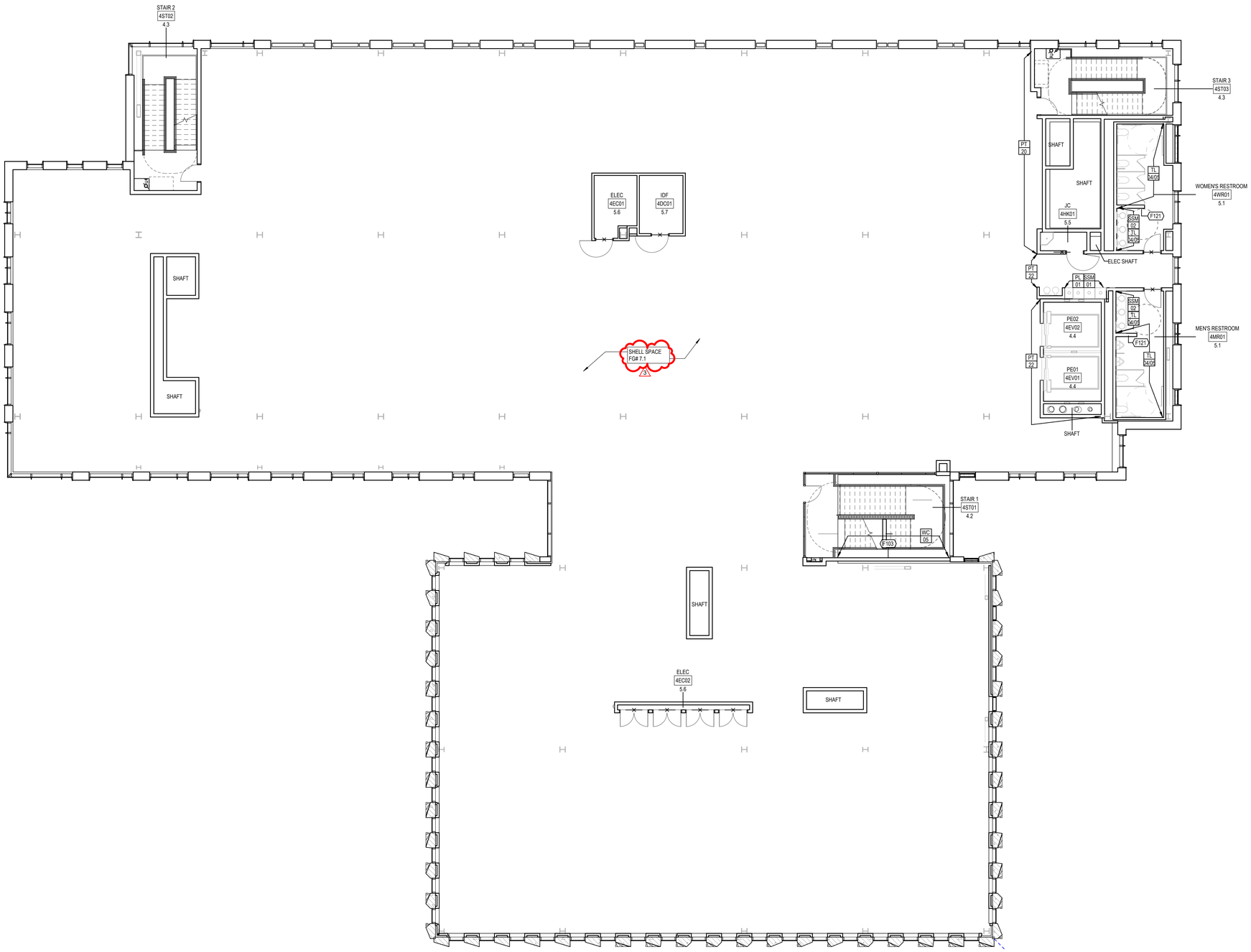
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Sheet Title
FINISH PLAN - LEVEL 2

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Sheet Number
I102

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1 FINISH PLAN - LEVEL 4
1/8" = 1'-0"

KEYNOTE LEGEND

F103	PROVIDE LEVEL 5 FINISH, INCLUDING PRIMER AND PAINT, AT GWB IN PREPARATION FOR APPLIED GRAPHICS, DRY ERASE PAINT, OR SPECIALTY FINISH. TO BE HAND TROWELLED AND SANDED LEVEL 5 FINISH TO ELIMINATE APPEARANCE AND SHADOWING OF METAL STUDS TELEGRAPHING TO PARTITION FACE. SPRAY-APPLIED OR ROLLER-APPLIED LEVEL 5 COMPOUND WILL NOT BE ACCEPTED.
F121	PROVIDE FULL HEIGHT TILE AT INDICATED RESTROOM WALLS AND RETURN WALLS WITHIN NOTED AREA. TILE TO BE COMBINATION OF TL04 AND TL05 WITH TL04 TO BEGIN AT FINISH FLOOR AND EXTEND IN FULL TILE SHEETS TO APPROX. 84in AFF. TL05 TO BEGIN AT TOP OF TL04 AND CONTINUE IN FULL SHEETS TO CEILING HEIGHT. PROVIDE SHLUTER QUADEC AND JOLLY TRIMS AT TILE TERMINATIONS AND OUTSIDE CORNERS.

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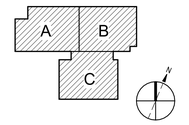
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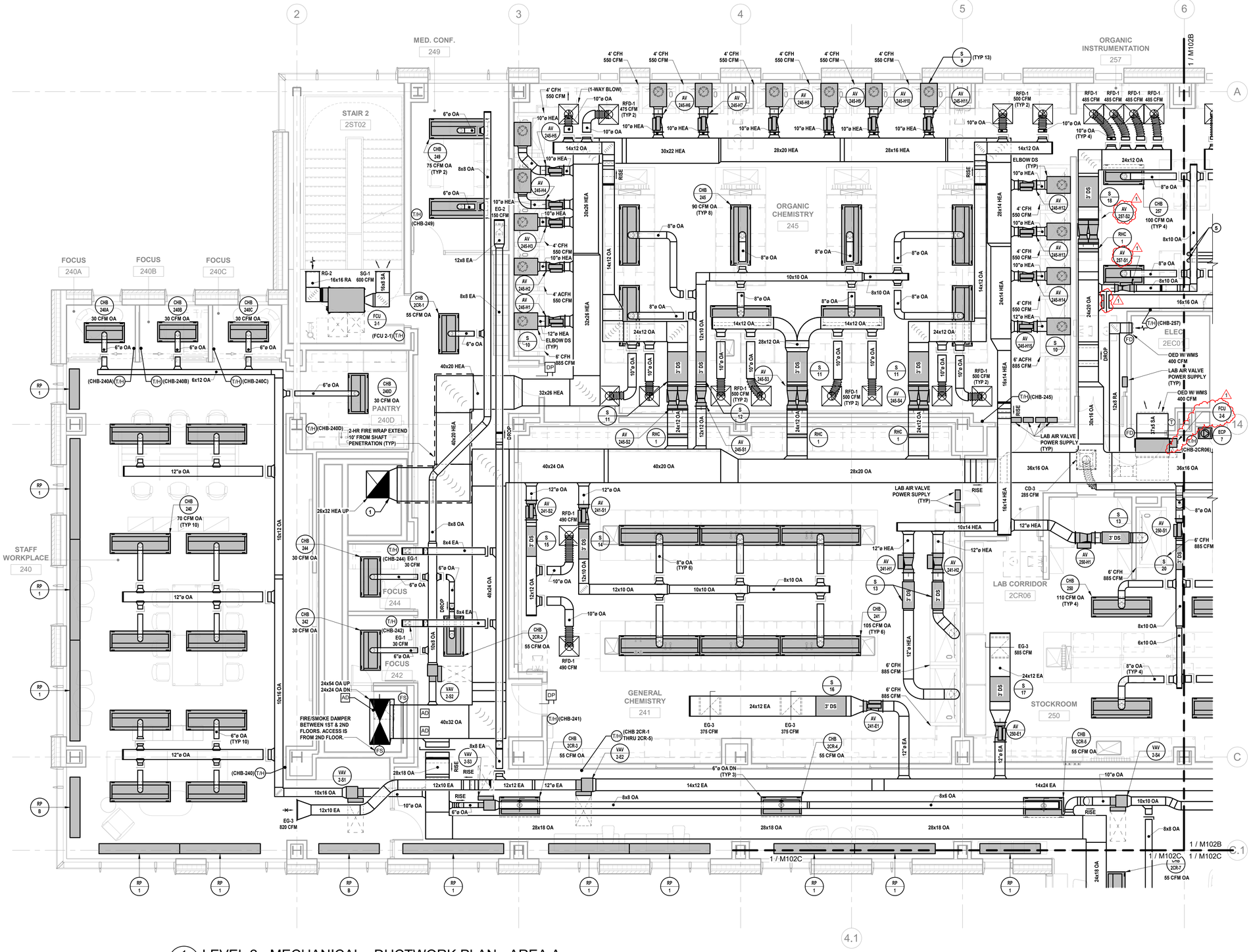
FINISH PLAN - LEVEL 4

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Sheet Number

I104

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1 M102A LEVEL 2 - MECHANICAL - DUCTWORK PLAN - AREA A

SCALE: 1/4" = 1'-0"

0' 1' 2' 4' 8'

SCALE BAR: 1/4"=1'-0"

3/23/2026 2:10:46 PM

MECHANICAL SYSTEM NOTES:

1. GENERAL NOTES:
   - A. REFER TO THE MECHANICAL AND ELECTRICAL LEAD SHEETS, M001 AND E001 FOR "NOTES" THAT PERTAIN TO THE SCOPE OF THIS PROJECT.
   - B. REFER TO M400 SERIES FLOW DIAGRAMS FOR FURTHER INFORMATION.
   - C. REFER TO M500 AND M600 SERIES DRAWINGS FOR DETAILS AND MECHANICAL SCHEDULES PERTAINING TO THIS PROJECT.
   - D. REFER TO M700 SERIES DRAWINGS FOR CONTROL DIAGRAMS.
   - E. REFER TO BOOK SPECIFICATIONS FOR PROJECT DETAILS AND EXECUTION REQUIREMENTS.
   - F. CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND APPURTENANCES IN STRICT ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS AND SHALL MAINTAIN ALL CLEARANCES (INSTALLATION AND MAINTENANCE) AS NOTED WITHIN THE WRITTEN ISNTRUCTIONS.
2. DUCTWORK SYSTEM NOTES:
   - A. CONTRACTOR SHALL FURNISH AND INSTALL ALL EQUIPMENT INDICATED ON PLANS AND AS SCHEDULED.
   - B. CONTRACTOR SHALL COORDIANTE ALL FRAME TYPES FOR AIR DEVICES WITH CEILING TYPES AS INDICATED ON THE ARCHITECTURAL DRAWINGS.
   - C. ALL DUCTWORK DIMENSIONS INDICATED ARE INSIDE CLEAR. REFER TO SPECIFICATIONS FOR ACOUSTICAL LINING AND INSULATION REQUIREMENTS.
   - D. ALL FIRE DAMPERS AND COMBINATION FIRE/SMOKE DAMPERS SHALL HAVE ACCESS DOORS INSTALLED PER THE PROJECT DETAILS. REFER TO ELECTRICAL DRAWINGS FOR FIRE ALARM REQUIREMENTS.
   - E. CONTRACTOR SHALL PROVIDE FIRE STOPPING EQUIVALENT TO HILTI SYSTEMS (OR APPROVED EQUAL) AT ALL PENETRATIONS OF FIRE RATED WALLS AND FLOOR PENETRATIONS. REFER TO SPECIFICATIONS FOR ADDITIONAL FIRE STOPPING REQUIREMENTS.
   - F. CONTRACTOR SHALL COORDINATE 120V POWER AT ALL BMS PANEL LOCATIONS WITH ELECTRICAL CONTRACTOR.
3. DUCTWORK KEYED NOTES:

GENERAL: KEYED NOTES ARE INDICATED WITH THE FOLLOWING SYMBOL (#) AND ARE NUMBERED AS FOLLOWS (NOT ALL NOTES ARE USED ON EVERY PLAN):

1. PROVIDE PRE-FABRICATED SUB-DUCT ASSEMBLY FOR CONNECTION OF HAZARDOUS EXHAUST DUCT AT VERTICAL RISER. REFER TO DETAIL FOR FURTHER INSTRUCTIONS.
2. PROVIDE 6"ø EXHAUST CONNECTION FROM SNORKEL LOCATED ABOVE LAB EQUIPMENT TO HAZARDOUS EXHAUST SYSTEM. .
3. PROVIDE 2.5"ø EXHAUST CONNECTION FROM MUFFLE FURNACE TO HAZARDOUS EXHAUST SYSTEM.
4. PROVIDE 6"ø EXHAUST CONNECTION FROM GAS SAFETY CABINET TO HAZARDOUS EXHAUST SYSTEM.
5. PROVIDE CONNECTION TO HAZARDOUS EXHAUST SYSTEM FOR MASS SPECTROMETER VACUUM PUMPS. REFER TO DETAIL. COORDINATE FINAL SIZE AND LOCATION WITH EQUIPMENT MANUFACTURER AND UNIVERSITY STAFF.
6. PROVIDE CONNECTION TO HAZARDOUS EXHAUST SYSTEM FOR GLOVE BOX. COORDINATE FINAL SIZE AND LOCATION WITH EQUIPMENT MANUFACTURER AND UNIVERSITY STAFF.
7. DIFFERENTIAL PRESSURE SENSOR SHALL MONITOR PRESSURE RELATIONSHIP BETWEEN ROOM AND ADJACENT SPACE. BMS TO MONITOR AND ALARM IF DIFFERENTIAL SETPOINT IS NOT MET FOR 5 MIN. (ADJ.) TIME PERIOD.
8. LAB SPACES SHALL BE PROVIDED WITH DEDICATED POWER SUPPLIES TO PROVIDE LOW VOLTAGE POWER TO AIR VALVES, CONTROLLERS, SENSORS AND OTHER CONTROL DEVICES AS REQUIRED. MOUNT POWER SUPPLIES ABOVE CEILING NEAR ENTRY TO ROOM. COORDINATE WITH ELECTRICAL CONTRACTOR FOR POWER. QUANTITY IS DEPENDENT ON THE AMOUNT OF LOW VOLTAGE LAB CONTROL EQUIPMENT SERVING THE ROOM. EACH POWER SUPPLY HAS (5) 100 VA FEEDS. BASIS OF DESIGN: RIB PSH 500A

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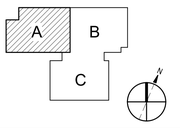
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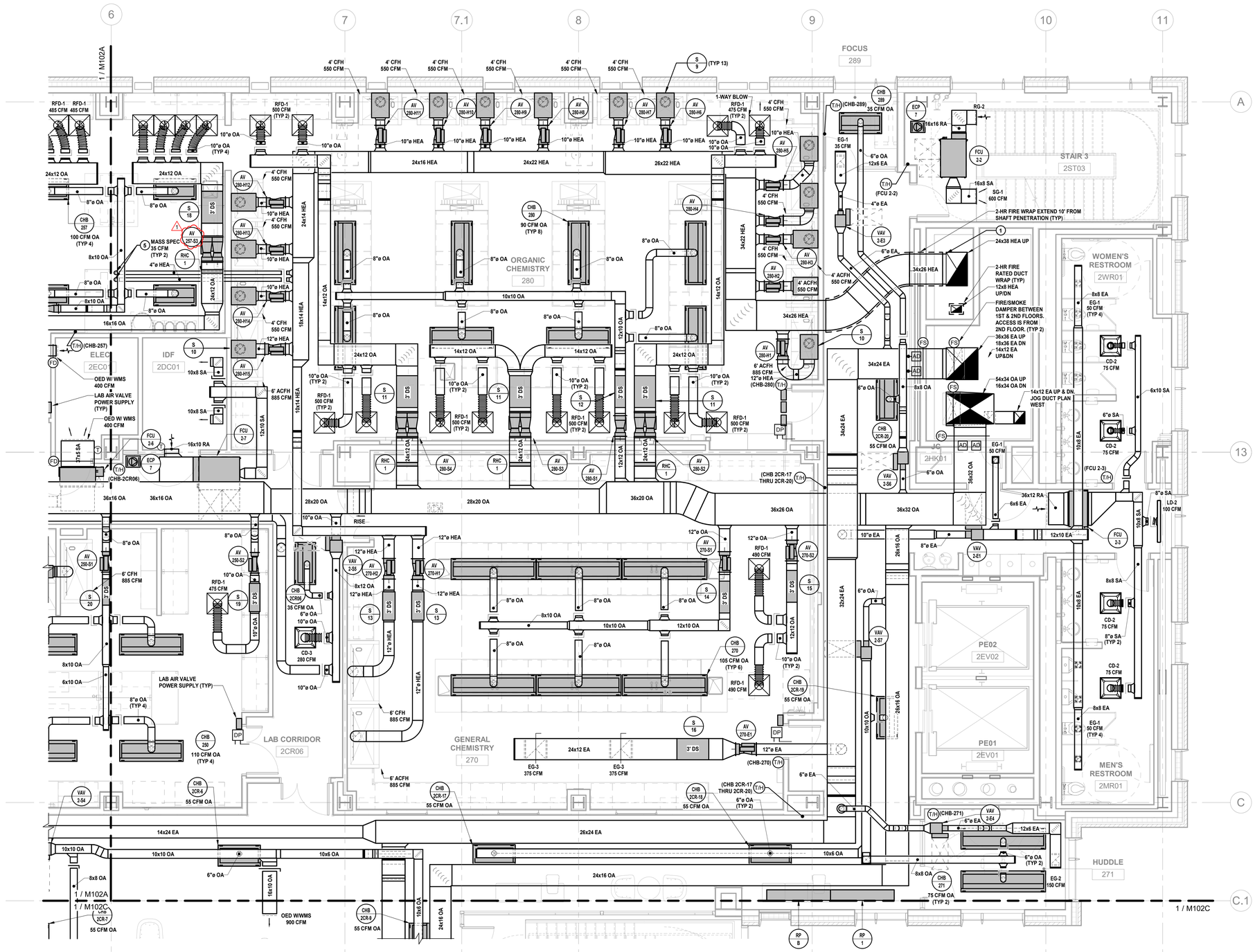
Sheet Title

MECHANICAL - LEVEL 2 DUCTWORK PLAN - AREA A

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

M102A



1 M102B **LEVEL 2 - MECHANICAL - DUCTWORK PLAN - AREA B**
SCALE: 1/4" = 1'-0"

SCALE BAR: 1/4"=1'-0" (0' 1' 2" 4' 8')

3/3/2026 2:10:52 PM

MECHANICAL SYSTEM NOTES:

1. GENERAL NOTES:
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   - C. REFER TO M500 AND M600 SERIES DRAWINGS FOR DETAILS AND MECHANICAL SCHEDULES PERTAINING TO THIS PROJECT.
   - D. REFER TO M700 SERIES DRAWINGS FOR CONTROL DIAGRAMS.
   - E. REFER TO BOOK SPECIFICATIONS FOR PROJECT DETAILS AND EXECUTION REQUIREMENTS.
   - F. CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND APPURTENANCES IN STRICT ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS AND SHALL MAINTAIN ALL CLEARANCES (INSTALLATION AND MAINTENANCE) AS NOTED WITHIN THE WRITTEN ISNTRUCTIONS.
2. DUCTWORK SYSTEM NOTES:
   - A. CONTRACTOR SHALL FURNISH AND INSTALL ALL EQUIPMENT INDICATED ON PLANS AND AS SCHEDULED.
   - B. CONTRACTOR SHALL COORDIANTE ALL FRAME TYPES FOR AIR DEVICES WITH CEILING TYPES AS INDICATED ON THE ARCHITECTURAL DRAWINGS.
   - C. ALL DUCTWORK DIMENSIONS INDICATED ARE INSIDE CLEAR. REFER TO SPECIFICATIONS FOR ACOUSTICAL LINING AND INSULATION REQUIREMENTS.
   - D. ALL FIRE DAMPERS AND COMBINATION FIRE/SMOKE DAMPERS SHALL HAVE ACCESS DOORS INSTALLED PER THE PROJECT DETAILS. REFER TO ELECTRICAL DRAWINGS FOR FIRE ALARM REQUIREMENTS.
   - E. CONTRACTOR SHALL PROVIDE FIRE STOPPING EQUIVALENT TO HILTI SYSTEMS (OR APPROVED EQUAL) AT ALL PENETRATIONS OF FIRE RATED WALLS AND FLOOR PENETRATIONS. REFER TO SPECIFICATIONS FOR ADDITIONAL FIRE STOPPING REQUIREMENTS.
   - F. CONTRACTOR SHALL COORDINATE 120V POWER AT ALL BMS PANEL LOCATIONS WITH ELECTRICAL CONTRACTOR.
3. DUCTWORK KEYED NOTES:
   GENERAL- KEYED NOTES ARE INDICATED WITH THE FOLLOWING SYMBOL (#) AND ARE NUMBERED AS FOLLOWS (NOT ALL NOTES ARE USED ON EVERY PLAN):
   1. PROVIDE PRE-FABRICATED SUB-DUCT ASSEMBLY FOR CONNECTION OF HAZARDOUS EXHAUST DUCT AT VERTICAL RISER. REFER TO DETAIL FOR FURTHER INSTRUCTIONS.
   2. PROVIDE 6"ø EXHAUST CONNECTION FROM SNORKEL LOCATED ABOVE LAB EQUIPMENT TO HAZARDOUS EXHAUST SYSTEM. .
   3. PROVIDE 2.5"ø EXHAUST CONNECTION FROM MUFFLE FURNACE TO HAZARDOUS EXHAUST SYSTEM.
   4. PROVIDE 6"ø EXHAUST CONNECTION FROM GAS SAFETY CABINET TO HAZARDOUS EXHAUST SYSTEM.
   5. PROVIDE CONNECTION TO HAZARDOUS EXHAUST SYSTEM FOR MASS SPECTROMETER VACUUM PUMPS. REFER TO DETAIL. COORDINATE FINAL SIZE AND LOCATION WITH EQUIPMENT MANUFACTURER AND UNIVERSITY STAFF.
   6. PROVIDE CONNECTION TO HAZARDOUS EXHAUST SYSTEM FOR GLOVE BOX. COORDINATE FINAL SIZE AND LOCATION WITH EQUIPMENT MANUFACTURER AND UNIVERSITY STAFF.
   7. DIFFERENTIAL PRESSURE SENSOR SHALL MONITOR PRESSURE RELATIONSHIP BETWEEN ROOM AND ADJACENT SPACE. BMS TO MONITOR AND ALARM IF DIFFERENTIAL SETPOINT IS NOT MET FOR 5 MIN. (ADJ.) TIME PERIOD.
   8. LAB SPACES SHALL BE PROVIDED WITH DEDICATED POWER SUPPLIES TO PROVIDE LOW VOLTAGE POWER TO AIR VALVES, CONTROLLERS, SENSORS AND OTHER CONTROL DEVICES AS REQUIRED. MOUNT POWER SUPPLIES ABOVE CEILING NEAR ENTRY TO ROOM. COORDINATE WITH ELECTRICAL CONTRACTOR FOR POWER. QUANTITY IS DEPENDENT ON THE AMOUNT OF LOW VOLTAGE LAB CONTROL EQUIPMENT SERVING THE ROOM. EACH POWER SUPPLY HAS (5) 100 VA FEEDS. BASIS OF DESIGN: RIB PSH 500A

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Project
Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For
Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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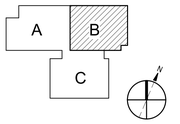
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	ISSUED FOR BID	2026-01-19
1	ADDENDUM #5	2026-03-23

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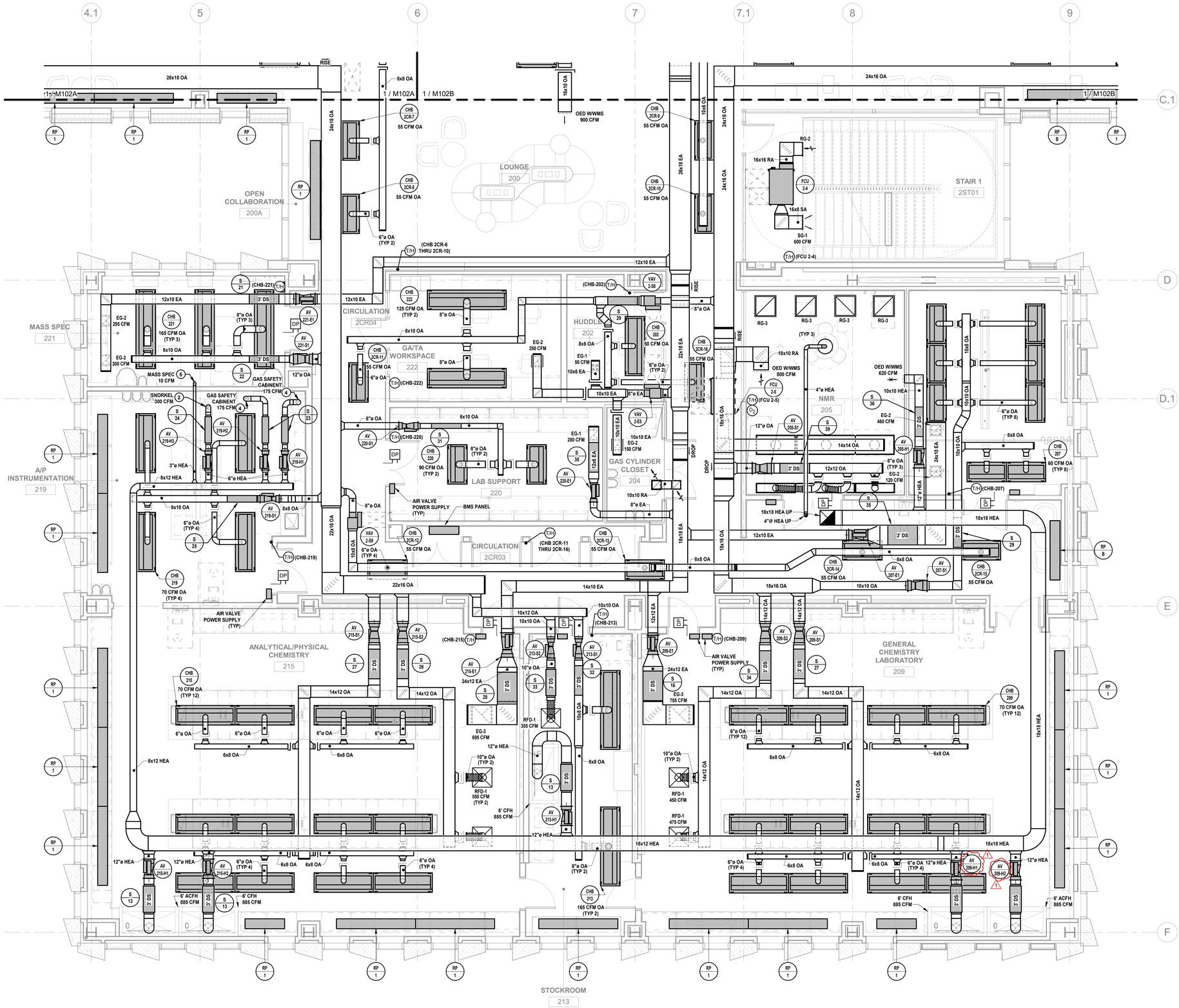
Sheet Title

MECHANICAL - LEVEL 2 DUCTWORK PLAN - AREA B

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

M102B



1 M102C **LEVEL 2 - MECHANICAL - DUCTWORK PLAN - AREA C**

SCALE: 1/4" = 1'-0"

0' 1' 2' 4' 8'

SCALE BAR: 1/4"=1'-0"

3/23/2026 2:10:56 PM

MECHANICAL SYSTEM NOTES:

1. GENERAL NOTES:
   - A. REFER TO THE MECHANICAL AND ELECTRICAL LEAD SHEETS, M001 AND E001 FOR "NOTES" THAT PERTAIN TO THE SCOPE OF THIS PROJECT.
   - B. REFER TO M400 SERIES FLOW DIAGRAMS FOR FURTHER INFORMATION.
   - C. REFER TO M500 AND M600 SERIES DRAWINGS FOR DETAILS AND MECHANICAL SCHEDULES PERTAINING TO THIS PROJECT.
   - D. REFER TO M700 SERIES DRAWINGS FOR CONTROL DIAGRAMS.
   - E. REFER TO BOOK SPECIFICATIONS FOR PROJECT DETAILS AND EXECUTION REQUIREMENTS.
   - F. CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND APPURTENANCES IN STRICT ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS AND SHALL MAINTAIN ALL CLEARANCES (INSTALLATION AND MAINTENANCE) AS NOTED WITHIN THE WRITTEN ISNTRUCTIONS.
2. DUCTWORK SYSTEM NOTES:
   - A. CONTRACTOR SHALL FURNISH AND INSTALL ALL EQUIPMENT INDICATED ON PLANS AND AS SCHEDULED.
   - B. CONTRACTOR SHALL COORDIANTE ALL FRAME TYPES FOR AIR DEVICES WITH CEILING TYPES AS INDICATED ON THE ARCHITECTURAL DRAWINGS.
   - C. ALL DUCTWORK DIMENSIONS INDICATED ARE INSIDE CLEAR. REFER TO SPECIFICATIONS FOR ACOUSTICAL LINING AND INSULATION REQUIREMENTS.
   - D. ALL FIRE DAMPERS AND COMBINATION FIRE/SMOKE DAMPERS SHALL HAVE ACCESS DOORS INSTALLED PER THE PROJECT DETAILS. REFER TO ELECTRICAL DRAWINGS FOR FIRE ALARM REQUIREMENTS.
   - E. CONTRACTOR SHALL PROVIDE FIRE STOPPING EQUIVALENT TO HILTI SYSTEMS (OR APPROVED EQUAL) AT ALL PENETRATIONS OF FIRE RATED WALLS AND FLOOR PENETRATIONS. REFER TO SPECIFICATIONS FOR ADDITIONAL FIRE STOPPING REQUIREMENTS.
   - F. CONTRACTOR SHALL COORDINATE 120V POWER AT ALL BMS PANEL LOCATIONS WITH ELECTRICAL CONTRACTOR.
3. DUCTWORK KEYED NOTES:

GENERAL: KEYED NOTES ARE INDICATED WITH THE FOLLOWING SYMBOL (#) AND ARE NUMBERED AS FOLLOWS (NOT ALL NOTES ARE USED ON EVERY PLAN):

1. PROVIDE PRE-FABRICATED SUB-DUCT ASSEMBLY FOR CONNECTION OF HAZARDOUS EXHAUST DUCT AT VERTICAL RISER. REFER TO DETAIL FOR FURTHER INSTRUCTIONS.
2. PROVIDE 6"ø EXHAUST CONNECTION FROM SNORKEL LOCATED ABOVE LAB EQUIPMENT TO HAZARDOUS EXHAUST SYSTEM. .
3. PROVIDE 2.5"ø EXHAUST CONNECTION FROM MUFFLE FURNACE TO HAZARDOUS EXHAUST SYSTEM.
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5. PROVIDE CONNECTION TO HAZARDOUS EXHAUST SYSTEM FOR MASS SPECTROMETER VACUUM PUMPS. REFER TO DETAIL. COORDINATE FINAL SIZE AND LOCATION WITH EQUIPMENT MANUFACTURER AND UNIVERSITY STAFF.
6. PROVIDE CONNECTION TO HAZARDOUS EXHAUST SYSTEM FOR GLOVE BOX. COORDINATE FINAL SIZE AND LOCATION WITH EQUIPMENT MANUFACTURER AND UNIVERSITY STAFF.
7. DIFFERENTIAL PRESSURE SENSOR SHALL MONITOR PRESSURE RELATIONSHIP BETWEEN ROOM AND ADJACENT SPACE. BMS TO MONITOR AND ALARM IF DIFFERENTIAL SETPOINT IS NOT MET FOR 5 MIN. (ADJ.) TIME PERIOD.
8. LAB SPACES SHALL BE PROVIDED WITH DEDICATED POWER SUPPLIES TO PROVIDE LOW VOLTAGE POWER TO AIR VALVES, CONTROLLERS, SENSORS AND OTHER CONTROL DEVICES AS REQUIRED. MOUNT POWER SUPPLIES ABOVE CEILING NEAR ENTRY TO ROOM. COORDINATE WITH ELECTRICAL CONTRACTOR FOR POWER. QUANTITY IS DEPENDENT ON THE AMOUNT OF LOW VOLTAGE LAB CONTROL EQUIPMENT SERVING THE ROOM. EACH POWER SUPPLY HAS (5) 100 VA FEEDS. BASIS OF DESIGN: RIB PSH 500A

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5 Bryant Park
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New York, NY 10018 USA
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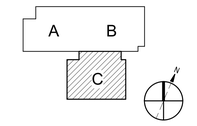
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A/V Engineer
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1	ADDENDUM #5	2026-03-23

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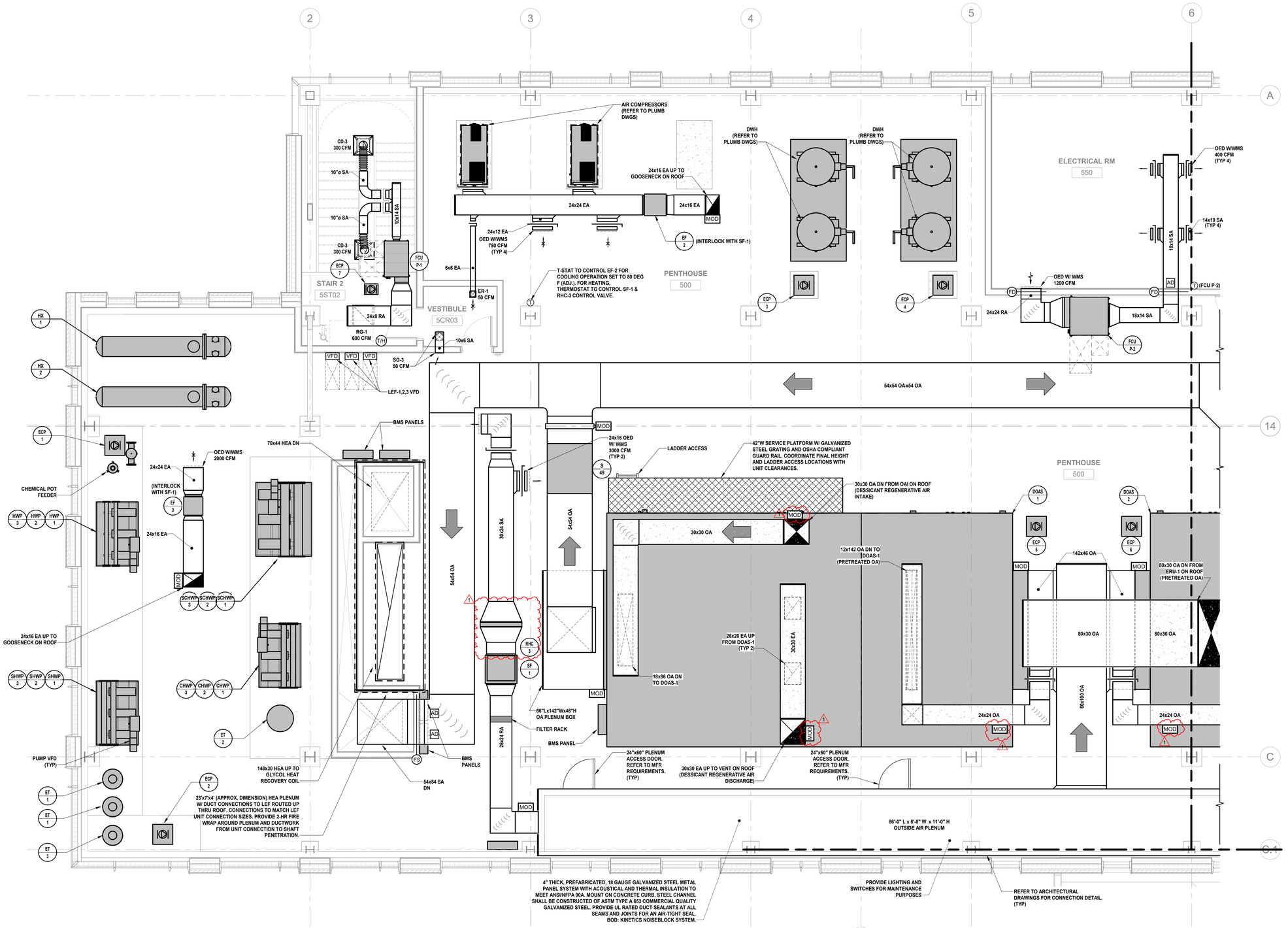
Sheet Title

MECHANICAL - LEVEL 2 DUCTWORK PLAN - AREA C

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

M102C



1 M105A PENTHOUSE - MECHANICAL - DUCTWORK PLAN - AREA A

SCALE: 1/4" = 1'-0"

0' 1' 2' 4' 8'

SCALE BAR: 1/4"=1'-0"

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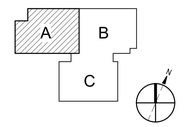
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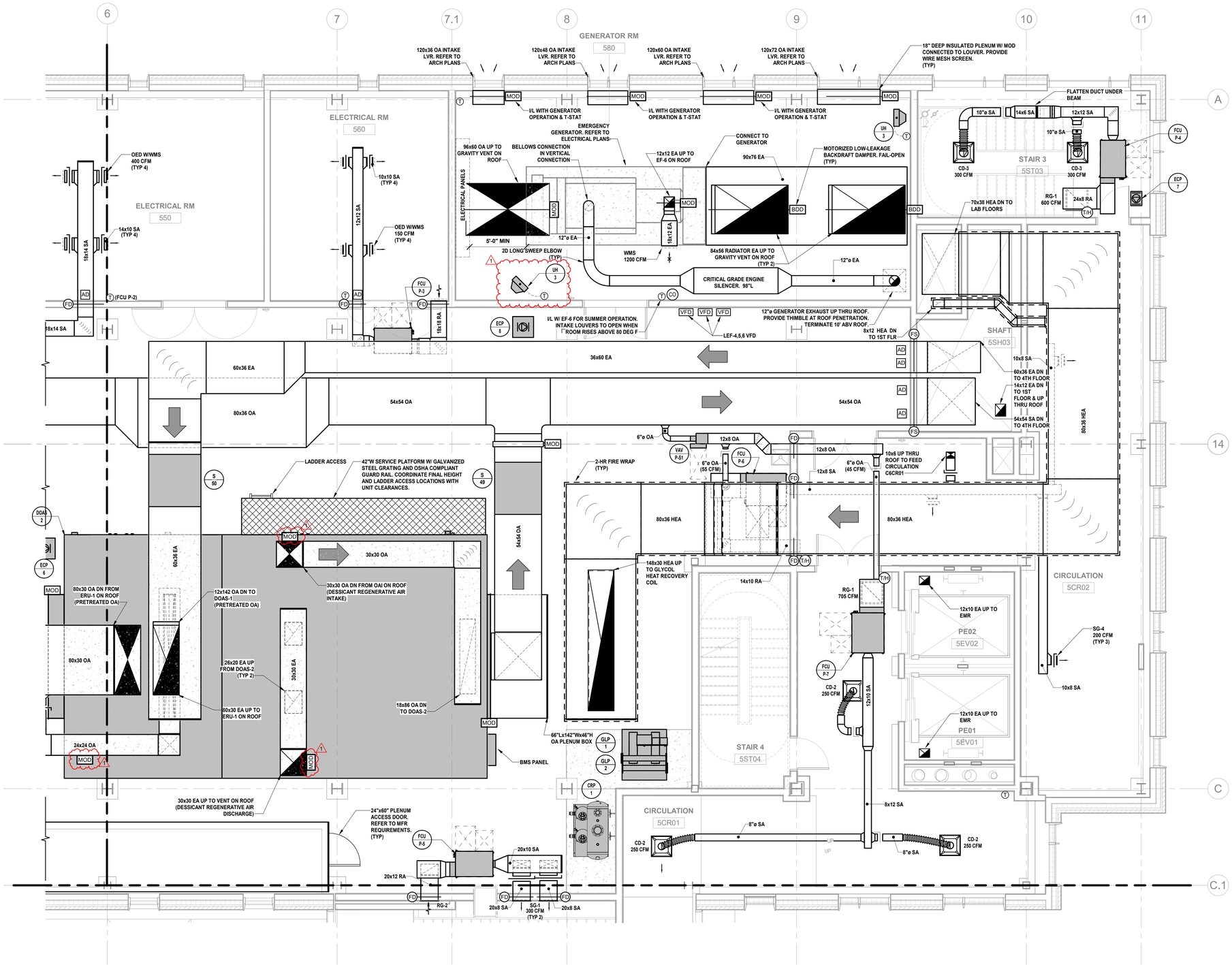
Sheet Title

MECHANICAL - PENTHOUSE PLAN - AREA A

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

M105A



1 M105B PENTHOUSE - MECHANICAL - DUCTWORK PLAN - AREA B

SCALE: 1/4" = 1'-0"

0' 1' 2' 4' 8'

SCALE BAR: 1/4"=1'-0"

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1065 Avenue of the Americas, 6th Floor
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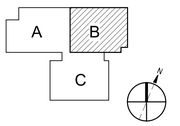
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275 Madison Avenue, 14th Floor
New York, NY 10016

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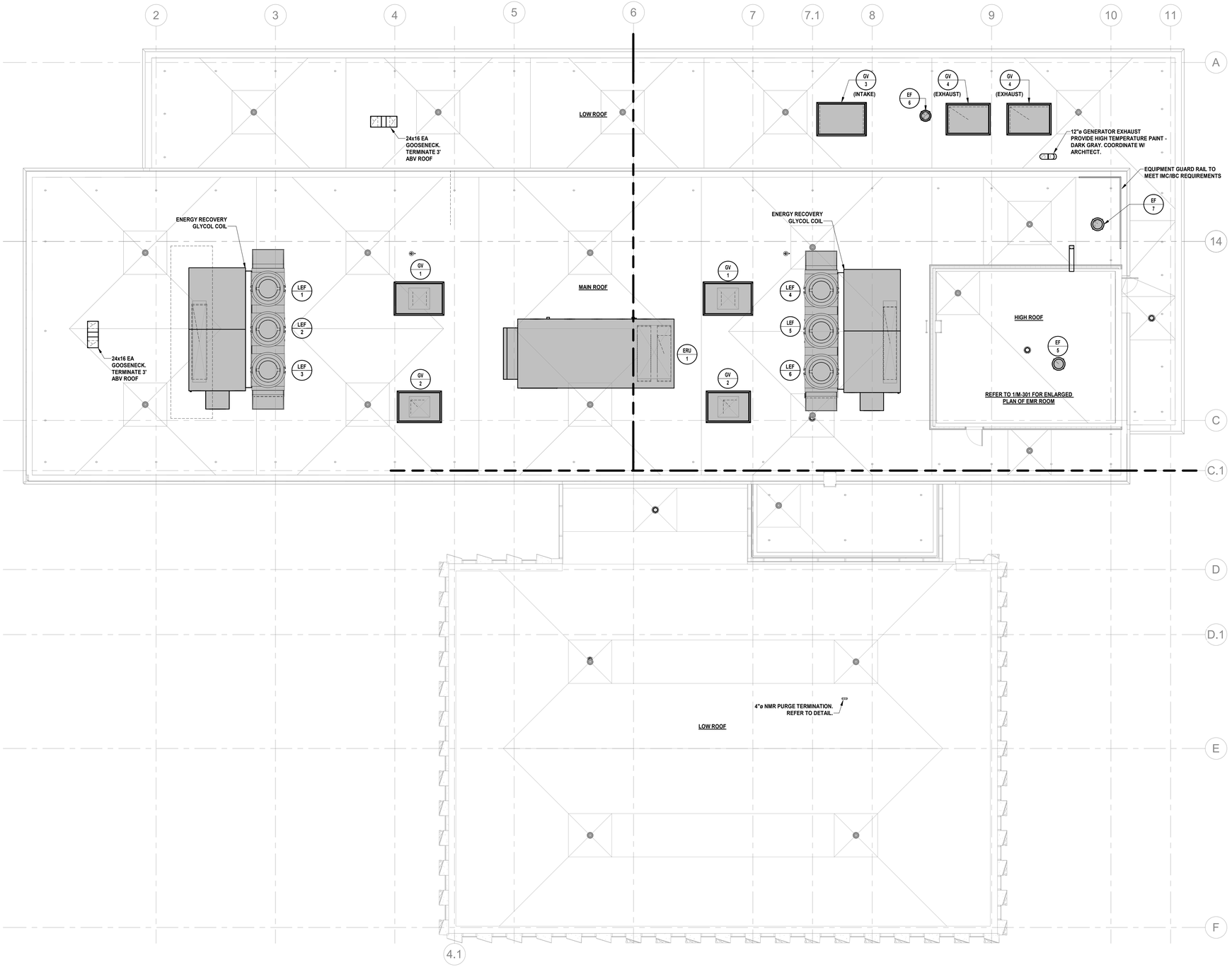
Sheet Title

MECHANICAL - PENTHOUSE PLAN - AREA B

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

M105B



1 M106 ROOF - MECHANICAL PLAN

SCALE: 1/8" = 1'-0"

0' 2' 4' 8' 16'

SCALE BAR: 1/8"=1'-0"

3/23/2026 2:03:52 PM

MECHANICAL SYSTEM NOTES:

1. GENERAL NOTES:
   - A. REFER TO THE MECHANICAL AND ELECTRICAL LEAD SHEETS, M001 AND E001 FOR "NOTES" THAT PERTAIN TO THE SCOPE OF THIS PROJECT.
   - B. REFER TO M400 SERIES FLOW DIAGRAMS FOR FURTHER INFORMATION.
   - C. REFER TO M500 AND M600 SERIES DRAWINGS FOR DETAILS AND MECHANICAL SCHEDULES PERTAINING TO THIS PROJECT.
   - D. REFER TO M700 SERIES DRAWINGS FOR CONTROL DIAGRAMS.
   - E. REFER TO BOOK SPECIFICATIONS FOR PROJECT DETAILS AND EXECUTION REQUIREMENTS.
   - F. CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND APPURTENANCES IN STRICT ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS AND SHALL MAINTAIN ALL CLEARANCES (INSTALLATION AND MAINTENANCE) AS NOTED WITHIN THE WRITTEN ISNTRUCTIONS.
2. DUCTWORK SYSTEM NOTES:
   - A. CONTRACTOR SHALL FURNISH AND INSTALL ALL EQUIPMENT INDICATED ON PLANS AND AS SCHEDULED.
   - B. CONTRACTOR SHALL COORDIANTE ALL FRAME TYPES FOR AIR DEVICES WITH CEILING TYPES AS INDICATED ON THE ARCHITECTURAL DRAWINGS.
   - C. ALL DUCTWORK DIMENSIONS INDICATED ARE INSIDE CLEAR. REFER TO SPECIFICATIONS FOR ACOUSTICAL LINING AND INSULATION REQUIREMENTS.
   - D. ALL FIRE DAMPERS AND COMBINATION FIRE/SMOKE DAMPERS SHALL HAVE ACCESS DOORS INSTALLED PER THE PROJECT DETAILS. REFER TO ELECTRICAL DRAWINGS FOR FIRE ALARM REQUIREMENTS.
   - E. CONTRACTOR SHALL PROVIDE FIRE STOPPIGN EQUIVALENT TO HILTI SYSTEMS (OR APPROVED EQUAL) AT ALL PENETRATIONS OF FIRE RATED WALLS AND FLOOR PENETRATIONS. REFER TO SPECIFICATIONS FOR ADDITIONAL FIRE STOPPING REQUIREMENTS.
   - F. CONTRACTOR SHALL COORDINATE 120V POWER AT ALL BMS PANEL LOCATIONS WITH ELECTRICAL CONTRACTOR.

1

3. GENERAL ROOF NOTES
   - A. ALL DUCTWORK PENETRATIONS THRU THE ROOF SHALL BE PROVIDED WITH A MINIMUM 20" TALL CURB. REFER TO DETAIL ON M-501. FLASH AND SEAL PER ARCHITECTURAL DETAILS.
   - B. ALL ROOF WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE ARCHITECTURAL DRAWINGS AND DETAILS. WORK SHALL BE PERFORMED IN A MANNER THAT THE ROOF WARRANTIES ARE MAINTAINED.
   - C. EQUIPMENT SHALL BE LOCATED GREATER THAN 10'-0" FROM THE ROOF EDGE. WHERE THIS DIMENSION CANNOT BE ACHIEVED. GUARD RAILS SHALL BE COORDINATED AND PROVIDED IN ACCORDANCE WITH THE INTERNATIONAL BUILDING CODE.
   - D. ALL CODE REQUIRED CLEARANCES FROM EXHAUST TERMINATIONS TO BUILDING INTAKES SHALL BE MET.
   - E. MANUFACTURER REQUIRED EQUIPMENT ACCESS SHALL BE PROVIDED.

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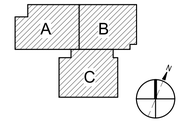
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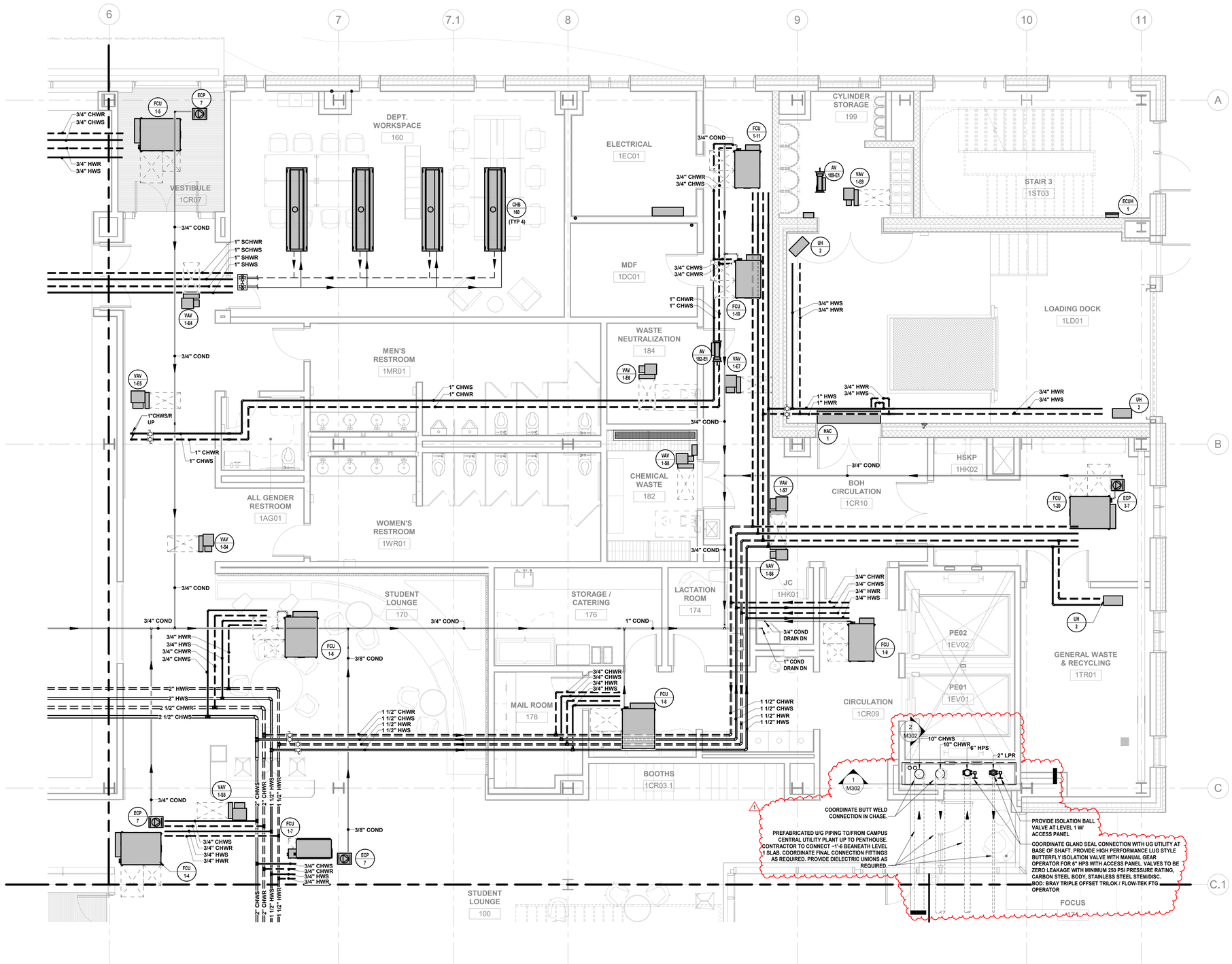
Sheet Title

MECHANICAL - ROOF PLAN

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

M106



1 M201B LEVEL 1 - MECHANICAL - PIPING PLAN - AREA B

SCALE: 1/4" = 1'-0"

0' 1' 2' 4' 8'

SCALE BAR: 1/4"=1'-0"

MECHANICAL SYSTEM NOTES:

1. GENERAL NOTES:
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   - C. REFER TO M500 AND M600 SERIES DRAWINGS FOR DETAILS AND MECHANICAL SCHEDULES PERTAINING TO THIS PROJECT.
   - D. REFER TO M700 SERIES DRAWINGS FOR CONTROL DIAGRAMS.
   - E. REFER TO BOOK SPECIFICATIONS FOR PROJECT DETAILS AND EXECUTION REQUIREMENTS.
   - F. CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND APPURTENANCES IN STRICT ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS AND SHALL MAINTAIN ALL CLEARANCES (INSTALLATION AND MAINTENANCE) AS NOTED WITHIN THE WRITTEN ISNTRUCTIONS.
2. PIPING SYSTEM NOTES:
   - A. CONTRACTOR SHALL FIELD ROUTE FINAL CONNECTIONS TO ALL EQUIPMENT INCLUDING ALL VALVES, FITTINGS, AND APPURTENENACES AS PER THE PROJECT SPECIFICATIONS AND DETAILS.
   - B. PROVIDE ISOLATION VALVES WITH DRAINS AT THE MAIN PIPING RUN OUT FROM THE SHAFT CONNECTION AT EACH FLOOR LEVEL.
   - C. CONTRACTOR SHALL PROVIDE DRAIN VALVES AT ALL LOW POINTS OF THE SYSTEM AND AIR VENTS AT ALL HIGH POINTS IN THE SYSTEM.
   - D. ALL MATERIALS SHALL BE PLENUM RATED UNLESS NOTED OTHERWISE.
   - E. CONTRACTOR SHALL PROVIDE FIRE STOPPING EQUIVALENT TO HILTI SYSTEMS (OR APPROVED EQUAL) AT ALL PENETRATIONS OF FIRE RATED WALLS AND FLOOR PENETRATIONS. REFER TO SPECIFICATIONS FOR ADDITIONAL FIRE STOPPING REQUIREMENTS.
   - F. CONTRACTOR SHALL SLOPE ALL CONDENSATE PIPING 1% IN THE DIRECTION OF THE DISCHARGE LOCATION.
   - G. COORDINATE FINAL LOCATIONS OF ALL EQUIPMENT TO PROVIDE PROPER CLEARANCES, MAINTENANCE, AND ACCESS.

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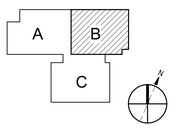
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A/V Engineer
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NOT FOR CONSTRUCTION

No.	Description	Date
	ISSUED FOR CONTRACT DOCUMENTS	2025-06-14
	ISSUED FOR BID	2026-01-19
1	ADDENDUM #5	2026-03-23

Project No:

Sheet Title

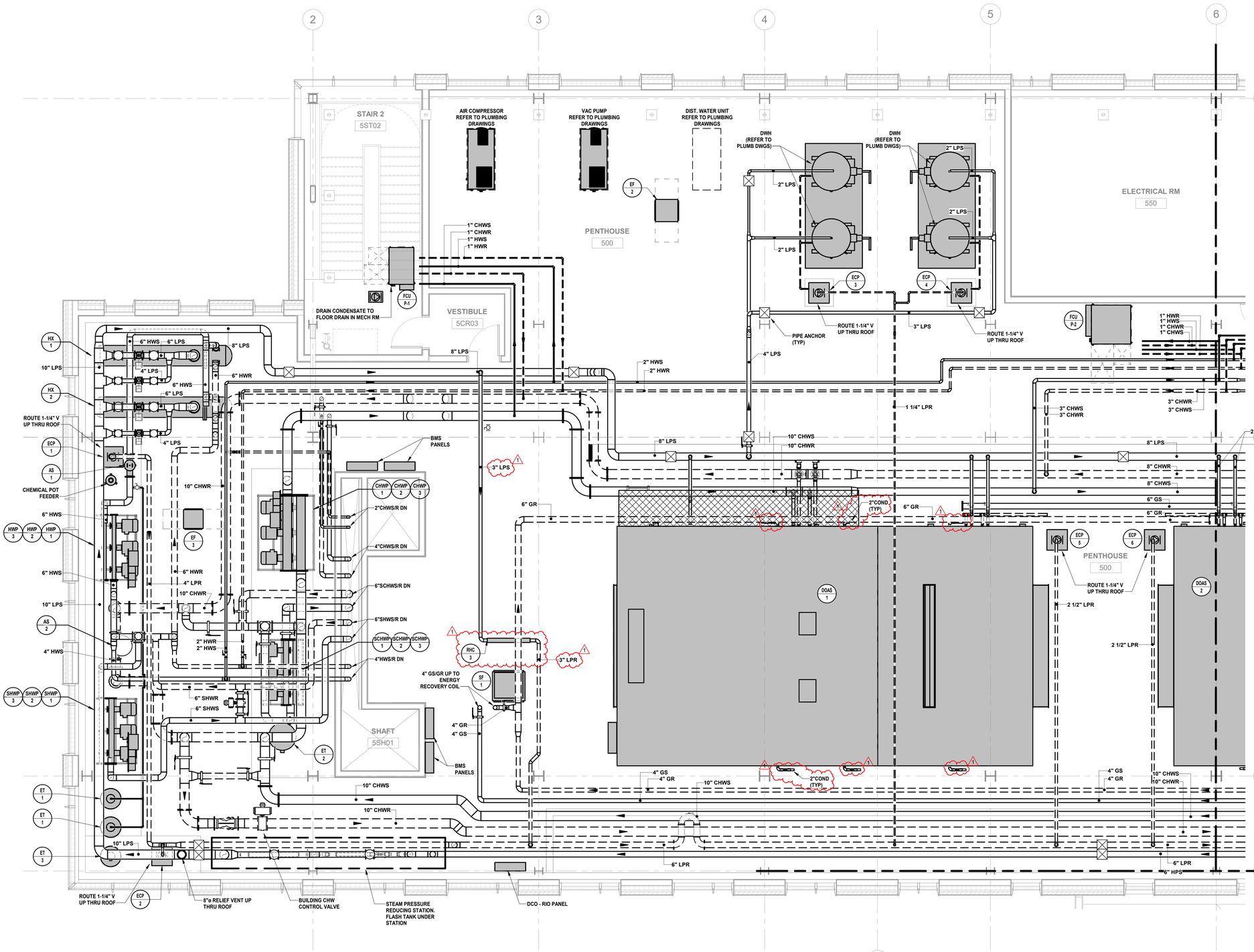
MECHANICAL - LEVEL 1 PIPING PLAN - AREA B

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

M201B

3/23/2026 2:03:55 PM



1 M205A MECHANICAL - PENTHOUSE PIPING PLAN - AREA A

SCALE: 1/4" = 1'-0"

0' 1' 2' 4' 8'

SCALE BAR: 1/4"=1'-0"

MECHANICAL SYSTEM NOTES:

1. GENERAL NOTES:
   - A. REFER TO THE MECHANICAL AND ELECTRICAL LEAD SHEETS, M001 AND E001 FOR "NOTES" THAT PERTAIN TO THE SCOPE OF THIS PROJECT.
   - B. REFER TO M400 SERIES FLOW DIAGRAMS FOR FURTHER INFORMATION.
   - C. REFER TO M500 AND M600 SERIES DRAWINGS FOR DETAILS AND MECHANICAL SCHEDULES PERTAINING TO THIS PROJECT.
   - D. REFER TO M700 SERIES DRAWINGS FOR CONTROL DIAGRAMS.
   - E. REFER TO BOOK SPECIFICATIONS FOR PROJECT DETAILS AND EXECUTION REQUIREMENTS.
   - F. CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND APPURTENANCES IN STRICT ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS AND SHALL MAINTAIN ALL CLEARANCES (INSTALLATION AND MAINTENANCE) AS NOTED WITHIN THE WRITTEN ISNTRUCTIONS.
2. PIPING SYSTEM NOTES:
   - A. CONTRACTOR SHALL FIELD ROUTE FINAL CONNECTIONS TO ALL EQUIPMENT INCLUDING ALL VALVES, FITTINGS, AND APPURTENENACES AS PER THE PROJECT SPECIFICATIONS AND DETAILS.
   - B. PROVIDE ISOLATION VALVES WITH DRAINS AT THE MAIN PIPING RUN OUT FROM THE SHAFT CONNECTION AT EACH FLOOR LEVEL.
   - C. CONTRACTOR SHALL PROVIDE DRAIN VALVES AT ALL LOW POINTS OF THE SYSTEM AND AIR VENTS AT ALL HIGH POINTS IN THE SYSTEM.
   - D. ALL MATERIALS SHALL BE PLENUM RATED UNLESS NOTED OTHERWISE.
   - E. CONTRACTOR SHALL PROVIDE FIRE STOPPING EQUIVALENT TO HILTI SYSTEMS (OR APPROVED EQUAL) AT ALL PENETRATIONS OF FIRE RATED WALLS AND FLOOR PENETRATIONS. REFER TO SPECIFICATIONS FOR ADDITIONAL FIRE STOPPING REQUIREMENTS.
   - F. CONTRACTOR SHALL SLOPE ALL CONDENSATE PIPING 1% IN THE DIRECTION OF THE DISCHARGE LOCATION.
   - G. COORDINATE FINAL LOCATIONS OF ALL EQUIPMENT TO PROVIDE PROPER CLEARANCES, MAINTENANCE, AND ACCESS.

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building

1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University

1 Normal Avenue Montclair, NJ 07043

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5 Bryant Park
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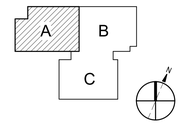
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Clifton, NJ 07013

Key Plan



Professional Seals

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1	ADDENDUM #5	2026-03-23

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Sheet Title

MECHANICAL - PENTHOUSE PIPING PLAN - AREA A

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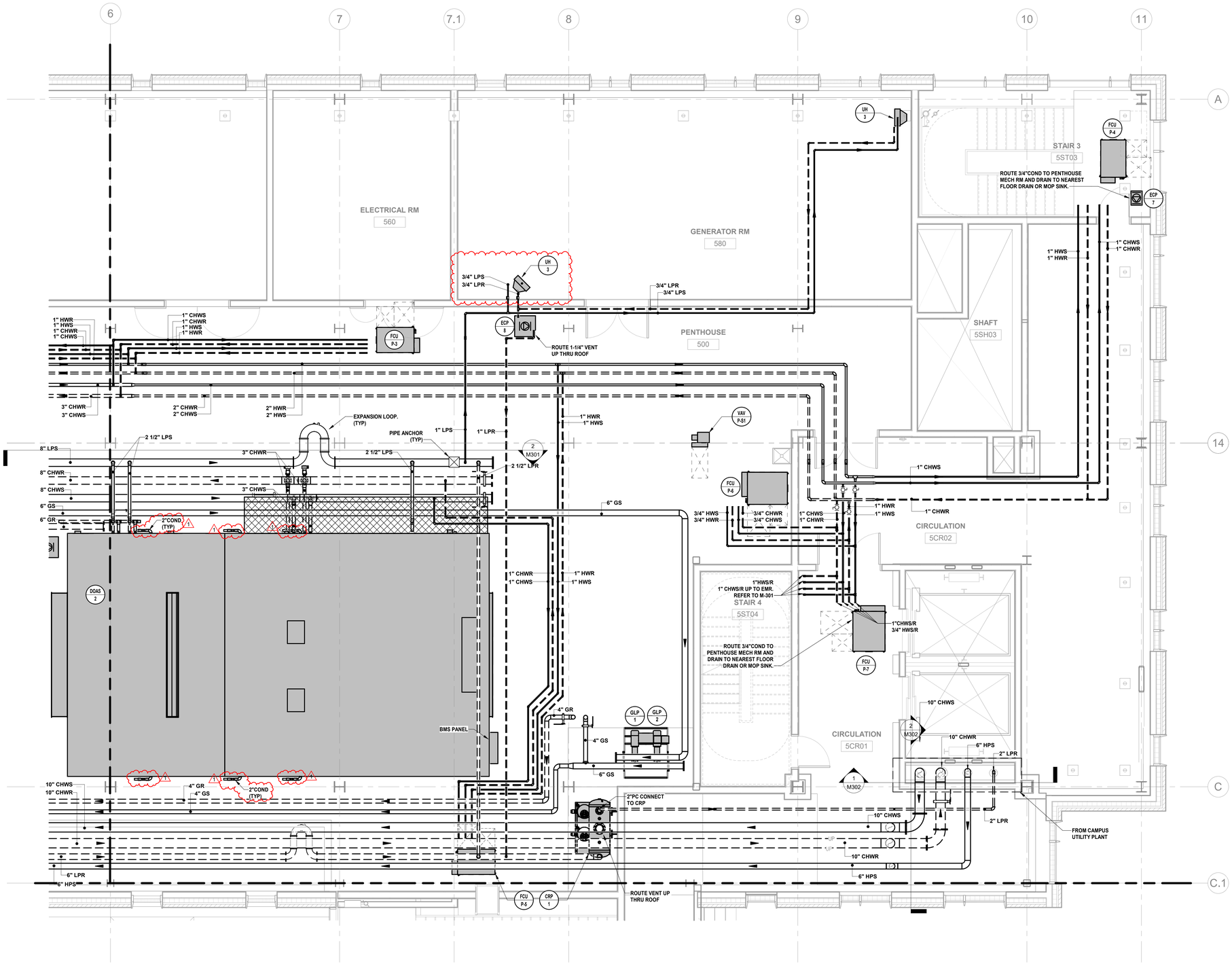
Sheet Number

M205A

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MECHANICAL SYSTEM NOTES:

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1 M205B MECHANICAL - PENTHOUSE PIPING PLAN - AREA B

SCALE: 1/4" = 1'-0"

0' 1' 2' 4' 8'

SCALE BAR: 1/4"=1'-0"

3/23/2026 2:04:19 PM

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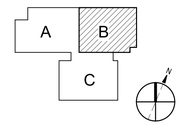
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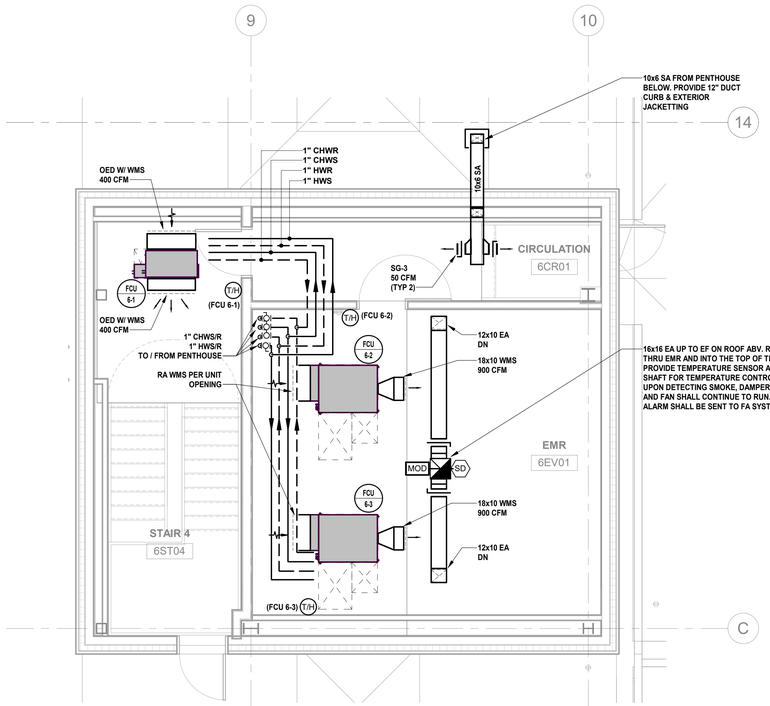
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MECHANICAL - PENTHOUSE PIPING PLAN - AREA B

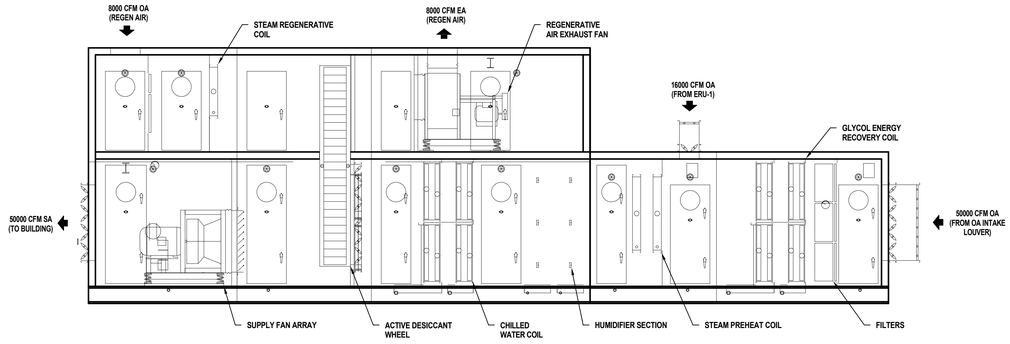
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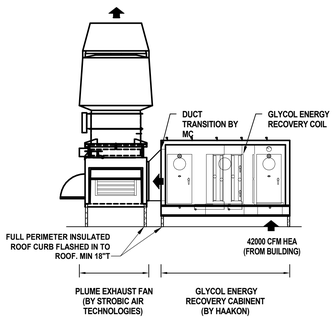
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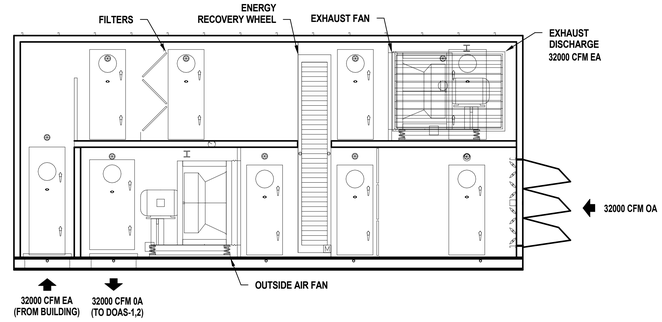
1 M301 EMR - MECHANICAL PLAN
SCALE: 1/4" = 1'-0"



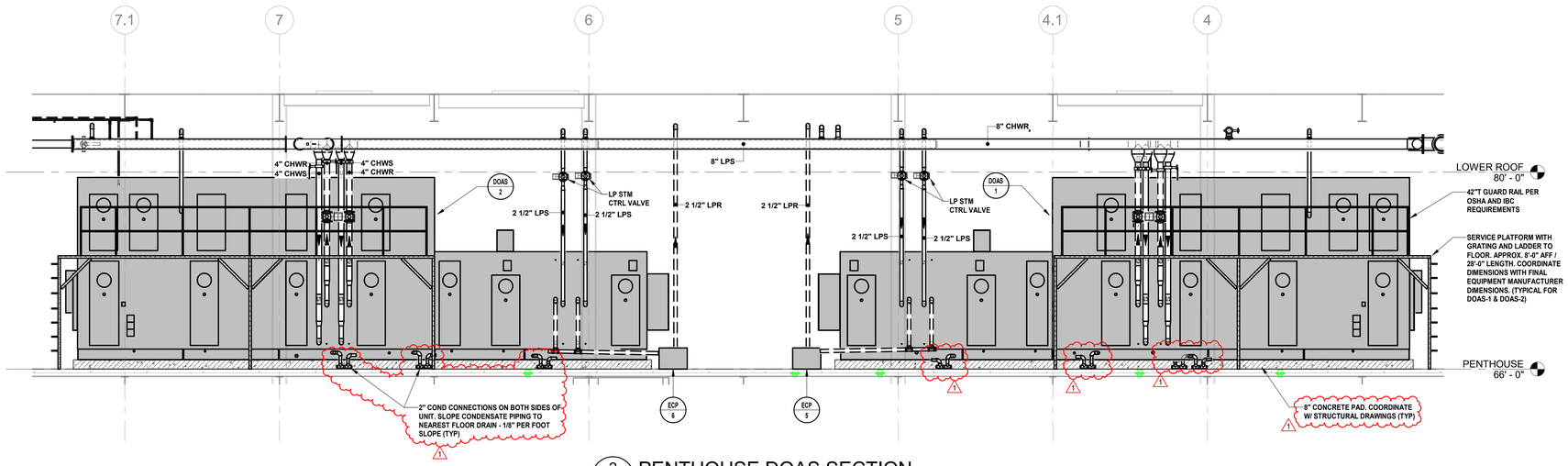
3 M301 DOAS DIAGRAM
SCALE: N.T.S.



4 M301 LEF DIAGRAM
SCALE: N.T.S.



5 M301 ERU DIAGRAM
SCALE: N.T.S.



2 M301 PENTHOUSE DOAS SECTION
SCALE: 1/4" = 1'-0"

3/3/2026 2:11:01 PM

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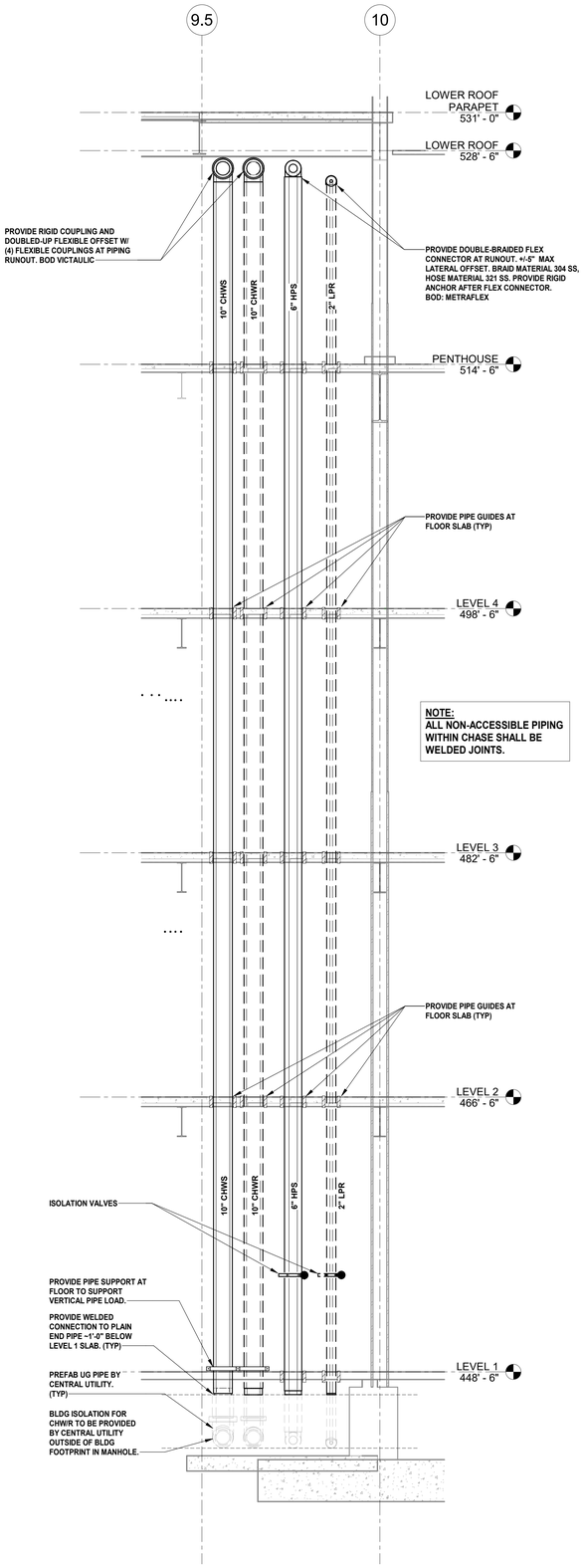
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MECHANICAL - ENLARGED PLANS

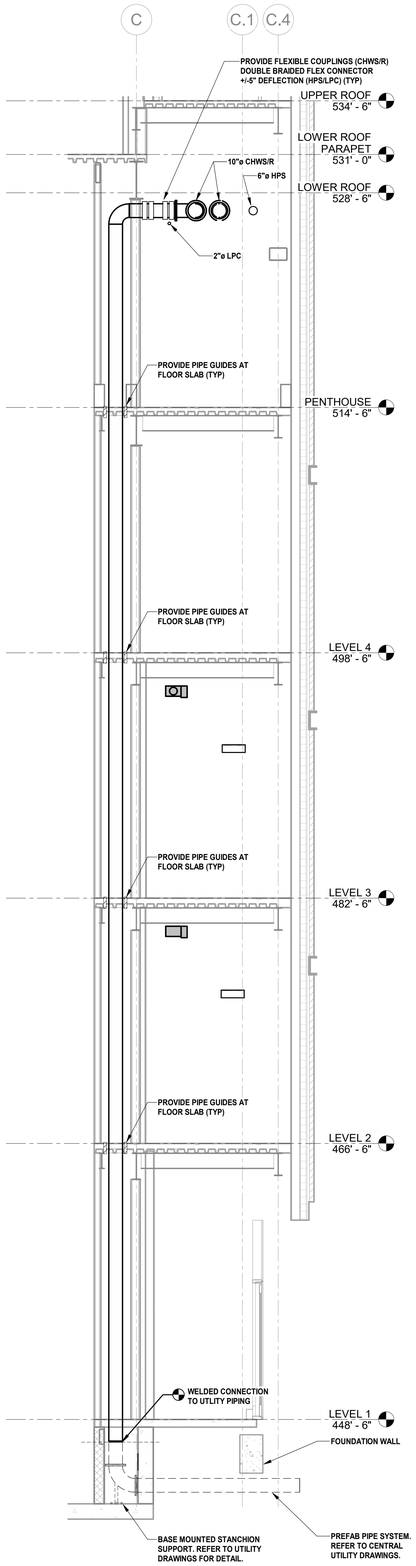
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Sheet Number

M301



1 M302 PIPE RISER ELEVATION
SCALE: 1/4" = 1'-0"



2 M302 PIPE RISER ELEVATION (W-E)
SCALE: 1/4" = 1'-0"

3/23/2026 2:04:26 PM

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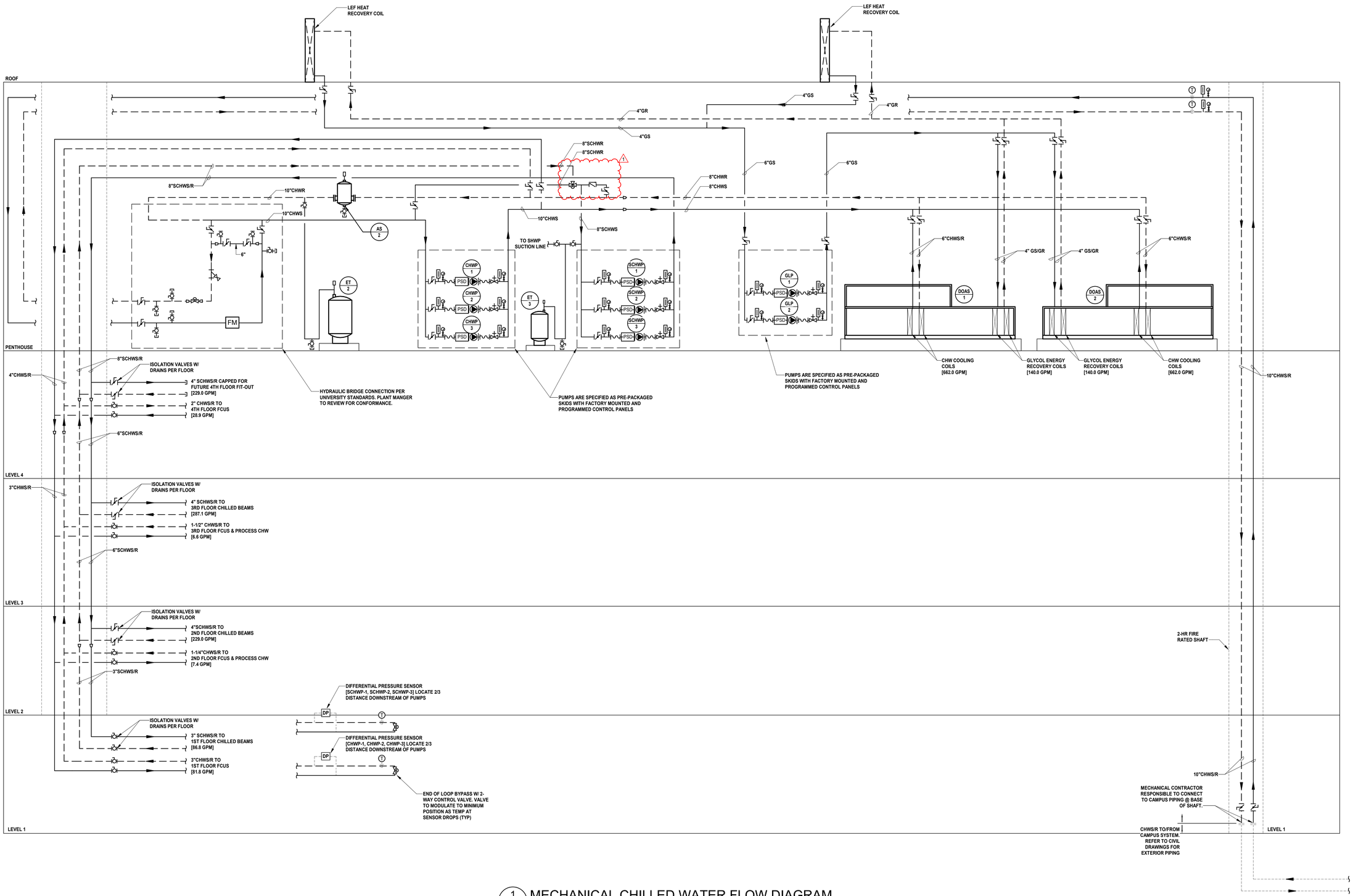
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MECHANICAL - ENLARGED PLANS

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

1 M302



1 M401 MECHANICAL CHILLED WATER FLOW DIAGRAM

SCALE: N.T.S.

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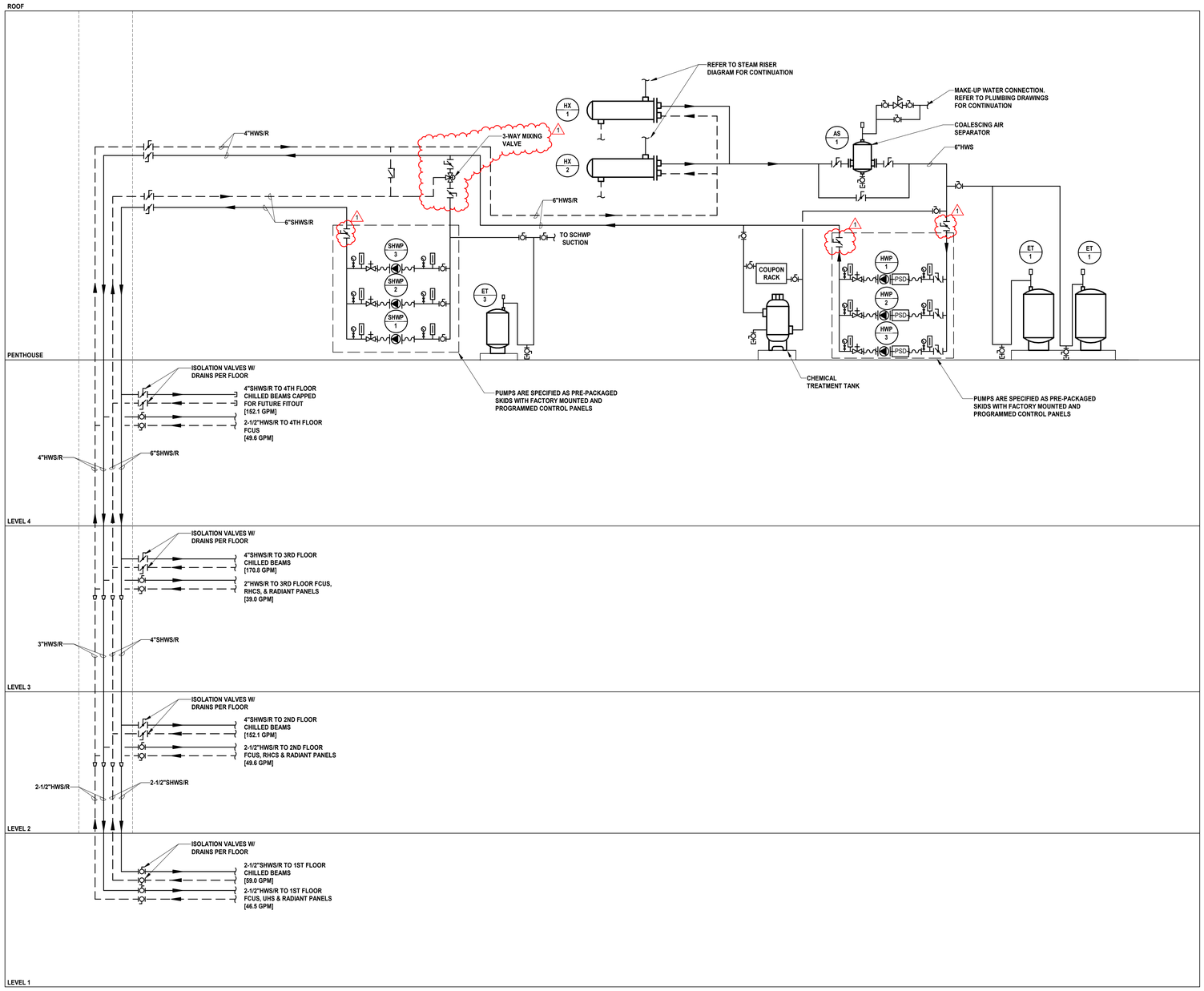
Sheet Title

MECHANICAL - CHILLED WATER FLOW DIAGRAM

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

M401



1 M403 MECHANICAL - HOT WATER FLOW DIAGRAM
SCALE: N.T.S.

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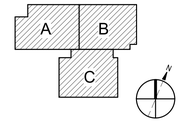
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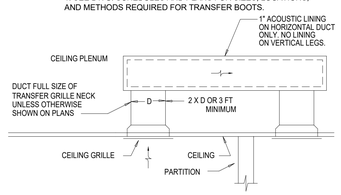
Sheet Title

MECHANICAL - HOT WATER FLOW DIAGRAM

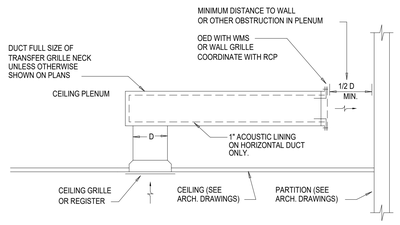
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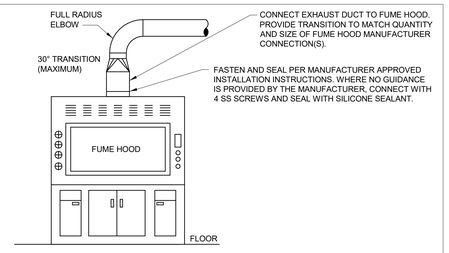


U-BOOT METHOD

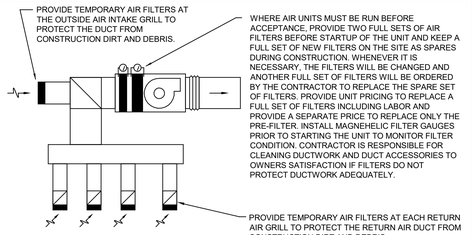


L-BOOT METHOD

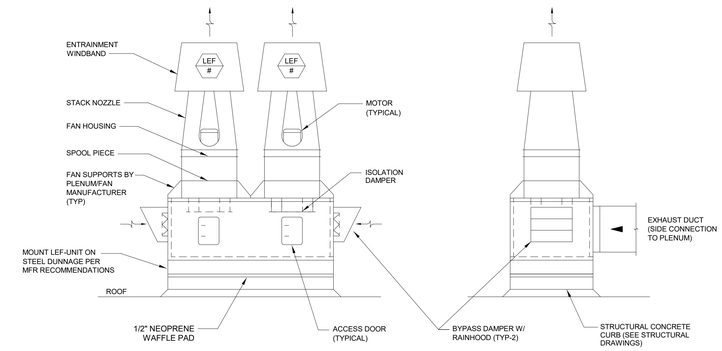
TRANSFER BOOTS WITH GRILLES



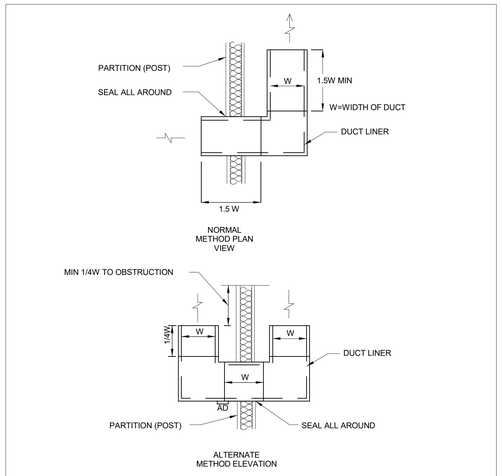
FUME HOOD DUCT CONNECTION DETAIL



CONSTRUCTION AIR FILTER MANAGEMENT



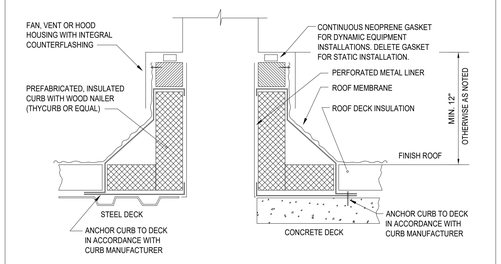
HIGH PLUME LABORATORY EXHAUST FANS



NOTES:

1. DUCTWORK SHALL BE GALVANIZED SHEETMETAL WITH 1" FIBERGLASS ACOUSTICAL LINER OR FIBERGLASS-DUCTBOARD DUCT WITH MITERED RECTANGULAR ELBOWS (NO VANES).
2. PROVIDE FIRE DAMPER AT FIRE RATED PARTITIONS.
3. SEE PLANS FOR SIZE AND LOCATION OF RETURN AIR TRANSFER DUCTS.
4. PROVIDE 1/2" X 1/2" WIRE MESH SCREEN AT OPEN ENDS OF DUCTS.

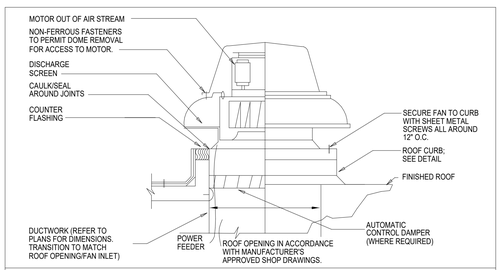
PLENUM TRANSFER DUCT



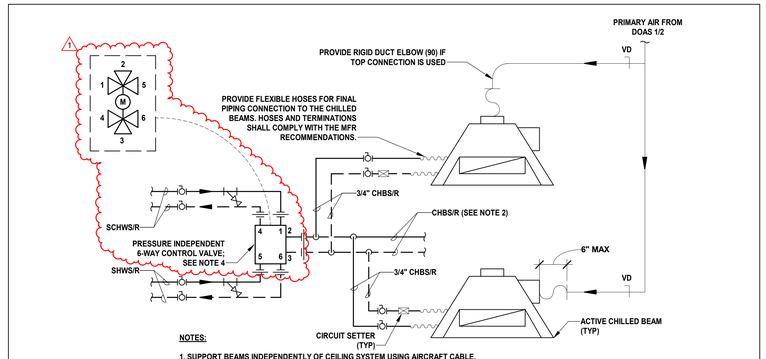
NOTES:

1. SEE ARCHITECTURAL DRAWINGS FOR ROOFING AND FLASHING REQUIREMENTS AND COORDINATE EXACT CURB CONFIGURATION ACCORDINGLY.
2. SHIM CURB TO ENSURE TOP IS DEAD LEVEL OVER ENTIRE LENGTH OF CURB FOR LEVEL EQUIPMENT INSTALLATION.

ROOF CURB



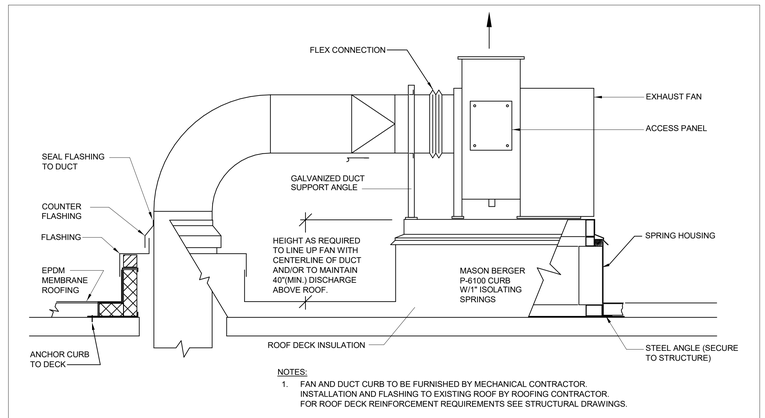
ROOF-MOUNTED EXHAUST FAN



NOTES:

1. SUPPORT BEAMS INDEPENDENTLY OF CEILING SYSTEM USING AIRCRAFT CABLE.
2. CHBS/R (PIPING DOWNSTREAM OF 6-WAY VALVE) SHALL BE THE FULL SIZE OF THE CONNECTED SCHWS/R AND SHWS/R (LARGER OF THE TWO) AND SHALL EXTEND TO THE FURTHEST CHILLED BEAM TAKEOFF.
3. ALL FLEX DUCT CONNECTIONS SHALL BE 6" MAX AND SHALL BE STRAIGHT WITHOUT KINKS.
4. THIS DETAIL SHOWS PIPING CONNECTIONS FOR 2-PIPE ACTIVE CHILLED BEAM AND 6-WAY CONTROL VALVE. 4-PIPE CHILLED BEAMS IN CORRIDOR SHALL BE PIPED WITH STANDARD 2-WAY CONTROL VALVES. REFER TO CONTROL VALVE PIPING DETAIL.

ACTIVE CHILLED BEAM PIPING AND DUCTWORK DETAIL



NOTES:

1. FAN AND DUCT CURB TO BE FURNISHED BY MECHANICAL CONTRACTOR. INSTALLATION AND FLASHING TO EXISTING ROOF BY ROOFING CONTRACTOR. FOR ROOF DECK REINFORCEMENT REQUIREMENTS SEE STRUCTURAL DRAWINGS.

ROOF MOUNTED GENERAL EXHAUST UTILITY SET FAN DETAIL

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building

1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University

1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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In Association with

Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan

Professional Seals

ANTHONY H. CAUCCI, PE
LICENSE NO. 24GE04480600

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No.	Description	Date
	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
	ISSUED FOR BID	2026-01-19
1	ADDENDUM #5	2026-03-23

Project No:

Sheet Title

MECHANICAL DETAILS

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

M504

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DOAS SCHEDULE

DOAS -

SYMBOL	LOCATION	OVERALL DESIGN CRITERIA				ENERGY RECOVERY COIL (LAB EXHAUST ENERGY RECOVERY SYSTEM)									STEAM PREHEAT COIL				HUMIDIFIER						CHILLED WATER COIL										SUPPLY FAN ARRAY								OPERATING WEIGHT (LBS)	BASIS OF DESIGN	
		TOTAL AIRFLOW (CFM)		UNIT LAT (F)		WINTER SENSIBLE CAPACITY (MBH)	ROWS / FPI	AIR				WATER - 30% PG					CAPACITY (MBH)	AIR			STEAM		AIR				STEAM		MINIMUM NET CAPACITY (MBH)	AIR					WATER				QUANTITY (N+1)	AIRFLOW PER FAN (CFM)	TYPE	ESP / TSP (IN W.C.)	RPM	HP	BHP	V/PH/HZ		MANUFACTURER	MODEL NUMBER
		MINIMUM	MAXIMUM	DB	DP			CFM	EAT DB (F)	LAT DB (F)	APD (IN. W.C.)	GPM	EWT (F)	LWT (F)	WPD (FT HD)			EAT DB (F)	EAT DB (F)	LB/HR	PSI	EAT DB (F)	EAT RH (%)	LAT DB (F)	LAT RH (%)	LB/HR	PSI	TOTAL	SENSIBLE	EAT DB (F)	EAT WB (F)	LAT DB (F)	LAT WB (F)	GPM	WPD (FT HD)	EWT (F)	LWT (F)										
DOAS-1	PENTHOUSE	30000	52500	65	46	1286	140	42500	10	38	0.38	140	49	30	38		3115	10	65	3294	15	65	3	65	51	1456	15	4629	2414	95	78	52	52	662	31	42	60	4	17500	PLENUM	2.0 / 6.43	2018	30	30	460/3/60	62660	HAAKON	AIRPAK
DOAS-2	PENTHOUSE	30000	52500	65	46	1286	140	42500	10	38	0.38	140	49	30	38		3115	10	65	3294	15	65	3	65	51	1456	15	4629	2414	95	78	52	52	662	31	42	60	4	17500	PLENUM	2.0 / 6.43	2018	30	30	460/3/60	62660	HAAKON	AIRPAK

NOTES:
1. PROVIDE 100% OUTSIDE AIR, CUSTOM BUILT, FACTORY ASSEMBLED, AIR HANDLING UNITS WITH ALL SECTIONS, ACCESSORIES, CONTROLS, ETC AS LISTED WITH THE BASIS OF DESIGN INDICATED IN 1/M601 THIS SHEET.
2. PROVIDE 6" CONCRETE PAD WITH 10" BASE RAIL.
3. PROVDE PLENUM FAN ARRAY AS INDICATED.
4. PROVIDE PREMIUM EFFICIENCY, INVERTER DUTY RATED, MOTORS WITH VARIABLE FREQUENCY DRIVES SUITABLE FOR THE LISTED HORSEPOWERS PER FAN. SELECTABLE 0-10 VDC OR 0-20 mA OUTPUT FOR MONITORING VFD SPEED. MINIMUM 7 MULTI-FUNCTION DIGITAL INPUT TERMINALS.
5. PROVIDE ACCESS PLATFORM WITH STEPS TO ACCESS UPPER LEVEL OF UNIT.
6. PROVIDE OSHA APPROVED INLET SCREENS FOR PLENUM FANS.
7. PROVIDE WITH 2" MERV 8 & 12" MERV 14 THROWAWAY FILTERS. PROVIDE SPARE REPLACEMENT FILTERS PER UNIT.

ACTIVE DESSICANT WHEEL SCHEDULE

DOAS -

LOCATION/SERVICE	PROCESS AIR (SUPPLY AIR)							REGEN AIR (OUTSIDE AIR)							STEAM HEATER COIL			REGENERATIVE AIR EXHAUST FAN ARRAY							
	AIRFLOW (CFM)	EAT DB (F)	EAT DP (F)	GR/LB	LAT DB (F)	LAT DP (F)	GR/LB	AIRFLOW (CFM)	EAT DB (F)	EAT DP (F)	GR/LB	LAT DB (F)	LAT DP (F)	GR/LB	CAPACITY (MBH)	LB/HR	PSI	QUANTITY (N+1)	AIRFLOW PER FAN (CFM)	TYPE	ESP / TSP (IN W.C.)	RPM	HP	BHP	V/PH/HZ
DOAS - 1	16000	52	52	58	88	26	20	8000	82	75	129	109	88	204	850	899	15	2	8000	PLENUM	1.0 / 2.78	1416	7.5	7.5	460/3/60
DOAS - 2	16000	52	52	58	88	26	20	8000	82	75	129	109	88	204	850	899	15	2	8000	PLENUM	1.0 / 2.78	1416	7.5	7.5	460/3/60

ENERGY RECOVERY UNIT

ERU -

SYMBOL	LOCATION	MINIMUM AIRFLOW OPERATION		MAXIMUM AIRFLOW OPERATION		EFFECTIVENESS AT MAX AIRFLOW OPERATION (%)	SUMMER PERFORMANCE					WINTER PERFORMANCE					SUPPLY FAN ARRAY								EXHAUST FAN ARRAY								OPERATING WEIGHT (LBS)	BASIS OF DESIGN	
		EXHAUST AIRFLOW (CFM)	OUTSIDE AIRFLOW (CFM)	EXHAUST AIRFLOW (CFM)	OUTSIDE AIRFLOW (CFM)		OUTSIDE AIR (CFM)				ENERGY RECOVERED (MBH)	OUTSIDE AIR (CFM)				ENERGY RECOVERED (MBH)	QUANTITY (N+1)	AIRFLOW PER FAN (CFM)	TYPE	ESP (IN W.C.)	TSP (IN W.C.)	RPM	HP	BHP	V/PH/HZ	QUANTITY (N+1)	AIRFLOW PER FAN (CFM)	TYPE	ESP (IN W.C.)	TSP (IN W.C.)	RPM	HP	BHP	V/PH/HZ		MANUFACTURER	MODEL NUMBER
							EAT DB (F)	EAT WB (F)	LAT DB (F)	LAT WB (F)		EAT DB (F)	EAT WB (F)	LAT DB (F)	LAT WB (F)																					
ERU-1	ROOF	20000	20000	32000	32000	76	95	78	80	67	1334	10	7	56	46	2220	2	32000	PLENUM	0.50	2.21	954	25	20.7	460/3/60	2	32000	PLENUM	1.50	3.60	1063	30	27.7	460/3/60	35710	HAAKON	AIRPAK

NOTES:
1. PROVIDE CUSTOM BUILT AND FACTORY ASSEMBLED ENERGY RECOVERY UNITS WITH ALL SECTIONS, ACCESSORIES, CONTROLS, ETC AS LISTED WITH THE BASIS OF DESIGN INDICATED IN 2/M601 THIS SHEET.
2. PROVIDE 6" CONCRETE PAD WITH 10" BASE RAIL.
3. PROVDE PLENUM FAN ARRAY AS INDICATED.
4. PROVIDE PREMIUM EFFICIENCY, INVERTER DUTY RATED, MOTORS WITH VARIABLE FREQUENCY DRIVES SUITABLE FOR THE LISTED HORSEPOWERS PER FAN. SELECTABLE 0-10 VDC OR 0-20 mA OUTPUT FOR MONITORING VFD SPEED. MINIMUM 7 MULTI-FUNCTION DIGITAL INPUT TERMINALS.
4. UNIT MANUFACTURER TO COORDINATE WITH CONTROLS VENDOR TO HAVE UNIT SHIPPED TO FACTORY FOR MOUNTING AND PROGRAMMING OF ALL CONTROL DEVICES.
5. PROVIDE OSHA APPROVED INLET SCREENS FOR PLENUM FANS.

LAB EXHAUST FAN W/ GLYCOL ENERGY RECOVERY SCHEDULE

LEF -

SYMBOL	LOCATION	SERVICE	AIRFLOW (CFM)		ESP (IN W.C.)	RPM	BHP	MOTOR HP	ENERGY RECOVERY GLYCOL COIL - WINTER PERFORMANCE								FAN PLATFORM OPERATING WEIGHT (LBS)	BASIS OF DESIGN	
			MIN	MAX					AIR				WATER - 30% PG				ENERGY RECOVERED (MBH)		
									TOTAL AIRFLOW (CFM)	APD (IN WC)	EAT DB (F)	LAT DB (F)	GPM	WPD (FT HD)	EWT (F)	LWT (F)			MANUFACTURER	MODEL NUMBER
LEF - 1	MAIN ROOF - PLENUM 123	LAB HAZARDOUS EXHAUST	12500	21000	4	1200	24.2	25	42500	0.78	72	45	140	33.18	30	51	1360	23850	STROBIC	TRISTACK
LEF - 2	MAIN ROOF - PLENUM 123	LAB HAZARDOUS EXHAUST	12500	21000	4	1200	24.2	25											STROBIC	TRISTACK
LEF - 3	MAIN ROOF - PLENUM 123	LAB HAZARDOUS EXHAUST	12500	21000	4	1200	24.2	25											STROBIC	TRISTACK
LEF - 4	MAIN ROOF - PLENUM 456	LAB HAZARDOUS EXHAUST	12500	21000	4	1200	24.2	25	42500	0.78	72	45	140	33.18	30	51	1360	23850	STROBIC	TRISTACK
LEF - 5	MAIN ROOF - PLENUM 456	LAB HAZARDOUS EXHAUST	12500	21000	4	1200	24.2	25											STROBIC	TRISTACK
LEF - 6	MAIN ROOF - PLENUM 456	LAB HAZARDOUS EXHAUST	12500	21000	4	1200	24.2	25											STROBIC	TRISTACK

NOTES:
1. DESIGN INTENT INCLUDES 2 FANS OPERATING + 1 REDUNDANT FAN. ALL FANS ARE DIRECT DRIVE INCLUDING INTEGRAL MOTOR WITH SHAFT GROUNDING.
2. PROVIDE INTEGRATED SILENCER NOZZLE WITH EACH FAN.
3. UNITS TO BE FED WITH STANDBY POWER. COORDINATE ELECTRICAL REQUIREMENTS.
4. PROVIDE NEMA MG-1 PREMIUM EFFICIENCY MOTORS.
5. PROVIDE SINGLE WALL PLENUM TO SUPPORT TOP MOUNTED FAN SYSTEM INCLUDING HORIZONTAL DUCTED INLET CONNECTION, HINGED ACCESS DOOR, AND ROOF CURB. CURB HEIGHT AS REQUIRED TO ALIGN CONNECTION WITH HEAT RECOVERY UNIT CONNECTION.
6. FOR EACH BYPASS INLET, PROVIDE ACOUSTICAL LOUVER, BYPASS DAMPER INCLUDING MODULATING ACTUATOR WITH POSITION FEEDBACK, AND RAIN HOOD.
7. PROVIDE ISOLATION DAMPER PER FAN INCLUDING ON/OFF SPRING RETURN FAIL-SAFE ACTUATORS WITH OPEN/CLOSED FEEDBACK.
8. FOR EACH FAN, PROVIDE PRESSURE TRANSMITTER ACROSS INLET BELL FOR USE IN MEASURING AIRFLOW.
9. PROVIDE INTERNAL JIB CRANE FOR FUTURE REMOVAL OF FAN, MOTOR, AND SILENCER NOZZLE.
10. PROVIDE FACTORY MOUNTED CONTROL SYSTEM INCLUDING THE FOLLOWING COMPONENTS:
    - HMI TOUCH SCREEN DISPLAY IN NEMA 3R ENCLOSURE
    - LOGIC BASED ON INTEGRATED FAN CURVE DATA TO CONTROL NOZZLE VELOCITY UNDER ALL OPERATING CONDITIONS.
    - VARIABLE FREQUENCY DRIVE PER FAN.
    - BACNET GATEWAY TO COMMUNICATE WITH BMS

AIR TERMINAL DEVICE SCHEDULE

SYMBOL	SERVICE	TYPE	CFM RANGE	NECK SIZE	N.C. (@ MAX CFM)	FACE OVERALL DIMENSIONS WxL (IN.)	BASIS OF DESIGN	
							MANUFACTURER	MODEL NUMBER
CD-1	SUPPLY	LAY-IN	0-120	6"Ø	20	24x24	PRICE	SPD
CD-2	SUPPLY	LAY-IN	100-250	8"Ø	20	24x24	PRICE	SPD
CD-3	SUPPLY	LAY-IN	251-400	10"Ø	20	24x24	PRICE	SPD
RCD-1	SUPPLY	LAY-IN	0-150	8"Ø	-	####- (4 CONE)	PRICE	RCD
RFD-1	SUPPLY	LAY-IN	0-550	10"Ø	35	24x24	PRICE	FRFD
LFD-1	SUPPLY	LAY-IN	0-125	8"Ø	-	12x48	PRICE	LFD
LFD-2	SUPPLY	LAY-IN	0-180	8"Ø	-	12x60	PRICE	LFD
LFD-3	SUPPLY	LAY-IN	0-225	12"Ø	-	24x48	PRICE	LFD
LFD-4	SUPPLY	LAY-IN	0-350	12"Ø	-	24x60	PRICE	LFD
SG-1	SUPPLY	WALL REGISTER	0-600	16x8	-	18x10	PRICE	510
SG-2	SUPPLY	WALL REGISTER	0-400	22x8	-	24x10	PRICE	510
SG-3	SUPPLY	WALL REGISTER	0-200	8x6	-	10x8	PRICE	510
SG-4	SUPPLY	DUCT MOUNTED	100-300	10x6	22	12x8	PRICE	510
LD-1	SUPPLY	SEE DWG	0-56 CFM/FT	(4) 8"Ø	-	(2) 3/4" SLOT WIDTH - SEE DWGS FOR LENGTHS	PRICE	2-SLOT SDS
LD-2	SUPPLY	SEE DWG	0-225	8"Ø	-	(2) 3/4" SLOT WIDTH	PRICE	2-SLOT SDB 75
RG-1	RETURN	LAY-IN	0-1300	22x22	-	24x24	PRICE	610
RG-2	RETURN	WALL GRILLE	0-600	16x16	-	18x18	PRICE	610
RG-3	RETURN/TRANSFER	WALL GRILLE	0-400	14x10	-	16x12	PRICE	610
LR-1	RETURN	SEE DWG	0-60 CFM/FT	-	-	(2) 3/4" SLOT WIDTH - SEE DWGS FOR LENGTHS	PRICE	2-SLOT SDR 75
ER-1	EXHAUST	LAY-IN	0-125	6x6	-	8x8	PRICE	610
ER-2	EXHAUST	LAY-IN	0-450	10x10	-	12x12	PRICE	610
ER-3	EXHAUST	LAY-IN	0-1300	22x22	-	24x24	PRICE	610

NOTES:
1. REFER TO PLANS TO LOCATIONS.
2. MOUNTING FRAME TYPE SHALL BE COORDINATED WITH THE CEILING/WALL CONSTRUCTION TYPE.
3. FLEXIBLE DUCTS CONNECTING TO THE DIFFUSERS SHALL BE FULL SIZE OF NECK DIAMETER AND NOT EXCEED 8' IN LENGTH.
4. DIFFUSERS SHALL BE 4-WAY BLOW UNLESS OTHERWISE INDICATED ON PLANS. RFD-1 SHALL BE 2-WAY BLOW UNLESS OTHERWISE INDICATED ON PLAN.
5. PROVIDE SQUARE TO ROUND NECK ADAPTERS IF REQUIRED.
6. ALL GRILLES MOUNTED IN CEILINGS, SOFFITS, OR WALL SHALL HAVE A BAKED ENAMEL FINISH; COLOR TO BE SELECTED BY ARCHITECT DURING THE SUBMITTAL PROCESS FROM THE MANUFACTURERS FULL RANGE OF COLORS.
7. PROVIDE BUILT IN DAMPER (630D) FOR ALL GRILLES LOCATED WITHIN INACCESIBLE CEILINGS

3/3/2026 2:04:26 PM

MONTCLAIR STATE UNIVERSITY

Project
Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For
Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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In Association with

Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
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100 Overlook Center, 2nd Floor
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275 Madison Avenue, 14th Floor
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152 Huron Ave
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Key Plan

Professional Seals

ANTHONY H. CAUCCI, PE
LICENSE NO. 24GE04480600

NOT FOR CONSTRUCTION

No.	Description	Date
	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
	ISSUED FOR BID	2026-01-19
1	ADDENDUM #5	2026-03-23

Project No:

Sheet Title

MECHANICAL SCHEDULES

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

M601

AIR SEPARATOR SCHEDULE

AS -

SYMBOL	LOCATION	SERVICE	GPM	TYPE	INLET (IN)	OUTLET (IN)	PD (FT HD)	STRAINER (Y/N)	FLODED WEIGHT (LBS)	BASIS OF DESIGN	
										MANUFACTURER	MODEL NUMBER
AS-1	PENTHOUSE	CHILLED WATER LOOP	820	COALESCING	8	8	1.73	N	655	BELL & GOSSETT	CRSN-8F
AS-2	PENTHOUSE	HOT WATER LOOP	305	COALESCING	6	6	0.72	N	366	BELL & GOSSETT	CRSN-6F

NOTES:
1. PROVIDE COALESCINGTYPE W/TANGENTIAL INLET AND OUTLET.
2. PROVIDE INSULATION FOR AIR SEPERATOR OF SAME THICKNESS AND PIPING INSULATION.
3. REFER TO DRAWINGS, DETAILS, AND SPECIFICATIONS FOR ADDITIONAL INFORMATION AND FURTHER REQUIREMENTS.

SHELL AND TUBE HEAT EXCHANGER SCHEDULE

HX -

SYMBOL	LOCATION	SERVICE	MINIMUM CAPACITY (MBH)	SHELL SIDE (LPS)			TUBE SIDE (HW)				TOTAL SURFACE AREA - CLEAN (SF)	NUMBER OF PASSES	FOULING FACTOR	SIZE		OPERATING WEIGHT (LBS)	BASIS OF DESIGN	
				SYSTEM PRESSURE (PSIG)	STEAM (LB/HR)	INLET NOZZLE VELOCITY (FPS)	EWT (F)	LWT (F)	FLOW (GPM)	PD (FT HD)				LENGTH (FT)	DIAMETER (IN)		MANUFACTURER	MODEL NUMBER
HX-1	PENTHOUSE	BUILDING HOT WATER	6902	10	7250	33.41	110	160	280	0.99	119.8	4	0.0005	12	24		THRUSH	TS24-108-422BS-SSBS
HX-2	PENTHOUSE	BUILDING HOT WATER	6902	10	7250	33.41	110	160	280	0.99	119.8	4	0.0005	12	24		THRUSH	TS24-108-422BS-SSBS

NOTES:
1. PROVIDE WELDED STEEL FRAME TO ELEVATE UNIT FOR TRAPPING AND CONDENSATE RECOVERY. PAINT FRAME WITH CORROSION RESISTANT ENAMEL PAINT. PAINT COLOR BY ARCHITECT.
2. REFER TO DRAWINGS, DETAILS, AND SPECIFICATIONS FOR ADDITIONAL INFORMATION AND FURTHER REQUIREMENTS.

EXPANSION TANK SCHEDULE

ET -

SYMBOL	LOCATION	HORIZONTAL OR VERTICAL	SERVICE	TYPE	TANK VOLUME (GAL)	SIZE DIA x L	SYSTEM CONNECTION SIZE	OPER WEIGHT (LBS)	BASIS OF DESIGN	
									MANUFACTURER	MODEL NUMBER
ET-1	PENTHOUSE	VERTICAL	HW LOOP	BLADDER	44	24x34	3/4"	517	BELL & GOSSETT	B165
ET-2	PENTHOUSE	VERTICAL	CHW LOOP	BLADDER	211	32x76	2"	2,233	BELL & GOSSETT	B200
ET-3	PENTHOUSE	VERTICAL	CHB LOOPS	BLADDER					BELL & GOSSETT	B165

NOTES:
1. PRESSURIZE EXPANSION TANK TO MATCH PRESSURE OF MAKE-UP PRESSURE REDUCING VALVE SET POINT.
2. REFER TO DRAWINGS, DETAILS, AND SPECIFICATIONS FOR ADDITIONAL INFORMATION AND FURTHER REQUIREMENTS.

GRAVITY VENT SCHEDULE

GV -

SYMBOL	LOCATION	SERVICE	AIRFLOW (CFM)	APD (IN W.C.)	OVERALL LENGTH (IN)	OVERALL WIDTH (IN)	OVERALL HEIGHT (IN)	ROOF OPENING (IN)	OPERATING WEIGHT	BASIS OF DESIGN	
										MANUFACTURER	MODEL NUMBER
GV - 1	MAIN ROOF - 2 INSTANCES	DOAS REGEN AIR INTAKE			54	54	35.5	40 x 40	158	GREENHECK	WIH-40X40
GV - 2	MAIN ROOF - 2 INSTANCES	DOAS REGEN AIR DISCHARGE			52	52	35.5	38 x 38	140	GREENHECK	WRH-38X38
GV - 3	LOW ROOF	GENERATOR ROOM INTAKE	20000	0.045	110	74	54.25	96 x 60	450	GREENHECK	WIH 60x96
GV - 4	LOW ROOF	GENERATOR ROOM DISCHARGE	32500 (X2)	0.152	98	70	50.5	84 x 56	400	GREENHECK	WRH 56x84

NOTES:
1. PROVIDE 20" HIGH INSUALTED ROOF CURB.
2. REFER TO DRAWINGS, DETAILS, AND SPECIFICATIONS FOR ADDITIONAL INFORMATION AND FURTHER REQUIREMENTS. 1

PUMP SCHEDULE

SYMBOL	LOCATION	SERVICE	TYPE	FLUID	OPERATING	STANDBY	DESIGN TEMPERATURE (F)	GPM	HEAD (FT)	CONTROL	RPM	EFF (%)	BHP	MOTOR HP	V/PH/Hz	BASIS OF DESIGN	
																MANUFACTURER	MODEL NUMBER
CHWP-1	PENTHOUSE	BUILDING CHW	BASE MOUNTED	WATER	X		42	820	75	VFD	1745	85.73	18.15	20	460/3/60	GRUNDFOS	040-095-4P-20HP
CHWP-2	PENTHOUSE	BUILDING CHW	BASE MOUNTED	WATER	X		42	820	75	VFD	1745	85.73	18.15	20	460/3/60	GRUNDFOS	040-095-4P-20HP
CHWP-3	PENTHOUSE	BUILDING CHW	BASE MOUNTED	WATER		X	42	820	75	VFD	1745	85.73	18.15	20	460/3/60	GRUNDFOS	040-095-4P-20HP
SCHWP-1	PENTHOUSE	CHILLED BEAM CHW	BASE MOUNTED	WATER	X		60	175	65	VFD	1639	74.37	3.87	5	460/3/60	GRUNDFOS	015-095-4P-5HP
SCHWP-2	PENTHOUSE	CHILLED BEAM CHW	BASE MOUNTED	WATER	X		60	175	65	VFD	1639	74.37	3.87	5	460/3/60	GRUNDFOS	015-095-4P-5HP
SCHWP-3	PENTHOUSE	CHILLED BEAM CHW	BASE MOUNTED	WATER		X	60	175	65	VFD	1639	74.37	3.87	5	460/3/60	GRUNDFOS	015-095-4P-5HP
HWP-1	PENTHOUSE	FCU / RADIANT HW	BASE MOUNTED	WATER	X		160	130	65	VFD	1566	72.43	2.95	5	460/3/60	GRUNDFOS	015-095-4P-5HP
HWP-2	PENTHOUSE	FCU / RADIANT HW	BASE MOUNTED	WATER	X		160	130	65	VFD	1566	72.43	2.95	5	460/3/60	GRUNDFOS	015-095-4P-5HP
HWP-3	PENTHOUSE	FCU / RADIANT HW	BASE MOUNTED	WATER		X	160	130	65	VFD	1566	72.43	2.95	5	460/3/60	GRUNDFOS	015-095-4P-5HP
SHWP-1	PENTHOUSE	CHILLED BEAM HW	BASE MOUNTED	WATER	X		110	260	70	VFD	1631	75.6	6.09	7.5	460/3/60	GRUNDFOS	020-095-4P-7.5HP
SHWP-2	PENTHOUSE	CHILLED BEAM HW	BASE MOUNTED	WATER	X		110	260	70	VFD	1631	75.6	6.09	7.5	460/3/60	GRUNDFOS	020-095-4P-7.5HP
SHWP-3	PENTHOUSE	CHILLED BEAM HW	BASE MOUNTED	WATER		X	110	260	70	VFD	1631	75.6	6.09	7.5	460/3/60	GRUNDFOS	020-095-4P-7.5HP
GLP-1	PENTHOUSE	ENERGY RECOVERY SYSTEM	INLINE	40% PG	X		42	280	105	VFD	1734	70	10.62	15	460/3/60	GRUNDFOS	020-110-4P-15HP
GLP-2	PENTHOUSE	ENERGY RECOVERY SYSTEM	INLINE	40% PG		X	42	280	105	VFD	1734	70	10.62	15	460/3/60	GRUNDFOS	020-110-4P-15HP

1
NOTES:
1. PUMPS ARE SPECIFIED AS PREFABRICATED MANIFOLDED SKIDS WITH MULTI-PUMP CONTROL PANELS PER SKID.
2. PROVIDE BACNET MS/TP BMS COMMUNICATION INTERFACE PER PUMP SKID.
2. PROVIDE 6" CONCRETE PAD WITH INERTIA BASES PER PUMP SKID. COORDINATE PAD DIMENSIONS WITH STRUCTURAL.
2. PROVIDE SUCTION DIFFUSERS WITH STRAINERS.
3. PROVIDE PREMIUM EFFICIENCY INVERTER DUTY MOTORS WITH VARIABLE FREQUENCY DRIVES.
4. REFER TO DRAWINGS, DETAILS, AND SPECIFICATIONS FOR ADDITIONAL INFORMATION AND FURTHER REQUIREMENTS.

ELECTRIC CONDENSATE PUMP SCHEDULE

ECP #

SYMBOL	LOCATION	SERVICE	MOUNTING	PUMP CAPACITY (GPM)	RECIEVER CAPACITY (GAL)	DISCHARGE PRESSURE (PSI)	RPM	MOTOR HP	OPERATING WEIGHT (LBS)	BASIS OF DESIGN	
										MANUFACTURER	MODEL NUMBER
ECP-1	PENTHOUSE	HW HEAT EXCHANGERS	FLOOR	37.5	45	20	3450	3/4	350	STERLCO	41225-JD
ECP-2	PENTHOUSE	PRV STATION DRIP LEGS	FLOOR	15	30	20	3450	1/2	240	STERLCO	41210-G
ECP-3	PENTHOUSE	DOMESTIC WATER HEATERS	FLOOR	12	15	20	3450	1/3	185	STERLCO	4128-GD
ECP-4	PENTHOUSE	DOMESTIC WATER HEATERS	FLOOR	12	15	20	3450	1/3	185	STERLCO	4128-GD
ECP-5	PENTHOUSE	DOAS-1 STEAM COILS	FLOOR	37.5	45	40	3450	1-1/2	355	STERLCO	41425-JD
ECP-6	PENTHOUSE	DOAS-2 STEAM COILS	FLOOR	37.5	45	40	3450	1-1/2	355	STERLCO	41425-JD
ECP-7	VARIES	TERMINAL UNIT CONDENSATE	VARIES	45 (gph)	1/2	12 ft hd	-	1/30	-	LITTLE GIANT	20ULS
ECP-8	PENTHOUSE	GENERATOR RM UNIT HEATERS	FLOOR	6	15	20	3450	1/3	185	STERLCO	4124-GD

NOTES:
1. REFER TO DRAWINGS, DETAILS, AND SPECIFICATIONS FOR ADDITIONAL INFORMATION AND FURTHER REQUIREMENTS.

EXHAUST FAN SCHEDULE

SYMBOL	LOCATION	SERVICE	AIRFLOW (CFM)	ESP (IN W.C.)	RPM	BHP	MOTOR HP	ELECTRICAL			BASIS OF DESIGN	
								V/PH/HZ	MCA	MOP	MANUFACTURER	MODEL NUMBER
EF-1	PENTHOUSE	PENTHOUSE	2000	0.25	1169	0.31	3/4	230/1/60	7.5	15	GREENHECK	SQ-140-VG
EF-2	PENTHOUSE	PENTHOUSE	3000	0.25	1122	0.48	3/4	230/1/60	7.5	15	GREENHECK	SQ-160-VG
EF-3	CIRCULATION 5CR01	CIRCULATION 5CR01	350	0.25	1239	0.03	1/6	230/1/60	1.9	15	GREENHECK	SQ-90-VG
EF-4	CIRCULATION 5CR02	CIRCULATION 5CR02	450	0.25	1222	0.05	1/6	230/1/60	1.9	15	GREENHECK	SQ-95-VG
EF-5	EMR HIGH ROOF	ELEVATOR SHAFT	1100	0.25	779	0.1	1/4	230/1/60	2.6	15	GREENHECK	G-140-VG
EF-6	GENERATOR ROOM - ROOF	GENERATOR ROOM	1200	0.3	1179	0.14	1/4	115/1/60	4.8	15	GREENHECK	G-120-VG
EF-7	ROOF	LOADING DOCK	850	0.6	1413	0.16	1/4	115/1/60	4.8	15	GREENHECK	G-100-VG

1
NOTES:
1. PROVIDE BIRD SCREEN.
2. PROVIDE 20" HIGH INSULATED ROOF CURB.
3. PROVIDE INTEGRAL BACKDRAFT DAMPER AT SAME VOLTAGE AS FAN.
4. PROVIDE FACTORY MOUNTED PREWIRED DISCONNECT SWITCH.
5. PROVIDE SPEED CONTROLLER IF DIRECT DRIVE FAN. PROVIDE BELT TENSIONER IF BELT DRIVEN FAN.
6. PROVIDE MOTOR STARTERS FOR FANS WHERE VARIABLE FREQUENCY DRIVES ARE NOT PROVIDED.

RADIANT PANEL SCHEDULE

RP -

SYMBOL	CAPACITY/ LINEAR FT	WATER					PIPE			PANEL MATERIAL	DIMENSIONS (IN)		OPERATING WEIGHT (LBS)	BASIS OF DESIGN	
		EWT (F)	LWT (F)	AWT (F)	MIN FLOW PER CKT (GPM)	MAX PD (FT)	TYPE	DIAMETER	MIN NUMBER OF PASSES		LENGTH	WIDTH		MANUFACTURER	MODEL NUMBER
RP-1	162	160	140	150	0.5	8	COPPER	1/2"	2	ALUMINUM	SEE PLANS	12	2 LB/SF	STERLING	LINEAR RADIANT PANEL

NOTES:
1. REFER TO DRAWINGS, DETAILS, AND SPECIFICATIONS FOR ADDITIONAL INFORMATION AND FURTHER REQUIREMENTS.
2. PROVDE TEMPERATURE SENSOR AND MODULATING CONTROL VALVE PER ZONE.
3. PROVIDE INSULATION FOR RADIANT PANEL AND INSTALL PER MANUFACTURER'S GUIDELINES.

CONDENSATE RETURN PUMP SCHEDULE

ECP -

SYMBOL	LOCATION	SERVICE	TYPE	MOTIVE PRESSURE (PSI)	TOTAL BACK-PRESSURE (PSI)	CAPACITY (LB/HR)	RECEIVER CAPACITY (GAL)	INLET (IN)	OUTLET (IN)	VENT (IN)	OPERATING WEIGHT (LBS)	BASIS OF DESIGN	
												MANUFACTURER	MODEL NUMBER
CRP-1	PENTHOUSE	BUILDING CONDENSATE RETURN	DUPLEX STEAM POWERED	125	60	21060	48	3"	2"	6"		WATSON MCDANIEL	D-PMPF 3x2-SS-116

NOTES:
1. REFER TO DRAWINGS, DETAILS, AND SPECIFICATIONS FOR ADDITIONAL INFORMATION AND FURTHER REQUIREMENTS.
2. PROVIDE PRESSURE REGULATOR AND DRIP TRAP FOR MOTIVE SUPPLY LINE.
3. PROVIDE INSULATION COVERS.
4. UNIT TO BE PRE-PACKAGED SYSTEM. PUMPS TO INCLUDE STAINLESS STEEL CHECK VALVES, ASME VENTED RECEIVER WITH "UM" CODE STAMP.
5. PUMP MECHANISM SHALL BE FLOAT OPERATED CONSTRUCTED OF ALL STAINLESS STEEL MATERIAL.

REHEAT COIL SCHEDULE

RHC -

SYMBOL	LOCATION / SERVICE	AIRFLOW (CFM)	HEATING COIL											DIMENSIONS			BASIS OF DESIGN
			CAPACITY (MBH)	AIR			WATER					STEAM		W (IN)	H (IN)	D (IN)	
				EAT DB (F)	LAT DB (F)	PD (IN WC)	GPM	EWT (F)	LWT (F)	ROWS	PD (FT HD)	LB/HR	PSI				
RHC-1	SEE PLANS	1950	21.0	65	75	0.211	2.2	160	140	1	0.4	-	-	24	12	4	AEROFIN
RHC-2	SEE PLANS	3020	33.0	65	75	0.333	3.4	160	140	1	1.2	-	-	36	12	4	AEROFIN
RHC-3	SEE PLANS	6000	586.7	0	90	0.14	-	-	-	-	-	613	10	50	36	5	USACOIL&AIR

1
NOTES:
1. PROVIDE WITH PERMANENTLY LUBRICATED EC FAN MOTOR.
2. PROVIDE LOCALLY CONTROLLED AND TAMPERPROOF SPST THERMOSTAT (FIELD MOUNTED) FOR EACH HEATER.
3.PROVIDE SURFACE MOUNTING KIT. COORDINATE COLOR WITH ARCHITECT.
5. REFER TO DRAWINGS, DETAILS, AND SPECIFICATIONS FOR ADDITIONAL INFORMATION AND FURTHER REQUIREMENTS.

SUPPLY FAN SCHEDULE

SF -

SYMBOL	LOCATION	SERVICE	AIRFLOW (CFM)	ESP (IN W.C.)	RPM	BHP	MOTOR HP	ELECTRICAL			BASIS OF DESIGN	
								V/PH/HZ	MCA	MOP	MANUFACTURER	MODEL NUMBER
SF-1	PENTHOUSE	PENTHOUSE VENTILATION	6000	2.5	1344	4.8	5	460/3/60	9.5	15	GREENHECK	BS-240HP

NOTES:
1. PROVIDE BIRD SCREEN ON INTAKE GOOSENECK.
2. PROVIDE VIBRATION SPRING ISOLATORS FOR MOUNTING.
3. PROVIDE INTEGRAL MOTOR OPERATED BACKDRAFT DAMPER.
4. PROVIDE FACTORY MOUNTED PREWIRED DISCONNECT SWITCH.
5. PROVIDE SPEED CONTROLLER IF DIRECT DRIVE FAN. PROVIDE BELT TENSIONER IF BELT DRIVEN FAN.

1
HEATED AIR CURTAIN SCHEDULE

HAC -

SYMBOL	LOCATION	AIRFLOW						HOT WATER HEATING					DIMENSIONS (IN)			OPERATING WEIGHT (LBS)	ELECTRICAL			BASIS OF DESIGN	
		AIRFLOW (CFM)	MAX VELOCITY (FPM)	FAN MOTOR QTY	FAN MOTOR HP (PER FAN)	EAT (F)	LAT (F)	CAPACITY (MBH)	FLOW (GPM)	EWT (F)	LWT (F)	WPD (FT HD)	LENGTH	WIDTH	HEIGHT		V/PH/HZ	MCA	MOP	MANUFACTURER	MODEL NUMBER
HAC - 1	LOADING DOCK	2010	2870	1	1/5	65	87.4	49.4	6	160	125	3.3	72	13.5	8.5	107	208/1/60	1.7	15	BERNER	CLC08-1072WB

NOTES:
1. PROVIDE UNIT MOUNTED DISCONNECT SWITCH.
2. PROVIDE THERMOSTAT, CONTROL VALVES, AND FAN SPEED SWITCH.
3. COORDINATE FINAL MOUNTING HEIGHT WITH ARCHITECT.
4. REFER TO DRAWINGS, DETAILS, AND SPECIFICATIONS FOR ADDITIONAL INFORMATION AND FURTHER REQUIREMENTS.
5. PROVIDE HOT WATER SOLENOID VALVE AND INTERLOCK WITH UNIT OPERATION.

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MONTCLAIR STATE UNIVERSITY

Project
Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For
Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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In Association with

Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan

Professional Seals

ANTHONY H. CAUCCI, PE
LICENSE NO. 24GE04480600

NOT FOR CONSTRUCTION

No.	Description	Date
	ISSUED FOR CONTRACT DOCUMENTS	2025-06-14
	ISSUED FOR BID	2026-01-19
1	ADDENDUM #5	2026-03-23

Project No:

Sheet Title
MECHANICAL SCHEDULES

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number
M602

LAB AIR VALVE SCHEDULE (PART 1)

AV -

SYMBOL	DESIGN MIN AIRFLOW (CFM)	DESIGN MAX AIRFLOW (CFM)	SERVICE	SIZE	MANUFACTURER'S CFM RANGE		APD (IN WC)	OPTIONS			ELECTRICAL		BASIS OF DESIGN	
					MIN	MAX		FAST ACTING ACTUATOR	SOUND ATTENUATOR	HERESITE COATING	VOLTAGE	POWER	MANUFACTURER	MODEL NUMBER
AV 199 - H1	300	500	CYLINDER STORAGE	8	35	500	0.3	Y	-	Y	24V	48VA	PHOENIX	PVEB108LA
AV 182 - H1	250	535	CHEMICAL WASTE WASTE NEUTR.	8	90	1050	0.3	Y	-	Y	24V	48VA	PHOENIX	PVEB108LA
AV 205 - S1	210	520	SUPPLY (DIFFUSERS)	12	90	1050	0.3	-	-	-	24V	48VA	PHOENIX	PVSA112LA
AV 205 - H1	310	620	HAZARDOUS EXHAUST	12	90	1050	0.3	-	-	-	24V	48VA	PHOENIX	PVEA112LA
AV 206 - S1	255	255	SUPPLY (CHILLED BEAMS)	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVSA108LA
AV 206 - E1	355	355	GENERAL EXHAUST	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVEA108LA
AV 207 - S1	480	480	SUPPLY (CHILLED BEAMS)	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVSA108LA
AV 207 - E1	590	590	GENERAL EXHAUST	12	90	1050	0.3	-	-	-	24V	48VA	PHOENIX	PVEA112LA
AV 209 - S1	720	720	SUPPLY (CHILLED BEAMS)	12	90	1050	0.3	-	-	-	24V	48VA	PHOENIX	PVSA112LA
AV 209 - S2	210	925	SUPPLY (DIFFUSERS)	12	90	1050	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA112LA
AV 209 - E1	75	785	GENERAL EXHAUST	12	0	900	0.3	Y	-	-	24V	96VA	PHOENIX	PVEA112LS
AV 209 - H1	530	885	6' FUME HOOD	12	90	1050	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB112LA
AV 209 - H2	530	885	6' FUME HOOD	12	90	1050	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB112LA
AV 213 - S1	330	330	SUPPLY (CHILLED BEAMS)	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVSA108LA
AV 213 - S2	0	455	SUPPLY (DIFFUSERS)	12	0	900	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA112LS
AV 213 - H1	530	885	6' FUME HOOD	12	90	1050	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB112LA
AV 215 - S1	840	840	SUPPLY (CHILLED BEAMS)	12	90	1050	0.3	-	-	-	24V	48VA	PHOENIX	PVSA112LA
AV 215 - S2	390	1100	SUPPLY (DIFFUSERS)	14	200	1400	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA114LA
AV 215 - E1	0	695	GENERAL EXHAUST	12	0	900	0.3	Y	-	-	24V	96VA	PHOENIX	PVEA112LS
AV 215 - H1	530	885	6' FUME HOOD	12	90	1050	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB112LA
AV 215 - H2	530	885	6' FUME HOOD	12	90	1050	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB112LA
AV 219 - S1	280	280	SUPPLY (CHILLED BEAMS)	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVSA108LA
PAV 219 - H1	175	175	GAS SAFETY CABINET (C2H2)	8	35	500	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB108LA
PAV 219 - H2	175	175	GAS SAFETY CABINET (H2)	8	35	500	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB108LA
PAV 219 - H3	0	300	FUME EXTRACTOR (HIGH HEAT)	8	0	400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB108LS
AV 220 - S1	180	180	SUPPLY	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVSA108LA
AV 220 - E1	280	280	GENERAL EXHAUST	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVEA108LA
AV 221 - S1	495	495	SUPPLY	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVSA108LA
AV 221 - E1	595	595	GENERAL EXHAUST	12	90	1050	0.3	-	-	-	24V	48VA	PHOENIX	PVEA112LA
AV 241 - S1	630	630	SUPPLY (CHILLED BEAMS)	12	90	1050	0.3	-	-	-	24V	48VA	PHOENIX	PVSA112LA
AV 241 - S2	230	980	SUPPLY (DIFFUSERS)	12	90	1050	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA112LA
AV 241 - E1	0	750	GENERAL EXHAUST	12	0	900	0.3	Y	-	-	24V	96VA	PHOENIX	PVEA112LS
AV 241 - H1	530	885	6' FUME HOOD	12	90	1050	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB112LA
AV 241 - H2	530	885	6' FUME HOOD	12	90	1050	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB112LA
AV 245 - S1	720	720	SUPPLY (CHILLED BEAMS)	12	90	1050	0.3	-	-	-	24V	48VA	PHOENIX	PVSA112LA
AV 245 - S2	1085	1950	SUPPLY (DIFFUSERS)	2-12	180	2100	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA212LA
AV 245 - S3	1085	1950	SUPPLY (DIFFUSERS)	2-12	180	2100	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA212LA
AV 245 - S4	1085	1950	SUPPLY (DIFFUSERS)	2-12	180	2100	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA212LA
AV 245 - H1	530	885	6' FUME HOOD	12	90	1050	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB112LA
AV 245 - H2	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 245 - H3	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 245 - H4	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 245 - H5	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 245 - H6	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 245 - H7	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 245 - H8	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 245 - H9	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 245 - H10	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 245 - H11	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 245 - H12	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 245 - H13	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 245 - H14	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 245 - H15	530	885	6' FUME HOOD	12	90	1050	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB112LA
AV 250 - S1	440	440	SUPPLY (CHILLED BEAMS)	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVSA108LA
AV 250 - S2	245	475	SUPPLY (DIFFUSERS)	8	35	500	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA108LA
AV 250 - E1	30	585	GENERAL EXHAUST	12	90	1050	0.3	Y	-	-	24V	96VA	PHOENIX	PVEA112LA
AV 250 - H1	530	885	6' FUME HOOD	12	90	1050	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB112LA
AV 257 - S1	400	400	SUPPLY (CHILLED BEAMS)	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVSA108LA
AV 257 - S2	1085	1950	SUPPLY (DIFFUSERS)	2-12	180	2100	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA212LA
AV 257 - S3	1085	1950	SUPPLY (DIFFUSERS)	2-12	180	2100	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA212LA
AV 270 - S1	630	630	SUPPLY (CHILLED BEAMS)	12	90	1050	0.3	-	-	-	24V	48VA	PHOENIX	PVSA112LA
AV 270 - S2	230	980	SUPPLY (DIFFUSERS)	12	90	1050	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA112LA
AV 270 - E1	0	750	GENERAL EXHAUST	12	0	900	0.3	Y	-	-	24V	96VA	PHOENIX	PVEA112LS
AV 270 - H1	530	885	6' FUME HOOD	12	90	1050	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB112LA
AV 270 - H2	530	885	6' FUME HOOD	12	90	1050	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB112LA

LAB AIR VALVE SCHEDULE (PART 2)

SYMBOL	DESIGN MIN AIRFLOW (CFM)	DESIGN MAX AIRFLOW (CFM)	SERVICE	SIZE	MANUFACTURER'S CFM RANGE		AIR PRESSURE DROP (IN WC)	OPTIONS			ELECTRICAL		BASIS OF DESIGN	
					MIN	MAX		FAST ACTING ACTUATOR	SOUND ATTENUATOR	HERESITE COATING	VOLTAGE	POWER	MANUFACTURER	MODEL NUMBER
AV 280 - S1	720	720	SUPPLY (CHILLED BEAMS)	12	90	1050	0.3	-	-	-	24V	48VA	PHOENIX	PVSA112LA
AV 280 - S2	1085	1950	SUPPLY (DIFFUSERS)	2-12	180	2100	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA212LA
AV 280 - S3	1085	1950	SUPPLY (DIFFUSERS)	2-12	180	2100	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA212LA
AV 280 - S4	1085	1950	SUPPLY (DIFFUSERS)	2-12	180	2100	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA212LA
AV 280 - H1	530	885	6' FUME HOOD	12	90	1050	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB112LA
AV 280 - H2	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 280 - H3	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 280 - H4	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 280 - H5	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 280 - H6	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 280 - H7	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 280 - H8	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 280 - H9	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 280 - H10	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 280 - H11	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 280 - H12	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 280 - H13	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 280 - H14	330	550	4' FUME HOOD	10	50	550	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB110LA
AV 280 - H15	530	885	6' FUME HOOD	12	90	1050	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB112LA
AV 303 - S1	360	360	SUPPLY (CHILLED BEAMS)	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVSA108LA
AV 303 - S2	170	660	SUPPLY (DIFFUSERS)	12	90	1050	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA112LA
AV 303 - E1	0	110	GENERAL EXHAUST	8	0	400	0.3	Y	-	-	24V	96VA	PHOENIX	PVEA108LS
AV 303 - H1	730	1220	8' FUME HOOD	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 307 - S1	600	600	SUPPLY (CHILLED BEAMS)	12	90	1050	0.3	-	-	-	24V	48VA	PHOENIX	PVSA112LA
AV 307 - E1	600	600	GENERAL EXHAUST	12	90	1050	0.3	-	-	-	24V	48VA	PHOENIX	PVEA112LA
AV 309 - S1	420	420	SUPPLY (CHILLED BEAMS)	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVSA108LA
AV 309 - S2	1570	3040	SUPPLY (DIFFUSERS)	3-12	270	3150	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA312LA
AV 309 - H1	730	1220	8' FUME HOOD	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 309 - H2	730	1220	8' FUME HOOD	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 309 - H3	730	1220	8' FUME HOOD	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 311 - S1	300	300	SUPPLY (CHILLED BEAMS)	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVSA108LA
AV 311 - S2	960	1940	SUPPLY (DIFFUSERS)	3-12	270	3150	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA312LA
AV 311 - H1	730	1220	8' FUME HOOD	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 311 - H2	730	1220	8' FUME HOOD	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 313 - S1	190	190	SUPPLY (CHILLED BEAMS)	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVSA108LA
AV 313 - E1	290	290	GENERAL EXHAUST	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVEA108LA
AV 315 - S1	320	320	SUPPLY (CHILLED BEAMS)	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVSA108LA
AV 315 - S2	940	1920	SUPPLY (DIFFUSERS)	3-12	270	3150	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA312LA
AV 315 - H1	730	1220	8' FUME HOOD	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 315 - H2	730	1220	8' FUME HOOD	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 317 - S1	440	440	SUPPLY (CHILLED BEAMS)	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVSA108LA
AV 317 - S2	1550	3020	SUPPLY (DIFFUSERS)	3-12	270	3150	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA312LA
AV 317 - H1	730	1220	8' FUME HOOD	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 317 - H2	730	1220	8' FUME HOOD	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 317 - H3	730	1220	8' FUME HOOD	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 319 - S1	360	360	SUPPLY (CHILLED BEAMS)	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVSA108LA
AV 319 - S2	1230	2430	SUPPLY (DIFFUSERS)	3-12	270	3150	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA312LA
AV 319 - H1	730	1220	8' FUME HOOD	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 319 - H2	730	1220	8' FUME HOOD	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 319 - H3	330	550	4' FUME HOOD	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 330 - S1	380	380	SUPPLY (CHILLED BEAMS)	8	35	500	0.3	-	-	-	24V	48VA	PHOENIX	PVSA108LA
AV 330 - S2	880	1860	SUPPLY (DIFFUSERS)	3-12	270	3150	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA312LA
AV 330 - H1	730	1220	8' FUME HOOD	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 330 - H2	730	1220	8' FUME HOOD	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 334 - S1	920	920	SUPPLY (CHILLED BEAMS)	12	90	1050	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA112LA
AV 334 - E1	1120	1120	GENERAL EXHAUST	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEA114LA
AV 336 - S1	920	920	SUPPLY (CHILLED BEAMS)	12	90	1050	0.3	Y	-	-	24V	96VA	PHOENIX	PVSA112LA
AV 336 - E1	1120	1120	GENERAL EXHAUST	14	200	1400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB114LA
AV 345 - S1	750	750	SUPPLY (CHILLED BEAMS)	12	90	1050	0.3	-	-	-	24V	48VA	PHOENIX	PVSA112LA
AV 345 - S2	0	910	SUPPLY (DIFFUSERS)	14	0	1000	0.3	-	-	-	24V	48VA	PHOENIX	PVSA114LS
AV 345 - E1	785	1695	GENERAL EXHAUST	2-12	180	2100	0.3	-	-	-	24V	48VA	PHOENIX	PVEA212LA
AV 345 - H1	0	165	FUME EXTRACTOR	8	0	400	0.3	Y	-	Y	24V	96VA	PHOENIX	PVEB108LS
AV 370 - S1	700	700	SUPPLY (CHILLED BEAMS)	12	90	1050	0.3	-	-	-	24V	48VA	PHOENIX	PVSA112LA
AV 370 - S2	0	870	SUPPLY (DIFFUSERS)	12	0	1300	0.3	-	-	-	24V	48VA	PHOENIX	PVSA112LS
AV 370 - E1	900	1770	GENERAL EXHAUST	2-12	180	2100	0.3	-	-	-	24V	48VA	PHOENIX	PVEA212LA
AV 380 - S1	750	750	SUPPLY (CHILLED BEAMS)	12	90	1050	0.3	-	-	-	24V	48VA	PHOENIX	PVSA112LA
AV 380 - S2	0	860	SUPPLY (DIFFUSERS)	14	0	1000	0.3	-	-	-	24V	48VA	PHOENIX	PVSA112LS
AV 380 - E1	950	1810	GENERAL EXHAUST	2-12	180	2100	0.3	-	-	-	24V	48VA	PHOENIX	PVEA212LA

NOTES:
1. PROVIDE WITH INTEGRAL SOUND ATTENUATOR, DISCONNECT SWITCH, AND HANGER BRACKETS FOR ALL AIR VALVES.
2. PROVIDE CODE REQUIRED CLEARANCE ON ALL UNITS. ALL UNITS SHALL BE INSTALLED IN AN ACCESSIBLE OR WITH FULL SIZE ACESS DOORS.
3. CONTROLLERS SHALL BE FACTORY MOUNTED. COORDINATE WITH EQUIPMENT MANUFACTURER.
4. COORDINATE CONTROLS HANDING PRIOR TO PURCHASING.
5. TERMINAL UNIT CONTROLLER TO BE PROVIDED BY THE AIR VALVE MANUFACTURER. CONTROLLER TO COMMUNICATE VIA BACNET WITH CENTRAL LAB CONTROLLER. PROVIDE 24V CONTROL TRANSFORMER AS REQUIRED. COORDINATE POWER REQUIREMENTS WITH ELECTRICAL DRAWINGS.
6. REFER TO DRAWINGS, DETAILS, AND SPECIFICATIONS FOR ADDITIONAL INFORMATION AND FURTHER REQUIREMENTS.
7. PROVIDE HERESITE PROTECTIVE COATING ON ALL VALVES SERVING FUME HOODS OR COROSIVE FUMES.

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MONTCLAIR STATE UNIVERSITY

Project
Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For
Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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In Association with

Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan

Professional Seals

ANTHONY H. CAUCCI, PE
LICENSE NO. 24GE04480600

NOT FOR CONSTRUCTION

No.	Description	Date
	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
	ISSUED FOR BID	2026-01-19
1	ADDENDUM #5	2026-03-23

Project No:

Sheet Title

MECHANICAL SCHEDULES

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

M605

HVAC INSULATION SCHEDULE

DUCTWORK (INCLUDES SOUND ATTENUATORS AND OTHER DUCT APPURTENANCES)

LOCATION	SHAPE	SERVICE	INDOOR				ABOVE GRADE OUTDOOR				NOTES
			MIN. R-VALUE	MIN. THICKNESS	TYPE(S)	JACKET	R-VALUE	MIN. THICKNESS	TYPE(S)	JACKET	
CONCEALED FROM VIEW	ROUND/OVAL	SUPPLY & RETURN DUCT	R-8	1-1/2"	C	--	R-12	3"	D	NOTE 4	10
		OUTSIDE AIR DUCT	R-8	2"	C	--	R-12	2"	D	NOTE 4	10
	RECTANGULAR	SUPPLY & RETURN DUCT	R-8	1-1/2"	C	--	R-12	3"	D	NOTE 4	10
		SUPPLY & RETURN PLENUM	R-8	1-1/2"	D	--	R-12	3"	D	NOTE 4	10
		OUTSIDE AIR DUCT	R-8	2"	C	--	R-12	2"	D	NOTE 4	
		OUTSIDE AIR PLENUM	R-8	2"	D	--	R-12	2"	D	NOTE 4	
		EXHAUST DUCT 25' UPSTREAM/DOWNSTREAM FROM PENETRATION OF BUILDING EXTERIOR		2"	C	--		2"	D	NOTE 4	
		TYPE I, COMMERCIAL KITCHEN HOOD EXHAUST DUCT & PLENUM		2-HR MIN. 2"; NOTE 1	K, L	--		2-HR MIN. 2"; NOTE 1	L	NOTE 4	2
EXPOSED	ROUND/OVAL	SUPPLY, RETURN, EXHAUST DUCT	R-8	1-1/2"	D	NOTE 3	R-12	3"	D	NOTE 4	10
		OUTSIDE AIR DUCT	R-8	2"	D	NOTE 3	R-12	2"	D	NOTE 4	
	RECTANGULAR	SUPPLY, RETURN, EXHAUST DUCT	R-8	1-1/2"	D	NOTE 3	R-12	3"	D	NOTE 4	10
		SUPPLY, RETURN, EXHAUST PLENUM	R-8	1-1/2"	D	NOTE 3	R-12	3"	D	NOTE 4	10
		OUTSIDE AIR DUCT	R-8	2"	D	NOTE 3	R-12	2"	D	NOTE 4	
		OUTSIDE AIR PLENUM	R-8	2"	D	NOTE 3	R-12	2"	D	NOTE 4	
		TYPE I, COMMERCIAL KITCHEN HOOD EXHAUST DUCT & PLENUM		2-HR MIN. 2"; NOTE 1	L			2-HR MIN. 2"; NOTE 1	L	NOTE 4	2

PIPING

LOCATION	TEMP	SERVICE	SIZE	INDOOR				ABOVE GRADE OUTDOOR				
					THICKNESS	TYPE(S)	JACKET		THICKNESS	TYPE(S)	JACKET	
CONCEALED OR EXPOSED	ALL	CONDENSATE & EQUIPMENT DRAIN WATER	ALL		1"	B	NOTE 5		1"	B	NOTE 4	6,7,9
	ALL	CONDENSER WATER	ALL		1-1/2"	E	NOTE 5		3"	B	NOTE 4	6,7,9
	ALL	CHILLED WATER	< 1"		1-1/2"	E	NOTE 5		2"	B	NOTE 4	6,7,9
			1" TO 8"		1-1/2"	E	NOTE 5		3"	B	NOTE 4	6,7,9
			8" AND GREATER		2"	E	NOTE 5		3"	B	NOTE 4	6,7,9
	ALL	GEOTHERMAL WATER	ALL		1-1/2"	E	NOTE 5		2"	B	NOTE 4	6,7,9
	251-350	STEAM, HOT WATER, CONDENSATE	< 1"		3"	E	NOTE 5		3"	E	NOTE 4	6,7,9
			1" TO 1-1/2"		4-1/2"	E	NOTE 5		4-1/2"	E	NOTE 4	6,7,9
			1-1/2" AND GREATER		4-1/2"	E	NOTE 5		4-1/2"	E	NOTE 4	6,7,9
	ALL	REFRIGERANT SUCTION & HOT GAS	ALL		1"	E			2"	B		
	201-250	STEAM, HOT WATER, CONDENSATE	<4"		2-1/2"	E	NOTE 5		2-1/2"	E	NOTE 4	6,7,9
			4" AND GREATER		3"	E	NOTE 5		3"	E	NOTE 4	6,7,9
	140-200	HOT WATER, CONDENSATE	< 1-1/2"		1-1/2"	E	NOTE 5		2"	E	NOTE 4	6,7,9
			1-1/2" AND GREATER		2"	E	NOTE 5		3"	E	NOTE 4	6,7,9
	105-139	HOT WATER, CONDENSATE	< 1-1/2"		1"	E	NOTE 5		2"	E	NOTE 4	6,7,9
			1-1/2" AND GREATER		1-1/2"	E	NOTE 5		3"	E	NOTE 4	6,7,9

EQUIPMENT

LOCATION	SERVICE	TYPE	INDOOR				ABOVE GRADE OUTDOOR				NOTES
				THICKNESS	TYPE(S)	JACKET		THICKNESS	TYPE(S)	JACKET	
CONCEALED OR EXPOSED	HOT & CHILLED WATER	FREEZE PROTECTION PUMPS		2"	G	--		3"	G	NOTE 4	
		AIR SEPARATORS		2"	G	--		3"	G	NOTE 4	
	HYDRONIC SYSTEMS (GENERAL)	CHILLERS		1"	B	--		3"	B	PAINT	
		HEAT EXCHANGERS		1"	D	NOTE 3		3"	D	NOTE 4	
		PUMPS		2"	D	--		3"	G	NOTE 5	
		EXPANSION TANKS		1"	G	--		3"	G	NOTE 6	
		AIR (AND COMBINATION AIR / DIRT) SEPARATORS		1"	G	--		3"	G	NOTE 7	
		FILTRATION SYSTEMS		2"	G	--		2"	G	NOTE 8	
	AIR SYSTEMS	FANS		1"	D	--		2"	D	NOTE 4	

NOTES:
1. PROVIDE ADDITIONAL THICKNESS AS REQUIRED TO MEET SPECIFIED FIRE-RATING.
2. PROVIDE HIGH TEMPERATURE (HT) BOARD OR BLANKET WITH RATINGS PER SPECIFICATION.
3. FIELD-APPLIED 0.024" SMOOTH ALUMINUM (VENTURECLAD OR APPROVED EQUAL). WHEN SPECIFIED FOR DUCTWORK, ONLY REQUIRED IN OCCUPIED, FINISHED SPACES. FIELD-PAINTED COLOR BY ARCHITECT.
4. FIELD-APPLIED 0.032" SMOOTH WHITE PAINTED ALUMINUM W/ 0.020" THICK T-304 SS DRAW BANDS @12" O.C. (VENTURECLAD OR APPROVED EQUAL).
5. ALL SERVICE JACKET WITH SELF-SEALING LAP.
6. WHERE HEAT TRACE IS TO BE USED, FIBER INSULATION IS REQUIRED. CLOSED CELL IS NOT ACCEPTABLE.
7. FOR RUN-OUTS TO TERMINAL DEVICES LESS THAN 10' LONG, 1/2" INSULATION MAY BE USED.
8. PROVIDE Z-SHAPED LOCKING SEAMS ON EXPOSED OUTDOOR FIELD-APPLIED JACKETS.
9. PVC FITTING COVERS ARE REQUIRED FOR ALL PIPING. PROVIDE BLACK FITTINGS WHERE EXPOSED.
10. EXTERNAL INSULATION AND JACKETING NOT REQUIRED FOR DUCTS WITH INTERNAL ACOUSTIC LINING.
11. PROVIDE CORRUGATED JACKETS WHERE METAL JACKETS ARE REQUIRED, OVER 48" DIA OR 72" STRAIGHT DIMENSION.
12. INSULATION VALUES TO COINCIDE WITH CURRENT VERSION OF ASHRAE 189.1 FOR REGION. WHERE DISPARITIES OCCUR USE HIGHER INSULATION VALUE.
13. IN-LIEU OF EXTERNAL INSULATION FOR EXTERIOR DUCTWORK, DOUBLE WALLED DUCTWORK WITH SIMILAR r VALUE MAY BE INSTALLED.

INSULATION TYPES
- A: CELLULAR GLASS
- B: FLEXIBLE ELASTOMERIC
- C: MINERAL FIBER, BLANKET
- D: MINERAL FIBER, BOARD
- E: MINERAL FIBER, PRE-FORMED PIPE
- F: MINERAL FIBER, WICKING PIPE
- G: MINERAL FIBER, TANK
- H: POLYISOCYANURATE
- I: POLYOLEFIN
- J: MINERAL FIBER, BLANKET, FIRE-RATED
- K: MINERAL FIBER, BOARD, FIRE-RATED
- L: ACOUSTICAL DUCT LAGGING

DUCT MATERIALS SCHEDULE

SERVICE	SMACNA PRESSURE CLASS	MAXIMUM VELOCITY	MATERIAL	TRANSVERSE JOINTS	SMACNA CLASS		INSULATION	NOTES
					SEAL	LEAKAGE		
SUPPLY								
DISCHARGE FROM UNIT TO SHAFT OR FIRST DAMPER	+10	2000	G90	TDF/TDC	A	3	SEE SPECS	
UNIT, SHAFT OR FIRST DAMPER TO TERMINAL UNIT	+4	2000	G90	TDF/TDC	A	3	SEE SPECS	
TERMINAL UNIT TO AIR OUTLET	+2	1500	G90	TDF/TDC	A	6	SEE SPECS	
MAINS ABOVE AUDITORIUMS, RADIO, TELEVISION AND CLASSROOM AREAS	18 GA MIN	1200	G90	TDF/TDC	A	3	2"	1
RETURN AND EXHAUST								
AIR INLET TO FLOOR / SHAFT BREAKOUT	-2	1200	G90, ALUM	TDF/TDC	A	6	NONE	2
SHAFT / MAIN TO LAST DAMPER	-4	1500	G90	TDF/TDC	A	3	SEE SPECS	
LAST DAMPER TO FAN	-6	1800	G90	TDF/TDC	A	3	SEE SPECS	
DOWNSTREAM OF FAN	+6	1800	G90	TDF/TDC	A	3	SEE SPECS	
MAINS ABOVE AUDITORIUMS, RADIO, TELEVISION AND CLASSROOM AREAS	18 GA MIN	1200	G90	TDF/TDC	A	6	1"	3
LABORATORY HAZARDOUS EXHAUST								
BRANCH DUCTS TO LAB EQUIPMENT	-3	1800	SS	WELDED	A	0	NONE	6
MAIN TO EXHAUST FAN	-6	3000	SS	WELDED	A	0	NONE	4, 6
CANOPY HOOD								
TYPE 2 HOODS TO DUCT MAIN	-3	2500	SS	WELDED	A	0	SEE SPECS	
GENERAL / MISCELLANEOUS								
ALL OUTDOOR DUCTS	+/-10	SEE ABOVE	SEE ABOVE	TDF/TDC	A	3	SEE SPECS	

NOTES:
1. ACOUSTICAL DUCT LAGGING: 'SOUNDSEAL' B-10LAG/QFA-9, 1.4 LB/SF, STC-30, R-8 (OR EQUAL).
2. ALUMINUM DUCT REQUIRED FOR TOILET ROOMS AND JANITOR'S CLOSETS.
3. ACOUSTICAL DUCT LAGGING: 'SOUNDSEAL' B-10LAG/QFA-3, 1.2 LB/SF, STC-29, R-4 (OR EQUAL).
4. INSULATE CONCEALED DUCTS WITHIN SHAFTS WITH FIRE WRAP (UL-LISTED FOR CHEMICAL FUME DUCTS) CONTINUOUSLY UNTIL DUCT EXITS BUILDING.
5. DUCTS LESS THAN 8" MAXIMUM DIM, MIN 24 GA; 9"-16" DUCTS MIN 22 GA; 19"-30" DUCTS MIN. 20 GA & DUCTS GREATER THAN 30" MIN 18 GA.
6. MINIMUM CLEARANCE TO COMBUSTIBLES IS 6" FOR LAB HAZARDOUS EXHAUST. PROVIDE SECTIONS OF FIRE WRAP (UL-LISTED FOR CHEMICAL FUME DUCTS) TO ACHIEVE 'ZERO' CLEARANCE TO COMBUSTIBLES. RATING WHERE REQUIRED BY FIELD CONDITIONS. COORDINATE THIS REQUIREMENT WITH ALL TRADES TO ENSURE WORK OF OTHERS DOES NOT COMPROMISE CLEARANCE.
7. NO DUCT FOR ANY SERVICE MAY BE LESS THAN 26 GA THICKNESS.
8. SECURELY COVER ALL OPEN DUCTS THROUGHOUT CONSTRUCTION. REFER TO ASHRAE 62.1 AND LEED REQUIREMENTS FOR ADDITIONAL INFORMATION.
9. DUCTWORK TO BE CONSTRUCTED GAS TIGHT AND ALL DAMPERS ON THE SYSTEM SHALL BE GAS TIGHT.

PIPE MATERIALS SCHEDULE

SIZE	PIPE		JOINTS	FITTINGS	CLASS	VALVES	INSULATION
	MATERIAL	TYPE					
CHILLED WATER, HEATING HOT WATER, MAKE-UP WATER							
2 " AND SMALLER	COPPER	L	SOLDERED OR GROOVED	WROUGHT	150	SEE SCHEDULE AND SPECS	SEE SCHEDULE AND SPECS
3" THRU 10"	STEEL	SCH 40	WELDED/FLANGED OR GROOVED	STEEL	150	SEE SCHEDULE AND SPECS	SEE SCHEDULE AND SPECS
LARGER THAN 10"	STEEL	STD WGT	WELDED/FLANGED OR GROOVED	STEEL	150	SEE SCHEDULE AND SPECS	SEE SCHEDULE AND SPECS
HIGH PRESSURE STEAM							
2 " AND SMALLER	STEEL	SCH 80	SCREWED	MALLEABLE IRON	250	SEE SCHEDULE AND SPECS	SEE SCHEDULE AND SPECS
LARGER THAN 2"	STEEL	SCH 80	WELDED & FLANGED	STEEL	250	SEE SCHEDULE AND SPECS	SEE SCHEDULE AND SPECS
MEDIUM AND LOW PRESSURE STEAM							
2 " AND SMALLER	STEEL	SCH 40	SCREWED	MALLEABLE IRON	150	SEE SCHEDULE AND SPECS	SEE SCHEDULE AND SPECS
LARGER THAN 2"	STEEL	SCH 40	WELDED & FLANGED	STEEL	150	SEE SCHEDULE AND SPECS	SEE SCHEDULE AND SPECS
STEAM CONDENSATE							
2 " AND SMALLER	STEEL	SEAMLESS SCH 80	SCREWED	MALLEABLE IRON	MATCH STEAM SERVICE	SEE SCHEDULE AND SPECS	SEE SCHEDULE AND SPECS
LARGER THAN 2"	STEEL	SEAMLESS SCH 80	WELDED & FLANGED	STEEL	MATCH STEAM SERVICE	SEE SCHEDULE AND SPECS	SEE SCHEDULE AND SPECS
VENTS							
4 " AND SMALLER	GALV STEEL	SCH 40	SCREWED	MALLEABLE IRON	150	SEE SCHEDULE AND SPECS	SEE SCHEDULE AND SPECS
LARGER THAN 4"	STEEL	SCH 40	WELDED & FLANGED	STEEL	150	SEE SCHEDULE AND SPECS	SEE SCHEDULE AND SPECS
AC CONDENSATE DRAINS							
ALL SIZES	COPPER	DWV	SOLDERED OR PROPRESS	WROUGHT	125	SEE SCHEDULE AND SPECS	SEE SCHEDULE AND SPECS

NOTES:
1. 2-1/2" AND 5" PIPE SHALL NOT BE USED UNLESS RELOCATING OR EXTENDING EXISTING PIPE OF THOSE SIZES.
2. GROOVED PIPING WITH MECHANICAL COUPLING JOINTS (FLEXIBLE AND RIGID) MAY BE PERMITTED FOR BRANCH PIPING WITHIN MECHANICAL ROOMS AND BETWEEN ISOLATION VALVES SERVING INDIVIDUAL TERMINAL DEVICES OR EQUIPMENT SUCH AS PUMPS, CHILLERS, COOLING TOWERS, CONDENSERS, COOLERS, BOILERS, HEAT EXCHANGERS, TANKS, COILS. SIDE-STREAM WATER FILTERS AND CHEMICAL TREATMENT PACKAGES, SIDE-STREAM AIR AND DIRT SEPARATORS, AND SIMILAR APPLICATIONS AS APPROVED BY ENGINEER/ARCHITECT. GROOVED PIPING IS NOT PERMITTED IN OR ABOVE OCCUPIED FINISHED SPACES, IN CONCEALED OR INACCESSIBLE SPACES, OR IN ELECTRICAL OR TELDATA SPACES. GROOVED PIPING IS NOT PERMITTED FOR MAINS OR BRANCH MAINS.
3. COVER ALL OPEN PIPES THROUGHOUT CONSTRUCTION TO KEEP OUT DIRT, DEBRIS AND PESTS.

MONTCLAIR STATE UNIVERSITY

Project
Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For
Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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In Association with

Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan

Professional Seals

ANTHONY H. CAUCCI, PE
LICENSE NO. 24GE04480600

NOT FOR CONSTRUCTION

No.	Description	Date
	ISSUED FOR CONTRACT DOCUMENTS	2025-06-14
	ISSUED FOR BID	2026-01-19
1	ADDENDUM #5	2026-03-23

Project No:

Sheet Title

MECHANICAL SCHEDULES

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

M607

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ABBREVIATIONS

@	AT	KVA	KILOVOLT AMPERE
A OR AMP	AMPERE	KW	KILOWATT
ABV.	ABOVE	KWH	KILOWATT-HOUR
AF	AMP FRAME	L.A.	LIGHTNING SURGE ARRESTER
A.F.C.	ABOVE FINISHED CEILING	LCP	LOCAL CONTROL PANEL
A.F.F.	ABOVE FINISHED FLOOR	LIM	LINE ISOLATION MONITOR
A.F.G.	ABOVE FINISHED GRADE	LO.	LUGS ONLY
A.I.C.	AMPERE INTERRUPTING CAPACITY	LPS	LIGHTNING PROTECTION SYSTEM
AL.	ALUMINUM	LS	LIMIT SWITCH
ALT.	ALTERNATE	LT.	LIGHT
AM	AMMETER	LTG	LIGHTING
ANNUN.	ANNUNCIATOR	LV	LOW VOLTAGE
ANT.	ANTENNA	MAX.	MAXIMUM
ARCH.	ARCHITECT	M.C.	MECHANICAL CONTRACTOR
AS	AMMETER SWITCH	MCB	MAIN CIRCUIT BREAKER
AT	AMP TRIP	MCC	MOTOR CONTROL CENTER
ATC	AUTOMATIC TEMPERATURE CONTROL	MCP	MOTOR CIRCUIT PROTECTOR
ATS	AUTOMATIC TRANSFER SWITCH	MCS	MOLDED CASE SWITCH
AUX.	AUXILIARY	ME	MODIFY EXISTING
BD	BUS DUCT	MFR.	MANUFACTURER
BIL	BASIC IMPULSE LEVEL	MIN.	MINIMUM
BKBD.	BACKBOARD	M.O.	MECHNICALLY OPERATED
BKR.	BREAKER	M.L.O.	MAIN LUGS ONLY
B.O.D.	BASIS OF DESIGN	MTD.	MOUNTED
C. OR CDT.	CONDUIT	MTS	MANUAL TRANSFER SWITCH
CAB.	CABINET	MV	MEDIUM VOLTAGE
CB	CIRCUIT BREAKER	N	NEUTRAL
CBL.	CABLE	(N)	NEW
CC	CASEWORK CONTRACTOR	NAC	NOTIFICATION APPLIANCE CIRCUIT
CKT	CIRCUIT	N.C.	NORMALLY CLOSED
CLG.	CEILING	N.E.C.	NATIONAL ELECTRIC CODE
CONN.	CONNECTION	N.I.C.	NOT IN CONTRACT
CONST.	CONSTRUCTION	N.O.	NORMALLY OPEN
CONT.	CONTINUOUS	N.T.S.	NOT TO SCALE
CONTR.	CONTRACTOR	O.C.	ON CENTER
CPT	CONTROL POWER TRANSFORMER	O.C.B.	OIL CIRCUIT BREAKER
CT	CURRENT TRANSFORMER	O.C.P.	OVERCURRENT PROTECTION
CU.	COPPER	O.D.	OUTSIDE DIMENSION
DEMO.	DEMOLITION	P	POLE
DC	DIRECT CURRENT	PB	PULL BOX
DIA.	DIAMETER	P.C.	PLUMBING CONTRACTOR
DIC.	DICTATION	PF	POWER FACTOR
DISC.	DISCONNECT	PH OR Ø	PHASE
DIST.	DISTRIBUTION	PL	PILOT LIGHT
DWG.	DRAWING	PNL.	PANEL
DP	DISTRIBUTION PANEL	PRI.	PRIMARY
EM.	EMERGENCY	PRJ	PROJECTOR
EA.	EACH	PRS	PROJECTOR SCREEN
E.C.	ELECTRICAL CONTRACTOR	PS	PULL STATION
E.D.P.	ELECTRONIC DATA PROCESSING	PSI	POUNDS PER SQUARE INCH
ELEC.	ELECTRICAL	PT	POTENTIAL TRANSFORMER
ELEV.	ELEVATOR	PWR.	POWER
EMT	ELECTRICAL METALLIC TUBING	RCVR.	RECEIVER
ENCL.	ENCLOSURE	RE (RE)	REMOVE EXISTING
E.O.	ELECTRICALLY OPERATED	REQ.	REQUIRED
E.R.	EXISTING RELOCATED	REX	RELOCATE EXISTING
EQUIP.	EQUIPMENT	SEC.	SECONDARY
E.W.C.	ELECTRIC WATER COOLER	SLC	SIGNALING LINE CIRCUIT
EX (E)	EXISTING TO REMAIN	SLD.	SINGLE LINE DIAGRAM
F.	FUSED	SLV.	SLEEVE
F/A	FIRE ALARM	SPEC.	SPECIFICATION
F.B.O.	FURNISHED BY OWNER	SS.	SUBSTATION
F.D.	FEEDER DUCT	S.T.	SHUNT TRIP
FDR.	FEEDER	STD.	STANDARD
F.H.C.	FIRE HOSE CABINET	STR.	STARTER
F.I.	FILM ILLUMINATOR	SW.	SWITCH
FL.	FLOOR	SWGR.	SWITCHGEAR
FLUOR.	FLUORESCENT	SYS.	SYSTEM
F.S.	FLOW SWITCH	TEL.	TELEPHONE
FUT.	FUTURE	TEMP.	TEMPERATURE
G	EQUIPMENT GROUND CONDUCTOR	TERM.	TERMINAL
GA.	GAUGE	TV	TELEVISION
G.C.	GENERAL CONTRACTOR	TYP.	TYPICAL
G.F.I.	GROUND FAULT INTERRUPTER	UC	UNDERCOUNTER
G.F.S.C.	GROUND FAULT SENSING RELAY	U/F	UNFUSED
GND.	GROUND	U.L.	UNDERWRITERS' LABORATORY
GSC	SYSTEM CIRCUIT GROUND CONDUCTOR	U.O.N.	UNLESS OTHERWISE NOTED
H.I.D.	HIGH INTENSITY DISCHARGE	U.V.	UNDER VOLTAGE
H.O.A.	HAND-OFF-AUTOMATIC	V	VOLT
H.P.	HORSEPOWER	VFD	VARIABLE FREQUENCY DRIVE
HT.	HEIGHT	VM	VOLTMETER
H.V.	HIGH VOLTAGE	VS	VOLTMETER SWITCH
HVAC	HEATING, VENTILATING, AIR COND.	W	WATT
I.D.	INSIDE DIMENSION	WP	WEATHERPROOF
ILL.	ILLUMINATION	XDR	TRANSDUCER
IMC.	INTERMEDIATE METAL CONDUIT	XFMR	TRANSFORMER
INV.	INVERT	XFR	TRANSFER
JB	JUNCTION BOX	XMTR	TRANSMITTER
JUNC.	JUNCTION	XP	EXPLOSION-PROOF
K.E.C.	KITCHEN EQUIPMENT CONTRACTOR	XPDR 4W	TRANSPONDER FOUR WIRE

MOUNTING HEIGHTS

STANDARD MOUNTING HEIGHTS

9" BELOW FINISHED CEILING OR 10'-0" AFF	WALL-MOUNTED CLOCKS AND PROGRAM BELLS (LOWEST OF TWO HEIGHTS OR AS SHOWN ON ARCHITECTURAL DETAILS)
10'-0"	BATTERY LIGHTING UNITS AND REMOTE WALL MOUNTED LIGHT HEADS (OR 1'-0" BELOW FINISHED CEILING TO TOP OF UNIT)
7'-6"*	TELEVISION OUTLET AND SERVICE RECEPTACLE FOR SHELF MOUNTED TV IN BEDROOMS
7'-6"	TOP OF BACK MOUNTED WALL EXIT LUMINAIRES (NOT MOUNTED ABOVE DOORS)
CENTERED ABOVE DOOR OR OPENING OPENING	WARNING AND SIGNALING LUMINAIRES / SIGNS
6'-6"	TOP OF FLUSH AND SURFACE MOUNTED ELECTRICAL LIGHTING OR POWER PANELBOARDS AND TELEPHONE CABINETS
6'-0"	TOP OF HIGHEST ELECTRICAL SAFETY DISCONNECT SWITCHES, MAGNETIC STARTERS, CONTACTORS, AND FA PANELS
3'-8"	ELECTRICAL RECEPTACLES FOR REFRIGERATORS, FREEZERS, AND VENDING MACHINES (18" AT UNDER COUNTER LOCATIONS)
3'-8"	WALL-MOUNTED TELEPHONES AND PAY STATIONS (3'-6" AT ADA LOCATIONS)
3'-8"	WALL-MOUNTED ELECTRICAL DEVICES, LIGHTING SWITCHES, OCCUPANCY SENSORS, AND MANUAL MOTOR STARTERS
3'-0"	CARD READERS
2'-0"	ELECTRICAL RECEPTACLES WITHIN MECHANICAL SPACES, ELECTRICAL AND ELEVATOR ROOMS
18"	ELECTRICAL RECEPTACLES AND VOICE/DATA OUTLETS [PATIENT ROOM NIGHTLIGHTS]
6"	ELECTRICAL AND DATA CONNECTIONS TO SYSTEMS FURNITURE
0'-0"	FINISHED FLOOR

NOTES:

1. **ARCHITECTURAL PLAN MOUNTING HEIGHTS TAKE PRECEDENT OVER THE ABOVE LISTED MOUNTED HEIGHTS. REFER TO ARCHITECTURAL DRAWINGS AND INTERIOR ELEVATIONS FOR ADDITIONAL MOUNTING HEIGHT REQUIREMENTS.**
2. **REFER TO DWG QL001 FOR LABORATORY POWER/DATA MOUNTING HEIGHTS.**
3. MOUNTING HEIGHTS TO CENTER OF OUTLETS UNLESS OTHERWISE NOTED. IN MASONRY CONSTRUCTION THE ABOVE MOUNTING HEIGHTS SHALL BE USED FOR REFERENCE TO THE NEAREST BLOCK OR BRICK COURSING.
4. A "*" SYMBOL BESIDE A DEVICE INDICATES DEVICE MOUNTED ABOVE COUNTER OR CASEWORK. REFER TO ARCHITECTURAL AND CASEWORK DETAILS FOR ACTUAL ELEVATION.

WIRING DEVICES AND BOXES

- DUPLEX RECEPTACLE — XX: CIRCUIT NUMBER (TYPICAL FOR ALL ELECTRICAL DEVICES); 'S' PREFIX IS GENERATOR-BACKED CIRCUIT (EX: S1); PANEL INDICATED BY LOCAL TAG: (PANEL); (FUNCTION): TR - TAMPER RESISTANT; EP - EXPLOSION PROOF; HG - HOSPITAL GRADE; IG - ISOLATED GROUND; G - GROUND FAULT CIRCUIT INTERRUPTER; TV - DUPLEX MOUNTED BEHIND TELEVISION; WN - WASTE NEUTRALIZATION; WF - WATER FOUNTAIN; U - USB
  - * - 2-GANG WALLBOX FOR DUPLEX AND DATA WITH DIVIDER, B.O.D. - HUBBELL HBL985 WALLBOX WITH HUBBELL HBL989 PARTITION. PROVIDE AND INSTALL 1-1/4" CONDUIT RAN UP 6" ABOVE THE CEILING COORDINATE MOUNTING HEIGHTS WITH ARCHITECTURAL POWER/DATA PANS AND LABORATORY MOUNTING HEIGHTS ON DWG QL001.
- QUADRUPLEX RECEPTACLE
- SPLIT-WIRE QUADRUPLEX RECEPTACLE
- CEILING SERVICE PANEL WITH DEVICES AS INDICATED
- SPECIAL PURPOSE RECEPTACLE — XX: INDICATES NEMA TYPE - REFER TO DETAIL 3/E-005
- DUPLEX RECEPTACLE - CEILING MOUNTED — PRJ: (FUNCTION) PRJ - PROVIDE ADDITIONAL GANGS, COVER PLATES, AND DATA PORTS AS REQUIRED PER AV PLANS. PROVIDE 1-1/4" CONDUIT TO ABOVE ACCESSIBLE CEILING
- PEDESTAL TABLE BOX WITH DEVICE(S) AS INDICATED. B.O.D. - LEGRAND AL241S-HB SEE ARCHITECTURAL POWER/PLANS FOR MORE INFORMATION.
- FB — X: FLOOR BOX IN SLAB (TYPES OUTLINED BELOW) - PROVIDE 3/4" CONDUIT FOR POWER, 1-1/4" CONDUIT FOR DATA, 1-1/4" CONDUIT FOR A/V. PROVIDE QUADRUPLEX RECEPTACLE, DATA PORTS AS INDICATED ON DATA PLANS, AND AV AS REQUIRED PER AV PLANS. PROVIDE PARTITIONS BETWEEN POWER, DATA, AND A/V COMPARTMENTS. EXACT LOCATIONS TO BE COORDINATED WITH ARCHITECTURAL DIMENSIONED DRAWINGS.
  - (TYPE)
  - A (POWER) - HUBBELL MODELS CF82G30E, CFBS1R6CVR, & (2) PWFBMPCR20 OR APPROVED EQUAL
  - B (POWER & DATA) - HUBBELL MODEL CF84G30RCI, CFBS1R8CVR, FBMPREC, FBMP6KS, & (2) PWFBMPCR20 OR APPROVED EQUAL
  - C (POWER, DATA & A/V) - FSR MODEL FL-500P-4 OR APPROVED EQUAL COORDINATE COVER PLATE TYPE AND FINISH WITH ARCHITECT.
  - D (GRIDD SYSTEM) - RAISED FLOOR SYSTEM FLOORBOX W/ POWER, DATA AND/OR A/V. B.O.D. - FREEAXEZ GRIDD POWER MODEL NO. GP 708-FAS7001-001
- PK — X: POKE-THRU (TYPES OUTLINED BELOW) - PROVIDE 3/4" CONDUIT FOR POWER, 1-1/4" CONDUIT FOR DATA, 1-1/4" CONDUIT FOR A/V.
  - (TYPE)
  - A (POWER) - HUBBELL MODEL S1R4PTQUAD OR APPROVED EQUAL
  - B (POWER & DATA)- HUBBELL MODEL S1R6PTDEH OR APPROVED EQUAL
  - C (POWER, DATA & A/V) - HUBBELL MODEL S1R8PTWZ OR APPROVED EQUAL. COORDINATE COVER PLATE TYPE AND FINISH WITH ARCHITECT. EXACT LOCATIONS TO BE COORDINATED WITH ARCHITECTURAL DIMENSIONED DRAWINGS
- FURNITURE MOUNTED QUADRUPLEX RECEPTACLE — X
- FURNITURE MOUNTED DUPLEX RECEPTACLE — X: (TYPE) U - USB, F - FLUSHMOUNT, P - PEDESTAL MOUNT
- WB — AV RECESSED WALL BOX - BASIS OF DESIGN: LEGRAND PAC525 OR PAC526 PROVIDE QUADRUPLEX RECEPTACLE, 2 DATA PORTS AND AV AS REQUIRED PER AV PLANS. PROVIDE 3/4" CONDUIT FOR POWER, 1-1/4" CONDUIT FOR DATA AND 1-1/4" CONDUIT FOR A/V TO ABOVE ACCESSIBLE CEILING.
- WP — AV INPUT WALL PLATE - PROVIDE DUPLEX RECEPTACLE AND 2-GANG BOX FOR AV AS REQUIRED PER AV PLANS. PROVIDE 3/4" CONDUIT FOR POWER AND 1-1/4" CONDUIT FOR A/V TO ABOVE ACCESSIBLE CEILING.
- J — X: JUNCTION BOX (FUNCTION) AV - AUDIOVISUAL 2-GANG BACKBOX MOUNTED AT 18" A.F.F. U.O.N. PROVIDE 1-1/4" CONDUIT TO ABOVE ACCESSIBLE CEILING. COORDINATE WITH AV DRAWINGS FOR FINAL REQUIREMENTS. HD - HAND DRYER; TP - TRAP PRIMER; GW - GLASS WASHER; FH - FUME HOOD; ACM - AUTOMATIC CHANGEOVER MANIFOLD; PRS - MOTORIZED PROJECTOR SCREEN; GB - GLOVE BOX; FM - FLUSHOMETER; SS - SAFETY SHOWER STROBE LIGHT / ALARM HORN; PS - AIR VALVE POWER SUPPLY. COORDINATE WITH M.C. FOR EXACT LOCATION.
- PB — PULL BOX WITH SYSTEM AS INDICATED
- MOTOR
- X — TRANSFORMER - X INDICATES KVA RATING, PROVIDE ALL APPURTENANCES AS REQUIRED. PRIMARY AND SECONDARY VOLTAGES AS INDICATED ON PLANS
- HH — HANDHOLE - COORDINATE FINAL LOCATION WITH ARCHITECT
- PUSH PLATE SWITCH FOR AUTOMATIC DOOR OPENER
- WALL CONNECTION TO FURNITURE SYSTEM - POWER WHIP
- FLOOR CONNECTION TO FURNITURE SYSTEM - POWER WHIP

COMMUNICATIONS

- T — WALL MOUNTED TELEPHONE. PROVIDE, INSTALL, TERMINATE, AND TEST SINGLE CAT-6 DATA WIRES TO BE RUN TO DOUBLE GANG, RECESSED WALL BOX WITH SINGLE GANG FLANGE, WITH 3/4" CONDUIT RAN UP 6" ABOVE THE CEILING. SEE WIRE SPECIFICATION FOR ADDITIONAL INFORMATION.
- CLK — WALL MOUNTED CLOCK. PROVIDE AND INSTALL RECESSED WALL BOX FOR POWER OVER ETHERNET REQUIREMENTS WITH 3/4" CONDUIT RAN UP 6" ABOVE THE CEILING. SEE I.T. CONSULTANT'S DRAWINGS FOR WIRE TYPE AND FINAL LOCATION. SIZE WALL BOX AS NEEDED.
- WALL MOUNTED DATA RECEPTACLE. PROVIDE AND INSTALL RECESSED WALL BOX FOR DATA REQUIREMENTS WITH 1-1/4" CONDUIT RAN UP 6" ABOVE THE CEILING. SEE I.T. CONSULTANT'S DRAWINGS FOR QUANTITY AND TYPE OF WIRE. SIZE WALL BOX AS NEEDED.
- POTS LINE. PROVIDE, INSTALL, TERMINATE AND TEST SINGLE CAT-6 DATA WIRE TO BE RUN TO DOUBLE GANG, RECESSED WALL BOX WITH SINGLE GANG FLANGE, WITH 3/4" CONDUIT RAN UP 6" ABOVE THE CEILING. SEE WIRE SPECIFICATION FOR ADDITIONAL INFORMATION.
- TV — DOUBLE GANG RECESSED BOX WITH SINGLE GANG FLANGE. COORDINATE MOUNTING HEIGHT IN FIELD WITH FINAL APPROVED EQUIPMENT LOCATION. PROVIDE (2) 1-1/4"C STUBBED UP ABOVE NEAREST ACCESSIBLE CEILING. PROVIDE PLASTIC GROMMETS AT ALL CONDUIT ENDS. PROVIDE, INSTALL, TERMINATE AND TEST SINGLE CAT-6 DATA WIRE PER DISPLAY.
- XX — PROVIDE, INSTALL, TERMINATE AND TEST CAT-6 DATA WIRES TO BE RUN TO DOUBLE GANG, RECESSED WALL BOX WITH SINGLE GANG FLANGE, WITH 3/4" CONDUIT RAN UP 6" ABOVE THE CEILING. SEE WIRE SPECIFICATION FOR ADDITIONAL INFORMATION. XX REPRESENTS THE QUANTITY OF REQUIRED CAT-6 DATA WIRES.
- WAP — PROVIDE, INSTALL, TERMINATE AND TEST TWO CAT-6A DATA WIRES TO BE RUN TO PANDUIT 2-PORT SURFACE MOUNT BOX, MOUNTED ABOVE CEILING FOR WIRELESS ACCESS POINT. SEE WIRE SPECIFICATION FOR ADDITIONAL INFORMATION.
- PRJ — PROVIDE, INSTALL, TERMINATE AND TEST TWO CAT-6 DATA WIRES TO BE RUN TO PANDUIT 2-PORT SURFACE MOUNT BOX, MOUNTED ABOVE CEILING FOR PROJECTOR. SEE WIRE SPECIFICATION FOR ADDITIONAL INFORMATION.
- XX — FIRE RATED FLOOR MOUNTED DATA CONNECTION FEED TO SYSTEM FURNITURE. COORDINATE DATA REQUIREMENTS WITH FINAL APPROVED FURNITURE SYSTEM. LOCATION SHALL BE IN ACCORDANCE WITH ARCHITECTURAL DIMENSIONED FURNITURE LAYOUTS. XX REPRESENTS THE QUANTITY OF REQUIRED CAT-6 DATA WIRES.
- XX — WALL MOUNTED DATA CONNECTION FEED TO SYSTEMS FURNITURE. COORDINATE DATA REQUIREMENTS WITH FINAL APPROVED FURNITURE SYSTEM. LOCATION SHALL BE IN ACCORDANCE WITH ARCHITECTURAL DIMENSIONED FURNITURE LAYOUTS. XX REPRESENTS THE QUANTITY OF REQUIRED CAT-6 DATA WIRES.
- RS — ROOM SCHEDULER - PROVIDE, INSTALL, TERMINATE, AND TEST SINGLE CAT-6 DATA WIRES TO BE RUN TO DOUBLE GANG, RECESSED WALL BOX, WITH 3/4" CONDUIT RAN UP 6" ABOVE THE CEILING. SEE WIRE SPECIFICATION FOR ADDITIONAL INFORMATION.

LIGHTING FIXTURES

SYMBOLS FOR LIGHTING FIXTURES ARE DIAGRAMMATIC AND WILL NOT REPRESENT PRODUCT APPEARANCE. FIXTURE LETTER DESIGNATION "A,B,C", WHICH REFER TO THE LUMINAIRE SCHEDULE WILL DETERMINE ACTUAL PRODUCT SPECIFIED.

- HALF-SHADED FIXTURES OR FIXTURES TAGGED WITH 'EM' REPRESENT FIXTURES OPERATING ON EMERGENCY POWER
- INDICATES POWER SOURCE PANEL
- INDICATES PANEL CIRCUIT NUMBER
- LP1-3 a — INDICATES CONTROL ZONE
- A — INDICATES FIXTURE TYPE (WHERE NEEDED FOR CLARIFICATION)
- 2'x4' LIGHTING FIXTURE - REFER TO LUMINAIRE SCHEDULE
- 2'x2' LIGHTING FIXTURE - REFER TO LUMINAIRE SCHEDULE
- LINEAR LIGHTING FIXTURE - REFER TO LUMINAIRE SCHEDULE
- PENDANT LINEAR LIGHTING FIXTURE - REFER TO LUMINAIRE SCHEDULE
- WALL MOUNTED LIGHTING FIXTURE - REFER TO LUMINAIRE SCHEDULE
- CHANNEL LIGHTING FIXTURE - REFER TO LUMINAIRE SCHEDULE
- LIGHTING FIXTURE - WALL MOUNTED - REFER TO LUMINAIRE SCHEDULE
- ADJUSTABLE DOWN-LIGHT - REFER TO LUMINAIRE SCHEDULE
- DOWN-LIGHT - REFER TO LUMINAIRE SCHEDULE
- WALLWASHER DOWNLIGHT - REFER TO LUMINAIRE SCHEDULE
- EXIT SIGN - ARROWS AS INDICATED ON PLANS - CEILING MOUNTED REFER TO ARCHITECTURAL EGRESS PLANS FOR ARROW DIRECTION AND FACE DIRECTION
- EXIT SIGN - ARROWS AS INDICATED ON PLANS - WALL MOUNTED REFER TO ARCHITECTURAL EGRESS PLANS FOR ARROW DIRECTION AND FACE DIRECTION
- EMERGENCY BATTERY UNIT (CONNECT AHEAD OF SWITCH)
- WALL PACK WALL MOUNTED LIGHTING FIXTURE - COORDINATE EXACT HEIGHT & LOCATION WITH OWNER / ARCHITECT APPROVAL -REFER TO LUMINAIRE SCHEDULE

CONTROL DEVICES

- S — X: TOGGLE SWITCH (SINGLE POLE UNLESS OTHERWISE NOTED) (FUNCTION) a, b, c - INDICATES CONTROL ZONE; 2 - TWO POLE; 3 - THREE POLE; 4 - FOUR POLE; D - DIMMING; LX - LOW VOLTAGE (X INDICATES # OF SELECTOR BUTTONS); LM - LOW VOLTAGE MASTER SWITCH; OC - OCCUPANCY SENSOR; TW - TUNABLE WHITE; M - MOTOR RATED SWITCH; V - VACANCY SENSOR; MS - MOTORIZED SHADE CONTROLLER; 3P - SINGLE POLE, 3 POSITION, CENTER OFF MOMENTARY CONTACT SWITCH; SC - SCENE SELECTION (FOUR SCENE STANDARD); P - WITH PILOT LIGHT; LT - LIGHTED TOGGLE (LIGHTED WHEN LOAD IS OFF); PRS - PROJECTOR SCREEN RAISE/LOWER SWITCH - PROVIDE 3/4" CONDUIT FOR LOW VOLTAGE CONNECTION TO PROJECTOR SCREEN; FM - MOTOR RATED SWITCH FOR FLUSHOMETER XFMR; E - INDICATES EMERGENCY CIRCUIT AND LIGHTED TOGGLE
- OC — CEILING MOUNTED OCCUPANCY SENSOR
- VS — CEILING MOUNTED VACANCY SENSOR
- DS — CEILING MOUNTED DAYLIGHT SENSOR (PHOTOSENSOR)
- OC — WALL MOUNTED OCCUPANCY SENSOR

GROUNDING SYMBOLS

- MECHANICAL CONNECTION
- 3/4" COPPERWELD GROUND ROD, 10 FEET LONG
- GROUND CONDUCTOR (EMBEDDED)
- GROUND CONDUCTOR (EXPOSED)
- 5'-0" COILED GROUND CONDUCTOR FOR FUTURE GROUND CONNECTION
- BOLTED GROUND CONNECTION
- TW — THERMOWELD CONNECTION
- TEST WELL
- GROUND INSERT PLATE
- GROUND BAR
- TVSS — TRANSIENT VOLTAGE SURGE SUPPRESSOR - AS SPECIFIED
- CONNECTION TO GROUND (GND), PER APPLICABLE SECTION OF ARTICLE 250, N.E.C.
- THROUGH ROOF CONNECTION TO STEEL
- A — LIGHTNING TERMINAL

EQUIPMENT DESIGNATION LEGEND

VOLTAGE; POWER TYPE; EQUIPMENT TYPE; LEVEL CODE; SEQUENTIAL NUMBER

P | OS | 2 | 1 | 1

EXAMPLE NAME REFLECTS OPTIONAL STANDBY POWER PANEL AT 208Y/120V, LOCATED ON LEVEL 1, FIRST PANEL OF THIS TYPE ON THIS FLOOR.

EQUIPMENT TYPE	POWER TYPE	VOLTAGE	LEVEL CODE	SEQUENCE
SW = SWITCHBOARD DP = DISTRIBUTION PANEL L = LIGHTING PANEL LC = LIGHTING CONTROL PANEL H = HVAC EQUIPMENT PANEL P = POWER PANEL ATS = AUTOMATIC TRANSFER SWITCH IT = IT PANEL LP = LAB PANEL FP = FIRE PUMP	N = NORMAL POWER LS = LIFE SAFETY LR = LEGALLY REQUIRED OS = OPTIONAL STANDBY EM = EMERGENCY	4 = 480Y/277V 2 = 208Y/120V	1 = LEVEL 1 2 = LEVEL 2 3 = LEVEL 3 4 = LEVEL 4 P = PENTHOUSE	1 - FIRST PANEL 2 - SECOND PANEL 3 - THIRD PANEL ETC.

CIRCUIT PROTECTION / DISCONNECT/MOTOR CONTROL

- ELECTRICAL PANELBOARD, 480Y/277V OR 208Y/120V, SURFACE OR RECESSED MOUNTED - AS NOTED IN PANELBOARD SCHEDULES
- XX — UNFUSED SAFETY SWITCH, XX: SWITCH AMPERE RATING
- XX/YY — FUSED SAFETY SWITCH, XX/YY: SWITCH/FUSE AMPERE RATINGS
- XX/YY # — FUSED COMBINATION STARTER, XX/YY: SWITCH/FUSE AMPERE RATINGS, #: NEMA RATING
- EPO — EMERGENCY POWER OFF - LASER EMERGENCY SHUT-OFF
- S_M — MANUAL MOTOR STARTER
- VFD — VARIABLE FREQUENCY DRIVE

RACEWAYS

SURFACE MOUNTED ALUMINIUM MULTI-OUTLET DUAL OR SINGLE CHANNEL RACEWAY WITH DEVICES AS SHOWN ON PLAN. RACEWAY MOUNTED ABOVE COUNTER / WORKBENCH HEIGHT AS INDICATED ON ARCHITECTURAL POWER/DATA PLANS AND LABRATORY DRAWING QL001.
B.O.D. - SINGLE CHANNEL: LEGRAND WIREMOLD AL3300 SERIES OR APPROVED EQUAL.
DUAL CHANNEL: LEGRAND WIREMOLD AL4200 SERIES OR APPROVED EQUAL.
PROVIDE CONDUIT SYSTEMS WITHIN WALLS EXTENDING FROM A CONDUIT STUB OUT ABOVE THE NEAREST DROP CEILING AND DOWN WITHIN THE WALLS WITH A FINAL PENETRATION INTO THE RACEWAY SYSTEM APPROPRIATE CHANNELS. COORDINATE ALL POWER AND TELECOMMUNICATIONS CONDUIT SYSTEMS PRIOR TO INSTALLATION.

ELECTRICAL REFERENCE NOTES

1. REFER TO THE ARCHITECTURAL DRAWINGS FOR THE LOCATIONS OF THE FOLLOWING:
   - 1.1. ALL CEILING MOUNTED LIGHTING FIXTURES AND DEVICES.
   - 1.2. ALL FIRE RATED PARTITIONS AND BUILDING EXPANSION JOINTS.
   - 1.3. MOUNTING HEIGHT OF EQUIPMENT AND DEVICES.
2. REFER TO THE HVAC/MECHANICAL DRAWINGS FOR THE LOCATIONS OF THE FOLLOWING:
   - 2.1. MECHANICAL EQUIPMENT, CONTROL PANELS, AND MOTORS.
   - 2.2. AUTOMATIC TEMPERATURE CONTROL SYSTEM PANELS AND DEVICES.
   - 2.3. MOTORIZED DAMPERS AND CONTROL VALVES.
3. REFER TO THE PLUMBING DRAWINGS FOR THE LOCATIONS OF THE FOLLOWING:
   - 3.1. ELECTRIC FLUSH VALVES AND ELECTRIC FAUCETS.
4. REFER TO THE FIRE PROTECTION/SPRINKLER DRAWINGS FOR THE LOCATIONS OF THE FOLLOWING:
   - 4.1. WATER FLOW AND TAMPER SWITCHES.

LIGHTNING PROTECTION SYSTEM NOTES

1. FURNISH AND INSTALL A COMPLETE LIGHTNING PROTECTION SYSTEM.
2. ALL EQUIPMENT MATERIALS AND INSTALLATION SHALL BE IN ACCORDANCE WITH THE LATEST REQUIREMENTS OF THE NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) ARTICLE 780 AND UL STANDARD 96A.
3. ALL LIGHTNING PROTECTION EQUIPMENT SHALL BE NEW AND LABELED.
4. INSTALLATION SHALL BE PERFORMED BY OR UNDER THE SUPERVISION OF A CERTIFIED LIGHTNING PROTECTION SYSTEM MASTER INSTALLER.
5. SUBMIT FOR REVIEW BY THE ENGINEER AND ARCHITECT FOR APPROVAL PRIOR TO THE START OF WORK:
   - 5.1. SUBMIT SIGNED/SEALED SHOP DRAWINGS DETAILING THE COMPLETE LIGHTNING PROTECTION SYSTEM. INCLUDE ALL SYSTEM DETAILS, CONNECTION DIAGRAMS, AND CALCULATIONS.
   - 5.2. DETAILED LIGHTNING PROTECTION SYSTEM SHOP DRAWINGS.
   - 5.3. SHOP DRAWINGS MUST IDENTIFY THE SIZES AND LOCATIONS FOR ALL LIGHTNING PROTECTION EQUIPMENT.
6. REFER TO SPECIFICATION SECTION 264113 - LIGHTNING PROTECTION FOR STRUCTURES FOR ADDITIONAL REQUIREMENTS.
7. REFER TO ARCHITECTURAL DRAWINGS FOR INSULATION DETAILS.

TYPICAL VOLTAGE DROP CALCULATIONS

MAXIMUM WIRE DISTANCES VS. WIRE SIZE FOR 20A, 1PH BRANCH CIRCUIT

VOLTAGE (V)	LOAD AMPS	WIRE SIZE (COPPER)			
		#12	#10	#8	#6
		RUN DISTANCE (FT)*			
120V	14	50	80	125	215
120V	12	55	100	150	225
120V	10	65	125	175	250
120V	5	125	200	-	-
277V	14	110	200	-	-
277V	12	125	225	-	-
277V	10	150	250	-	-
277V	5	300	-	-	-

* THE ABOVE WIRE LENGTHS ARE PROVIDED FOR REFERENCE ONLY. ELECTRICAL CONTRACTOR IS RESPONSIBLE TO CONFIRM VOLTAGE DROP IS LESS THAN 3% FOR THE ACTUAL BRANCH CIRCUIT ROUTING.

INTERCOM SYSTEM

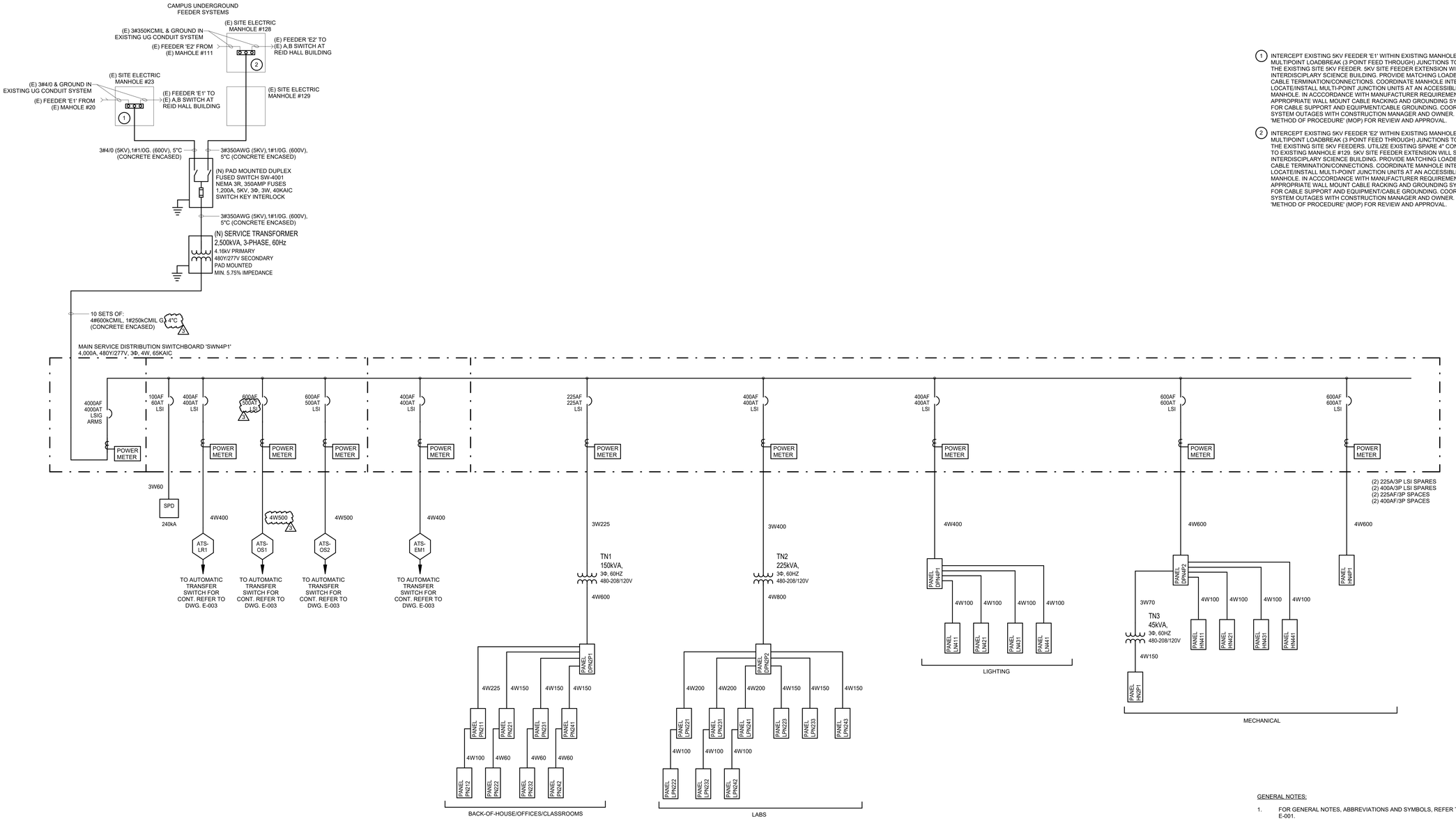
- I — S: INTERCOM SYSTEM STATION (STATION FUNCTION) S - STAFF STATION; R - REMOTE CONTROL UNIT; PU - PAGING UNIT; PS - POWER SUPPLY
- I — I: INTERCOM SYSTEM SPEAKER - CEILING OR WALL MOUNTED
- I: INTERCOM SYSTEM TRUMPET SPEAKER
- IMS: INTERCOM MASTER STATION
- IEC: INTERCOM EQUIPMENT CABINET

SECURITY SYSTEM

- XX — SECURITY ALARM DEVICE AND/OR CONTACT (ALARM CONTROL FUNCTION) EH - ELECTRIC DOOR HINGE; ES - ELECTRIC DOOR STRIKE; DP - DOOR POSITION; ML - MAGNETIC LOCK; KP - KEY PAD; CR - CARD READER; HB - HOLD UP BUTTON; KS - LOCAL KEY SWITCH FOR ALARM BYPASS; RS - ROOM SCHEDULER; MR - MANUAL RELEASE; CM - CLOSED CIRCUIT TV MONITOR; MD - MOTION DETECTOR; SD - SOUND DETECTOR; DA - DURESS ALARM; AS - DURESS ALARM SWITCH; GS - GUARD TOUR STATION; CB - CODE BLUE EMERGENCY PHONE; SC - SECURITY CAMERA - WALL MTD
- ECM — ELECTRONIC CONTROL MODULE
- ACP — ACCESS CONTROL PANEL
- SC — SECURITY CAMERA - CEILING MOUNTED

GENERAL ELECTRICAL PROJECT NOTES

1. SOME LEGEND SYMBOLS MAY NOT BE USED. SEE FLOOR PLANS FOR APPLICABLE DEVICES.
2. ALL 125 VOLT, SINGLE-PHASE, 15 AND 20 AMP RECEPTACLES, WHEN INSTALLED OUTDOORS WHERE THERE IS DIRECT ACCESS, SHALL HAVE GROUND-FAULT CIRCUIT INTERRUPTER PROTECTION AND WEATHERPROOF SECURE COVERS WITH LOCKING TAB. THIS SHALL APPLY, BUT NOT BE LIMITED TO, ALL OUTLETS ON THE EXTERIOR OF BUILDING AND ROOF.
3. ALL 125 VOLT, SINGLE-PHASE, 15 AND 20 AMP RECEPTACLES, WHEN INSTALLED WITHIN A SIX FOOT RADIUS OF SINKS, SHALL HAVE GROUND-FAULT CIRCUIT INTERRUPTER PROTECTION. THIS SHALL APPLY, BUT NOT BE LIMITED TO, PANTRY AREAS, LAVATORIES, AND OTHER WET AREAS.
4. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE 2020 EDITION OF THE NATIONAL ELECTRICAL CODE (NEC), THE SPECIFICATION, AND THE AUTHORITY HAVING JURISDICTION.
5. ALL CIRCUIT BREAKERS SERVING HVAC EQUIPMENT SHALL BE UL LISTED AS 'HACR'.
6. THE DRAWINGS ARE DIAGRAMMATIC. EXACT LOCATION OF EQUIPMENT, WIRING AND RACEWAYS SHALL BE DETERMINED BY CONTRACTOR SUBJECT TO ARCHITECT APPROVAL.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE ELECTRICAL CHARACTERISTICS OF ALL NEW EQUIPMENT, MOTORS, ETC. BEFORE INSTALLING CABLING AND RACEWAY. IF THERE ARE ANY DISCREPANCIES BETWEEN THE ACTUAL RATING OF EQUIPMENT AT THE SITE AND THE DRAWINGS, THEN THE ENGINEER SHALL BE NOTIFIED.
8. THE CONTRACTOR SHALL SECURE FROM ALL OTHER CONTRACTORS ON THE PROJECT; SHOP DRAWINGS TO VERIFY CHARACT



1. INTERCEPT EXISTING 5KV FEEDER 'E1' WITHIN EXISTING MANHOLE #23. INSTALL NEW 15KV MULTIPOINT LOADBREAK (3 POINT FEED THROUGH) JUNCTIONS TO ALLOW EXTENSION OF THE EXISTING SITE 5KV FEEDER. 5KV SITE FEEDER EXTENSION WILL SERVE THE NEW MSU INTERDISCIPLARY SCIENCE BUILDING. PROVIDE MATCHING LOADBREAK ELBOWS FOR CABLE TERMINATION/CONNECTIONS. COORDINATE MANHOLE INTERNAL LAYOUT/S AND LOCATE/INSTALL MULTI-POINT JUNCTION UNITS AT AN ACCESSIBLE LOCATION WITHIN EACH MANHOLE. IN ACCCORDANCE WITH MANUFACTURER REQUIREMENTS, PROVIDE APPROPRIATE WALL MOUNT CABLE RACKING AND GROUNDING SYSTEMS WITHIN MANHOLE FOR CABLE SUPPORT AND EQUIPMENT/CABLE GROUNDING. COORDINATE ALL ELECTRICAL SYSTEM OUTAGES WITH CONSTRUCTION MANAGER AND OWNER. SUBMIT DETAILED 'METHOD OF PROCEDURE' (MOP) FOR REVIEW AND APPROVAL.

2. INTERCEPT EXISTING 5KV FEEDER 'E2' WITHIN EXISTING MANHOLE #128. INSTALL NEW 15KV MULTIPOINT LOADBREAK (3 POINT FEED THROUGH) JUNCTIONS TO ALLOW EXTENSION OF THE EXISTING SITE 5KV FEEDERS. UTILIZE EXISTING SPARE 4" CONDUIT TO ROUTE FEEDER TO EXISTING MANHOLE #129. 5KV SITE FEEDER EXTENSION WILL SERVE THE NEW MSU INTERDISCIPLARY SCIENCE BUILDING. PROVIDE MATCHING LOADBREAK ELBOWS FOR CABLE TERMINATION/CONNECTIONS. COORDINATE MANHOLE INTERNAL LAYOUT/S AND LOCATE/INSTALL MULTI-POINT JUNCTION UNITS AT AN ACCESSIBLE LOCATION WITHIN EACH MANHOLE. IN ACCCORDANCE WITH MANUFACTURER REQUIREMENTS, PROVIDE APPROPRIATE WALL MOUNT CABLE RACKING AND GROUNDING SYSTEMS WITHIN MANHOLE FOR CABLE SUPPORT AND EQUIPMENT/CABLE GROUNDING. COORDINATE ALL ELECTRICAL SYSTEM OUTAGES WITH CONSTRUCTION MANAGER AND OWNER. SUBMIT DETAILED 'METHOD OF PROCEDURE' (MOP) FOR REVIEW AND APPROVAL.

GENERAL NOTES:

1. FOR GENERAL NOTES, ABBREVIATIONS AND SYMBOLS, REFER TO DRAWING E-001.
2. UNLESS OTHERWISE NOTED, ALL DEVICES AND SPACES ARE 3 POLE.
3. NETWORKED ELECTRIC SUBMETERS PROVIDED BY DIV. 26 AND WIRED TO BUILDING AUTOMATION SYSTEM BY DIV. 23. ADHERE TO THE FOLLOWING REQUIREMENTS FOR ALL SUBMETERS (MAIN SWITCHBOARD METER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 262413):
   - A. THE POWER METER SHALL CONSIST OF THREE SPLIT-CORE CURRENT TRANSFORMERS HINGED AT BOTH AXES WITH THE POWER.
   - B. THE METER SHALL MEASURE TRUE (RMS) POWER, INSTANTANEOUS DEMAND (kW) AND CONSUMPTION (kWh) AT INTERVALS OF ONE HOUR OR LESS.
   - C. THE METER SHALL REPORT (TO A REMOTE LOCATION) kW/kWh SERIALLY OVER AN RS-485 NETWORK USING A COMMUNICATION PROTOCOL COMPATIBLE WITH THE BAS OR PROVIDE A GATEWAY TO TRANSLATE NETWORKED INFORMATION TO BACNET IP OR BACNET MS/TP FOR BAS COMMUNICATION.
   - D. THE CONSUMPTION (kWh) VARIABLE SHALL BE STORED IN NONVOLATILE MEMORY AND RETAINED IN THE EVENT OF A POWER OUTAGE.
   - E. THE METER SHALL DIRECTLY ACCEPT ANY VOLTAGE INPUT FROM 208-480 VAC.
   - F. THE METER SHALL BE CALIBRATED AS A SYSTEM AND BE ACCURATE TO +/- 1% FROM 10% TO 100% OF THE RATED CURRENT OVER A TEMPERATURE RANGE OF 0-60 DEGREES.
   - G. THE METER SHALL CONFORM TO ANSI C12.1 METERING STANDARDS.
   - H. THE POWER METER SHALL BE INTERNALLY ISOLATED TO 2000 VAC.
   - I. THE POWER METER CASE ISOLATION SHALL BE 600 VAC.
   - J. THE POWER METER AVAILABLE ORDERING RANGES SHALL BE 100-4000 AMPS.
4. THE BUILDING AUTOMATION SYSTEM SHALL DETERMINE AND REPORT THE FOLLOWING:
   - A. MAIN ELECTRICAL SERVICE - KW AND KWH
   - B. EXTERIOR LIGHTING - KW AND KWH
   - C. RECEPTACLES - KW AND KWH
   - D. HVAC EQUIPMENT - KW AND KWH
5. THE BAS OR DATA COLLECTION SYSTEM SHALL BE CAPABLE OF STORING ALL METER DATA FOR AT LEAST 18 MONTHS AND THAT DATA MUST BE REMOTELY ACCESSIBLE.
6. ALL METERS IN THE SYSTEM MUST BE CAPABLE OF REPORTING HOURLY, MONTHLY, AND ANNUAL ENERGY USES.
7. PROVIDE CIRCUIT BREAKER WITH KW/KWH READINGS WITH INTEGRAL COMMUNICATIONS AND METERING CAPABILITIES.
8. REFER TO TYPICAL CIRCUIT SIZING REFERENCE TABLES 1/E-005.

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building

1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University

1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

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Landscape
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Jersey City, NJ 07302

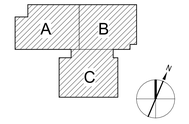
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Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

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IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan



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1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2025-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

Sheet Title

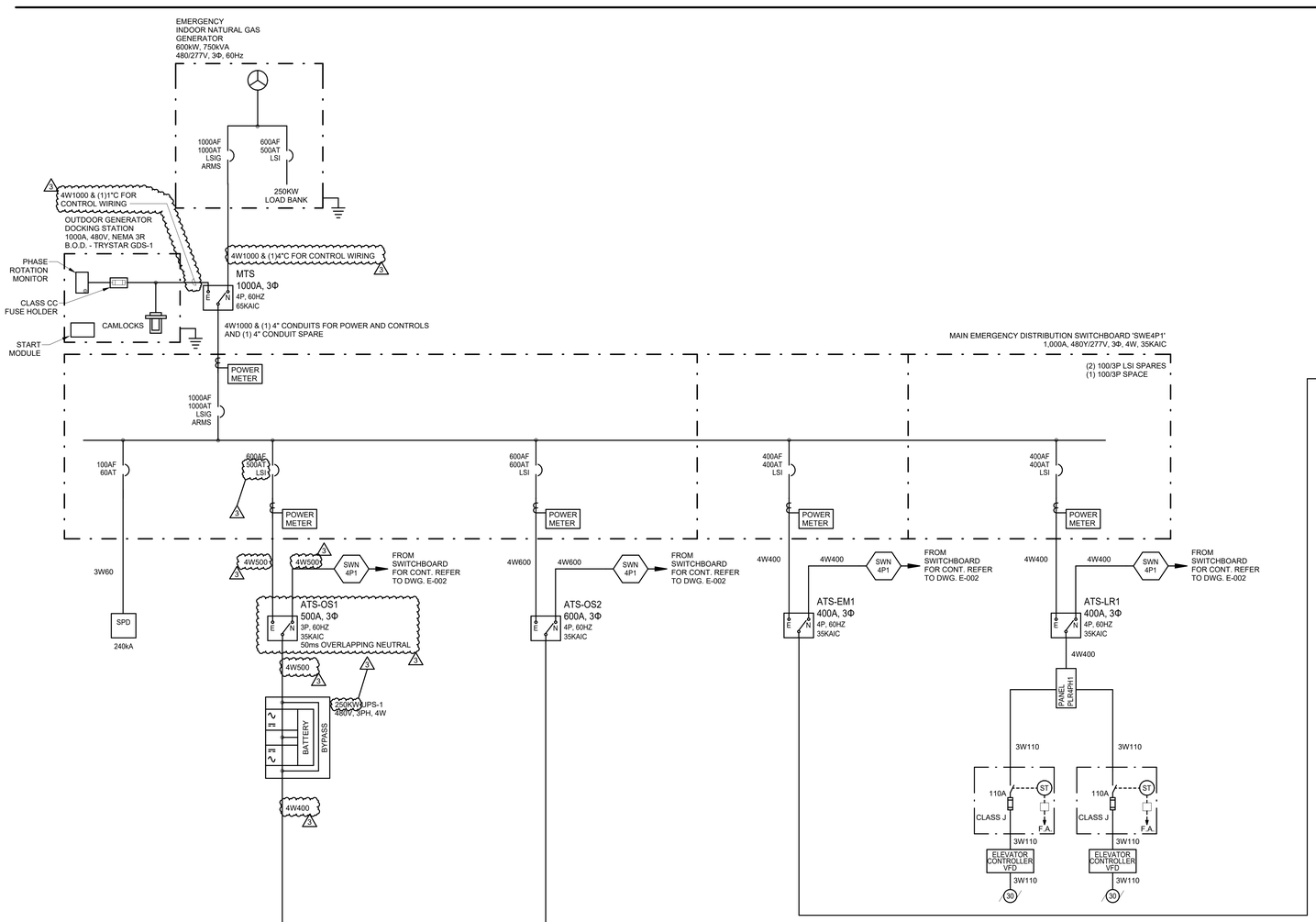
ELECTRICAL - NORMAL POWER ONE-LINE DIAGRAM

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Sheet Number

E-002

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GENERAL NOTES:

1. FOR GENERAL NOTES, ABBREVIATIONS AND SYMBOLS, REFER TO DRAWING E0.1.
2. UNLESS OTHERWISE NOTED, ALL DEVICES AND SPACES ARE 3 POLE.
3. UNLESS OTHERISED NOTED, ALL EMERENCY PANELS SHALL HAVE A SPD.
4. NETWORKED ELECTRIC SUBMETERS PROVIDED BY DIV. 26 AND WIRED TO BUILDING AUTOMATION SYSTEM BY DIV. 23. ADHERE TO THE FOLLOWING REQUIREMENTS FOR ALL SUBMETERS (MAIN SWITCHBOARD METER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 262413):
   - A. THE POWER METER SHALL CONSIST OF THREE SPLIT-CORE CURRENT TRANSFORMERS HINGED AT BOTH AXES WITH THE POWER.
   - B. THE METER SHALL MEASURE TRUE (RMS) POWER, INSTANTANEOUS DEMAND (kW) AND CONSUMPTION (kWh).
   - C. THE METER SHALL REPORT kW/kWh SERIALLY OVER AN RS-485 NETWORK USING A COMMUNICATION PROTOCOL COMPATIBLE WITH THE BAS OR PROVIDE AGATEWAY TO TRANSLATE NETWORKED INFORMATION TO BACNET IP OR BACNET MS/TP FOR BAS COMMUNICATION.
   - D. THE CONSUMPTION (kWh) VARIABLE SHALL BE STORED IN NONVOLATILE MEMORY AND RETAINED IN THE EVENT OF A POWER OUTAGE.
   - E. THE METER SHALL DIRECTLY ACCEPT ANY VOLTAGE INPUT FROM 208-480 VAC.
   - F. THE METER SHALL BE CALIBRATED AS A SYSTEM AND BE ACCURATE TO +/- 1% FROM 10% TO 100% OF THE RATED CURRENT OVER A TEMPERATURE RANGE OF 0-60 DEGREES
   - G. THE METER SHALL CONFORM TO ANSI C12.1 METERING STANDARDS.
   - H. THE POWER METER SHALL BE INTERNALLY ISOLATED TO 2000 VAC.
   - I. THE POWER METER CASE ISOLATION SHALL BE 600 VAC.
   - J. THE POWER METER AVAILABLE ORDERING RANGES SHALL BE 100-2400 AMPS.
5. THE BUILDING AUTOMATION SYSTEM SHALL DETERMINE AND REPORT THE FOLLOWING:
   - A. MAIN ELECTRICAL SERVICE - KW AND KWH
   - B. EXTERIOR LIGHTING - KW AND KWH
   - C. RECEPTACLES - KW AND KWH
   - D. HVAC EQUIPMENT - KW AND KWH
6. PROVIDE CIRCUIT BREAKER WITH KW/KWH READINGS WITH INTEGRAL COMMUNICATIONS AND METERING CAPABILITIES.
7. REFER TO TYPICAL CIRCUIT SIZING REFERENCE TABLES 1/E-005.

MONTCLAIR
STATE UNIVERSITY

Project

Interdisciplinary Science Building

1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University

1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Parsippany, NJ 07054

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Landscape
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Jersey City, NJ 07302

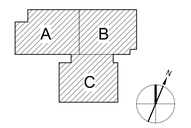
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Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

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IT/Security
152 Huron Ave
Clifton, NJ 07013

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1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2025-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

Sheet Title

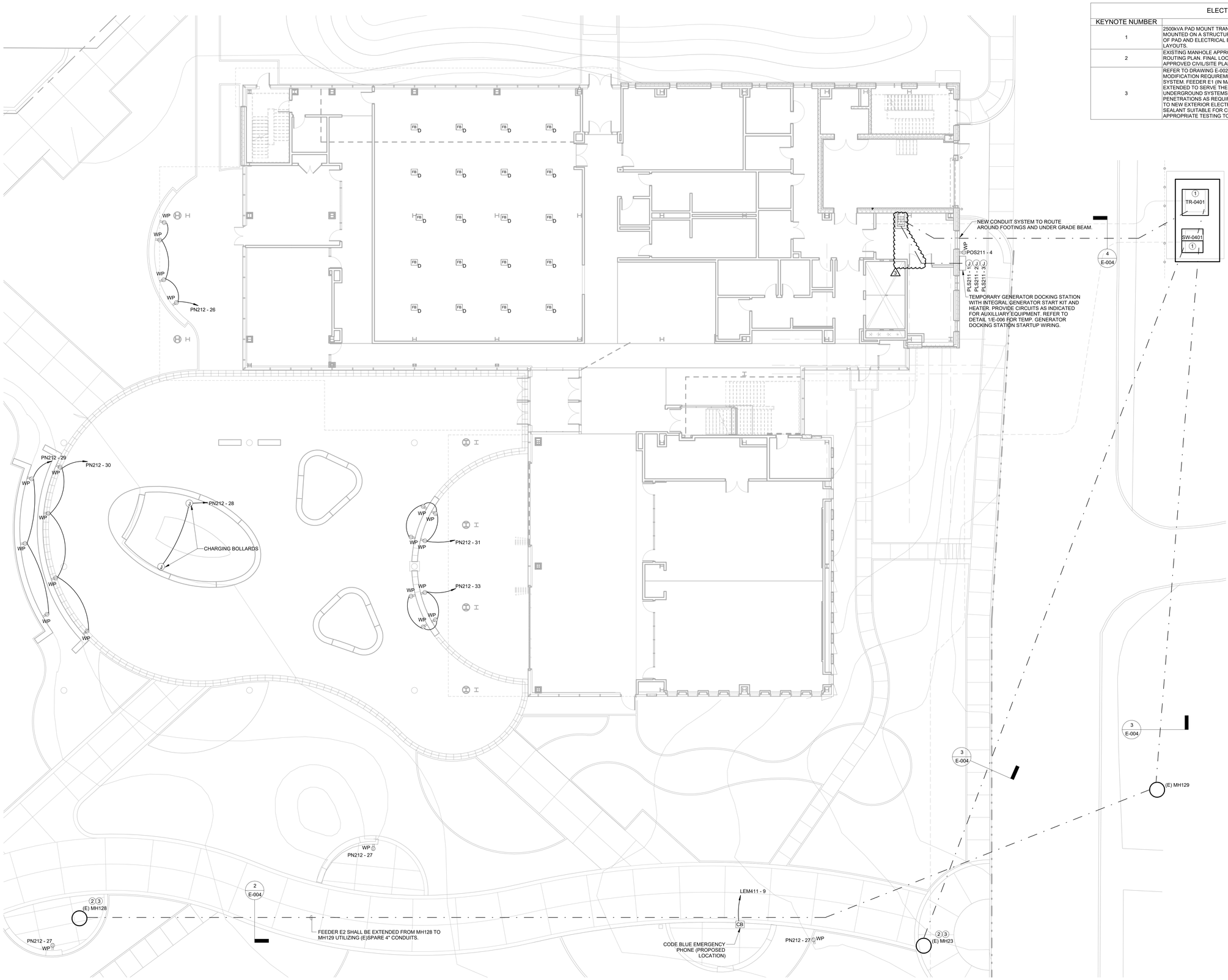
ELECTRICAL - EMERGENCY ONE-LINE DIAGRAM

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Sheet Number

E-003

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ELECTRICAL KEYNOTES

KEYNOTE NUMBER	KEYNOTE
1	2500kVA PAD MOUNT TRANSFORMER TR-0401 & SW DUPLEX SWITCH SW-0401 SHALL BE MOUNTED ON A STRUCTURALLY CERTIFIED AND REINFORCED CONCRETE PAD. FINAL LOCATION OF PAD AND ELECTRICAL EQUIPMENT TO BE COORDINATED WITH FINAL APPROVED SITE LAYOUTS.
2	EXISTING MANHOLE APPROXIMATE LOCATION. LOCATION BASED ON DUCT BANK FIELD SURVEY ROUTING PLAN. FINAL LOCATION OF MANHOLES TO BE COORDINATED WITH THE FINAL APPROVED CIVIL/SITE PLAN.
3	REFER TO DRAWING E-002 NORMAL POWER ONE-LINE DIAGRAM, WHICH DETAILS THE MODIFICATION REQUIREMENTS OF THE EXISTING MSU SITE MEDIUM VOLTAGE DISTRIBUTION SYSTEM. FEEDER E1 (IN MANHOLE 23) & FEEDER E2 (IN MANHOLE 128) SHALL BE MODIFIED AND EXTENDED TO SERVE THE NEW MSU INTERDISCIPLINARY SCIENCE BUILDING. ALL UNDERGROUND SYSTEMS SHALL BE CONCRETE-ENCASED. PROVIDE NEW MANHOLE PENETRATIONS AS REQUIRED FOR EXTENDING FEEDERS FROM EXISTING MANHOLES THROUGH TO NEW EXTERIOR ELECTRICAL EQUIPMENT. SEAL ALL MANHOLES WATERTIGHT WITH A SEALANT SUITABLE FOR CONDUIT SYSTEMS AND ENVIRONMENTAL CONDITIONS. PROVIDE APPROPRIATE TESTING TO ENSURE PENETRATION IS WATERTIGHT.

GENERAL ELECTRICAL NOTES:

1. REFER TO ELECTRICAL SHEET E001 FOR PROJECT GENERAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.
2. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE 2020 EDITION OF THE NATIONAL ELECTRICAL CODE.
3. WIRE SIZE OF BRANCH CIRCUITS SHALL BE MINIMUM #12 AWG, BUT NO LESS THAN PERMITTED BY THE NATIONAL ELECTRICAL CODE (NEC) FOR SPECIFIED OVERCURRENT PROTECTION. ANY DISCREPANCY MUST BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO BID.
4. ELECTRICAL CONTRACTOR TO CIRCUIT AND ROUTE WIRING TO MINIMIZE TOTAL RUN LENGTH.
5. ALL CONDUCTORS ARE COPPER UNLESS OTHERWISE NOTED.
6. ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL DISCONNECT SWITCHES / FUSES, AS REQUIRED BY CODE, WHETHER OR NOT THEY ARE INDICATED ON THE PLANS.
7. CONTRACTOR SHALL VERIFY ALL DIMENSIONS PRIOR TO BEGINNING WORK.
8. EXPOSED EMT, CONDUIT AND SURFACE MOUNTED WIRING ARE NOT PERMITTED IN ANY FINISHED SPACE.
9. ALL EQUIPMENT AND EQUIPMENT ENCLOSURES SHALL BE PROPERLY BONDED AND GROUNDED PER NEC ARTICLE 250.
10. INSTALL NO MORE THAN THE EQUIVALENT OF (4) 90 - DEGREE BENDS IN ANY CONDUIT RUN BETWEEN JUNCTION BOX OR PULL POINTS.
11. THE CONDUIT ROUTING SHOWN ON THIS PLAN IS DIAGRAMMATIC. E.C. SHALL ADJUST ROUTING IN FIELD AS NECESSARY. FOR ANY SIGNIFICANT DEVIATIONS IN THE ROUTING, THE E.C. SHALL CHECK VOLTAGE DROP AND ADJUST CONDUIT AND WIRE SIZES AS REQUIRED.
12. REFER TO CIVIL DRAWINGS FOR ADDITIONAL REQUIREMENTS.
13. SITE E.C. TO COORDINATE LOCATION OF EASEMENTS, UNDERGROUND UTILITIES AND DRAINAGE BEFORE DRILLING POLE BASES.
14. E.C. TO INCREASE CONDUIT SIZE OR PROVIDE ADDITIONAL CONDUITS FOR EASE OF INSTALLATION AS DETERMINED BY THE E.C. AND THE NEC.
15. E.C. TO PROVIDE ADDITIONAL HANDHOLES, AS NECESSARY, TO:
    A. ALLOW EASE OF INSTALLATION.
    B. REDUCE PULLING STRESS ON THE WIRING,
    C. MEET THE NATIONAL ELECTRICAL CODE REQUIREMENT OF A MAXIMUM OF FOUR NINETY DEGREE BENDS, OR EQUIVALENT, BETWEEN PULL POINTS. HANDHOLE LOCATIONS SHALL BE COORDINATED WITH THE CIVIL ENGINEER AND ALL TRADES.
16. E.C TO RUN ADDITIONAL CONDUITS, AS NECESSARY, TO MEET THE NEC 2020 CONDUIT FILL AND WIRE AMPACITY DERATING REQUIREMENTS.
17. E.C TO INCREASE WIRE AND RACEWAY SIZES, AS NECESSARY, TO KEEP VOLTAGE DROP FOR EACH BRANCH CIRCUIT AT 3% OR LESS.
18. BURIED CONDUITS SHALL HAVE MINIMUM COVER AS SPECIFIED IN NEC TABLE 300.5.
19. E.C. TO ROUTE ALL WIRING TO MINIMIZE TOTAL RUN LENGTH.
20. THESE DRAWINGS ARE DIAGRAMMATIC IN NATURE AND ARE ONLY INTENDED TO SHOW THE FUNCTIONALITY AND CONNECTIVITY OF THE SITE POWER AND ASSOCIATED CONTROLS. THE PHYSICAL LOCATIONS OF THE CONDUIT RUNS, JUNCTION BOXES, ELECTRICAL EQUIPMENT AND SYSTEM EQUIPMENT SHALL BE COORDINATED WITH THE CIVIL ENGINEERING DRAWINGS AND CONFIRMED IN THE FIELD BY THE INSTALLER AND THE INSTALLER'S COMMUNICATIONS WITH THE APPLICABLE UTILITY AND CITY PERSONNEL. THE INSTALLER SHALL CONTACT THE LOCAL UTILITIES, THE CITY AND THE ONE CALL SYSTEM, WHERE AVAILABLE, TO HAVE THE SITE MARKED OUT WITH THE EXISTING UTILITY LOCATIONS, PRIOR TO BEGINNING WORK. THE INSTALLER SHALL CONTACT THE UTILITIES AND NOTIFY THEM OF ANY EXCAVATIONS BEING PERFORMED IN THE VICINITY OF THEIR SYSTEMS. IT IS THE INSTALLER'S RESPONSIBILITY TO ENSURE THAT THE WORK IS PERFORMED IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL ADOPTED LAWS, SAFETY CODES, BUILDING CODES AND ASSOCIATED DESIGN STANDARDS.

1 ELECTRICAL SITE PLAN

E-100B SCALE: 1" = 10'-0"

3/23/2026 5:26:07 PM

MONTCLAIR STATE UNIVERSITY

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1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

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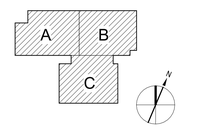
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Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

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Project No: 24.07023.00

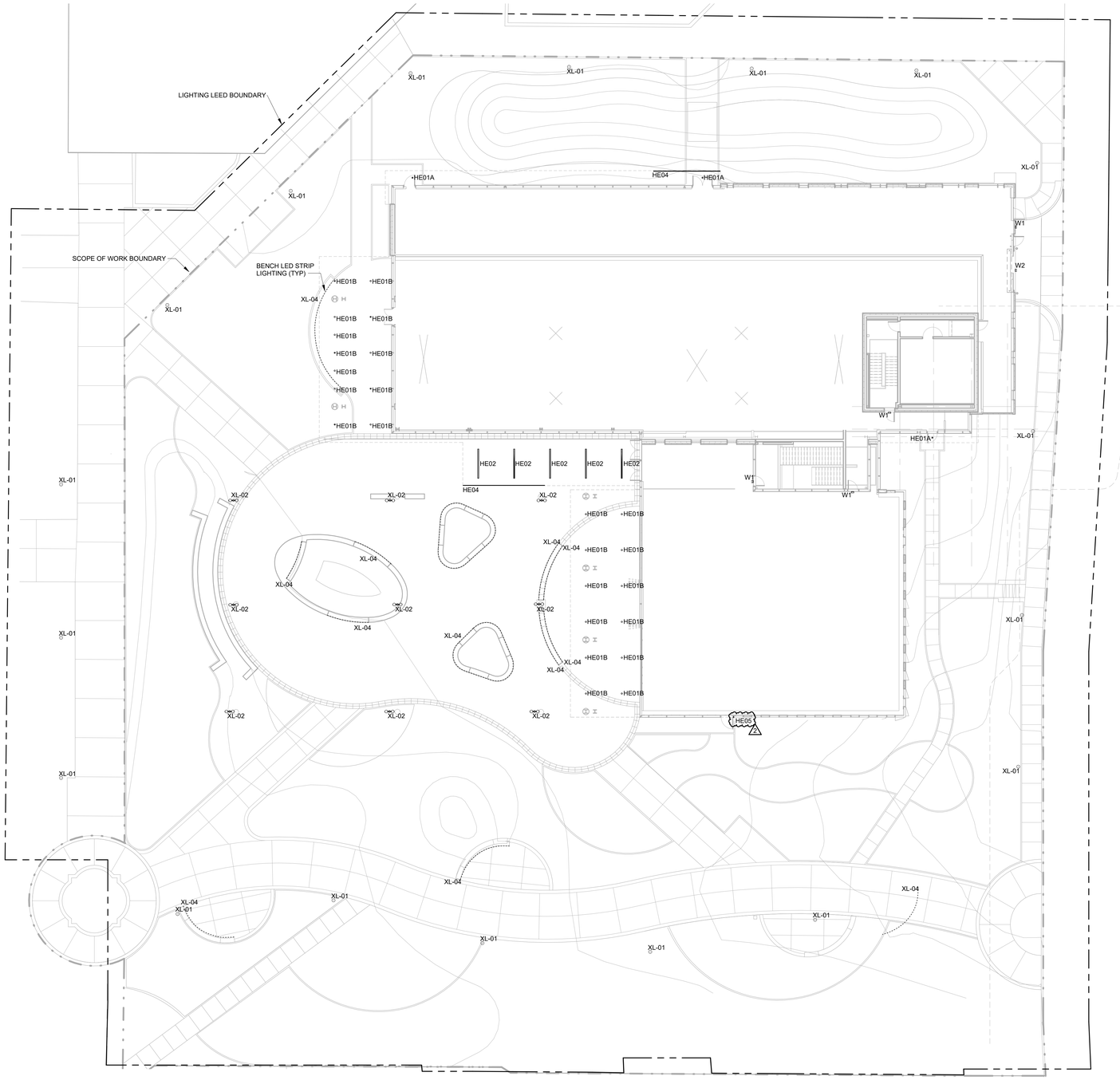
Sheet Title

ELECTRICAL SITE PLAN

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

E-100B



1 SITE LIGHTING - LEED LIGHTING POLLUTION REDUCTION PLAN
E-100D SCALE: 1" = 15'-0"

EXTERIOR LIGHTING SCHEDULE								
TYPE	FIX. DISCRIPTION	MANUFACTURER	LAMP	WATTS	VOLTS	CONTROL	MOUNTING HEIGHT	BUG RATING
HE01A	RECESSED DOWNLIGHT	USAI	1300 LM	9 W	UNV	ON/OFF/DIM	13'-0"	B1-U0-G0
HE01B	RECESSED DOWNLIGHT	USAI	1300 LM	16 W	UNV	ON/OFF/DIM	13'-0"	B1-U0-G0
HE02	SURFACE-MOUNTED LINEAR	FINELITE	350 LM/FT	3.5 W/FT	277	ON/OFF/DIM	13'-0"	B1-U0-G1
HE05	RECESSED EXTERIOR STEPLIGHT	BEGA	400 LM/FT	5 W/FT	UNV	PC	20" AFF	B0-U0-G0
HE04	LINEAR STRIPLIGHT	ACOLYTE	637 LM/FT	14 W/FT	277	ON/OFF/DIM	14'-0"	B0-U2-G0
XL-01	POST-TOP W/ COMFORT OPTIC	HADCO	8908 LM,	93 W	UNV	PC	16'-0"	B3-U0-G2
XL-02	5-ARM POLE	SELUX	1190 LM/ARM	14 W	UNV	PC	ARM 1-26'-0" ARM 2-24'-6" ARM 3-23'-0" ARM 4-21'-6" ARM 5-20'-0"	B1-U0-G1
W1	WALL-MOUNTED WEDGE LIGHT	LITHONIA	2000 LM	4 W	UNV	PC	9'-0"	B1-U0-G0
W2	WALL-MOUNTED WEDGE LIGHT	LITHONIA	4200 LM	10 W	UNV	PC	16'-0"	B1-U0-G1

ZONE LZ2			
DISTANCE	BACKLIGHT	UPLIGHT	GLARE
> 2 MOUNT HEIGHTS FROM LIGHTING BOUNDARY	B4	U2	G2
1 TO 2 MOUNTING HEIGHT FROM LIGHTING BOUNDARY	B3	U2	G2
0.5 TO 1 MOUNTING HEIGHT FROM LIGHTING BOUNDARY	B2	U2	G2
< 0.5 MOUNTING HEIGHT FROM LIGHTING BOUNDARY	B0	U2	G2
BUILDING MOUNTED > 2 MOUNT HEIGHTS FROM LIGHTING BOUNDARY	B4	U2	G2
BUILDING MOUNTED 1 TO 2 MOUNTING HEIGHT FROM LIGHTING BOUNDARY	B3	U2	G1
BUILDING MOUNTED 0.5 TO 1 MOUNTING HEIGHT FROM LIGHTING BOUNDARY	B2	U2	G0
BUILDING MOUNTED < 0.5 MOUNTING HEIGHT FROM LIGHTING BOUNDARY	B0	U2	G0

NOTE: EXTERIOR LANDSCAPE LED STRIP LIGHTS AT THE BASE OF SEATWALLS ARE UNDERMOUNTED AT LESS THAN 0'-6" A.F.F. AND WILL HAVE NO UPLIGHT OR GLARE RIST TO OCCUPANTS.

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Project

Interdisciplinary Science Building

1 Quad Road
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HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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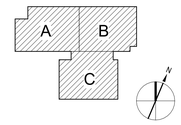
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Key Plan



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No.	Description	Date
1	ISSUED FOR BID	2025-01-19
2	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

Sheet Title

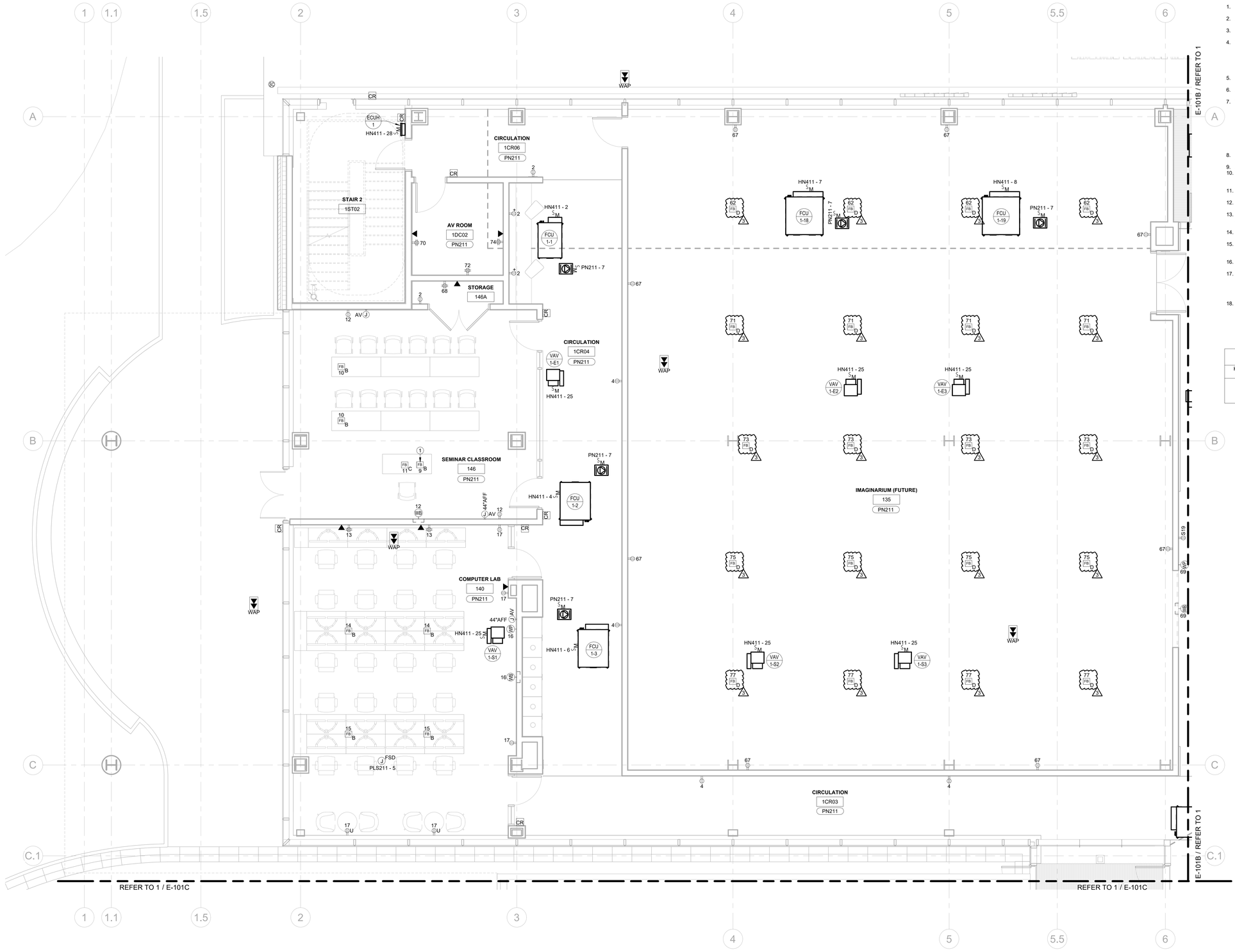
LEED ACCREDITATION - LIGHT POLLUTION REDUCTION

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

E-100D

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1 ELECTRICAL POWER PLAN - FIRST FLOOR AREA A

E-101A SCALE: 1/4" = 1'-0"

GENERAL ELECTRICAL NOTES:

1. REFER TO ELECTRICAL SHEET E-001 FOR PROJECT GENERAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.
2. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE 2020 EDITION OF THE NATIONAL ELECTRICAL CODE.
3. REFER TO BOOK SPECIFICATIONS FOR PROJECT DETAILS AND EXECUTION REQUIREMENTS.
4. WIRE SIZE OF BRANCH CIRCUITS SHALL BE MINIMUM #12 AWG, BUT NO LESS THAN PERMITTED BY THE NATIONAL ELECTRICAL CODE (NEC) FOR SPECIFIED OVERCURRENT PROTECTION. MINIMUM CONDUIT SIZE SHALL BE 3/4" UNLESS OTHERWISE NOTED. ANY DISCREPANCY MUST BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO BID. REFER TO DETAIL 1/E-005.
5. ELECTRICAL CONTRACTOR TO CIRCUIT AND ROUTE WIRING TO MINIMIZE TOTAL RUN LENGTH.
6. ALL HVAC AND REFRIGERATION CIRCUIT BREAKERS TO BE HACR RATED.
7. WHERE WALLS AND PARTITIONS ARE REQUIRED TO HAVE A MINIMUM 1-HOUR FIRE RESISTANCE RATING, RECESSED FIXTURES SHALL BE INSTALLED SUCH THAT THE REQUIRED FIRE RESISTANCE WILL NOT BE REDUCED. STEEL ELECTRICAL BOXES THAT DO NOT EXCEED 16 SQUARE INCHES IN AREA ARE ACCEPTABLE PROVIDED THE TOTAL AREA OF SUCH OPENINGS DOES NOT EXCEED 100 SQUARE INCHES FOR ANY 100 SQUARE FEET OF WALL AREA. OUTLET BOXES ON OPPOSITE SIDES OF THE WALL SHALL BE SEPARATED BY A HORIZONTAL DISTANCE OF NOT LESS THAN 24 INCHES.
8. INSTALLATION OF ELECTRIC PANELS SHALL BE IN ACCORDANCE WITH NEC ARTICLE 408.
9. ALL CONDUCTORS ARE COPPER UNLESS OTHERWISE NOTED.
10. ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL DISCONNECT SWITCHES / FUSES, AS REQUIRED BY CODE, WHETHER OR NOT THEY ARE INDICATED ON THE PLANS.
11. CONTRACTOR SHALL VERIFY ALL DIMENSIONS PRIOR TO BEGINNING WORK.
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13. PROVIDE GROUNDING ELECTRODE CONDUCTORS AND BONDING JUMPERS FOR ALL DRY TYPE TRANSFORMERS. SEE DETAILS FOR REQUIREMENTS.
14. ALL EQUIPMENT AND EQUIPMENT ENCLOSURES SHALL BE PROPERLY BONDED AND GROUNDED PER NEC ARTICLE 250.
15. INSTALL NO MORE THAN THE EQUIVALENT OF (4) 90 - DEGREE BENDS IN ANY CONDUIT RUN BETWEEN JUNCTION BOX OR PULL POINTS.
16. MODULAR FURNITURE SHALL BE FIXED-TYPE AND THE INSTALLATION SHALL COMPLY WITH NEC ARTICLE 605.
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18. ELECTRICAL CONTRACTOR SHALL COORDINATE WITH AND REVIEW ARCHITECTURAL DRAWINGS AND ELEVATIONS FOR EXACT PLACEMENT AND HEIGHTS OF ELECTRICAL DEVICES.

ELECTRICAL KEYNOTES

KEYNOTE NUMBER	KEYNOTE
1	FLOOR BOX TO PROVIDE POWER AND DATA TO A/V RACK WITHIN FURNITURE. PROVIDE DEDICATED QUAD OULET AND A MINIMUM OF SIX (6) DATA PORTS TO ACCOMMODATE A/V RACK.

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t +1 212 741 1200 www.hok.com

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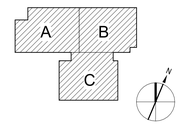
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Project No: 24.07023.00

Sheet Title

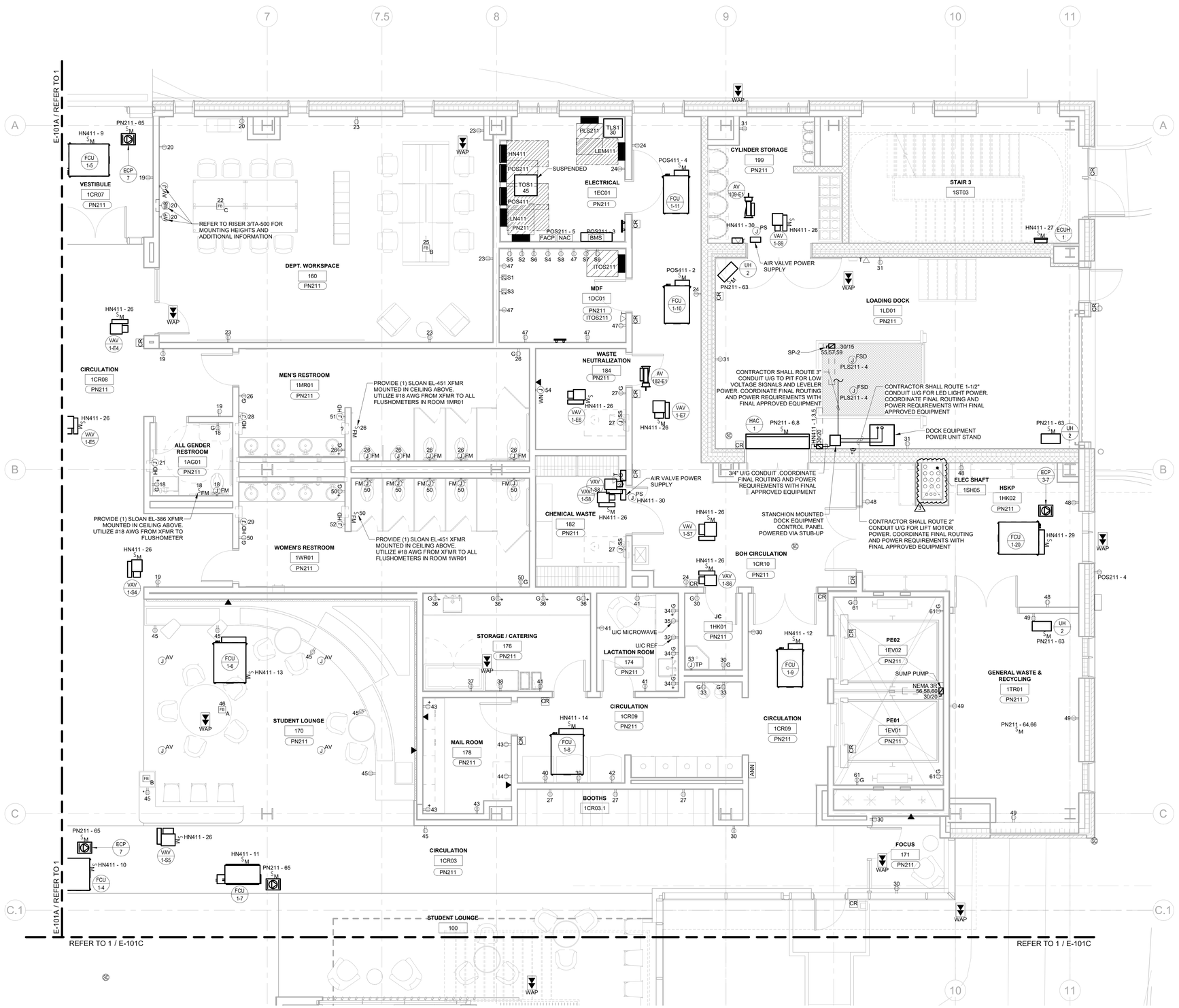
ELECTRICAL POWER PLAN - FIRST FLOOR AREA A

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Sheet Number

E-101A

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1 E-101B ELECTRICAL POWER PLAN - FIRST FLOOR AREA B

SCALE: 1/4" = 1'-0"

3/23/2026 5:26:13 PM

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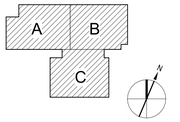
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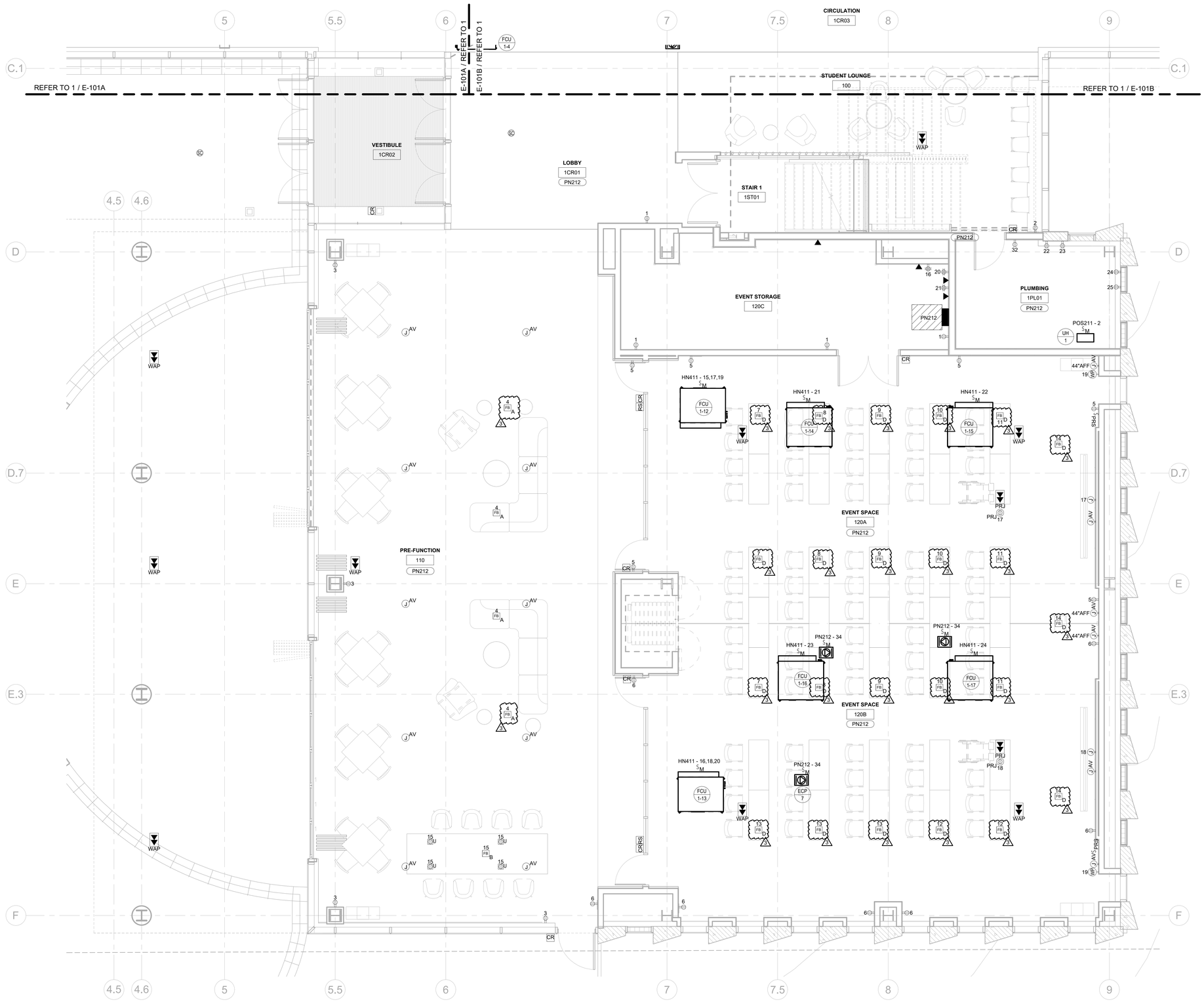
Sheet Title

ELECTRICAL POWER PLAN - FIRST FLOOR AREA B

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

E-101B



1 E-101C ELECTRICAL POWER PLAN - FIRST FLOOR AREA C

SCALE: 1/4" = 1'-0"

3/4/2026 12:50:52 PM

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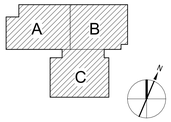
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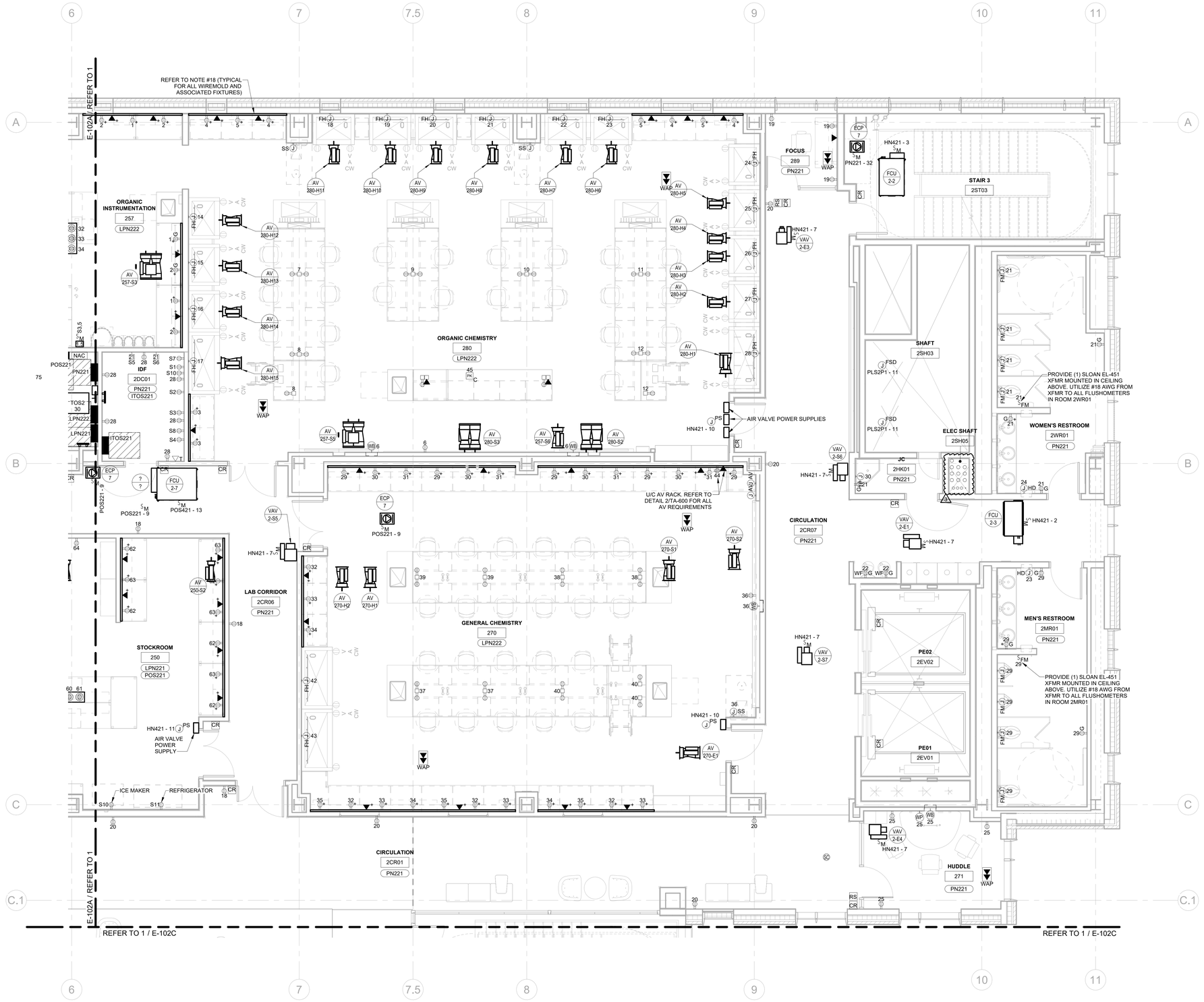
Sheet Title

ELECTRICAL POWER PLAN - FIRST FLOOR AREA C

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

E-101C



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1 E-102B ELECTRICAL POWER PLAN - SECOND FLOOR AREA B

SCALE: 1/4" = 1'-0"

3/3/2026 5:26:19 PM

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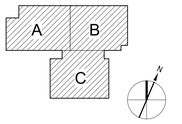
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New York, NY 10016

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IT/Security
152 Huron Ave
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3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

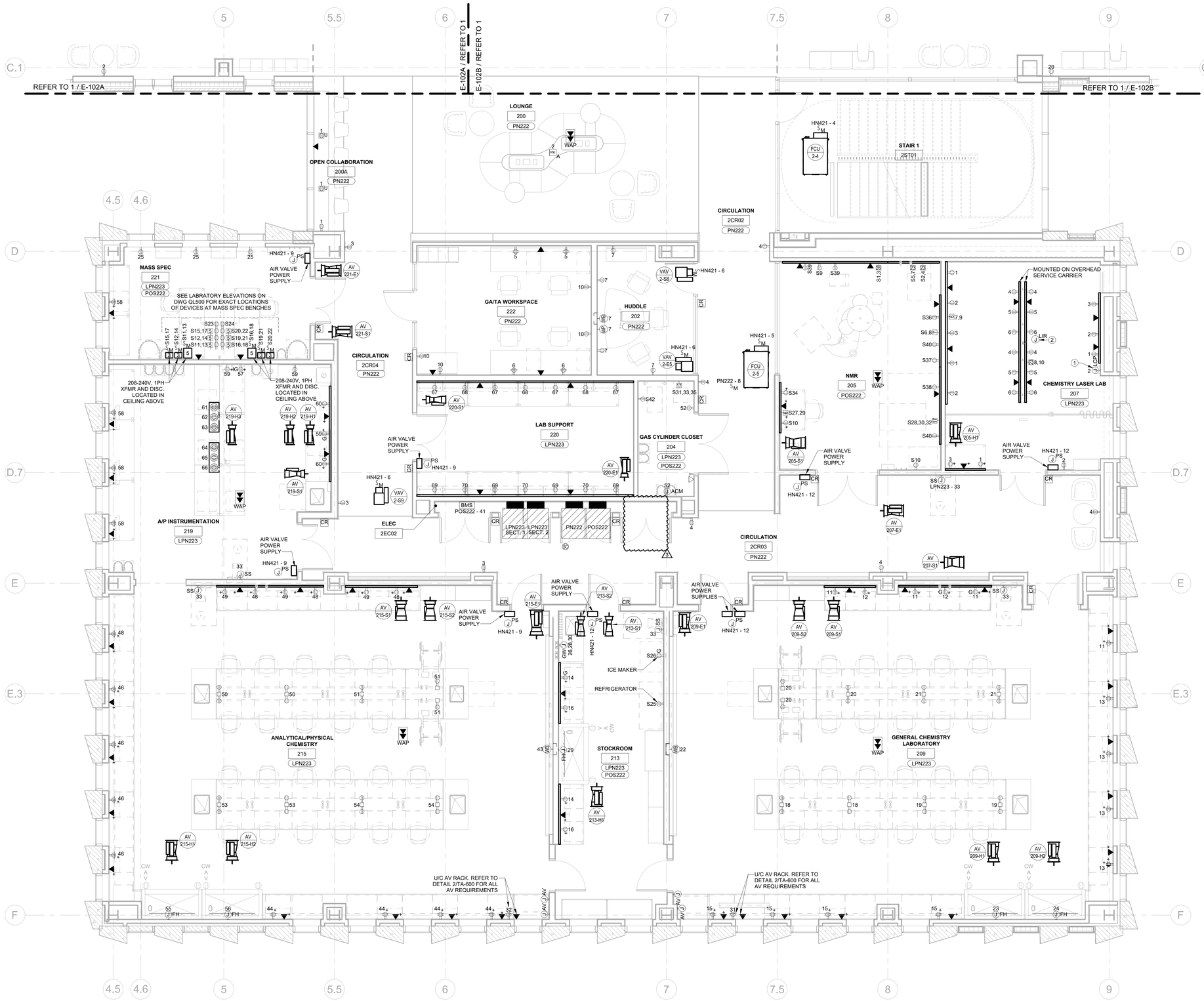
Sheet Title

ELECTRICAL POWER PLAN - SECOND FLOOR AREA B

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

E-102B



1 ELECTRICAL POWER PLAN - SECOND FLOOR AREA C

E-102C SCALE: 1/4" = 1'-0"

GENERAL ELECTRICAL NOTES:

1. REFER TO ELECTRICAL SHEET E-001 FOR PROJECT GENERAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.
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4. WIRE SIZE OF BRANCH CIRCUITS SHALL BE MINIMUM #12 AWG, BUT NO LESS THAN PERMITTED BY THE NATIONAL ELECTRICAL CODE (NEC) FOR SPECIFIED OVERCURRENT PROTECTION. MINIMUM CONDUIT SIZE SHALL BE 3/4" UNLESS OTHERWISE NOTED. ANY DISCREPANCY MUST BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO BID. REFER TO DETAIL 1/E-005.
5. ELECTRICAL CONTRACTOR TO CIRCUIT AND ROUTE WIRING TO MINIMIZE TOTAL RUN LENGTH.
6. ALL HVAC AND REFRIGERATION CIRCUIT BREAKERS TO BE HACR RATED.
7. WHERE WALLS AND PARTITIONS ARE REQUIRED TO HAVE A MINIMUM 1-HOUR FIRE RESISTANCE RATING, RECESSED FIXTURES SHALL BE INSTALLED SUCH THAT THE REQUIRED FIRE RESISTANCE WILL NOT BE REDUCED. STEEL ELECTRICAL BOXES THAT DO NOT EXCEED 16 SQUARE INCHES IN AREA ARE ACCEPTABLE PROVIDED THE TOTAL AREA OF SUCH OPENINGS DOES NOT EXCEED 100 SQUARE INCHES FOR ANY 100 SQUARE FEET OF WALL AREA. OUTLET BOXES ON OPPOSITE SIDES OF THE WALL SHALL BE SEPARATED BY A HORIZONTAL DISTANCE OF NOT LESS THAN 24 INCHES.
8. INSTALLATION OF ELECTRIC PANELS SHALL BE IN ACCORDANCE WITH NEC ARTICLE 408.
9. ALL CONDUCTORS ARE COPPER UNLESS OTHERWISE NOTED.
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13. PROVIDE GROUNDING ELECTRODE CONDUCTORS AND BONDING JUMPERS FOR ALL DRY TYPE TRANSFORMERS. SEE DETAILS FOR REQUIREMENTS.
14. ALL EQUIPMENT AND EQUIPMENT ENCLOSURES SHALL BE PROPERLY BONDED AND GROUNDED PER NEC ARTICLE 250.
15. INSTALL NO MORE THAN THE EQUIVALENT OF (4) 90 - DEGREE BENDS IN ANY CONDUIT RUN BETWEEN JUNCTION BOX OR PULL POINTS.
16. MODULAR FURNITURE SHALL BE FIXED-TYPE AND THE INSTALLATION SHALL COMPLY WITH NEC ARTICLE 605.
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18. ELECTRICAL CONTRACTOR SHALL COORDINATE WITH AND REVIEW ARCHITECTURAL DRAWINGS AND ELEVATIONS FOR EXACT PLACEMENT AND HEIGHTS OF ELECTRICAL DEVICES.

ELECTRICAL KEYNOTES

KEYNOTE NUMBER	KEYNOTE
1	LASER CONTROL PANEL: SEE ARCHITECTURAL DWG QL904 FOR LASER ENTRY CONTROL SYSTEM DIAGRAM AND EQUIPMENT LOCATIONS FOR LASER SAFETY MEASURES. PROVIDE ALL REQUIRED BACKBOXES, CONDUIT, WIRING AND ASSOCIATED APPURTENANCES FOR A COMPLETE AND FULLY FUNCTIONAL SYSTEM. BASIS OF DESIGN: KENTEK LASER CONTROL MEASURES – CONTROL PANEL MODEL NO. ETG-CP; DUAL STATUS SIGN MODEL NO. ETG-DLS-2; EXTERNAL INTERLOCK CONNECTOR MODEL NO. ETG-X2; DUAL INTERLOCK RECEPTACLE MODEL NO. ETG-X1; ACCESS CONTROL SWITCH MODEL NO. ETG-RE.
2	LASER INTERLOCK RECEPTACLE: PROVIDE SINGLE GANG FLUSH-MOUNTED FLOORBOX FOR LASER DUAL INTERLOCK RECEPTACLE WITH 3/4" CONDUIT TO 0'-6" ABOVE ACESSIBLE CEILING.

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building

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Montclair, New Jersey

Prepared For

Montclair State University

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HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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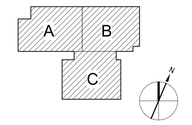
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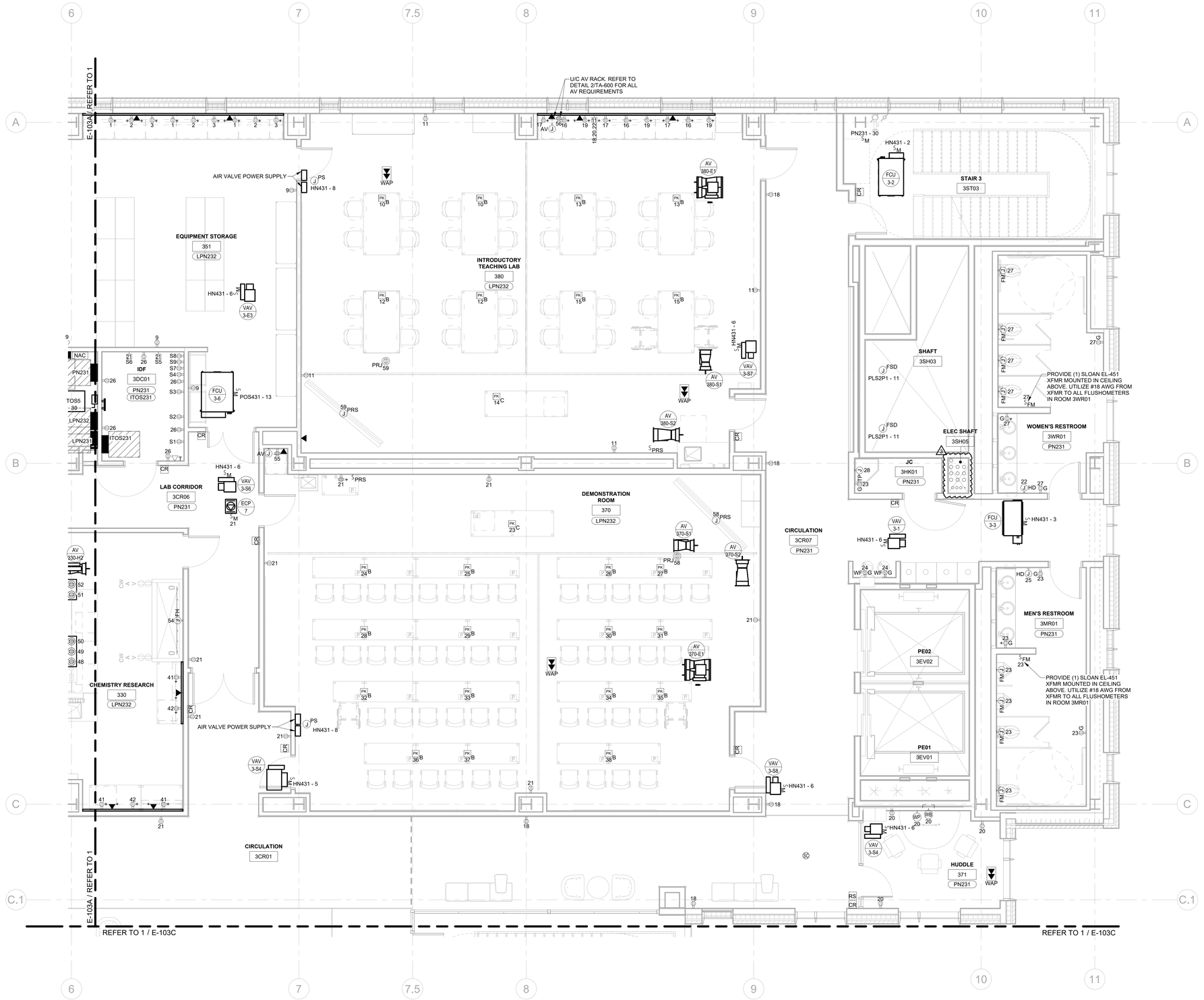
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E-102C

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1 E-103B ELECTRICAL POWER PLAN - THIRD FLOOR AREA B
SCALE: 1/4" = 1'-0"

3/3/2026 5:26:26 PM

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t +1 212 741 1200 www.hok.com

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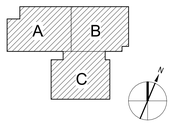
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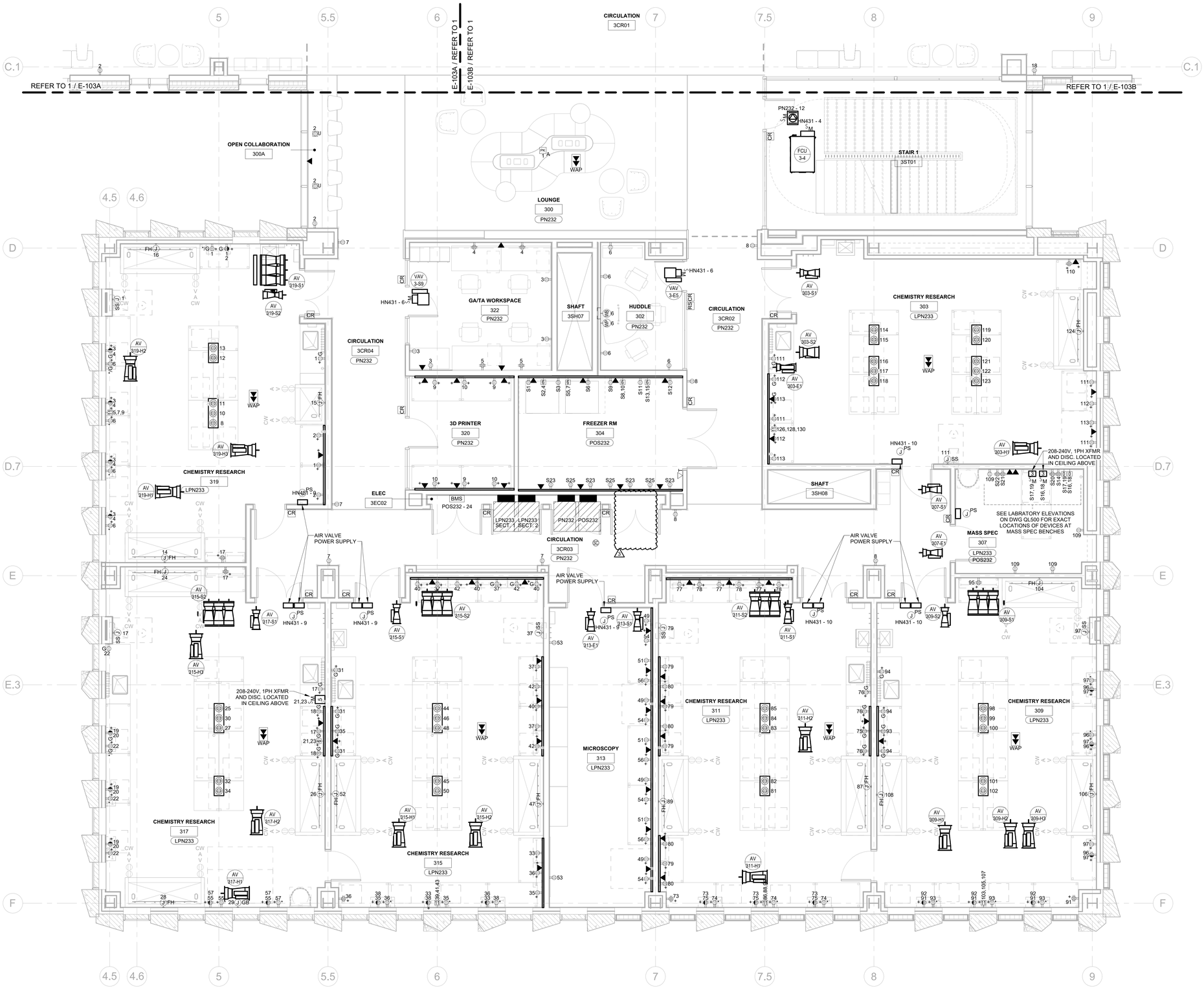
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ELECTRICAL POWER PLAN - THIRD FLOOR AREA B

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Sheet Number

E-103B



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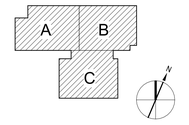
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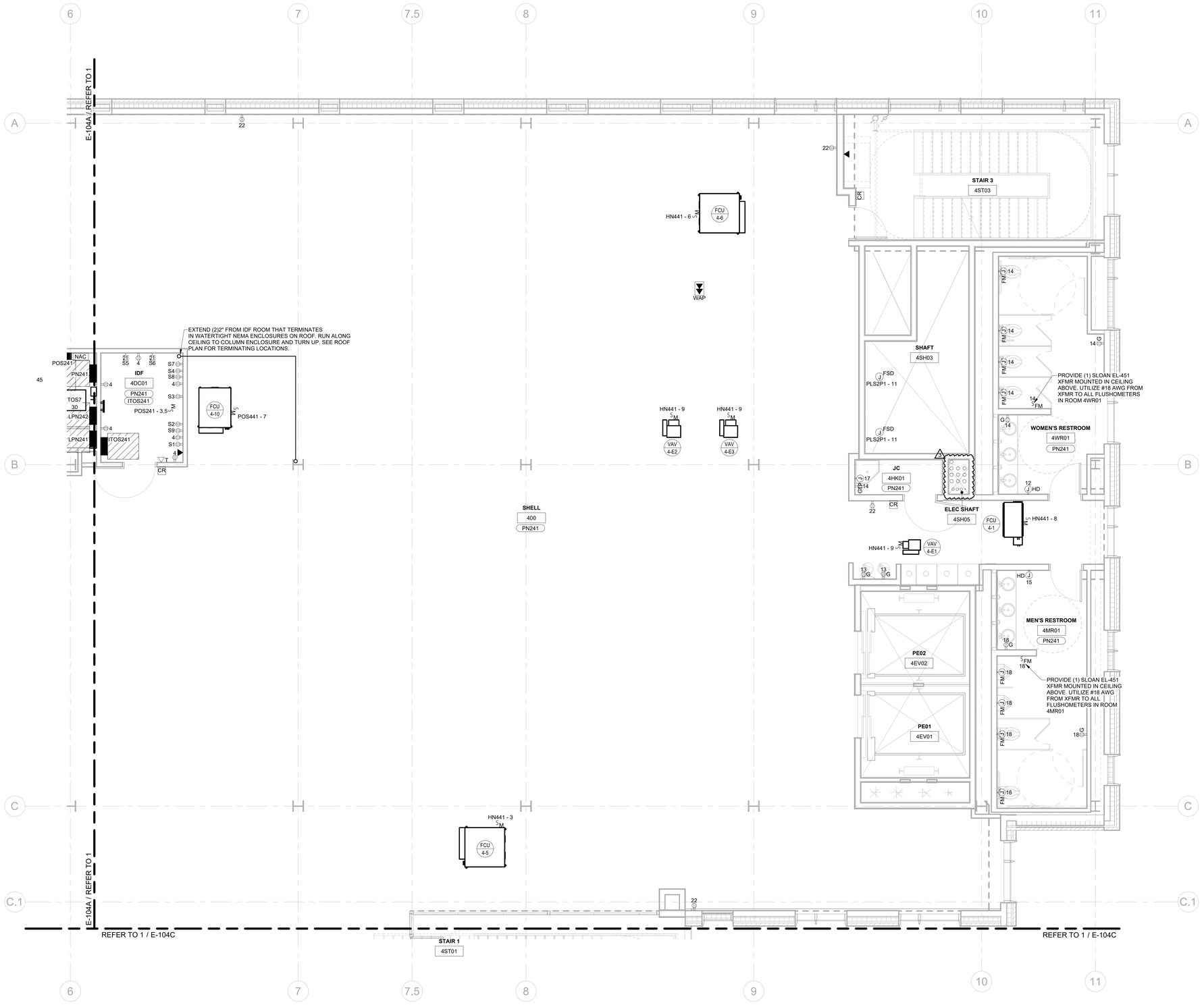
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ELECTRICAL POWER PLAN - THIRD FLOOR AREA C

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Sheet Number

E-103C



1 ELECTRICAL POWER PLAN - FOURTH FLOOR AREA B

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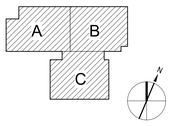
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1 E-104C ELECTRICAL POWER PLAN - FOURTH FLOOR AREA C

SCALE: 1/4" = 1'-0"

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MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building

1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University

1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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In Association with

Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

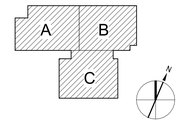
Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

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IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan



Professional Seals

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No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2025-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

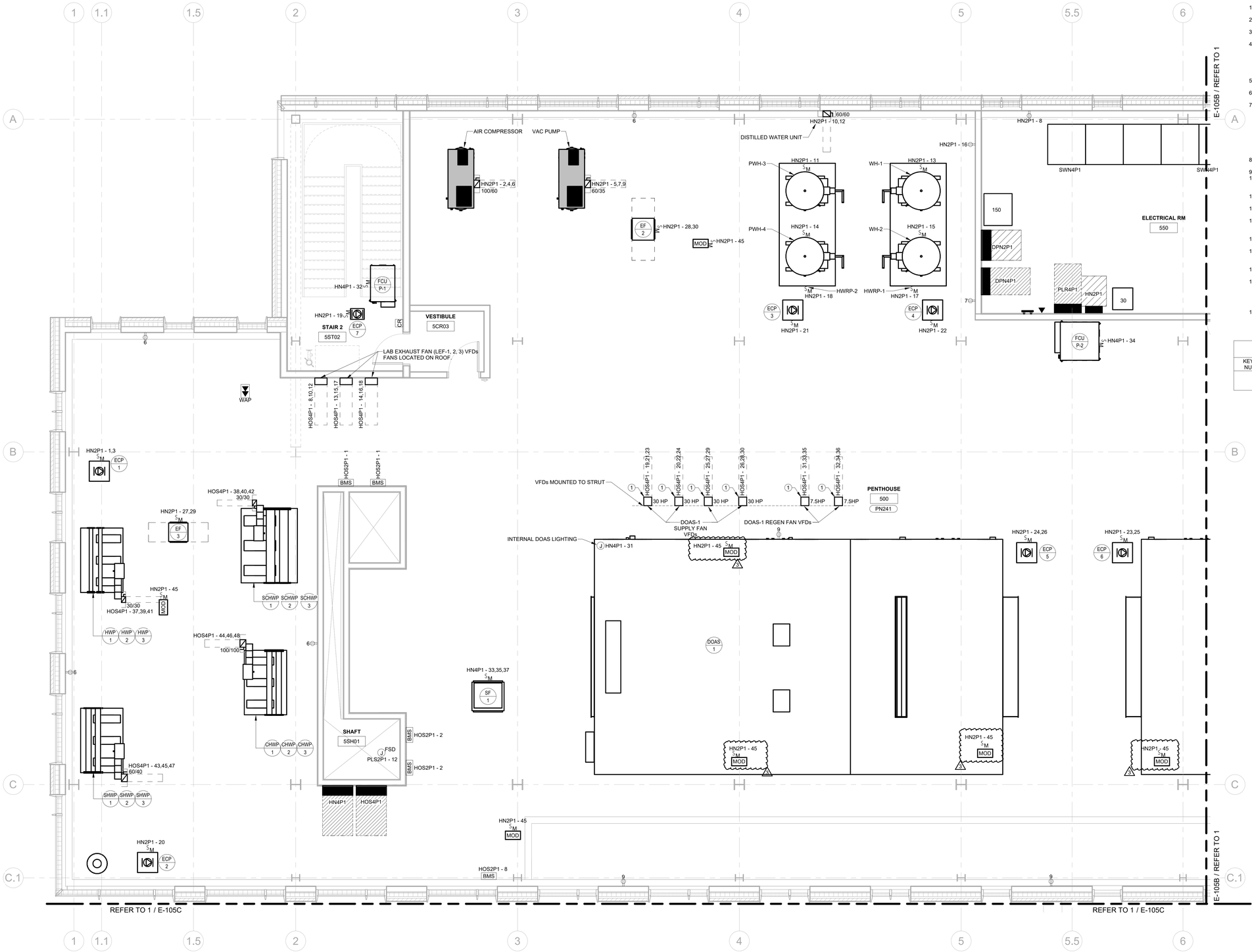
Sheet Title

ELECTRICAL POWER PLAN - FOURTH FLOOR AREA C

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

E-104C



GENERAL ELECTRICAL NOTES:

1. REFER TO ELECTRICAL SHEET E-001 FOR PROJECT GENERAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.
2. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE 2020 EDITION OF THE NATIONAL ELECTRICAL CODE.
3. REFER TO BOOK SPECIFICATIONS FOR PROJECT DETAILS AND EXECUTION REQUIREMENTS.
4. WIRE SIZE OF BRANCH CIRCUITS SHALL BE MINIMUM #12 AWG, BUT NO LESS THAN PERMITTED BY THE NATIONAL ELECTRICAL CODE (NEC) FOR SPECIFIED OVERCURRENT PROTECTION. MINIMUM CONDUIT SIZE SHALL BE 3/4" UNLESS OTHERWISE NOTED. ANY DISCREPANCY MUST BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO BID. REFER TO DETAIL 1/E-005.
5. ELECTRICAL CONTRACTOR TO CIRCUIT AND ROUTE WIRING TO MINIMIZE TOTAL RUN LENGTH.
6. ALL HVAC AND REFRIGERATION CIRCUIT BREAKERS TO BE HACR RATED.
7. WHERE WALLS AND PARTITIONS ARE REQUIRED TO HAVE A MINIMUM 1-HOUR FIRE RESISTANCE RATING, RECESSED FIXTURES SHALL BE INSTALLED SUCH THAT THE REQUIRED FIRE RESISTANCE WILL NOT BE REDUCED. STEEL ELECTRICAL BOXES THAT DO NOT EXCEED 16 SQUARE INCHES IN AREA ARE ACCEPTABLE PROVIDED THE TOTAL AREA OF SUCH OPENINGS DOES NOT EXCEED 100 SQUARE INCHES FOR ANY 100 SQUARE FEET OF WALL AREA. OUTLET BOXES ON OPPOSITE SIDES OF THE WALL SHALL BE SEPARATED BY A HORIZONTAL DISTANCE OF NOT LESS THAN 24 INCHES.
8. INSTALLATION OF ELECTRIC PANELS SHALL BE IN ACCORDANCE WITH NEC ARTICLE 408.
9. ALL CONDUCTORS ARE COPPER UNLESS OTHERWISE NOTED.
10. ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL DISCONNECT SWITCHES / FUSES, AS REQUIRED BY CODE, WHETHER OR NOT THEY ARE INDICATED ON THE PLANS.
11. CONTRACTOR SHALL VERIFY ALL DIMENSIONS PRIOR TO BEGINNING WORK.
12. EXPOSED EMT, CONDUIT AND SURFACE MOUNTED WIRING ARE NOT PERMITTED IN ANY FINISHED SPACE.
13. PROVIDE GROUNDING ELECTRODE CONDUCTORS AND BONDING JUMPERS FOR ALL DRY TYPE TRANSFORMERS. SEE DETAILS FOR REQUIREMENTS.
14. ALL EQUIPMENT AND EQUIPMENT ENCLOSURES SHALL BE PROPERLY BONDED AND GROUNDED PER NEC ARTICLE 250.
15. INSTALL NO MORE THAN THE EQUIVALENT OF (4) 90 - DEGREE BENDS IN ANY CONDUIT RUN BETWEEN JUNCTION BOX OR PULL POINTS.
16. MODULAR FURNITURE SHALL BE FIXED-TYPE AND THE INSTALLATION SHALL COMPLY WITH NEC ARTICLE 605.
17. REFER TO PANEL TAGS LOCATED WITHIN EACH ROOM FOR DEVICE CIRCUITING INFORMATION. AN 'S' PREFIX PRIOR TO THE ASSOCIATED CIRCUIT NUMBER INDICATES THE DEVICE IS POWERED FROM THE GENERATOR-BACKED PANEL TAGGED WITHIN THE ROOM. REFER TO LEAD SHEET E-001 FOR MORE INFORMATION.
18. ELECTRICAL CONTRACTOR SHALL COORDINATE WITH AND REVIEW ARCHITECTURAL DRAWINGS AND ELEVATIONS FOR EXACT PLACEMENT AND HEIGHTS OF ELECTRICAL DEVICES.

ELECTRICAL KEYNOTES	
KEYNOTE NUMBER	KEYNOTE
1	PROVIDE STRUCTURALLY CERTIFIED P1000 UNISTRUT STRUCTURE FOR MOUNTING MANUFACTURER-PROVIDED VFD UNITS. PROVIDE VFD CABLING AS REQUIRED.

1 E-105A ELECTRICAL POWER PLAN - PENTHOUSE AREA A
SCALE: 1/4" = 1'-0"

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MONTCLAIR STATE UNIVERSITY

Project
Interdisciplinary Science Building
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Prepared For
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1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
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Jersey City, NJ 07302

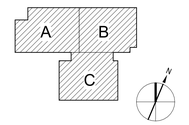
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Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

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Key Plan



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3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

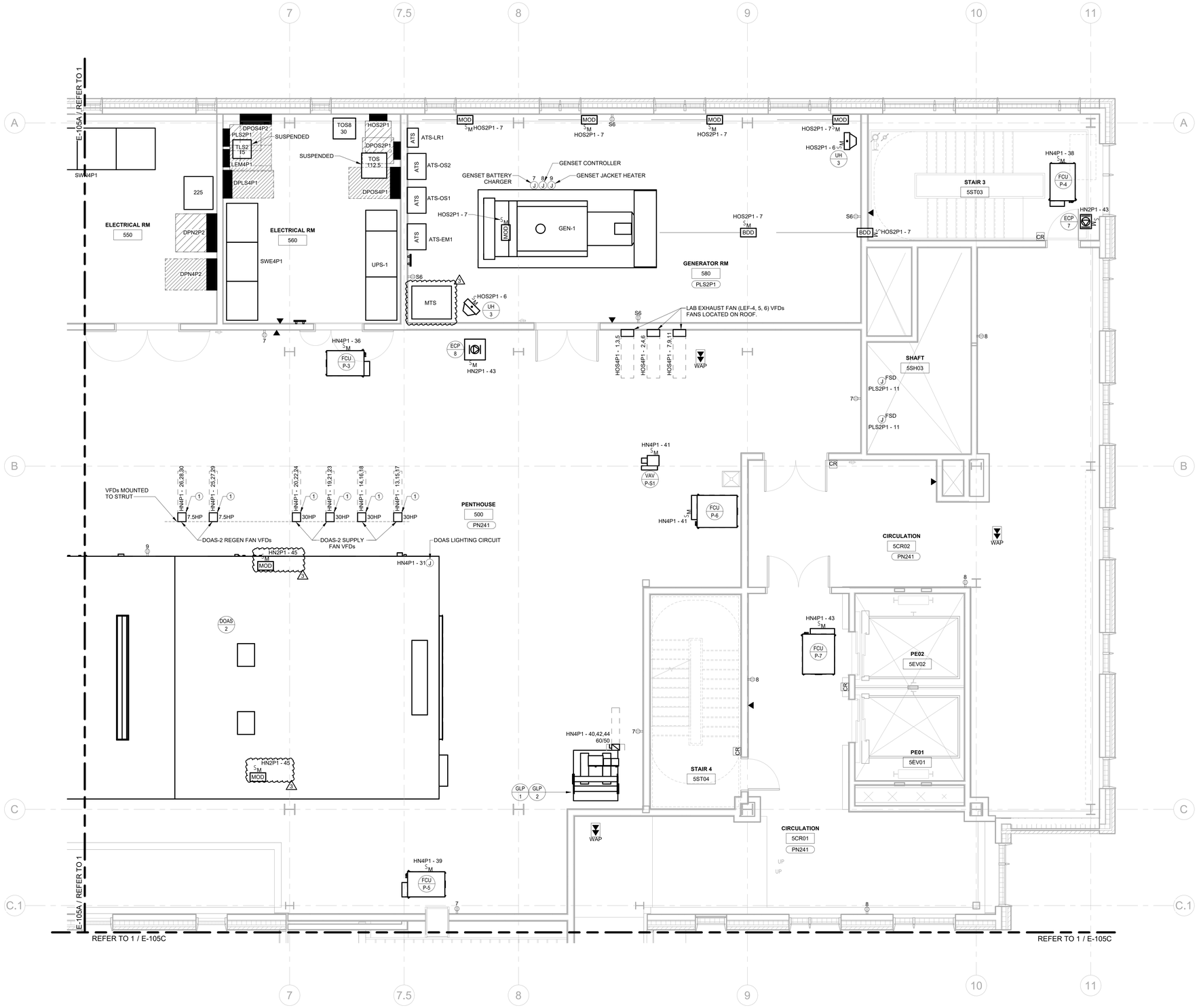
Sheet Title

ELECTRICAL POWER PLAN - PENTHOUSE AREA A

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

E-105A



1 E-105B ELECTRICAL POWER PLAN - PENTHOUSE AREA B

SCALE: 1/4" = 1'-0"

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ELECTRICAL KEYNOTES

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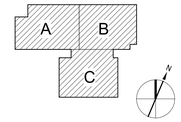
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Key Plan



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No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2025-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

Sheet Title

ELECTRICAL POWER PLAN - PENTHOUSE AREA B

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

E-105B

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Branch Panel: PN211

Location: ELECTRICAL 1EC01 | **Volts:** 120/208 Wye | **A.I.C. Rating:** 10 KAIC
Supply From: DPN2P1 | **Phases:** 3 | **Mains Type:** MAIN CB
Mounting: SURFACE | **Wires:** 4 | **Mains Rating:** 225 A
Enclosure: NEMA 1 | **MCB Rating:** 225 A

Notes:

CKT	Circuit Description	Trip	Poles	Wire Size	A		B		C		Wire Size	Poles	Trip	Circuit Description	CKT
1					8380 VA	860 VA					2W20	1	20 A	RECEPT - CIRCULATION 1CR04/5	2
3	PN212	100 A	3	4W100			8555 VA	720 VA			2W20	1	20 A	RECEPT - CIRCULATION 1CR06	4
5									8120 VA	1728 VA	3W20	2	20 A	HAC-1 - LOADING DOCK 1LD01	6
7	ECP-7 - 1ST FLOOR AREA 'A'	20 A	1	2W20	125 VA	1728 VA									8
9	AV RACK - SEMINAR CLASSRM 146	20 A	1	2W20			360 VA	720 VA			2W20	1	20 A	FLOOR BOX - SEMINAR CLASS 146	10
11	FLOOR BOX - SEMINAR CLASS 146	20 A	1	2W20					500 VA	860 VA	2W20	1	20 A	WALL BOX - SEMINAR CLASSRM...	12
13	RECEPT - COMPUTER LAB 140	20 A	1	2W20	1000 VA	720 VA					2W20	1	20 A	FLOOR BOX - COMPUTER LAB 140	14
15	FLOOR BOX - COMPUTER LAB 140	20 A	1	2W20			720 VA	680 VA			2W20	1	20 A	WALL BOX - COMPUTER LAB 140	16
17	RECEPT - COMPUTER LAB 140	20 A	1	2W20					900 VA	366 VA	2W20	1	20 A	RECEPT - ALL GENDER RR 1AG01	18
19	RECEPT - RMS 1CR07 & 1CR06	20 A	1	2W20	900 VA	1040 VA					2W20	1	20 A	RECEPT - DEPT. WORKSPACE 160	20
21	HAND DRYER - RESTROOM 1AG01	20 A	1	2W20			1000 VA	500 VA			2W20	1	20 A	FLOOR BOX - DEPT. WS 160	22
23	RECEPT - DEPT. WORKSPACE 160	20 A	1	2W20					900 VA	720 VA	2W20	1	20 A	RECEPT - BOH CIRCULATION...	24
25	FLOOR BOX DEPT. WORKSPACE...	20 A	1	2W20	360 VA	570 VA					2W20	1	20 A	RECEPT - MEN'S RR 1MR01	26
27	RECEPT & SAFETY SHOWER -...	20 A	1	2W20			408 VA	1000 VA			2W20	1	20 A	HAND DRYER - MEN'S RR 1MR01	28
29	HAND DRYER - WOMEN'S RR...	20 A	1	2W20					1000 VA	1080 VA	2W20	1	20 A	RECEPT - RMS 171, 1HK01 & CIR...	30
31	RECEPT - RMS 199, 1LD01	20 A	1	2W20	720 VA	1600 VA					2W20	1	20 A	REF - LACTATION ROOM 174	32
33	WATER COOLER - CIRC 1CR09	20 A	1	2W20			520 VA	540 VA			2W20	1	20 A	RECEPT - LACTATION ROOM 174	34
35	MICROWAVE - LACTATION ROOM...	20 A	1	2W20					1200 VA	720 VA	2W20	1	20 A	RECEPT - STORAGE / CATERING...	36
37	RECEPT - RMS 174 & 176	20 A	1	2W20	1600 VA	1600 VA					2W20	1	20 A	RECEPT - STORAGE / CATERING...	38
39	RECEPT - VENDING ALCOVE v2	20 A	1	2W20			1920 VA	1920 VA			2W20	1	20 A	RECEPT - VENDING ALCOVE v2	40
41	RECEPT - STORAGE / CATERING...	20 A	1	2W20					720 VA	1920 VA	2W20	1	20 A	RECEPT - VENDING ALCOVE v2	42
43	RECEPT - MAIL ROOM 178	20 A	1	2W20	720 VA	180 VA					2W20	1	20 A	RECEPT - MAIL ROOM 178	44
45	RECEPT - STUDENT LOUNGE 170	20 A	1	2W20			1260 VA	360 VA			2W20	1	20 A	FLOOR BOX - STUDENT LOUNGE...	46
47	RECEPT - MDF 1DC01	20 A	1	2W20					1080 VA	720 VA	2W20	1	20 A	RECEPT - HSKP 1HK02	48
49	RECEPT - GEN WASTE & REC...	20 A	1	2W20	720 VA	570 VA					2W20	1	20 A	RECEPT - WOMEN'S RR 1WR01	50
51	HAND DRYER - MEN'S RR 1MR01	20 A	1	2W20			1000 VA	1000 VA			2W20	1	20 A	HAND DRYER - WOMEN'S RR...	52
53	TRAP PRIMER - JC 1HK01	20 A	1	2W20					756 VA	500 VA	2W20	1	20 A	NT-1 - WASTE NEUTRALIZATION...	54
55					300 VA	1321 VA									56
57	SP-2 - LOADING DOCK 1LD01	20 A	3	4W20			300 VA	1321 VA			4W20	3	20 A	SP-1 - ELEVATOR PIT	58
59									300 VA	1321 VA					60
61	RECEPT - ELEVATOR PIT	20 A	1	2W20	720 VA	1440 VA						1	0 A	Receptacle Space A351	62
63	UH-2 - LOADING DOCK & WASTE /...	20 A	1	2W20			540 VA	208 VA			3W20	2	15 A	IDU 1-2/3/4/5 - RMS 1CR10, 1HK02, 1TR01	64
65	ECP-7 - 1ST FLOOR AREA 'B'	20 A	1	2W20					75 VA	208 VA					66
67	RECEPT - IMAGINARIUM	20 A	1	2W20	1440 VA	1000 VA					2W20	1	20 A	AV RACK - SEMINAR 146	68
69	TV - LOUNGE 170	20 A	1	2W20			680 VA	1000 VA			2W20	1	20 A	DEDICATED QUAD - AV ROOM...	70
71	FLOOR BOX - IMAGINARIUM	20 A	1	2W20					1440 VA	1000 VA	2W20	1	20 A	DEDICATED QUAD - AV ROOM...	72
73	FLOOR BOX - IMAGINARIUM	20 A	1	2W20	1440 VA	1000 VA					2W20	1	20 A	DEDICATED QUAD - AV ROOM...	74
75	FLOOR BOX - IMAGINARIUM	20 A	1	2W20			1440 VA	0 VA			--	1	20 A	SPARE	76
77	FLOOR BOX - IMAGINARIUM	20 A	1	2W20					1440 VA	0 VA	--	1	20 A	SPARE	78
79	SPARE	20 A	1	--	0 VA	0 VA					--	1	20 A	SPARE	80
81	SPARE	20 A	1	--			0 VA	0 VA			--	1	20 A	SPARE	82
83	SPARE	20 A	1	--					0 VA	0 VA	--	1	20 A	SPARE	84
	THIS SECTION TOTAL:	**Total Load:**			32054 VA		28672 VA		29574 VA						
		Total Amps:			268 A		239 A		248 A						

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
HVAC	416 VA	125.00%	520 VA		
Heating	3996 VA	100.00%	3996 VA	**Total Conn. Load:**	90300 VA
Motor	5138 VA	119.28%	6129 VA	**Total Est. Demand:**	72605 VA
Other	1440 VA	100.00%	1440 VA	**Total Conn.:**	251 A
Power - General	360 VA	100.00%	360 VA	**Total Est. Demand:**	202 A
Receptacle	45360 VA	61.02%	27680 VA		
Non-Continuous	27230 VA	100.00%	27230 VA		
Continuous	360 VA	125.00%	450 VA		
Kitchen Equipment	6000 VA	80.00%	4800 VA		

Notes:

Branch Panel: PN212

Location: EVENT STORAGE 120C | **Volts:** 120/208 Wye | **A.I.C. Rating:** 10 KAIC
Supply From: PN211 | **Phases:** 3 | **Mains Type:** MAIN CB
Mounting: SURFACE | **Wires:** 4 | **Mains Rating:** 100 A
Enclosure: NEMA 1 | **MCB Rating:** 100 A

Notes:

CKT	Circuit Description	Trip	Poles	Wire Size	A		B		C		Wire Size	Poles	Trip	Circuit Description	CKT
1	RECEPT - EVENT STORAGE 120C	20 A	1	2W20	720 VA	180 VA					2W20	1	20 A	RECEPT - STUDENT LOUNGE 110	2
3	RECEPT - PRE-FUNCTION 100	20 A	1	2W20			720 VA	720 VA			2W20	1	20 A	FLOOR BOX - PRE-FUNCTION 100	4
5	RECEPT - EVENT SPACE 120A	20 A	1	2W20					1080 VA	1260 VA	2W20	1	20 A	RECEPT - EVENT SPACE 120B	6
7	FLOOR BOX - EVENT SPACE...	20 A	1	2W20	1080 VA	1080 VA					2W20	1	20 A	FLOOR BOX - EVENT SPACE...	8
9	FLOOR BOX - EVENT SPACE...	20 A	1	2W20			1080 VA	1080 VA			2W20	1	20 A	FLOOR BOX - EVENT SPACE...	10
11	FLOOR BOX - EVENT SPACE...	20 A	1	2W20					1080 VA	720 VA	2W20	1	20 A	FLOOR BOX - EVENT SPACE 120B	12
13	FLOOR BOX - EVENT SPACE 120B	20 A	1	2W20	1080 VA	1080 VA					2W20	1	20 A	FLOOR BOX - EVENT SPACE...	14
15	RECEPT - PRE-FUNCTION 100	20 A	1	2W20			1080 VA	1000 VA			2W20	1	20 A	AV RACK - EVENT STORAGE 120C	16
17	PROJECTION SCREEN A - EVENT...	20 A	1	2W20					1180 VA	1180 VA	2W20	1	20 A	PROJECTION SCREEN B - EVENT...	18
19	RECEPT - EVENT SPACE 120B	20 A	1	2W20	360 VA	1000 VA					2W20	1	20 A	AV RACK - EVENT STORAGE 120C	20
21	AV RACK - EVENT STORAGE 120C	20 A	1	2W20			1000 VA	180 VA			2W20	1	20 A	FCIS - PLUMBING 120D	22
23	FLOW METER - PLUMBING 120D	20 A	1	2W20					180 VA	180 VA	2W20	1	20 A	FCIS - PLUMBING 120D	24
25	FLOW METER - PLUMBING 120D	20 A	1	2W20	180 VA	720 VA					2W20	1	20 A	RECEPT - OUTDOOR TEACHING...	26
27	EXT. RECEPT - QUAD ROAD...	20 A	1	2W20			540 VA	360 VA			2W20	1	20 A	CHARGING BOLLARD - EXTERIOR...	28
29	EXT. RECEPT - UPPER SEAT WAL...	20 A	1	2W20					540 VA	720 VA	2W20	1	20 A	EXT. RECEPT - LOWER SEAT WA...	30
31	EXT. RECEPT - EVENT AREA SEA...	20 A	1	2W20	720 VA	180 VA					2W20	1	20 A	RECEPT - PLUMBING 120D	32
33	EXT. RECEPT - EVENT AREA SEA...	20 A	1	2W20			720 VA	75 VA			2W20	1	20 A	ECP-7 - 1ST FLOOR AREA 'C'	34
35	SPARE	20 A	1	--					0 VA	0 VA	--	1	20 A	SPARE	36
37	SPARE	20 A	1	--	0 VA	0 VA					--	1	20 A	SPARE	38
39	SPARE	20 A	1	--			0 VA	0 VA			--	1	20 A	SPARE	40
41	SPARE	20 A	1	--					0 VA	0 VA	--	1	20 A	SPARE	42
43	SPARE	20 A	1	--	0 VA	0 VA					--	1	20 A	SPARE	44
45	SPARE	20 A	1	--			0 VA	0 VA			--	1	20 A	SPARE	46
47	SPARE	20 A	1	--					0 VA	0 VA	--	1	20 A	SPARE	48
49	SPARE	20 A	1	--	0 VA	0 VA					--	1	20 A	SPARE	50
51	SPARE	20 A	1	--			0 VA	0 VA			--	1	20 A	SPARE	52
53	SPARE	20 A	1	--					0 VA	0 VA	--	1	20 A	SPARE	54
	THIS SECTION TOTAL:	**Total Load:**			8380 VA		8555 VA		8120 VA						
		Total Amps:			70 A		72 A		68 A						

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	75 VA	108.33%	81 VA		
Other	900 VA	100.00%	900 VA	**Total Conn. Load:**	25055 VA
Power - General	360 VA	100.00%	360 VA	**Total Est. Demand:**	21331 VA
Receptacle	17640 VA	78.34%	13820 VA	**Total Conn.:**	70 A
Non-Continuous	5720 VA	100.00%	5720 VA	**Total Est. Demand:**	59 A
Continuous	360 VA	125.00%	450 VA		

Notes:

Branch Panel: PN221

Location: ELEC 2EC01 | **Volts:** 120/208 Wye | **A.I.C. Rating:** 10 KAIC
Supply From: DPN2P1 | **Phases:** 3 | **Mains Type:** MAIN CB
Mounting: SURFACE | **Wires:** 4 | **Mains Rating:** 225 A
Enclosure: NEMA 1 | **MCB Rating:** 150 A

Notes:

CKT	Circuit Description	Trip	Poles	Wire Size	A		B		C		Wire Size	Poles	Trip	Circuit Description	CKT
1					2465 VA	1260 VA					2W20	1	20 A	RECEPT - CIRCULATION 2CR05	2
3	PN222	60 A	3	4W60			2160 VA	1360 VA			2W20	1	20 A	RECEPT - MED. CONF. 249	4
5									2000 VA	1200 VA	2W20	1	20 A	PRINTER - COPY 240E	6
7	RECEPT - COPY 240E	20 A	1	2W20	360 VA	1500 VA					2W20	1	20 A	RECEPT - PANTRY 240D	8
9	MICROWAVE - PANTRY 240D	20 A	1	2W20			750 VA	1100 VA			2W20	1	20 A	DISHWASHER - PANTRY 240D	10
11	REFRIGERATOR - PANTRY 240D	20 A	1	2W20					1100 VA	1110 VA	2W20	1	20 A	RECEPT & SCONCE - FOCUS...	12
13	RECEPT - STAFF WORKPLACE 240	20 A	1	2W20	900 VA	720 VA					2W20	1	20 A	RECEPT - STAFF WP 240	14
15	TVS & POKE THRU - STAFF WP 240	20 A	1	2W20			1180 VA	1000 VA			2W20	1	20 A	POKE THRU - STAFF WP 240	16
17	RECEPT - FOCUS 242 & 244	20 A	1	2W20					720 VA	900 VA	2W20	1	20 A	RECEPT - LAB CORRIDOR 2CR06	18
19	RECEPT & SCONCE - FOCUS 289	20 A	1	2W20	550 VA	1080 VA					2W20	1	20 A	RECEPT - CIRCULATION 2CR07	20
21	RECEPT - WOMEN'S RR 2WR01	20 A	1	2W20			744 VA	520 VA			2W20	1	20 A	WATER COOLER - CIRC 2CR07	22
23	HAND DRYER - MEN'S RR 2MR01	20 A	1	2W20					1000 VA	1000 VA	2W20	1	20 A	HAND DRYER - WOMEN'S RR...	24
25	RECEPT - HUDDLE 271	20 A	1	2W20	1220 VA	500 VA					2W20	1	20 A	POKE THRU - STAFF WP 240	26
27	RECEPT - BOOTHS z1	20 A	1	2W20			540 VA	1080 VA			2W20	1	20 A	RECEPT - IDF 2DC01	28
29	RECEPT - MEN'S RESTROOM...	20 A	1	2W20					564 VA	756 VA	2W20	1	20 A	TRAP PRIMER - JC 2HK01	30
31	ECP-7 - STAIR 3 2ST03	20 A	1	2W20	25 VA	25 VA						1	20 A	ECP-7 - STAIR 3 2ST03	32
33								0 VA			--	1	20 A	SPARE	34
35	SPARE	20 A	1	--					0 VA	0 VA	--	1	20 A	SPARE	36
37	SPARE	20 A	1	--	0 VA	0 VA					--	1	20 A	SPARE	38
39	SPARE	20 A	1	--			0 VA	0 VA			--	1	20 A	SPARE	40
41	SPARE	20 A	1	--					0 VA	0 VA	--	1	20 A	SPARE	42
	THIS SECTION TOTAL:	**Total Load:**			10605 VA		10434 VA		10350 VA						
		Total Amps:			88 A		87 A		86 A						

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	75 VA	108.33%	81 VA		
Other	540 VA	100.00%	540 VA	**Total Conn. Load:**	31389 VA
Receptacle	14760 VA	83.88%	12380 VA	**Total Est. Demand:**	27680 VA
Non-Continuous	11524 VA	100.00%	11524 VA	**Total Conn.:**	87 A
Lighting	40 VA	100.00%	40 VA	**Total Est. Demand:**	77 A
Kitchen Equipment	4450 VA	70.00%	3115 VA		

Notes:

Branch Panel: PN222

Location: ELEC 2EC02 | **Volts:** 120/208 Wye | **A.I.C. Rating:** 14 KAIC
Supply From: PN221 | **Phases:** 3 | **Mains Type:** MAIN CB
Mounting: SURFACE | **Wires:** 4 | **Mains Rating:** 100 A
Enclosure: NEMA 1 | **MCB Rating:** 60 A

Notes:

CKT	Circuit Description	Trip	Poles	Wire Size	A		B		C		Wire Size	Poles	Trip	Circuit Description	CKT
1	RECEPT - OPEN COLLABORATIO...	20 A	1	2W20	540 VA	500 VA					2W20	1	20 A	POKE THRU - LOUNGE 200	2
3	RECEPT - CIRCULATION 2CR04	20 A	1	2W20			540 VA	900 VA			2W20	1	20 A	RECEPT - CIRCULATION 2CR03	4
5	RECEPT - GA/TA WORKSPACE 204	20 A	1	2W20					1000 VA	1000 VA	2W20	1	20 A	RECEPT - GA/TA WORKSPACE 204	6
7	RECEPT - HUDDLE 202	20 A	1	2W20	1400 VA	25 VA					2W20	1	20 A	ECP-7 - 2ND FLOOR AREA 'C'	8
9	SPARE	20 A	1	--			0 VA	720 VA				1	20 A	RECEPT - GA/TA WORKSPACE 204	10
11	SPARE	20 A	1	--					0 VA	0 VA	--	1	20 A	SPARE	12
13	SPARE	20 A	1	--	0 VA	0 VA					--	1	20 A	SPARE	14
15	SPARE	20 A	1	--			0 VA	0 VA			--	1	20 A	SPARE	16
17	SPARE	20 A	1	--					0 VA	0 VA	--	1	20 A	SPARE	18
	THIS SECTION TOTAL:	**Total Load:**			2465 VA		2160 VA		2000 VA						
		Total Amps:			21 A		18 A		17 A						

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	25 VA	125.00%	31 VA		
Other	180 VA	100.00%	180 VA	**Total Conn. Load:**	6625 VA
Receptacle	3420 VA	100.00%	3420 VA	**Total Est. Demand:**	6631 VA
Non-Continuous	3000 VA	100.00%	3000 VA	**Total Conn.:**	18 A
				Total Est. Demand:	18 A

Notes:

Branch Panel: PN231

Location: ELEC 3EC01 | **Volts:** 120/208 Wye | **A.I.C. Rating:** 14 KAIC
Supply From: DPN2P1 | **Phases:** 3 | **Mains Type:** MAIN CB
Mounting: SURFACE | **Wires:** 4 | **Mains Rating:** 225 A
Enclosure: NEMA 1 | **MCB Rating:** 150 A

Notes:

CKT	Circuit Description	Trip	Poles	Wire Size	A		B		C		Wire Size	Poles	Trip	Circuit Description	CKT
1					2480 VA	1260 VA					2W20	1	20 A	RECEPT - CIRCULATION 3CR05	2
3	PN232	60 A	3	4W60			2800 VA	1110 VA			2W20	1	20 A	RECEPT - FOCUS 340A-C	4
5									2425 VA	1200 VA	2W20	1	20 A	PRINTER - COPY 340E	6
7	RECEPT - COPY 340E	20 A	1	2W20	360 VA	930 VA					2W20	1	20 A	RECEPT - PANTRY 340D	8
9	REFRIGERATOR - PANTRY 340D	20 A	1	2W20			1600 VA	930 VA			2W20	1	20 A	RECEPT - PANTRY 340D	10
11	DISHWASHER - PANTRY 340D	20 A	1	2W20					1100 VA	900 VA	2W20	1	20 A	RECEPT - STAFF WORKPLACE 340	12
13	RECEPT - STAFF WORKPLACE 340	20 A	1	2W20	720 VA	1000 VA					2W20	1	20 A	RECEPT - STAFF WORKPLACE 340	14
15	RECEPT - STAFF WORKPLACE 340	20 A	1	2W20			500 VA	680 VA			2W20	1	20 A	TV - STAFF WORKPLACE 340	16
17	RECEPT - FOCUS 344	20 A	1	2W20					720 VA	900 VA	2W20	1	20 A	RECEPT - CIRCULATION 3CR01 &...	18
19	RECEPT - ELEC 3EC01	20 A	1	2W20	720 VA	1220 VA					2W20	1	20 A	RECEPT - HUDDLE 371	20
21	RECEPT, ECP-7 - LAB CORR...	20 A	1	2W20			925 VA	1000 VA			2W20	1	20 A	HAND DRYER - WOMEN'S RR...	22
23	RECEPT - MEN'S RR 3MR01 &...	20 A	1	2W20					744 VA	520 VA	2W20	1	20 A	WATER COOLER - CIRC 3CR07	24
25	HAND DRYER - MEN'S RR 3MR01	20 A	1	2W20	1000 VA	1080 VA					2W20	1	20 A	RECEPT - IDF 3DC01	26
27	RECEPT - WOMEN'S RR 3WR01	20 A	1	2W20			564 VA	756 VA			2W20	1	20 A	TRAP PRIMER - JC 3HK01	28
29	ECP-7 - STAIR 2 3ST02	20 A	1	2W20					25 VA	25 VA	2W20	1	20 A	ECP-7 - STAIR 3 3ST03	30
31	SPARE	20 A	1	--	0 VA	0 VA					--	1	20 A	SPARE	32
33	SPARE	20 A	1	--			0 VA	0 VA			--	1	20 A	SPARE	34
35	SPARE	20 A	1	--					0 VA	0 VA	--	1	20 A	SPARE	36
37	SPARE	20 A	1	--	0 VA	0 VA					--	1	20 A	SPARE	38
39	SPARE	20 A	1	--			0 VA	0 VA			--	1	20 A	SPARE	40
41	SPARE	20 A	1	--					0 VA	0 VA	--	1	20 A	SPARE	42
	THIS SECTION TOTAL:	**Total Load:**			10770 VA		10865 VA		8559 VA						
		Total Amps:			93 A		93 A		71 A						

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	100 VA	106.25%	106 VA		
Other	540 VA	100.00%	540 VA	**Total Conn. Load:**	30194 VA
Receptacle	15300 VA	82.68%	12650 VA	**Total Est. Demand:**	26710 VA
Non-Continuous	10024 VA	100.00%	10024 VA	**Total Conn.:**	84 A
Lighting	30 VA	100.00%	30 VA	**Total Est. Demand:**	74 A
Kitchen Equipment	4200 VA	80.00%	3360 VA		

Notes:

Branch Panel: PN232

Location: CIRCULATION 3CR03 | **Volts:** 120/208 Wye | **A.I.C. Rating:** 14 KAIC
Supply From: PN231 | **Phases:** 3 | **Mains Type:** MAIN CB
Mounting: SURFACE | **Wires:** 4 | **Mains Rating:** 100 A
Enclosure: NEMA 1 | **MCB Rating:** 60 A

Notes:

CKT	Circuit Description	Trip	Poles	Wire Size	A		B		C		Wire Size	Poles	Trip	Circuit Description	CKT
1	FLOOR WHIP - LOUNGE 300	20 A	1	2W20	500 VA	540 VA					2W20	1	20 A	RECEPT - LOUNGE 300	2
3	RECEPT - GA/TA WORKSPACE 304	20 A	1	2W20			720 VA	1000 VA			2W20	1	20 A	RECEPT - GA/TA WORKSPACE 304	4
5	RECEPT - GA/TA WORKSPACE 304	20 A	1	2W20					1000 VA	1400 VA	2W20	1	20 A	RECEPT - HUDDLE 302	6
7	RECEPT - CIRCULATION 3CR04	20 A	1	2W20	720 VA	720 VA					2W20	1	20 A	RECEPT - CIRCULATION 3CR03	8
9	RECEPT - 3D PRINTER 321	20 A	1	2W20			540 VA	540 VA			2W20	1	20 A	RECEPT - 3D PRINTER 321	10
11									25 VA	2W20	1	20 A	ECP-7 - STAIR 1 3ST01	12	
13	SPARE	20 A	1	--	0 VA	0 VA					--	1	20 A	SPARE	14
15	SPARE	20 A	1	--			0 VA	0 VA			--	1	20 A	SPARE	16
17	SPARE	20 A	1	--					0 VA	0 VA	--	1	20 A	SPARE	18
19	SPARE	20 A	1	--	0 VA	0 VA					--	1	20 A	SPARE	20
21	SPARE	20 A	1	--			0 VA	0 VA			--	1	20 A	SPARE	22
23	SPARE	20 A	1	--					0 VA	0 VA	--	1	20 A	SPARE	24
	THIS SECTION TOTAL:	**Total Load:**			2480 VA		2800 VA		2425 VA						
		Total Amps:			21 A		23 A		20 A						

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	25 VA	125.00%	31 VA		
Other	180 VA	100.00%	180 VA	**Total Conn. Load:**	7705 VA
Receptacle	4500 VA	100.00%	4500 VA	**Total Est. Demand:**	7711 VA
Non-Continuous	3000 VA	100.00%	3000 VA	**Total Conn.:**	21 A
				Total Est. Demand:	21 A

Notes:

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building

1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University

1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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In Association with

Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

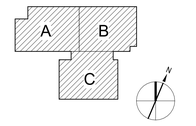
Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan



Professional Seals

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No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2025-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

Sheet Title

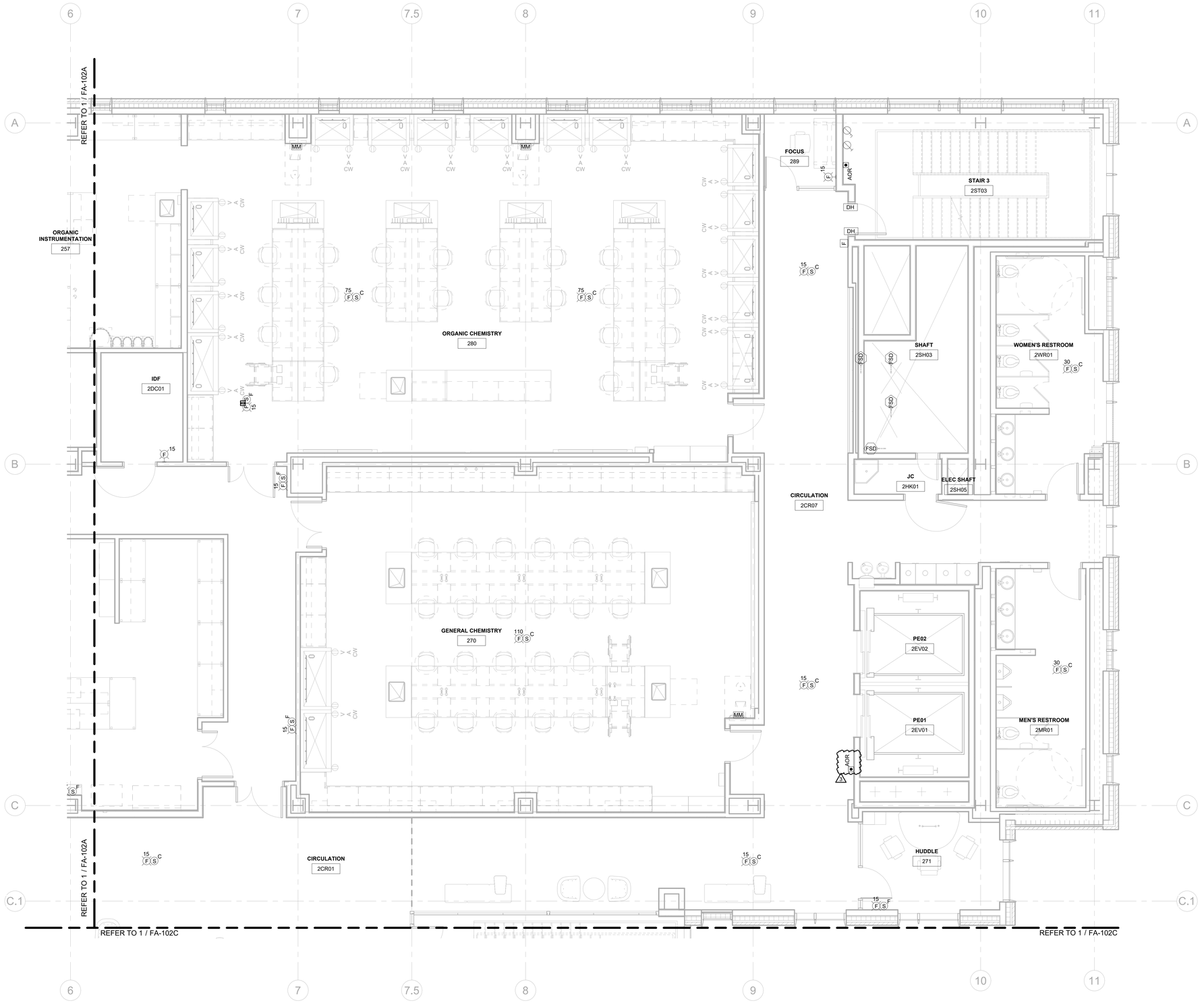
ELECTRICAL PANEL SCHEDULES

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Sheet Number

E-306

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1 FIRE ALARM PLAN - SECOND FLOOR AREA B
FA-102B SCALE: 1/4" = 1'-0"

GENERAL FIRE ALARM NOTES:

1. REFER TO ELECTRICAL DRAWING E-001 FOR PROJECT GENERAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.
2. REFER TO SHEET FA-002 FOR FIRE ALARM RISER DIAGRAM.
3. REFER TO SHEET FA-001 FOR FIRE ALARM SYMBOL LIST.
4. REFER TO BOOK SPECIFICATIONS FOR PROJECT DETAILS AND EXECUTION REQUIREMENTS.
5. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE 2020 EDITION OF THE NATIONAL ELECTRICAL CODE.
6. REFER TO NOTE #19 ON DRAWING E-001 FOR ADDITIONAL DEVICES, ASSOCIATED WIRING, RACEWAY, BACKBOXES AND INSTALLATION TO BE INCLUDED.
7. INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, ARTICLE 760.
8. DO NOT INSTALL FIRE ALARM CABLES IN RACEWAY WITH OTHER BUILDING SYSTEM CONDUCTORS.
9. ALL DEVICE LOCATIONS SHOWN ON THESE DRAWINGS ARE APPROXIMATE. EXACT LOCATIONS ARE DETERMINED BY THE INSTALLER AFTER CONSIDERATION OF CODES, SPECIFICATIONS AND MANUFACTURER REQUIREMENTS.
10. DO NOT INSTALL SMOKE DETECTORS WITHIN THREE FEET OF, OR IN THE DIRECT AIR STREAM OF SUPPLY AIR GRILLS.
11. DO NOT INSTALL SMOKE DETECTOR HEADS PRIOR TO COMPLETE AREA CLEANUP.
12. DUCT DETECTOR HOUSINGS MUST BE MOUNTED BELOW ROOFLINE.
13. PROVIDE AUXILIARY FIRE ALARM SIGNAL PANEL(S) W/ BATTERY BACKUP AS REQUIRED TO SUPPORT NOTIFICATION APPLIANCE LOADS.
14. ALL WIRING REQUIREMENTS SHALL BE AS PER MANUFACTURER'S RECOMMENDATIONS.
15. PROVIDE END OF LINE RESISTORS AS NECESSARY.
16. STROBE CANDELAS MUST BE SIZED PER NFPA 72 REQUIREMENTS BY THE FIRE ALARM VENDOR AND SHOWN ON THE SHOP DRAWINGS.
17. ALL PANELS BATTERY BACKUP (STANDBY & ALARM) SHALL BE SIZED PER NFPA 72 REQUIREMENTS.
18. A COMPLETE SET FOR FIRE ALARM PRODUCT CUTSHEETS, FIRE ALARM SHOP DRAWINGS, AND BATTERY / VOLTAGE / LOAD CALCULATIONS MUST BE SUBMITTED AND APPROVED BY THE AHJ AND THE ENGINEER PRIOR TO INSTALLATION.
19. PRIMARY FACP POWER SHALL BE FED VIA BRANCH CIRCUIT(S) DEDICATED FOR THE FIRE ALARM SYSTEM.
20. ALL EARTH GROUND PANEL CONNECTIONS REQUIRED BY THE MANUFACTURER SHALL BE CONNECTED TO THE BUILDING'S GROUND. PANEL NEUTRAL OR GROUNDING TO CONDUIT / BUILDING STEEL IS NOT ACCEPTABLE.
21. THE SELECTED SYSTEM IS MODULAR IN DESIGN. ALL SPECIFIED COMPONENTS MUST HAVE A MINIMUM 20% SPARE EXPANSION CAPACITY TO ACCOMMODATE CONSTRUCTION CHANGES AND FUTURE RENOVATIONS. THIS SPARE CAPACITY INCLUDES CABINET EXPANSION SPACE, CAPACITIES ON POWER SUPPLIES / PANEL CARDS AND NETWORKING CAPABILITY.
22. IT IS THE INTENT THAT THE DRAWINGS AND SPECIFICATIONS SHALL PROVIDE A WORKING INSTALLATION. THE OMISSION OF EXPRESSED REFERENCE IN THE DRAWINGS OR SPECIFICATION TO ANY LABOR OR MATERIAL NECESSARY FOR THE PROPER EXECUTION OF THE WORK IN ACCORDANCE WITH PRESENT GOOD PRACTICE OF THE TRADE SHALL NOT RELIEVE THIS CONTRACTOR FROM PROVIDING, AT NO COST, SUCH ADDITIONAL LABOR OR MATERIAL UNDER THIS CONTRACT. DEVICE LOCATIONS ARE FOR REFERENCE ONLY UNLESS SPECIFICALLY DIMENSIONED, ACTUAL LOCATIONS SHALL BE IN ACCORDANCE WITH NFPA 72 AND THIS SPECIFICATION.
23. ALL WIRING SHALL COMPLY WITH PROJECT SPECIFICATIONS, NFPA 72, ARTICLE 760, AND THE REQUIREMENTS OF THE AHJ. NO FIRE ALARM POWER-LIMITED WIRING SHALL BE PERMITTED IN THE SAME RACEWAY AS NON-POWER-LIMITED WIRING UNLESS SEPARATED BY AN APPROVED BARRIER.
24. FURNISH AND INSTALL ACCESS PANELS WHERE REQUIRED FOR ACCESS TO CONCEALED EQUIPMENT WHERE NO OTHER MEANS IS PROVIDED.
25. FOR CONDUIT APPLICATIONS, USE ELECTRICAL METALLIC TUBING (EMT), 3/4" MINIMUM.
26. ALL CONDUITS, CONDUCTORS, RACEWAYS, EQUIPMENT, ETC., SHALL BE SUPPORTED IN AN APPROVED MANNER BY THE BUILDING STRUCTURE, INCLUDING HANGERS AND RESTRAINTS, IN ACCORDANCE WITH ALL APPLICABLE CODE REQUIREMENTS.
27. SEAL ALL PENETRATIONS THROUGH EXTERIOR WALLS, FLOORS, AND ROOFS WITH WATERTIGHT MATERIAL.
28. MOUNTING FOR ALL DEVICES AND APPLIANCES SHALL COMPLY WITH STATE, LOCAL, AND FEDERAL REQUIREMENTS.
29. CONTRACTOR SHALL REPAIR / PATCH AND / OR REPAINT TO MATCH ADJACENT AREAS, ANY AREAS DAMAGED (OR WHERE ITEMS WERE REMOVED / DEMOLISHED) BY WORK OF THIS CONTRACT.
30. THE FIRE ALARM VENDOR MUST CALCULATE THE NOTIFICATION APPLIANCES CANDELA RATINGS AND DESIGNATE THEM ON THE SHOP DRAWINGS. ALL STROBE SETTINGS MUST COMPLY WITH NFPA 72 REQUIREMENTS.
31. EACH AIR HANDLING SYSTEM 2000 CFM OR GREATER SHALL BE EQUIPPED WITH A RETURN AIR DUCT DETECTOR OR SUPPLY AIR DUCT DETECTOR WHEN THERE IS NO RETURN AIR DUCT. EACH AIR HANDLING SYSTEM GREATER THAN 15,000 CFM SHALL BE EQUIPPED WITH A SUPPLY AND RETURN DUCT DETECTOR. WHEN THE AIR HANDLER SUPPLIES MORE THAN ONE STORY, RETURN DUCT DETECTORS ARE NOT REQUIRED. WHERE THE ENTIRE SPACE SERVED BY THE AIR HANDLER IS PROTECTED BY SYSTEM SMOKE DETECTORS, DUCT DETECTORS ARE NOT REQUIRED ON 100% EXHAUST FANS.
32. ALL WORK AND SHUTDOWNS ASSOCIATED WITH FIRE ALARM SYSTEM INTERFACES SHALL BE COORDINATED THROUGH THE RESPECTIVE CONTRACTOR, INCLUDING BUT NOT LIMITED TO: SPECIAL HAZARD SUPPRESSION SYSTEM(S), AUTOMATIC SPRINKLER SYSTEM(S), HVAC SYSTEM(S), ELEVATOR SYSTEM(S), AND SECURITY / ACCESS CONTROL SYSTEM(S).
33. SYSTEM MANUFACTURER SHALL COORDINATE FINAL QUANTITIES AND LOCATIONS OF ALL SYSTEM MONITORS AND CONTROL MODULES WITH THE RESPECTIVE CONTRACTORS FOR INTERFACE. FINAL LOCATIONS TO BE SHOWN ON SHOP DRAWINGS. CHECK AND VERIFY ALL CONDITIONS AT THE SITE WITHIN THE CONTRACT LIMITS. THE INSTALLATION CONTRACTOR IS RESPONSIBLE FOR ALL FIELD MEASUREMENTS AND VERIFICATION OF FIELD CONDITIONS PRIOR TO COMMENCING WORK. ANY CHANGES IN WORK NECESSITATED BY FAILURE OF THIS CONTRACTOR TO COMPLY WITH THIS PROCEDURE SHALL BE UNDERTAKEN BY THIS CONTRACTOR AT HIS / HER OWN EXPENSE.
34. THE INSTALLATION CONTRACTOR IS RESPONSIBLE FOR REVIEWING THE FIRE ALARM SHOP DRAWINGS SUBMITTAL FOR COMPLETE COMPLIANCE WITH THE FULL SET OF BID DOCUMENTS PRIOR TO SUBMITTING TO THE ENGINEER FOR APPROVAL.
35. ACCEPTANCE TESTING MUST BE PERFORMED IN ACCORDANCE WITH NFPA 72 AND AHJ REQUIREMENTS.
36. UPON COMPLETION OF FINAL TESTING AND APPROVAL OF THE AHJ, THE SYSTEM VENDOR SHALL SUBMIT RECORD DRAWINGS TO THE OWNER DETAILING AS-BUILT CIRCUITING AS SHOWN ON THE INSTALLER'S RED-LINE MARKUPS. THEY SHALL INCORPORATE ALL FIELD AND DESIGN DIRECTIVES GIVEN THROUGH OUT THE PROJECT.
37. CONTRACTOR SHALL UTILIZE SURFACE MOUNTED RACEWAY WHEN IT IS NOT POSSIBLE TO CONCEAL FIRE ALARM WIRING.
38. CONTRACTOR TO HIRE FIRE ALARM CONTRACTOR TO DEVELOP FIRE ALARM SYSTEM POINT TO POINT WIRING DIAGRAMS, VOLTAGE DROP CALCULATIONS AND BATTERY CALCULATIONS.
39. FIRE ALARM SPEAKER INTELLIGIBILITY: THE LOCATIONS OF FIRE ALARM SPEAKERS ON THE FIRE ALARM PLANS ARE DIAGRAMMATIC. THE FINAL LOCATIONS FOR FIRE ALARM SPEAKERS SHALL BE DETERMINED BY THE VENDOR TO ENSURE FIRE ALARM SPEAKER INTELLIGIBILITY. PUBLIC MODE AUDIBILITY SHALL MAINTAIN A MINIMUM OF 15dB OVER AMBIENT; PRIVATE MODE AUDIBILITY SHALL MAINTAIN A MINIMUM OF 10dB OVER AMBIENT. SOUND LEVELS AND INTELLIGIBILITY SHALL BE IN ACCORDANCE WITH NFPA 72 REQUIREMENTS. PROVIDE APPROPRIATE SPEAKER TAP SETTINGS TO MEET REQUIREMENTS.

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building

1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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In Association with

Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

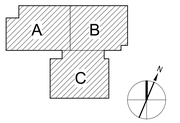
Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan



Professional Seals

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No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2025-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

Sheet Title

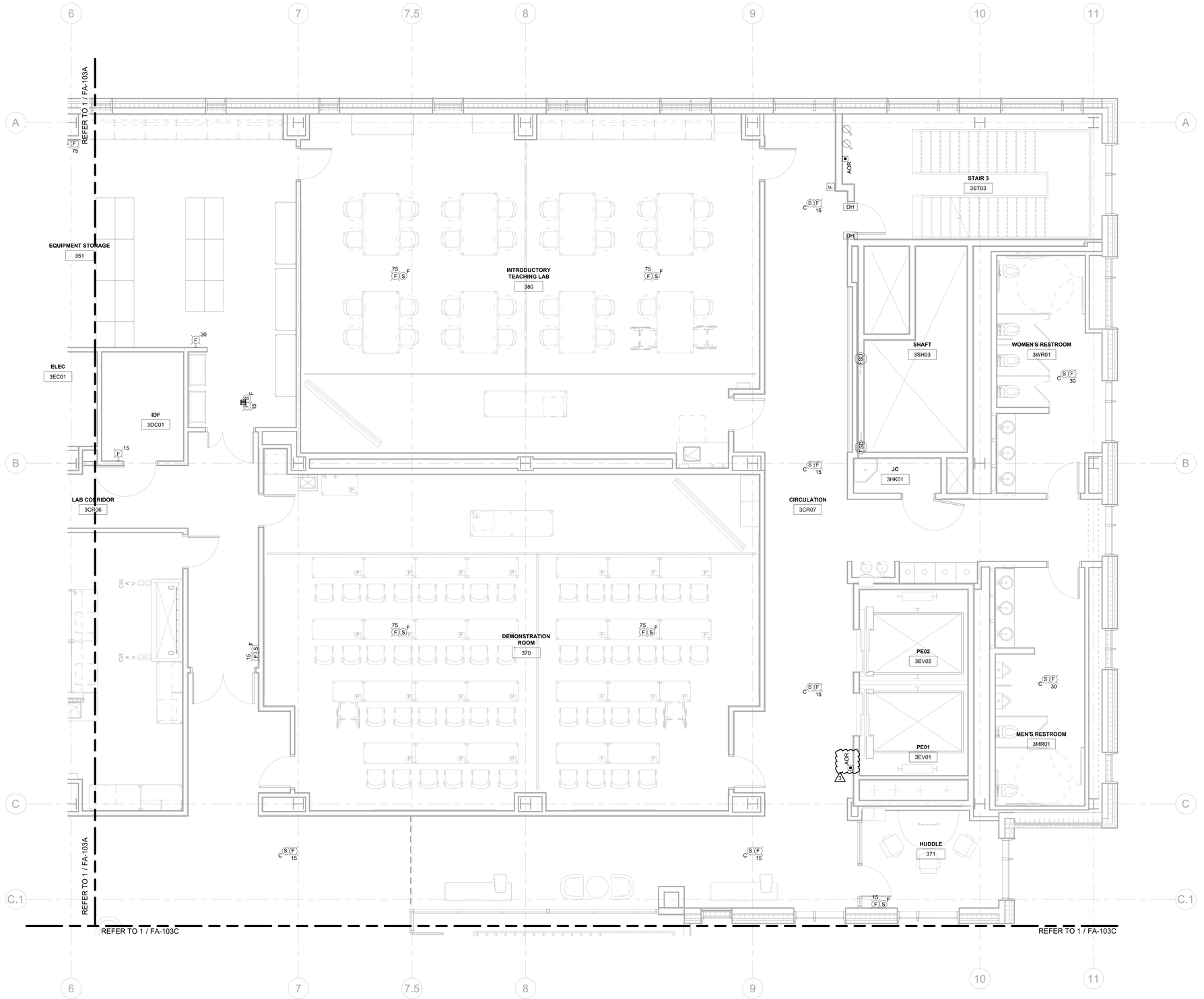
FIRE ALARM PLAN - SECOND FLOOR AREA B

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

FA-102B

3/23/2026 5:26:47 PM



1 FA-103B FIRE ALARM PLAN - THIRD FLOOR AREA B

SCALE: 1/4" = 1'-0"

GENERAL FIRE ALARM NOTES:

1. REFER TO ELECTRICAL DRAWING E-001 FOR PROJECT GENERAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.
2. REFER TO SHEET FA-002 FOR FIRE ALARM RISER DIAGRAM.
3. REFER TO SHEET FA-001 FOR FIRE ALARM SYMBOL LIST.
4. REFER TO BOOK SPECIFICATIONS FOR PROJECT DETAILS AND EXECUTION REQUIREMENTS.
5. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE 2020 EDITION OF THE NATIONAL ELECTRICAL CODE.
6. REFER TO NOTE #19 ON DRAWING E-001 FOR ADDITIONAL DEVICES, ASSOCIATED WIRING, RACEWAY, BACKBOXES AND INSTALLATION TO BE INCLUDED.
7. INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE, ARTICLE 760.
8. DO NOT INSTALL FIRE ALARM CABLES IN RACEWAY WITH OTHER BUILDING SYSTEM CONDUCTORS.
9. ALL DEVICE LOCATIONS SHOWN ON THESE DRAWINGS ARE APPROXIMATE. EXACT LOCATIONS ARE DETERMINED BY THE INSTALLER AFTER CONSIDERATION OF CODES, SPECIFICATIONS AND MANUFACTURER REQUIREMENTS.
10. DO NOT INSTALL SMOKE DETECTORS WITHIN THREE FEET OF, OR IN THE DIRECT AIR STREAM OF SUPPLY AIR GRILLS.
11. DO NOT INSTALL SMOKE DETECTOR HEADS PRIOR TO COMPLETE AREA CLEANUP.
12. DUCT DETECTOR HOUSINGS MUST BE MOUNTED BELOW ROOFLINE.
13. PROVIDE AUXILIARY FIRE ALARM SIGNAL PANEL(S) W/ BATTERY BACKUP AS REQUIRED TO SUPPORT NOTIFICATION APPLIANCE LOADS.
14. ALL WIRING REQUIREMENTS SHALL BE AS PER MANUFACTURER'S RECOMMENDATIONS.
15. PROVIDE END OF LINE RESISTORS AS NECESSARY.
16. STROBE CANDELAS MUST BE SIZED PER NFPA 72 REQUIREMENTS BY THE FIRE ALARM VENDOR AND SHOWN ON THE SHOP DRAWINGS.
17. ALL PANELS BATTERY BACKUP (STANDBY & ALARM) SHALL BE SIZED PER NFPA 72 REQUIREMENTS.
18. A COMPLETE SET FOR FIRE ALARM PRODUCT CUTSHEETS, FIRE ALARM SHOP DRAWINGS, AND BATTERY / VOLTAGE / LOAD CALCULATIONS MUST BE SUBMITTED AND APPROVED BY THE AHJ AND THE ENGINEER PRIOR TO INSTALLATION.
19. PRIMARY FACP POWER SHALL BE FED VIA BRANCH CIRCUIT(S) DEDICATED FOR THE FIRE ALARM SYSTEM.
20. ALL EARTH GROUND PANEL CONNECTIONS REQUIRED BY THE MANUFACTURER SHALL BE CONNECTED TO THE BUILDING'S GROUND. PANEL NEUTRAL OR GROUNDING TO CONDUIT / BUILDING STEEL IS NOT ACCEPTABLE.
21. THE SELECTED SYSTEM IS MODULAR IN DESIGN. ALL SPECIFIED COMPONENTS MUST HAVE A MINIMUM 20% SPARE EXPANSION CAPACITY TO ACCOMMODATE CONSTRUCTION CHANGES AND FUTURE RENOVATIONS. THIS SPARE CAPACITY INCLUDES CABINET EXPANSION SPACE, CAPACITIES ON POWER SUPPLIES / PANEL CARDS AND NETWORKING CAPABILITY.
22. IT IS THE INTENT THAT THE DRAWINGS AND SPECIFICATIONS SHALL PROVIDE A WORKING INSTALLATION. THE OMISSION OF EXPRESSED REFERENCE IN THE DRAWINGS OR SPECIFICATION TO ANY LABOR OR MATERIAL NECESSARY FOR THE PROPER EXECUTION OF THE WORK IN ACCORDANCE WITH PRESENT GOOD PRACTICE OF THE TRADE SHALL NOT RELIEVE THIS CONTRACTOR FROM PROVIDING, AT NO COST, SUCH ADDITIONAL LABOR OR MATERIAL UNDER THIS CONTRACT. DEVICE LOCATIONS ARE FOR REFERENCE ONLY UNLESS SPECIFICALLY DIMENSIONED, ACTUAL LOCATIONS SHALL BE IN ACCORDANCE WITH NFPA 72 AND THIS SPECIFICATION.
23. ALL WIRING SHALL COMPLY WITH PROJECT SPECIFICATIONS, NFPA 72, ARTICLE 760, AND THE REQUIREMENTS OF THE AHJ. NO FIRE ALARM POWER-LIMITED WIRING SHALL BE PERMITTED IN THE SAME RACEWAY AS NON-POWER-LIMITED WIRING UNLESS SEPARATED BY AN APPROVED BARRIER.
24. FURNISH AND INSTALL ACCESS PANELS WHERE REQUIRED FOR ACCESS TO CONCEALED EQUIPMENT WHERE NO OTHER MEANS IS PROVIDED.
25. FOR CONDUIT APPLICATIONS, USE ELECTRICAL METALLIC TUBING (EMT), 3/4" MINIMUM.
26. ALL CONDUITS, CONDUCTORS, RACEWAYS, EQUIPMENT, ETC., SHALL BE SUPPORTED IN AN APPROVED MANNER BY THE BUILDING STRUCTURE, INCLUDING HANGERS AND RESTRAINTS, IN ACCORDANCE WITH ALL APPLICABLE CODE REQUIREMENTS.
27. SEAL ALL PENETRATIONS THROUGH EXTERIOR WALLS, FLOORS, AND ROOFS WITH WATERTIGHT MATERIAL.
28. MOUNTING FOR ALL DEVICES AND APPLIANCES SHALL COMPLY WITH STATE, LOCAL, AND FEDERAL REQUIREMENTS.
29. CONTRACTOR SHALL REPAIR / PATCH AND / OR REPAINT TO MATCH ADJACENT AREAS, ANY AREAS DAMAGED (OR WHERE ITEMS WERE REMOVED / DEMOLISHED) BY WORK OF THIS CONTRACT.
30. THE FIRE ALARM VENDOR MUST CALCULATE THE NOTIFICATION APPLIANCES CANDELA RATINGS AND DESIGNATE THEM ON THE SHOP DRAWINGS. ALL STROBE SETTINGS MUST COMPLY WITH NFPA 72 REQUIREMENTS.
31. EACH AIR HANDLING SYSTEM 2000 CFM OR GREATER SHALL BE EQUIPPED WITH A RETURN AIR DUCT DETECTOR OR SUPPLY AIR DUCT DETECTOR WHEN THERE IS NO RETURN AIR DUCT. EACH AIR HANDLING SYSTEM GREATER THAN 15,000 CFM SHALL BE EQUIPPED WITH A SUPPLY AND RETURN DUCT DETECTOR. WHEN THE AIR HANDLER SUPPLIES MORE THAN ONE STORY, RETURN DUCT DETECTORS ARE NOT REQUIRED. WHERE THE ENTIRE SPACE SERVED BY THE AIR HANDLER IS PROTECTED BY SYSTEM SMOKE DETECTORS, DUCT DETECTORS ARE NOT REQUIRED ON 100% EXHAUST FANS.
32. ALL WORK AND SHUTDOWNS ASSOCIATED WITH FIRE ALARM SYSTEM INTERFACES SHALL BE COORDINATED THROUGH THE RESPECTIVE CONTRACTOR, INCLUDING BUT NOT LIMITED TO: SPECIAL HAZARD SUPPRESSION SYSTEM(S), AUTOMATIC SPRINKLER SYSTEM(S), HVAC SYSTEM(S), ELEVATOR SYSTEM(S), AND SECURITY / ACCESS CONTROL SYSTEM(S).
33. SYSTEM MANUFACTURER SHALL COORDINATE FINAL QUANTITIES AND LOCATIONS OF ALL SYSTEM MONITORS AND CONTROL MODULES WITH THE RESPECTIVE CONTRACTORS FOR INTERFACE. FINAL LOCATIONS TO BE SHOWN ON SHOP DRAWINGS. CHECK AND VERIFY ALL CONDITIONS AT THE SITE WITHIN THE CONTRACT LIMITS. THE INSTALLATION CONTRACTOR IS RESPONSIBLE FOR ALL FIELD MEASUREMENTS AND VERIFICATION OF FIELD CONDITIONS PRIOR TO COMMENCING WORK. ANY CHANGES IN WORK NECESSITATED BY FAILURE OF THIS CONTRACTOR TO COMPLY WITH THIS PROCEDURE SHALL BE UNDERTAKEN BY THIS CONTRACTOR AT HIS / HER OWN EXPENSE.
34. THE INSTALLATION CONTRACTOR IS RESPONSIBLE FOR REVIEWING THE FIRE ALARM SHOP DRAWINGS SUBMITTAL FOR COMPLETE COMPLIANCE WITH THE FULL SET OF BID DOCUMENTS PRIOR TO SUBMITTING TO THE ENGINEER FOR APPROVAL.
35. ACCEPTANCE TESTING MUST BE PERFORMED IN ACCORDANCE WITH NFPA 72 AND AHJ REQUIREMENTS.
36. UPON COMPLETION OF FINAL TESTING AND APPROVAL OF THE AHJ, THE SYSTEM VENDOR SHALL SUBMIT RECORD DRAWINGS TO THE OWNER DETAILING AS-BUILT CIRCUITING AS SHOWN ON THE INSTALLER'S RED-LINE MARKUPS. THEY SHALL INCORPORATE ALL FIELD AND DESIGN DIRECTIVES GIVEN THROUGH OUT THE PROJECT.
37. CONTRACTOR SHALL UTILIZE SURFACE MOUNTED RACEWAY WHEN IT IS NOT POSSIBLE TO CONCEAL FIRE ALARM WIRING.
38. CONTRACTOR TO HIRE FIRE ALARM CONTRACTOR TO DEVELOP FIRE ALARM SYSTEM POINT TO POINT WIRING DIAGRAMS, VOLTAGE DROP CALCULATIONS AND BATTERY CALCULATIONS.
39. FIRE ALARM SPEAKER INTELLIGIBILITY: THE LOCATIONS OF FIRE ALARM SPEAKERS ON THE FIRE ALARM PLANS ARE DIAGRAMMATIC. THE FINAL LOCATIONS FOR FIRE ALARM SPEAKERS SHALL BE DETERMINED BY THE VENDOR TO ENSURE FIRE ALARM SPEAKER INTELLIGIBILITY. PUBLIC MODE AUDIBILITY SHALL MAINTAIN A MINIMUM OF 15dB OVER AMBIENT; PRIVATE MODE AUDIBILITY SHALL MAINTAIN A MINIMUM OF 10dB OVER AMBIENT. SOUND LEVELS AND INTELLIGIBILITY SHALL BE IN ACCORDANCE WITH NFPA 72 REQUIREMENTS. PROVIDE APPROPRIATE SPEAKER TAP SETTINGS TO MEET REQUIREMENTS.

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building

1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

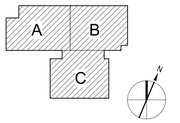
Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan



Professional Seals

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No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2025-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

Sheet Title

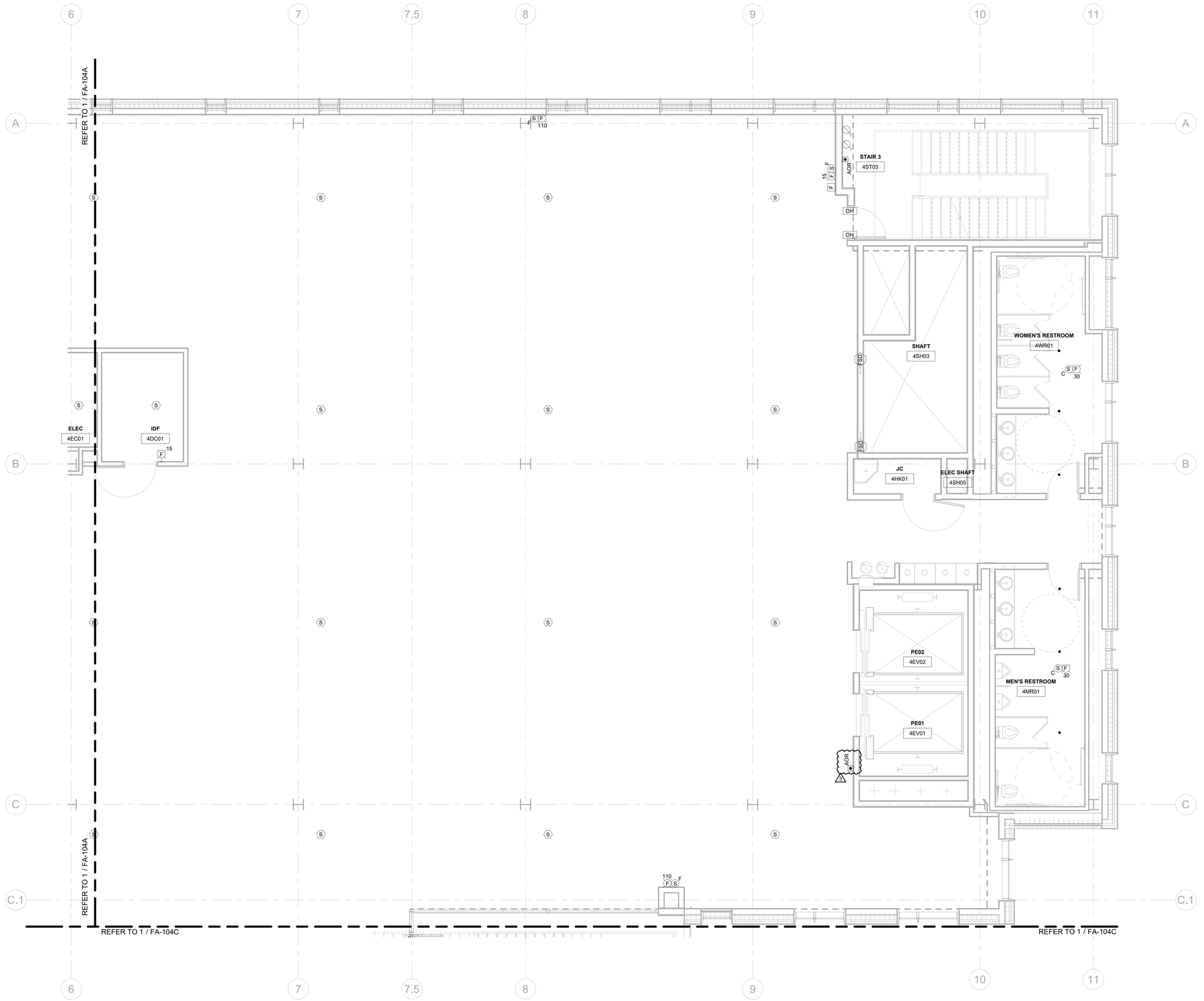
FIRE ALARM PLAN - THIRD FLOOR AREA B

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

FA-103B

3/23/2026 5:26:49 PM



1 FIRE ALARM PLAN - FOURTH FLOOR AREA B

FA-104B SCALE: 1/4" = 1'-0"

GENERAL FIRE ALARM NOTES:

1. REFER TO ELECTRICAL DRAWING E-001 FOR PROJECT GENERAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.
2. REFER TO SHEET FA-002 FOR FIRE ALARM RISER DIAGRAM.
3. REFER TO SHEET FA-001 FOR FIRE ALARM SYMBOL LIST.
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8. DO NOT INSTALL FIRE ALARM CABLES IN RACEWAY WITH OTHER BUILDING SYSTEM CONDUCTORS.
9. ALL DEVICE LOCATIONS SHOWN ON THESE DRAWINGS ARE APPROXIMATE. EXACT LOCATIONS ARE DETERMINED BY THE INSTALLER AFTER CONSIDERATION OF CODES, SPECIFICATIONS AND MANUFACTURER REQUIREMENTS.
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12. DUCT DETECTOR HOUSINGS MUST BE MOUNTED BELOW ROOFLINE.
13. PROVIDE AUXILIARY FIRE ALARM SIGNAL PANEL(S) W/ BATTERY BACKUP AS REQUIRED TO SUPPORT NOTIFICATION APPLIANCE LOADS.
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16. STROBE CANDELAS MUST BE SIZED PER NFPA 72 REQUIREMENTS BY THE FIRE ALARM VENDOR AND SHOWN ON THE SHOP DRAWINGS.
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MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building

1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University

1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

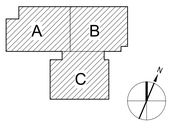
Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan



Professional Seals

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No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2025-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

Sheet Title

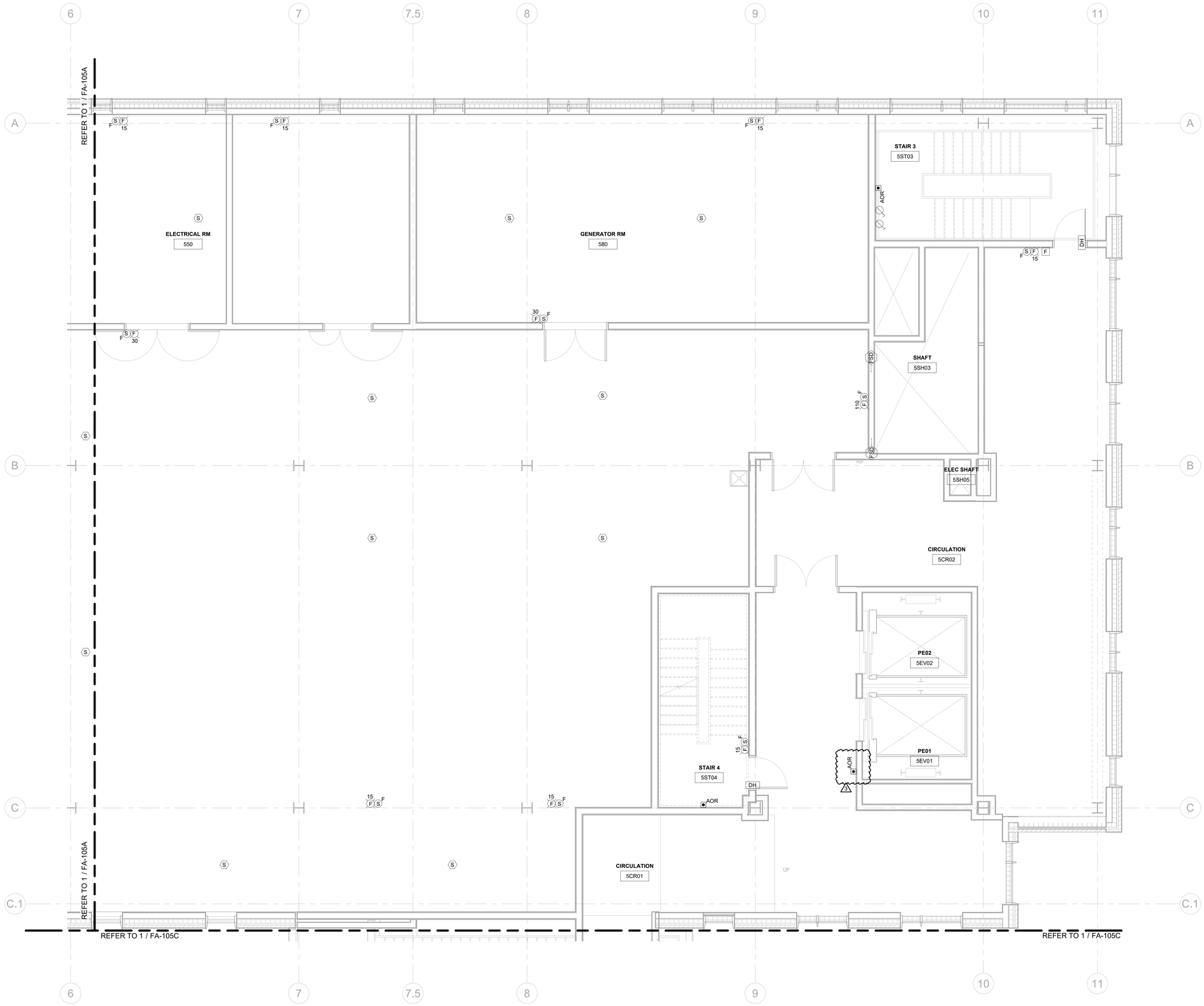
FIRE ALARM PLAN - FOURTH FLOOR AREA B

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

FA-104B

3/23/2026 5:26:51 PM



1 FIRE ALARM PLAN - PENTHOUSE AREA B
FA-105B SCALE: 1/4" = 1'-0"

GENERAL FIRE ALARM NOTES:

1. REFER TO ELECTRICAL DRAWING E-001 FOR PROJECT GENERAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.
2. REFER TO SHEET FA-002 FOR FIRE ALARM RISER DIAGRAM.
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12. DUCT DETECTOR HOUSINGS MUST BE MOUNTED BELOW ROOFLINE.
13. PROVIDE AUXILIARY FIRE ALARM SIGNAL PANEL(S) W/ BATTERY BACKUP AS REQUIRED TO SUPPORT NOTIFICATION APPLIANCE LOADS.
14. ALL WIRING REQUIREMENTS SHALL BE AS PER MANUFACTURER'S RECOMMENDATIONS.
15. PROVIDE END OF LINE RESISTORS AS NECESSARY.
16. STROBE CANDELAS MUST BE SIZED PER NFPA 72 REQUIREMENTS BY THE FIRE ALARM VENDOR AND SHOWN ON THE SHOP DRAWINGS.
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23. ALL WIRING SHALL COMPLY WITH PROJECT SPECIFICATIONS, NFPA 72, ARTICLE 760, AND THE REQUIREMENTS OF THE AHJ. NO FIRE ALARM POWER-LIMITED WIRING SHALL BE PERMITTED IN THE SAME RACEWAY AS NON-POWER-LIMITED WIRING UNLESS SEPARATED BY AN APPROVED BARRIER.
24. FURNISH AND INSTALL ACCESS PANELS WHERE REQUIRED FOR ACCESS TO CONCEALED EQUIPMENT WHERE NO OTHER MEANS IS PROVIDED.
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29. CONTRACTOR SHALL REPAIR / PATCH AND / OR REPAINT TO MATCH ADJACENT AREAS, ANY AREAS DAMAGED (OR WHERE ITEMS WERE REMOVED / DEMOLISHED) BY WORK OF THIS CONTRACT.
30. THE FIRE ALARM VENDOR MUST CALCULATE THE NOTIFICATION APPLIANCES CANDELA RATINGS AND DESIGNATE THEM ON THE SHOP DRAWINGS. ALL STROBE SETTINGS MUST COMPLY WITH NFPA 72 REQUIREMENTS.
31. EACH AIR HANDLING SYSTEM 2000 CFM OR GREATER SHALL BE EQUIPPED WITH A RETURN AIR DUCT DETECTOR OR SUPPLY AIR DUCT DETECTOR WHEN THERE IS NO RETURN AIR DUCT. EACH AIR HANDLING SYSTEM GREATER THAN 15,000 CFM SHALL BE EQUIPPED WITH A SUPPLY AND RETURN DUCT DETECTOR. WHEN THE AIR HANDLER SUPPLIES MORE THAN ONE STORY, RETURN DUCT DETECTORS ARE NOT REQUIRED. WHERE THE ENTIRE SPACE SERVED BY THE AIR HANDLER IS PROTECTED BY SYSTEM SMOKE DETECTORS, DUCT DETECTORS ARE NOT REQUIRED ON 100% EXHAUST FANS.
32. ALL WORK AND SHUTDOWNS ASSOCIATED WITH FIRE ALARM SYSTEM INTERFACES SHALL BE COORDINATED THROUGH THE RESPECTIVE CONTRACTOR, INCLUDING BUT NOT LIMITED TO: SPECIAL HAZARD SUPPRESSION SYSTEM(S), AUTOMATIC SPRINKLER SYSTEM(S), HVAC SYSTEM(S), ELEVATOR SYSTEM(S), AND SECURITY / ACCESS CONTROL SYSTEM(S).
33. SYSTEM MANUFACTURER SHALL COORDINATE FINAL QUANTITIES AND LOCATIONS OF ALL SYSTEM MONITORS AND CONTROL MODULES WITH THE RESPECTIVE CONTRACTORS FOR INTERFACE. FINAL LOCATIONS TO BE SHOWN ON SHOP DRAWINGS. CHECK AND VERIFY ALL CONDITIONS AT THE SITE WITHIN THE CONTRACT LIMITS. THE INSTALLATION CONTRACTOR IS RESPONSIBLE FOR ALL FIELD MEASUREMENTS AND VERIFICATION OF FIELD CONDITIONS PRIOR TO COMMENCING WORK. ANY CHANGES IN WORK NECESSITATED BY FAILURE OF THIS CONTRACTOR TO COMPLY WITH THIS PROCEDURE SHALL BE UNDERTAKEN BY THIS CONTRACTOR AT HIS / HER OWN EXPENSE.
34. THE INSTALLATION CONTRACTOR IS RESPONSIBLE FOR REVIEWING THE FIRE ALARM SHOP DRAWINGS SUBMITTAL FOR COMPLETE COMPLIANCE WITH THE FULL SET OF BID DOCUMENTS PRIOR TO SUBMITTING TO THE ENGINEER FOR APPROVAL.
35. ACCEPTANCE TESTING MUST BE PERFORMED IN ACCORDANCE WITH NFPA 72 AND AHJ REQUIREMENTS.
36. UPON COMPLETION OF FINAL TESTING AND APPROVAL OF THE AHJ, THE SYSTEM VENDOR SHALL SUBMIT RECORD DRAWINGS TO THE OWNER DETAILING AS-BUILT CIRCUITING AS SHOWN ON THE INSTALLER'S RED-LINE MARKUPS. THEY SHALL INCORPORATE ALL FIELD AND DESIGN DIRECTIVES GIVEN THROUGH OUT THE PROJECT.
37. CONTRACTOR SHALL UTILIZE SURFACE MOUNTED RACEWAY WHEN IT IS NOT POSSIBLE TO CONCEAL FIRE ALARM WIRING.
38. CONTRACTOR TO HIRE FIRE ALARM CONTRACTOR TO DEVELOP FIRE ALARM SYSTEM POINT TO POINT WIRING DIAGRAMS, VOLTAGE DROP CALCULATIONS AND BATTERY CALCULATIONS.
39. FIRE ALARM SPEAKER INTELLIGIBILITY: THE LOCATIONS OF FIRE ALARM SPEAKERS ON THE FIRE ALARM PLANS ARE DIAGRAMMATIC. THE FINAL LOCATIONS FOR FIRE ALARM SPEAKERS SHALL BE DETERMINED BY THE VENDOR TO ENSURE FIRE ALARM SPEAKER INTELLIGIBILITY. PUBLIC MODE AUDIBILITY SHALL MAINTAIN A MINIMUM OF 15dB OVER AMBIENT. PRIVATE MODE AUDIBILITY SHALL MAINTAIN A MINIMUM OF 10dB OVER AMBIENT. SOUND LEVELS AND INTELLIGIBILITY SHALL BE IN ACCORDANCE WITH NFPA 72 REQUIREMENTS. PROVIDE APPROPRIATE SPEAKER TAP SETTINGS TO MEET REQUIREMENTS.

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

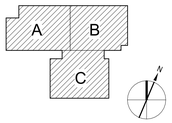
Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan



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No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2025-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

Sheet Title

FIRE ALARM PLAN - PENTHOUSE AREA B

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Sheet Number

FA-105B

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ABBREVIATIONS

ABV	ABOVE
ACCOM	ACCOMMODATE
AD	ACCESS DOOR
ATMOS	ATMOSPHERE
AFF	ABOVE FINISHED FLOOR
ALT	ALTERNATE
AP	ACCESS PANEL
APPROX	APPROXIMATE
ARRG	ARRANGEMENT
ATP	AUTOMATIC TRAP PRIMER
BFP	BACKFLOW PREVENTER
BLDG	BUILDING
BLW	BELOW
BTU	BRITISH THERMAL UNIT
BV	BUTTERFLY VALVE
C	COMMON
CA	COMPRESSED AIR (LAB AIR)
CAB	CABINET
CAP	CAPACITY
CFH	CUBIC FEET PER HOUR
℄	CENTER LINE
CLG	CEILING
CO	CLEAN OUT
COL	COLUMN
CON	CONCENTRIC
CONC	CONCRETE
CD	CONDENSATE DRAIN
CONN	CONNECTION
CONT	CONTINUATION
CONTR	CONTRACTOR
CU	CUBIC
CW	COLD WATER
DEPT	DEPARTMENT
DFU	DRAINAGE FIXTURE UNIT
DIA	DIAMETER
DIAG	DIAGRAM
DISCH	DISCHARGE
DN	DOWN
DW	DISTILLED WATER
DCW	DOMESTIC COLD WATER
DHW	DOMESTIC HOT WATER
DHWR	DOMESTIC HOT WATER RETURN
DWG	DRAWING
(E)	EXISTING TO REMAIN
EA	EACH
EC	ELECTRICAL CONTRACTOR
EL	ELEVATION
ELEC	ELECTRIC
ELEV	ELEVATOR
EQUIP	EQUIPMENT
ES	EMERGENCY SHOWER
EXPAN	EXPANSION
F°	DEGREES FAHRENHEIT
FAI	FRESH AIR INLET
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FH	FUME HOOD
FIN	FINISHED
FLR	FLOOR
FP	FIRE PROTECTION
G	GUIDE/S
GA	GAUGE
GAL	GALLON
GALV	GALVANIZED
GC	GENERAL CONTRACTOR
GPD	GALLONS PER DAY
GCO	GRADE CLEANOUT
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
H	HEIGHT
HB	HOSE BIBB
HD	HEAD
HP	HORSEPOWER
HR	HOUR
HTR	HEATER
HW	HOT WATER
HWR	HOT WATER RETURN
HZ	HERTZ
ID	INTERNAL DIAMETER
IDW	INDIRECT WASTE
IN	INCHES
INV	INVERT
KW	KILOWATT
LS	LAB SINK
LVG	LEAVING
LW	LAB WASTE
MAX	MAXIMUM
MBH	THOUSANDS OF BTU PER HOUR
MC	MECHANICAL CONTRACTOR
MED	MEDIUM
MFR	MANUFACTURER
MIN	MINIMUM
MTD	MOUNTED
(N)	NEW
NIC	NOT IN CONTRACT
No	NUMBER
NOM	NOMINAL
NTS	NOT TO SCALE
OD	OVERFLOW DRAIN
PC	PLUMBING CONTRACTOR
PCW	PROTECTED LAB COLD WATER
PHW	PROTECTED LAB HOT WATER
PHWR	PROTECTED LAB HOT WATER RETURN
PERF	PERFORATED
PEX	PEX PIPING
PEX-MF	PEX PIPING MANIFOLD
PH	PHASE
PRESS	PRESSURE
PSI	POUNDS PER SQUARE INCH
QUAN	QUANTITY
(R)	REMOVE EXISTING
RCP	REINFORCED CONCRETE PIPE
RD	ROOF DRAIN
(RE)	RELOCATE EXISTING
REQ	REQUIRED
RET	RETURN
RM	ROOM
RPM	REVOLUTIONS PER MINUTE
RWC	RAINWATER CONDUCTOR
SAN	SANITARY
SCH	SCHEDULE
SCHEM	SCHEMATIC
SFU	SUPPLY FIXTURE UNIT
SP	STATIC PRESSURE
SPEC	SPECIFICATION
SQ	SQUARE
SS	SERVICE SINK
ST.STL.	STAINLESS STEEL
ST.	STORM
STL	STEEL
TEMP	TEMPERATURE
TP	TOTAL PRESSURE
TYP	TYPICAL
V	VENT
VB	VACUUM BREAKER
VAC	VACUUM SYSTEM (LAB VAC)
VCO	VERTICAL CLEANOUT
VEL	VELOCITY
VOLT	VOLTAGE
VTR	VENT THRU ROOF
W	WIDTH
W/	WITH/WIDE
W/O	WITHOUT
WC	WATER COLUMN
WCO	WALL CLEANOUT
WG	WATER GAUGE

DRAINAGE SPECIALTIES LIST

NOTE: REFER TO PLANS AND RISER DIAGRAMS FOR LINE SIZES. PROVIDE TRAP PRIMER LINE TO ALL FLOOR DRAINS SERVING TOILET ROOMS. PROVIDE DEEP SEAL TRAP FOR ALL OTHER FLOOR DRAINS AND FLOOR SINKS.

FCO

DUCO CAST IRON CLEANOUT WITH ROUND ADJUSTABLE SCORIATED SECURED NICKEL BRONZE TOP. PROVIDE FLASHING CLAMP AND CARPET CLAMPING TYPE WHERE NOTED ON ARCHITECTURAL FLOOR PLANS, HUB AND SPIGOT FOR BELOW SLAB, HUBLESS TYPE FOR ABOVE GRADE. J.R. SMITH FIGURE 4020-S

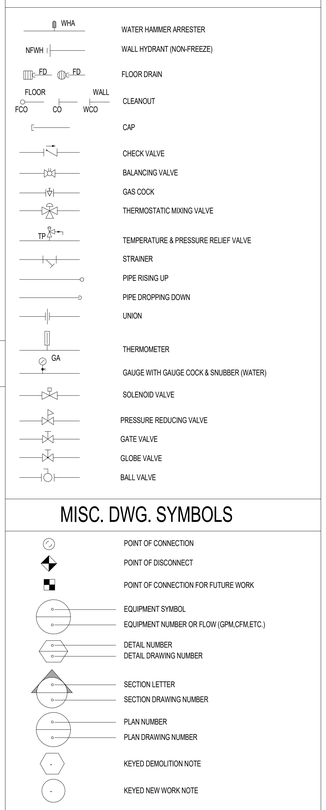
WCO

DUCO CAST IRON SPIGOT FERRULE WITH CASTBRONZE TAPER THREAD PLUG WITH STAINLESS STEEL ROUND COVER AND SCREW. PROVIDE WITH VANDAL PROOF SCREW J.R. SMITH FIGURE 4422C

LINE DESIGNATIONS

	VENT LINE
G	NATURAL GAS
DCW	DOMESTIC COLD WATER
DHW	DOMESTIC HOT WATER (110°F)
DHWR	DOMESTIC HOT WATER RECIRCULATING
140°F	DOMESTIC HOT WATER - 140°F
PCW	PROTECTED COLD WATER
PHW	PROTECTED HOT WATER
PHWR	PROTECTED HOT WATER RECIRCULATING
DW	DISTILLED WATER
CA	MEDICAL COMPRESSED AIR
VAC	VACUUM
	DIRECTION OF FLOW ARROW
ST	STORM LINE (ABOVE SLAB/ABOVE FIN. CLG.)
SAN	SANITARY LINE (ABOVE SLAB/ABOVE FIN. CLG.)
ST	STORM LINE (BELOW SLAB)
SAN	SANITARY LINE (BELOW SLAB)

PLUMBING SYMBOLS



WATER HAMMER ARRESTER
WALL HYDRANT (NON-FREEZE)
FLOOR DRAIN
CLEANOUT
CAP
CHECK VALVE
BALANCING VALVE
GAS COCK
THERMOSTATIC MIXING VALVE
TEMPERATURE & PRESSURE RELIEF VALVE
STRAINER
PIPE RISING UP
PIPE DROPPING DOWN
UNION
THERMOMETER
GAUGE WITH GAUGE COCK & SNUBBER (WATER)
SOLENOID VALVE
PRESSURE REDUCING VALVE
GATE VALVE
GLOBE VALVE
BALL VALVE

MISC. DWG. SYMBOLS

POINT OF CONNECTION
POINT OF DISCONNECT
POINT OF CONNECTION FOR FUTURE WORK
EQUIPMENT SYMBOL
EQUIPMENT NUMBER OR FLOW (GPM,CFM,ETC.)
DETAIL NUMBER
DETAIL DRAWING NUMBER
SECTION LETTER
SECTION DRAWING NUMBER
PLAN NUMBER
PLAN DRAWING NUMBER
KEYED DEMOLITION NOTE
KEYED NEW WORK NOTE

NOTES

THE FOLLOWING NOTES APPLY TO ALL "P" PLUMBING DRAWINGS :

1. THE ENTIRE PLUMBING INSTALLATION SHALL CONFORM TO THE NATIONAL STANDARD PLUMBING CODE 2021 EDITION ,INTERNATIONAL FUEL GAS CODE "2021" EDITION, AND LOCAL AUTHORITIES HAVING JURISDICTION AND THE TOWNSHIP OF MONTCLAIR AND MONTCLAIR STATE UNIVERSITY. NOTIFY CITY BUILDING CODE ENFORCEMENT FOR ALL REQUIRED INSPECTIONS.
2. PRIOR TO STARTING CONSTRUCTION, DETERMINE EXACT INVERT ELEVATION, SIZE, DEPTH AND LOCATION OF NEW UTILITIES WHERE CONNECTIONS ARE TO BE MADE OR INTERSECTIONS OCCUR. NOTIFY ARCHITECT OR ENGINEER OF ANY DISCREPANCY BETWEEN DRAWINGS AND ACTUAL FIELD CONDITIONS. WORK BACK TOWARD BUILDING FROM UTILITY CONNECTION FOR ALL PIPING SYSTEMS.
3. VERIFY WITH OWNER, PRIOR TO STARTING CONSTRUCTION, THE LOCATION OF ALL ON-SITE UNDERGROUND UTILITIES THAT WILL BE AFFECTED BY THIS WORK.
4. INSTALL ALL WATER HAMMER ARRESTORS IN ACCORDANCE WITH THE LATEST "PLUMBING AND DRAINAGE INSTITUTE STANDARDS" FOR WATER HAMMER ARRESTORS.
5. PROVIDE AND LOCATE ACCESS PANELS IN NON ACCESSIBLE CEILINGS AND WALLS FOR ALL VALVES, WATER HAMMER ARRESTORS, CLEANOUTS AND ALL OTHER ITEMS THAT REQUIRE ACCESS TO PROPERLY MAINTAIN OR SERVICE THE BUILDING. COORDINATE LOCATION WITH ARCHITECT AND OWNER.
6. COORDINATE PLUMBING WORK WITH ALL OTHER TRADES FOR CLEARANCES, ACCESS AND STRUCTURAL INTERFERENCES PRIOR TO INSTALLATION OF ANY SYSTEMS.
7. ALL VENT PIPING TO BE SLOPED BACK TO THE FIXTURES THEY SERVE.
8. ALL DRAINAGE PIPING SHALL BE SLOPED MIN. 1/4" PER FOOT FOR 3" AND SMALLER PIPING AND A MIN. OF 1/8" PER FOOT FOR 4" AND LARGER PIPING.
9. THE LOCATION AND ELEVATION OF ALL UNDERGROUND PIPING SHALL BE PROPERLY COORDINATED WITH STRUCTURAL FOOTING AND FOUNDATION DRAWINGS. SUITABLE OFFSETS IN UNDERGROUND PIPING SHALL BE PROVIDED WHERE PIPING MUST CLEAR THE TOP OF SHALLOW FOOTINGS BEFORE ATTAINING THE ELEVATIONS NOTED ON PLANS AND CIVIL/SITE CONTRACTOR.
10. DRAWINGS ARE DIAGRAMMATIC AND INDICATE GENERAL ARRANGEMENT OF SYSTEMS AND WORK. ROUTING IS DIAGRAMMATIC AND APPROXIMATE. ALL REQUIRED OFFSETS, RISE AND DROPS ARE NOT NECCESSARILY SHOWN. SUBMISSION BY THE PLUMBING CONTRACTOR SHALL BE CONSTRUED AS EVIDENCE THAT THE P.C. HAS INCLUDED IN HIS OR HER BID PRICE, INSTALLATION OF ALL PLUMBING SYSTEMS COORDINATED WITH G.C. AND ALL TRADES.
11. THE PLUMBING CONTRACTOR SHALL COORDINATE WITH ARCHITECTURAL DWGS. & G.C. FOR EXACT LOCATION OF ALL PROPOSED PLUMBING FIXTURES, ROOF AND OVERFLOW DRAINAGE. EQUIPMENT LOCATIONS, PRIOR TO ALL FINAL ROUGH-INS AND CONNECTIONS.
12. ALL PLUMBING PIPING AND EQUIPMENT SHALL BE SEISMICALLY SUPPORTED AND COMPLY WITH THE NEW JERSEY INTERNATIONAL BUILDING CODE SEISMIC FACTORS FOR THE BUILDING'S LOCATION. REFER TO SPECIFICATION SECTION 220548 "MECHANICAL VIBRATION CONTROLS AND SEISMIC RESTRAINTS".
13. PROVIDE BALL VALVES FOR EACH BRANCH CW AND/OR HW LINES FROM MAINS IN CORRIDORS SERVING ALL TOILET ROOMS, AND PLUMBING FIXTURES.
14. THE CONTRACTOR SHALL REFER TO PLANS FOR TAKE-OFFS FOR PIPING LENGTH OF DOMESTIC WATER PIPING TO ALL PLUMBING FIXTURES FROM CORRIDOR AND RISER MAINS. REFER TO RISER DIAGRAMS FOR BRANCH PIPING SIZES TO FIXTURES FROM MAINS SHOWN ON PLANS.
15. PROVIDE ALL REQUIRED APPURTENCES FOR ALL EQUIPMENT AND FIXTURES AS NEEDED FOR A FULLY OPERATIONAL PLUMBING SYSTEM.
16. PROVIDE ALL REQUIRED LOW VOLTAGE WIRING TO ALL EQUIPMENT OR FIXTURE AS PER MANUFACTURER'S RECOMMENDATIONS.

SPECIFICATIONS

DOMESTIC WATER SPECIFICATIONS

1. DOMESTIC WATER PIPE SHALL BE ASTM B88 TYPE "L" SEAMLESS COPPER TUBE WITH SOLDER JOINT FITTINGS USING 95-5 SOLDER PER ASTM B32. ALL WATER DISTRIBUTION PIPING SHALL BE WATER RATED FOR NOT LESS THAN 100PSI @ 180°F. DIELECTRIC COUPLING SHALL BE USED WHERE DISSIMILAR METALS ARE JOINED. PIPING MATERIALS FOR USE ON DOMESTIC WATER SYSTEMS, INCLUDING FIXTURES & VALVES, SHALL NOT CONTAIN MORE THAN 0.2 PERCENT LEAD. PRESS-CONNECT PIPING SYSTEMS, SUCH AS VIEGA PROPRESS, OR APPROVED EQUAL, ARE ACCEPTABLE. 3
2. PRIOR TO DISINFECTION, POTABLE WATER PIPING SHALL BE FLUSHED WITH WATER UNTIL NO DIRTY WATER APPEARS AT THE POINTS OF OUTLETS.
3. POTABLE WATER PIPING SHALL BE DISINFECTED PRIOR TO USE PER THE INTERNATIONAL PLUMBING CODE. THE PIPING SHALL BE FILLED WITH A WATER CHLORINE SOLUTION CONTAINING AT LEAST 50 PARTS PER MILLION OF CHLORINE AND SHALL BE VALVED OFF FOR 24 HOURS OR FILLED WITH A WATER CHLORINE SOLUTION CONTAINING AT LEAST 200 PARTS PER MILLION OF CHLORINE AND ALLOWED TO STAND FOR AT LEAST 3 HOURS. FOLLOWING THE ALLOWED STANDING TIME, THE SYSTEM SHALL BE FLUSHED WITH POTABLE WATER UNTIL NO CHLORINE REMAINS IN THE SYSTEM. PROVIDE RESULTS OF DISINFECTION TO OWNER WHEN COMPLETE.
4. DOMESTIC WATER PIPE SHALL CONSIST OF A HYDROSTATIC PRESSURE TEST OF 25 PSIG ABOVE THE WORKING PRESSURE UNDER WHICH IT IS OPERATED FOR NOT LESS THAN 60 MINUTES.
5. IF LEAKS OCCUR DURING TESTING, REPAIRS SHALL BE MADE AND SYSTEM RETESTED UNTIL NO EVIDENCE OF LEAKS EXIST FOR THE DURATION OF THE TEST.
6. DOMESTIC WATER PIPE SHALL BE INSULATED WITH 1" THICK FIBERGLASS PREFORMED INSULATION WITH VAPOR JACKET AND SELF SEALING TAPE, EQUAL TO OWENS-CORNING ASJ/SSL-2. PIPING IN EXTERIOR WALLS SHALL HAVE 2"THICK INSULATION.
7. BALL VALVES SHALL BE EQUAL TO APOLLO VALVE LEAD FREE SERIES 77CLF-100 OR 200 RATED FOR 150 PSIG W.O.G. FOR PER MSS SP-110.
8. CHECK VALVES SHALL BE EQUAL TO APOLLO VALVE LEAD FREE SERIES 61YLF OR 161YLF PER MSS SP-80 & 139.

SANITARY WASTE SPECIFICATIONS

1. SANITARY WASTE AND VENT PIPE & FITTINGS SHALL BE STANDARD WEIGHT HUBLESS CAST IRON ASTM A-888 WITH ALL STAINLESS STEEL HUBLESS COUPLING WITH NEOPRENE GASKETS IN ACCORDANCE WITH ASTM C-564 & CISPI-310; ALL COUPLINGS TO BE HEAVY DUTY EQUAL TO HUSKY SD 4000 WITH SEALING SLEEVE CONFORMING TO ASTM C-564. ALL CAST IRON SOIL PIPE, FITTINGS COUPLINGS AND GASKETS SHALL BE MARKED WITHE COLLECTIVE TRADEMARK OF THE CAST IRON SOIL PIPE INSTITUTE, IDENTIFIED IN ACCORDANCE WITH THE REQUIREMENTS OF CISPI 310, AND BE LISTED BY NSF INTERNATIONAL AND THE COMPANY ORIGIN'S IDENTIFICATION OF THE ORIGINAL MANUFACTURER. PVC IS ACCEPTABLE FOR UNDERGROUND USE ONLY. 3
2. SANITARY WASTE & VENT PIPE SHALL BE AIR TESTED TO NOT LESS THAN 5 PSIG PRESSURE IN THE SYSTEM. PIPING SYSTEM SHALL SUSTAIN A CONSTANT PRESSURE FOR NOT LESS THAN 15 MINUTES. IF LEAKS OCCUR DURING SYSTEM TESTING, REPAIRS SHALL BE MADE AND SYSTEM RETESTED UNTIL NO EVIDENCE OF LEAKS EXIST FOR THE DURATION OF THE TEST. DRAIN & VENT PIPING LOCATED ABOVE AREAS WHERE FOOD IS STORED, PREPARED OR DISPLAYED SHALL BE AIR TESTED TO NOT LESS THAN 10 PSIG.
3. CLEANOUTS SHALL BE TYLER PIPE CLEANOUT BODY STANDARD FERRULE 2-11 WITH TYPE "B" BRASS PLUG FOR ABOVE FLOOR. FLOOR CLEANOUTS SHALL BE JR SMITH SERIES 4020 W/ROUND ADJUSTABLE BRONZE TOP. GRADE CLEANOUTS SHALL BE JR SMITH SERIES 4250. WALL CLEANOUTS SHALL BE JR SMITH FIGURE 4402. CLEANOUTS SHALL BE INSTALLED AT BASE OF EACH RISER, AT EACH CHANGE OF DIRECTION OF HORIZONTAL RUN MORE THAN 45°, AND EVERY 75' OF HORIZONTAL RUN (FOR 4"DIA) AND EVERY 100' OF HORIZONTAL RUN(FOR 5"DIA & LARGER).
4. HORIZONTAL DRAIN PIPING SHALL BE INSTALLED AT UNIFORM SLOPE NOT LESS THAN 1/4" PER FOOT FOR 2" AND SMALLER AND NOT LESS THAN 1/8" PER FOOT FOR 3" AND LARGER, LESSER SLOPE MAY BE PERMITTED AS APPROVED BY LOCAL ADMINISTRATIVE AUTHORITY. PVC TO BE USED WHERE NOTED.
5. IN THE REMOVAL OF ANY PART OF A DRAINAGE SYSTEM, DEAD ENDS SHALL BE AVOIDED EXCEPT WHERE NECESSARY TO EXTEND TO A CLEANOUT SO AS TO BE ACCESSIBLE.
6. ALL WASTE PIPING LOCATED INSIDE EXTERIOR WALLS SHALL BE INSULATED WITH 2" THICK FIBERGLASS PREFORMED INSULATION WITH VAPOR JACKET AND SELF- SEALING TAPE, EQUAL TO OWENS-CORNING ASJ/SSL-2.

HANGERS & SUPPORTS

1. HANGERS AND ANCHORS SHALL BE SECURELY ATTACHED TO BUILDING CONSTRUCTION AT SUFFICIENTLY CLOSE INTERVALS TO SUPPORT PIPING AND ITS CONTENTS.
   A. VERTICAL PIPING FOR CAST IRON SHALL BE SUPPORTED AT BASE AND AT EACH STORY HEIGHT.
   B. VERTICAL PIPING FOR COPPER SHALL BE SUPPORTED AT EACH STORY HEIGHT BUT NOT MORE THAN 10 FOOT INTERVALS.
   C. HORIZONTAL PIPING FOR CAST IRON SHALL BE SUPPORTED WITH MINIMUM ONE HANGER LOCATED WITHIN 18" OF EACH JOINT UP TO 10 FOOT MAXIMUM PIPE LENGTH, AT CHANGES IN DIRECTION, AND AT EACH BRANCH CONNECTION. WHERE PIPE IS SUSPENDED BY NON-RIGID HANGERS MORE THAN 18" LONG PROVIDE LATERAL SUPPORT AT A MINIMUM 25 FOOT MAXIMUM SPACING. LATERAL SUPPORT SHALL CONSIST OF EITHER A SWAY BRACE OR EITHER A CHANGE IN DIRECTION OR A BRANCH CONNECTION THAT PROVIDES THE REQUIRED LATERAL SUPPORT.
   D. HORIZONTAL PIPING FOR COPPER SHALL BE SUPPORTED AT 6 FOOT INTERVALS FOR PIPE SIZES 1 1/4" AND SMALLER AND AT 10 FOOT INTERVALS FOR PIPE SIZES 1 1/2" AND LARGER. WHERE PIPE IS SUSPENDED BY NON-RIGID HANGERS MORE THAN 18" LONG PROVIDE LATERAL SUPPORT.
2. ALL SUPPORTS COMING IN CONTACT WITH COPPER PIPING SHALL BE PLASTIC COATED.
3. INSTALL METAL SHIELDS ON HANGERS SUPPORTING INSULATED PIPE.
4. PROVIDE HANGERS THAT ARE U.L. LISTED AND LABELED.
5. ALL DOMESTIC WATER AND SANITARY WASTE PIPE SUPPORTS SHALL BE IN ACCORDANCE WITH NSPC CHAPTER 8, MSS SP-58, 69 & 89.
6. PLUMBING SYSTEMS SHALL BE INSTALLED SO AS TO PREVENT STRAINS & STRESSES WHICH WILL EXCEED STRUCTURAL STRENGTH OF PIPE. PROVISIONS SHALL BE MADE FOR EXPANSION & CONTRACTION OF PIPING.
7. HANGERS, ANCHORS AND SUPPORTS SHALL BE OF METAL. OTHER MATERIAL OF SUFFICIENT STRENGTH TO SUPPORT THE PIPING AND ITS CONTENTS IS ACCEPTABLE. ALL SUPPORTS AND FASTENERS LOCATED OUTSIDE OR IN CORROSIVE AREAS SHALL BE GALVANIZED.
8. MINIMUM ROD DIAMETER FOR SINGLE RIGID SUPPORTS SHALL BE AS FOLLOWS:
   A. FOR 1/4" THRU 2" PIPE: 3/8"DIAMETER
   B. FOR 2 1/2" AND 3" PIPE: 1/2"DIAMETER
   C. FOR 4" AND 5" PIPE: 5/8"DIAMETER
   D. RODS MAY BE REDUCED ONE SIZE FOR DOUBLE ROD HANGERS(3/8"DIA MIN)

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building

1 Quad Road
Montclair, NJ 07043

Prepared For

Montclair State University

1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

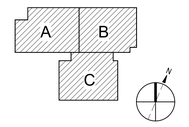
Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan



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No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

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Sheet Title

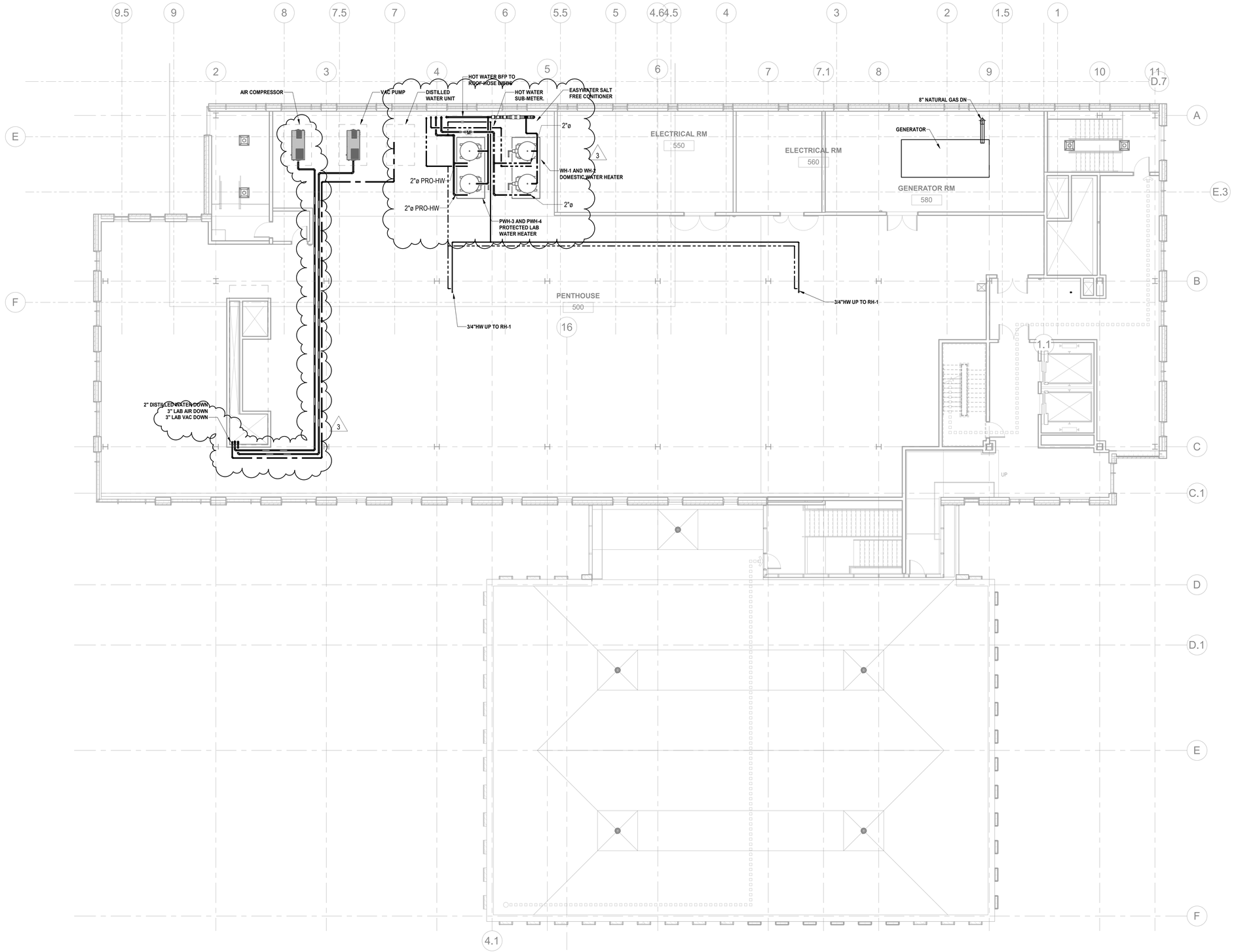
PLUMBING SYMBOLS AND ABBREVIATIONS

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Sheet Number

P001

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1 P205 PENTHOUSE - PLUMBING OVERALL DOMESTIC WATER PLAN

SCALE: 1/8" = 1'-0"

3/23/2026 5:06:31 PM

MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building

1 Quad Road
Montclair, NJ 07043

Prepared For

Montclair State University

1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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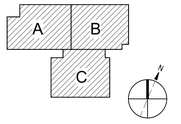
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PLUMBING-PENTHOUSE LAB GAS & DOMESTIC WATER PLAN

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Sheet Number

P205



1 P400 DOMESTIC & PROTECTED WATER RISER DIAGRAM 1
SCALE: N.T.S.

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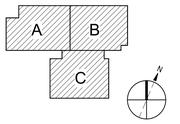
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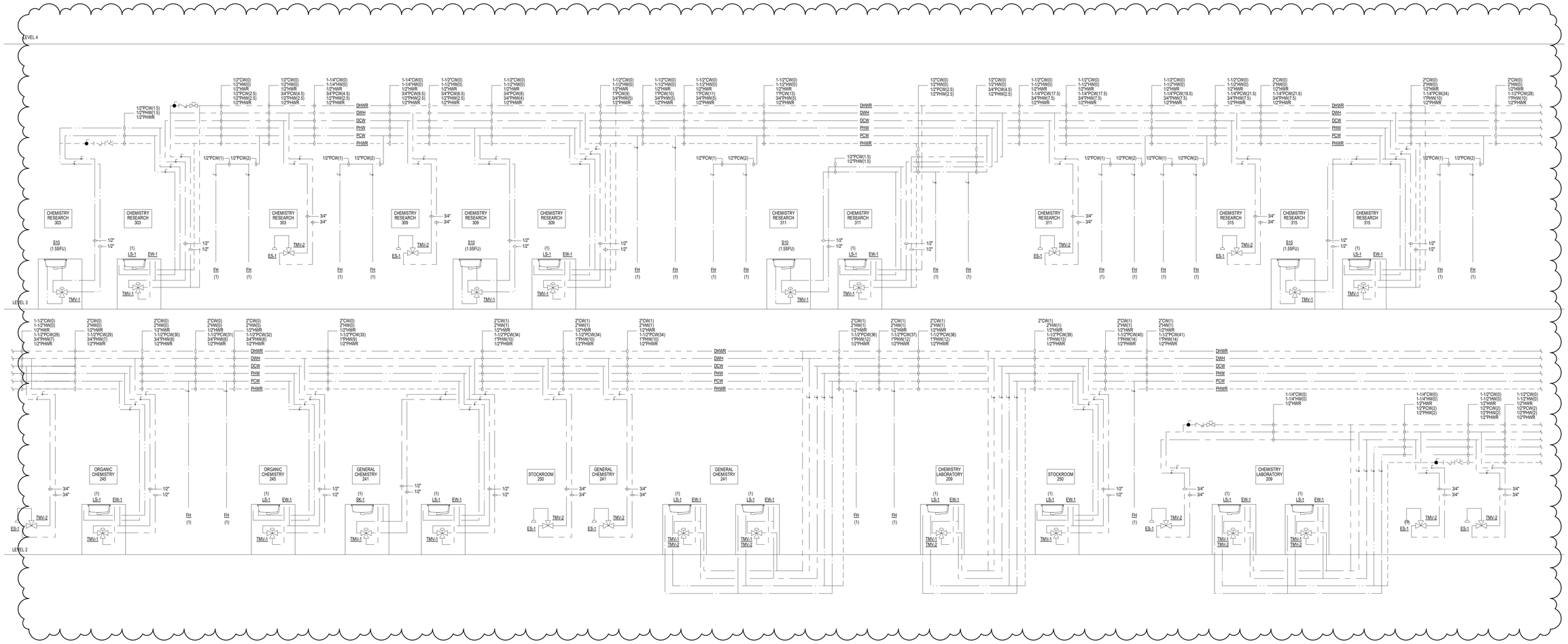
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DOMESTIC WATER RISER DIAGRAM

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Sheet Number

P400



1 P401 DOMESTIC & PROTECTED WATER RISER DIAGRAM 2

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5 Bryant Park
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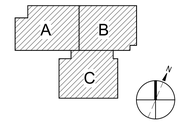
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DOMESTIC WATER RISER DIAGRAM CONT.

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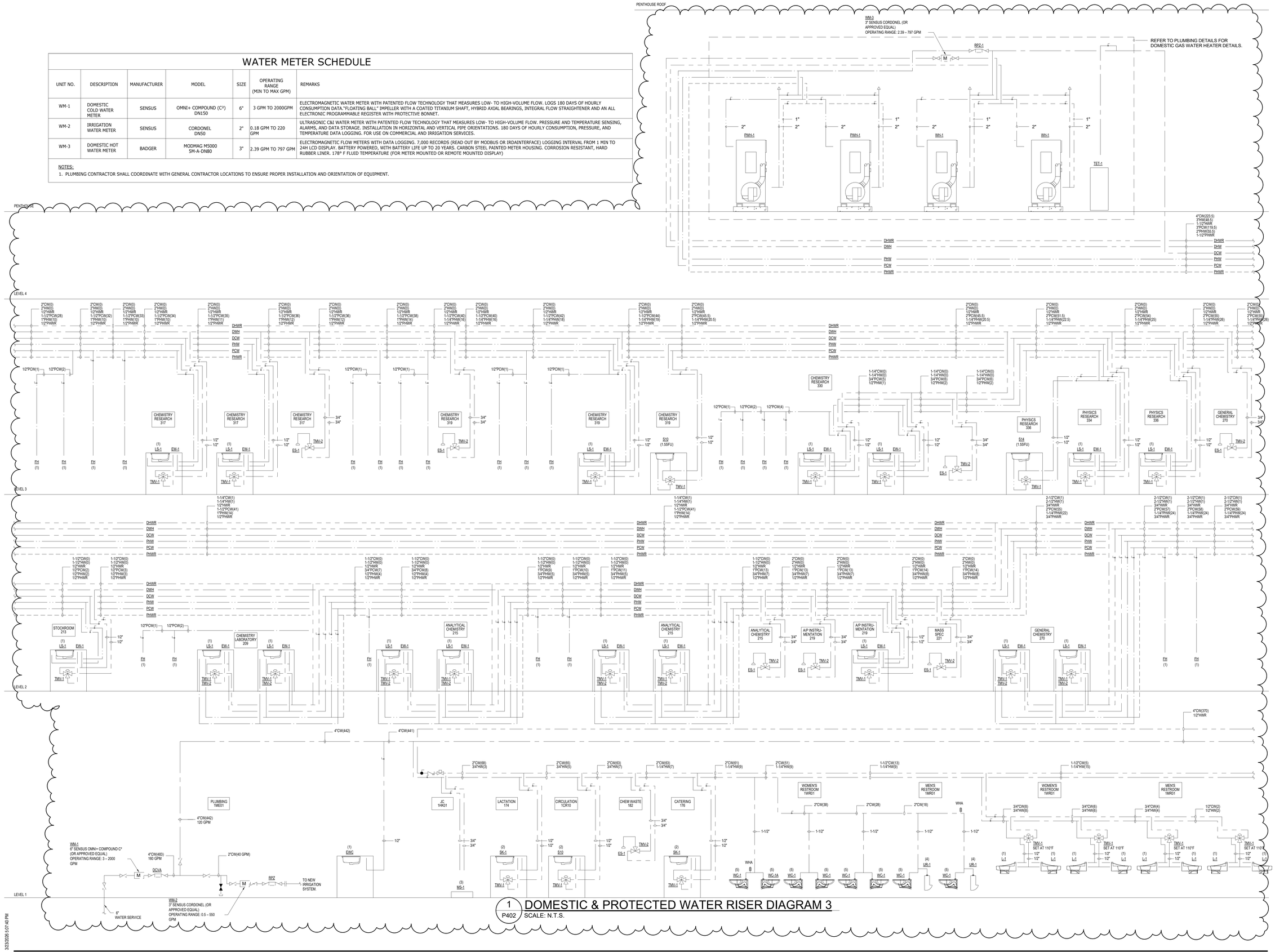
Sheet Number

P401

WATER METER SCHEDULE

UNIT NO.	DESCRIPTION	MANUFACTURER	MODEL	SIZE	OPERATING RANGE (MIN TO MAX GPM)	REMARKS
WM-1	DOMESTIC COLD WATER METER	SENSUS	OMNI+ COMPOUND (C²) DN150	6"	3 GPM TO 2000GPM	ELECTROMAGNETIC WATER METER WITH PATENTED FLOW TECHNOLOGY THAT MEASURES LOW- TO HIGH-VOLUME FLOW. LOGS 180 DAYS OF HOURLY CONSUMPTION DATA."FLOATING BALL" IMPELLER WITH A COATED TITANIUM SHAFT, HYBRID AXIAL BEARINGS, INTEGRAL FLOW STRAIGHTENER AND AN ALL ELECTRONIC PROGRAMMABLE REGISTER WITH PROTECTIVE BONNET.
WM-2	IRRIGATION WATER METER	SENSUS	CORDONEL DN50	2"	0.18 GPM TO 220 GPM	ULTRASONIC C&I WATER METER WITH PATENTED FLOW TECHNOLOGY THAT MEASURES LOW- TO HIGH-VOLUME FLOW. PRESSURE AND TEMPERATURE SENSING, ALARMS, AND DATA STORAGE. INSTALLATION IN HORIZONTAL AND VERTICAL PIPE ORIENTATIONS. 180 DAYS OF HOURLY CONSUMPTION, PRESSURE, AND TEMPERATURE DATA LOGGING. FOR USE ON COMMERCIAL AND IRRIGATION SERVICES.
WM-3	DOMESTIC HOT WATER METER	BADGER	MODMAG M5000 5M-A-DN80	3"	2.39 GPM TO 797 GPM	ELECTROMAGNETIC FLOW METERS WITH DATA LOGGING. 7,000 RECORDS (READ OUT BY MODBUS OR IRDAINTERFACE) LOGGING INTERVAL FROM 1 MIN TO 24H LCD DISPLAY. BATTERY POWERED, WITH BATTERY LIFE UP TO 20 YEARS. CARBON STEEL PAINTED METER HOUSING. CORROSION RESISTANT, HARD RUBBER LINER. 178° F FLUID TEMPERATURE (FOR METER MOUNTED OR REMOTE MOUNTED DISPLAY)

NOTES:
1. PLUMBING CONTRACTOR SHALL COORDINATE WITH GENERAL CONTRACTOR LOCATIONS TO ENSURE PROPER INSTALLATION AND ORIENTATION OF EQUIPMENT.



1 P402 DOMESTIC & PROTECTED WATER RISER DIAGRAM 3
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Montclair State University
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5 Bryant Park
1065 Avenue of the Americas, 6th Floor
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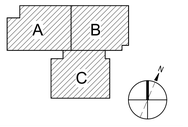
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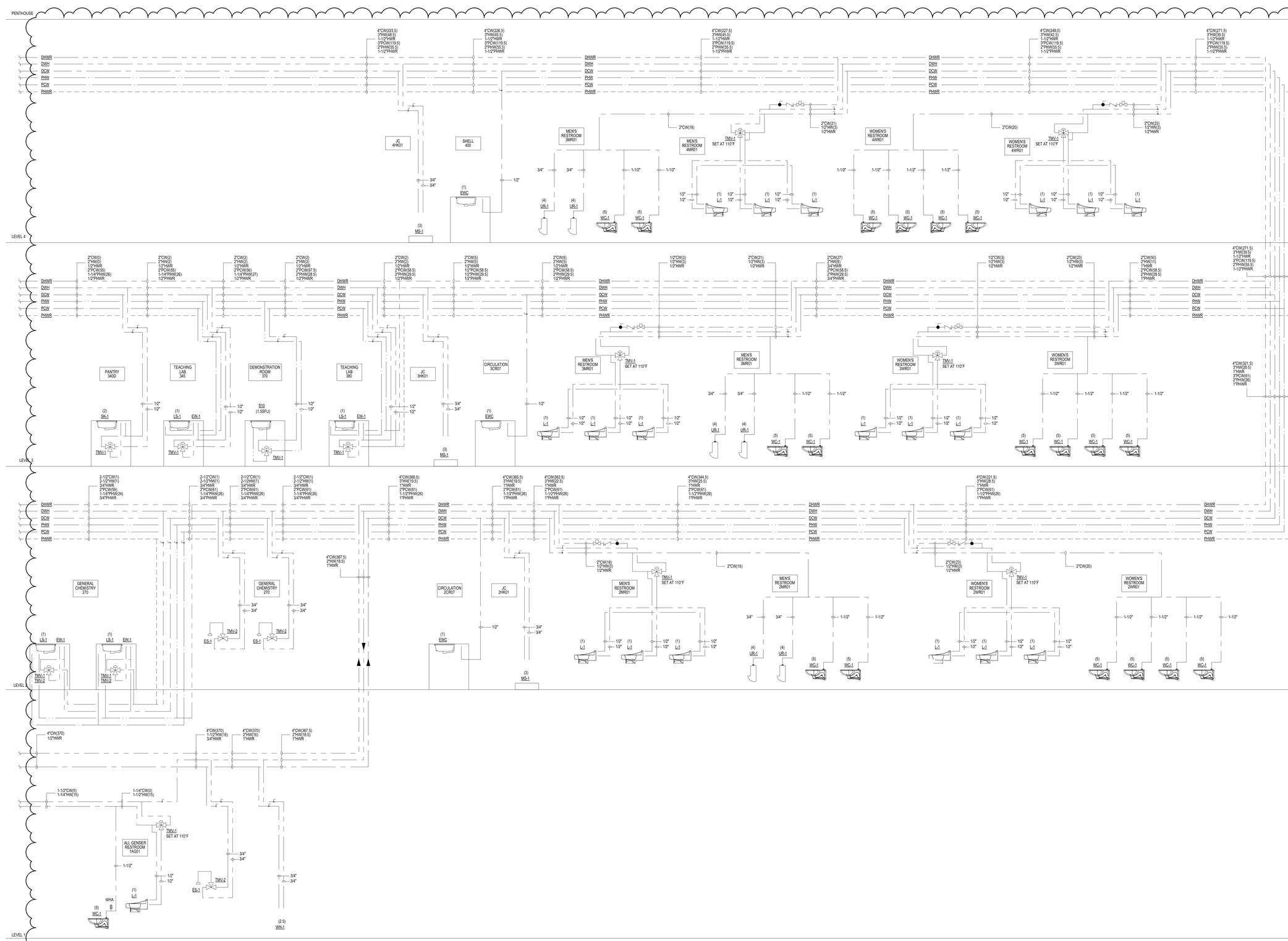
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Sheet Title
DOMESTIC WATER RISER DIAGRAM CONT.

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Sheet Number
P402



1 P403 DOMESTIC & PROTECTED WATER RISER DIAGRAM 4

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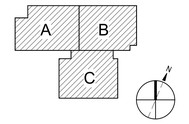
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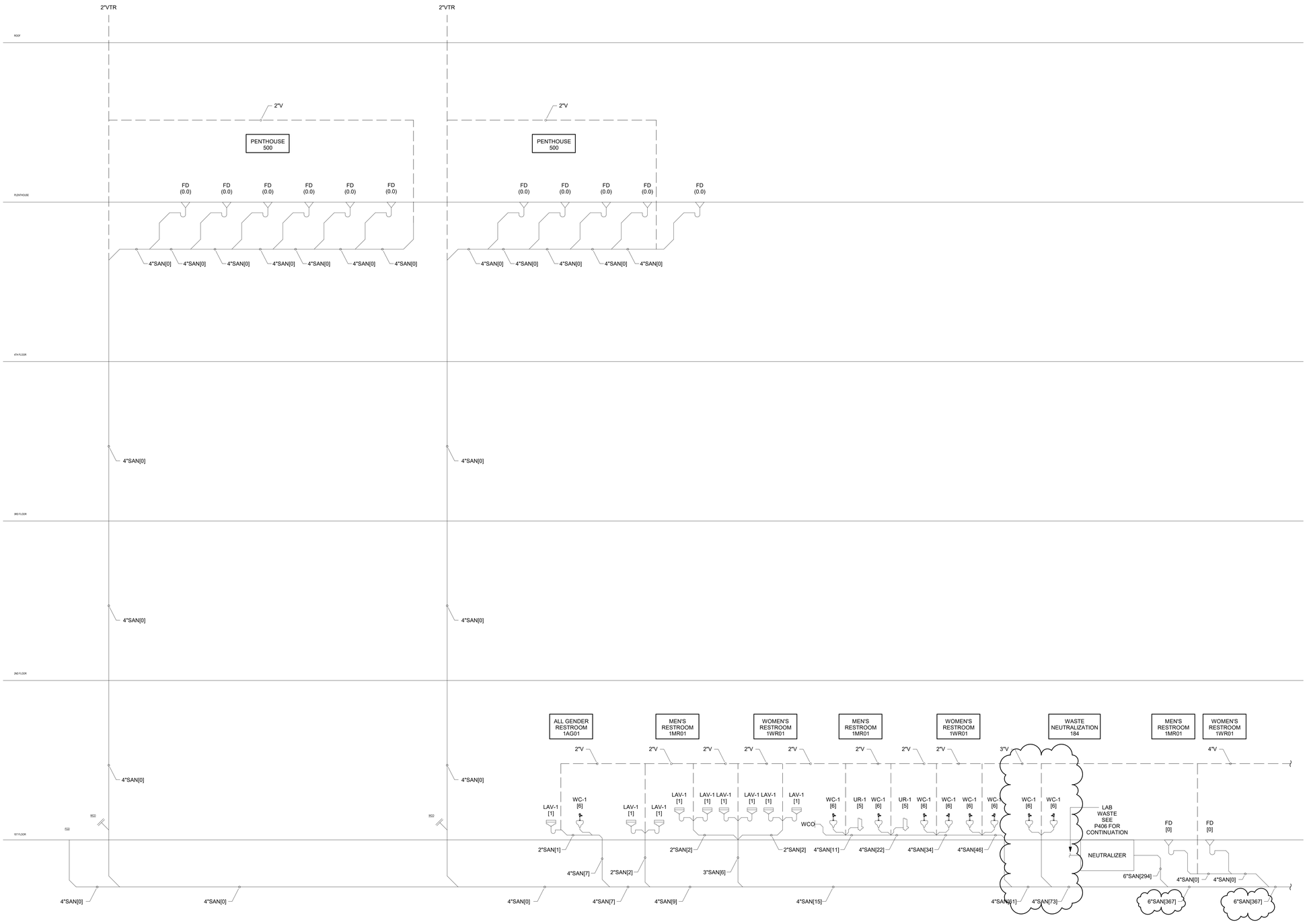
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DOMESTIC WATER RISER DIAGRAM CONT.

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P403



1 P404 SCALE: N.T.S.

SANITARY RISER DIAGRAM 1

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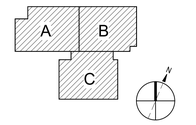
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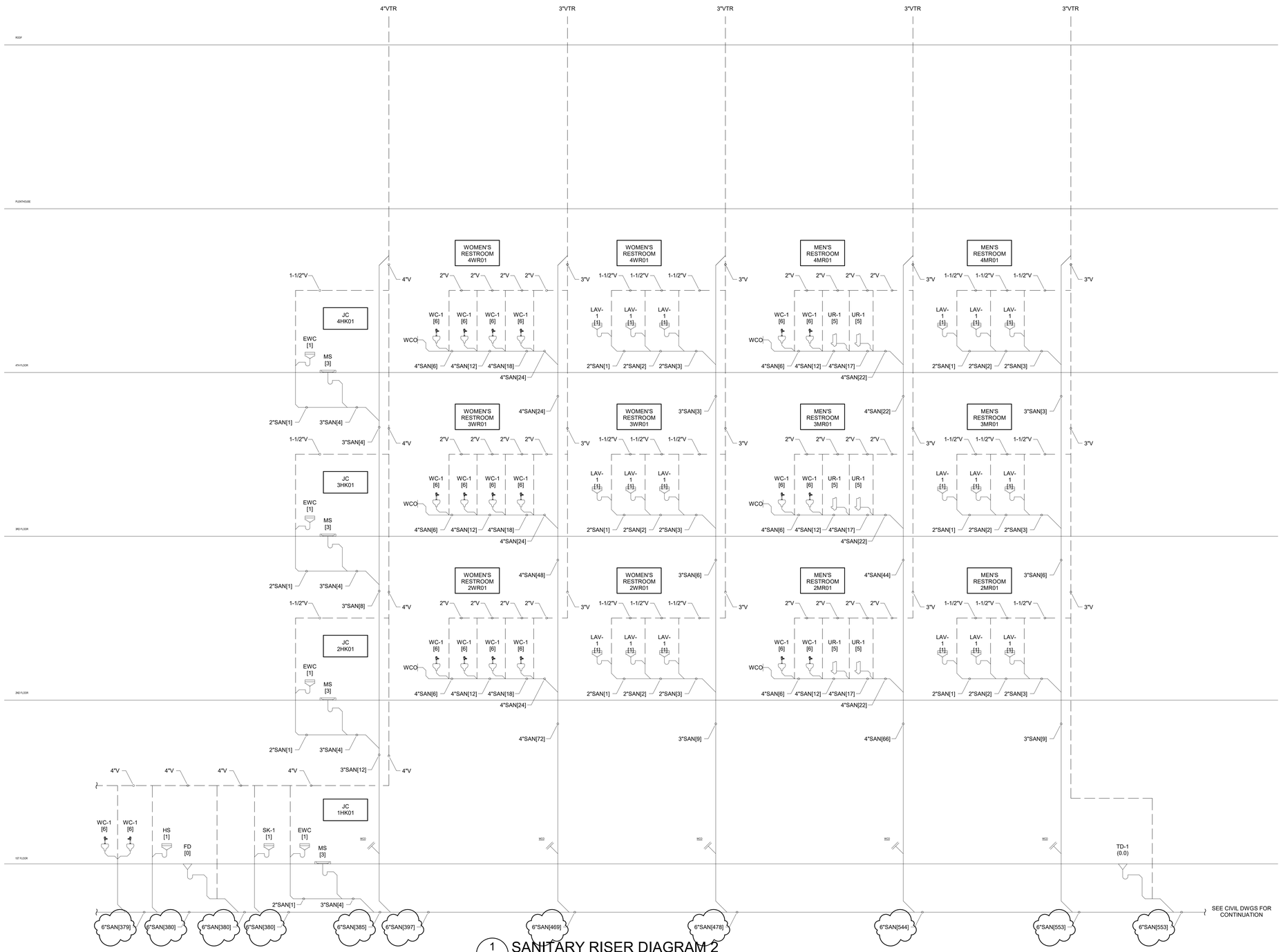
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SANITARY RISER DIAGRAM

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P404



1 P405 SANITARY RISER DIAGRAM 2

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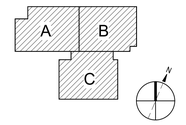
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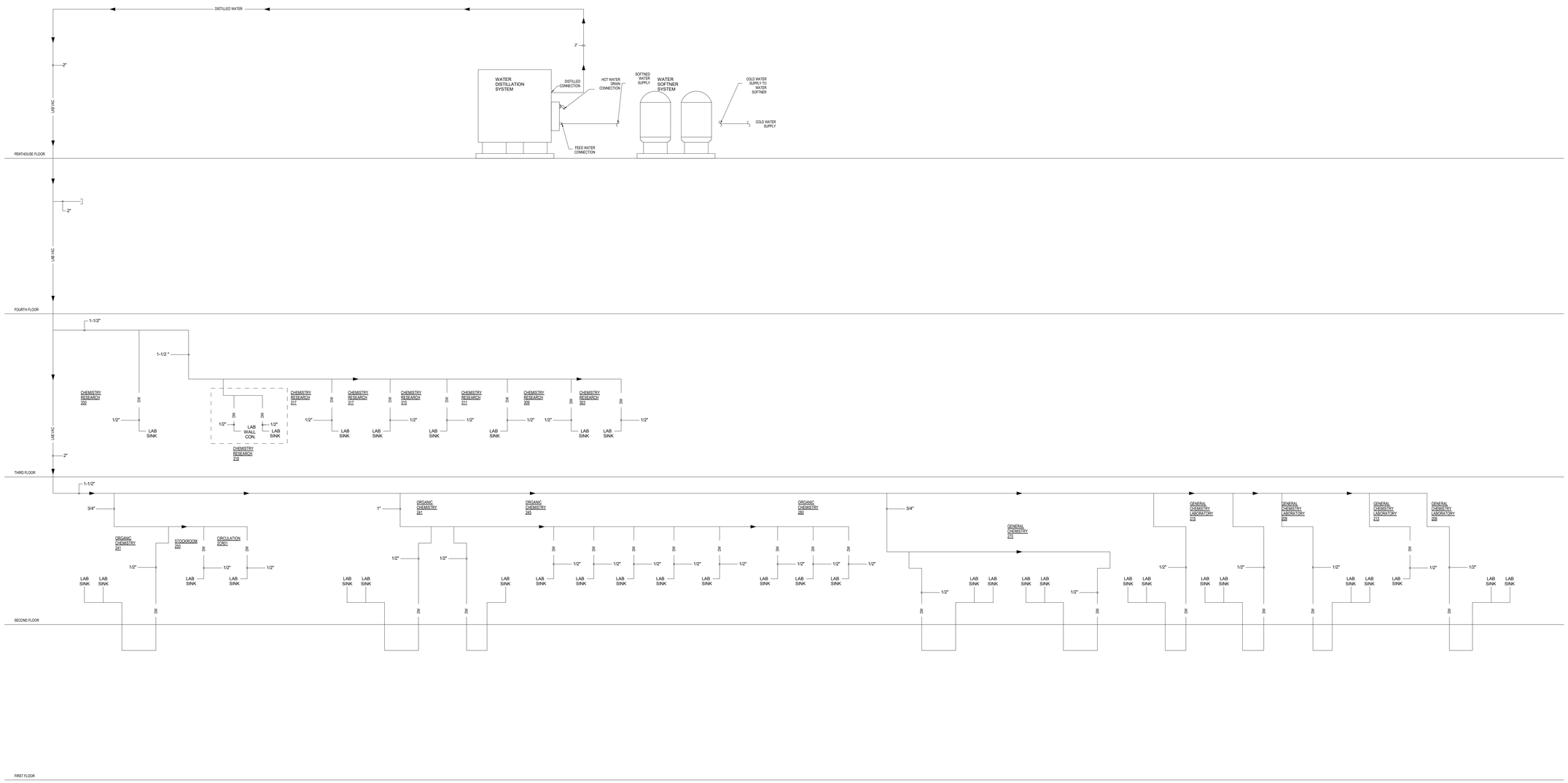
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SANITARY RISER DIAGRAM CONT.

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P405



1 P415 RISER DIAGRAM - DISTILLED WATER
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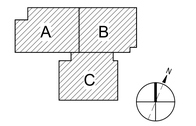
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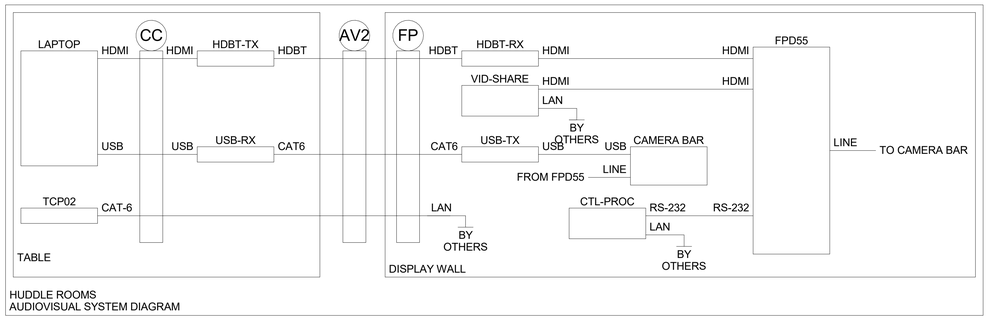
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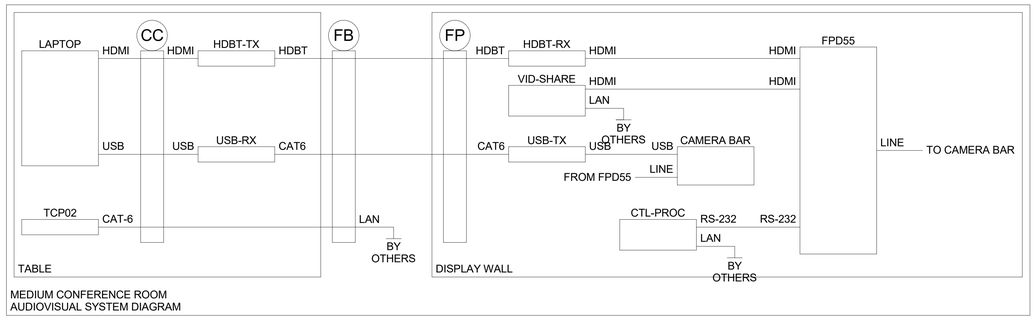
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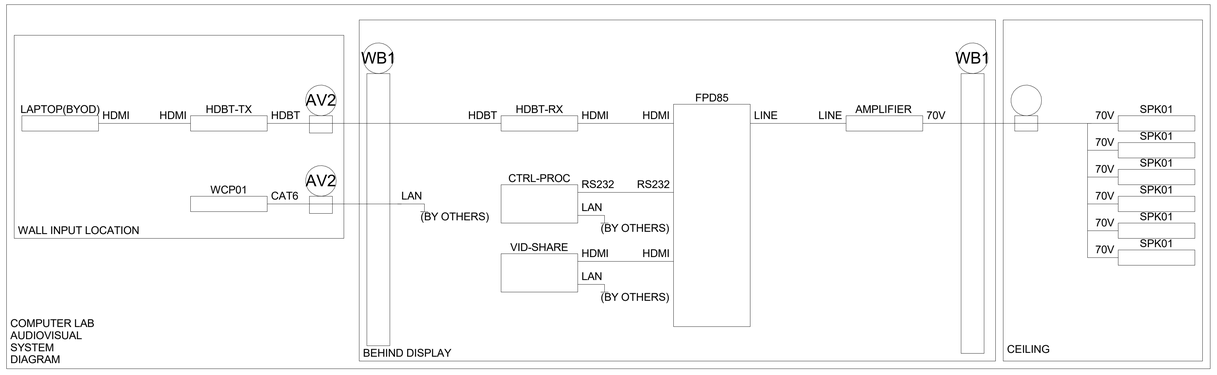
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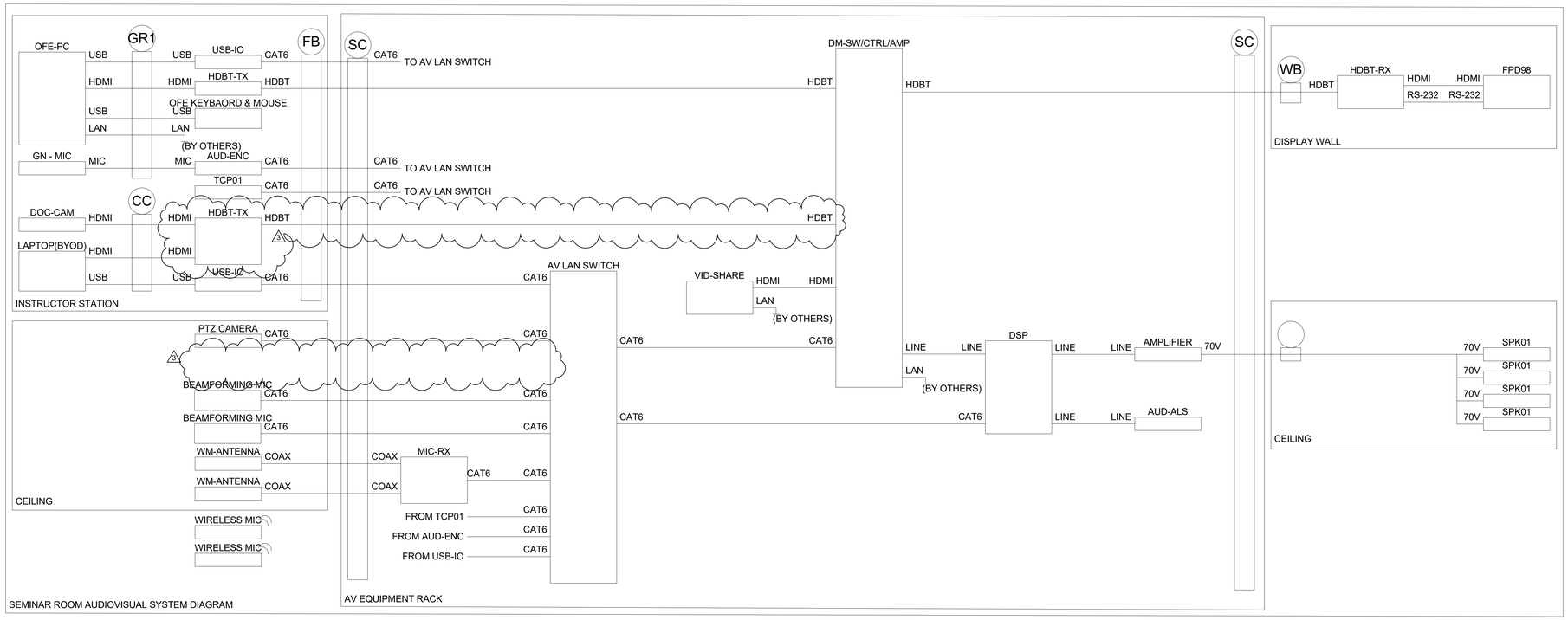
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NTS



2 AUDIOVISUAL SYSTEM DIAGRAM - MEDIUM CONFERENCE ROOM
NTS



4 AUDIOVISUAL SYSTEM DIAGRAM - COMPUTER LAB
NTS



3 AUDIOVISUAL SYSTEM DIAGRAM - SEMINAR ROOM
NTS

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Concord Engineering
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Princeton, NJ 08540

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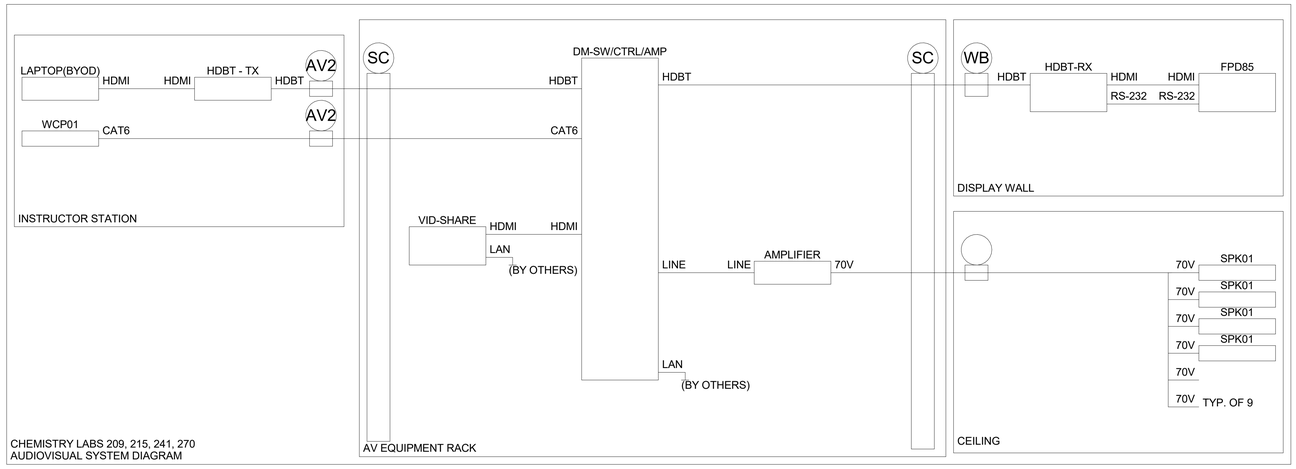
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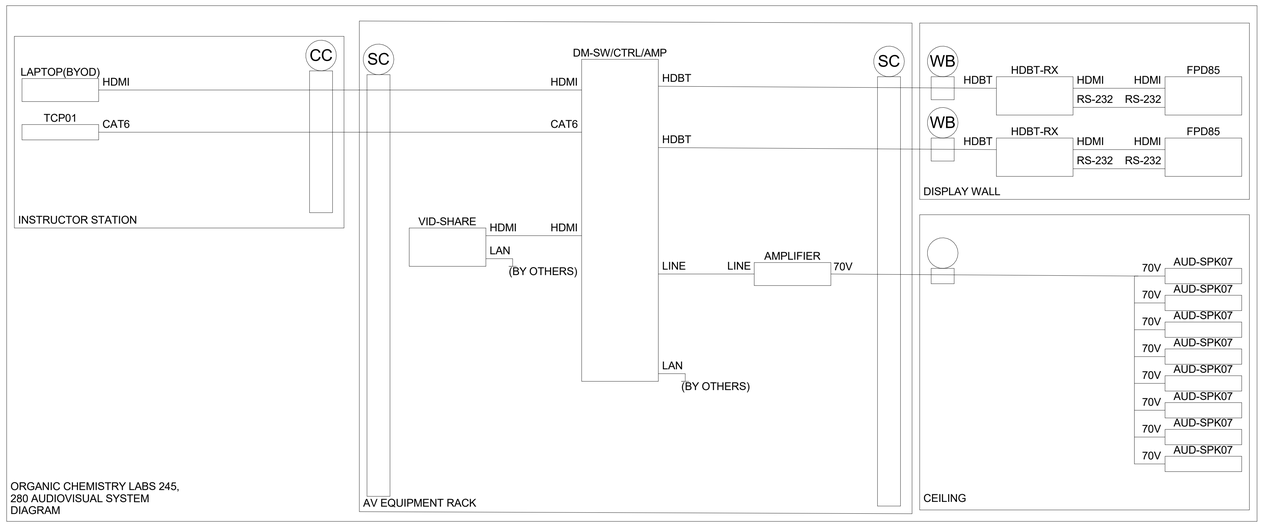
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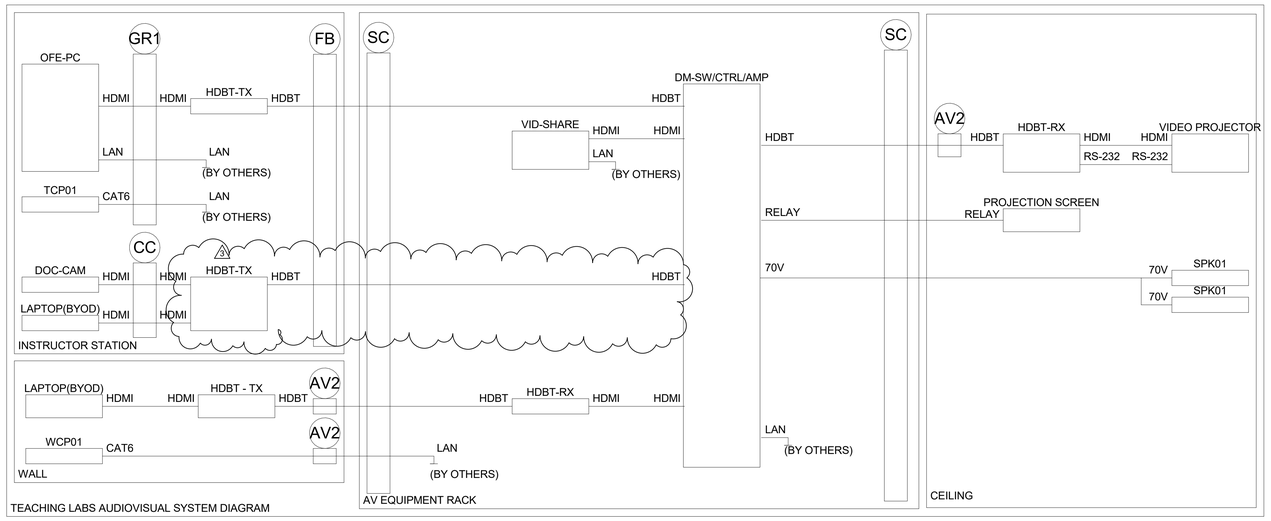
TA-700



1 AUDIOVISUAL SYSTEM DIAGRAM - GENERAL CHEMISTRY
NTS



2 AUDIOVISUAL SYSTEM DIAGRAM - ORGANIC CHEMISTRY
NTS



3 AUDIOVISUAL SYSETM DIAGRAM - INTRO & ADVANCED TEACHING LABS
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1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

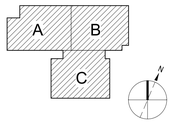
Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan



Professional Seals

NOT FOR CONSTRUCTION

No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No: 24.07023.00

Sheet Title

AUDIOVISUAL SYSTEM DIAGRAMS

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

TA-701

Montclair State University
Interdisciplinary Science Building
1Quad Road
Montclair, New Jersey
EQUIPMENT LIST

AV EQUIPMENT LIST

Interdisciplinary Science Building System Types 3

Room Type	Room Qty	Room Numbers
Huddle Rooms	4	Applies to Room(s): 202,271, 302, 371
Medium Conference Room	1	Applies to Room(s): 249
Department & Staff Workrooms	3	Applies to Room(s): 160, 240, 340
Seminar Room	1	Applies to Room(s): 146
Computer Lab 140	1	Applies to Room(s): 140
Chemistry Lab	4	Applies to Room(s): 209, 215, 241, 270
Organic Chemistry Lab	2	Applies to Room(s): 245, 280
Advanced & Introduction Teaching Lab	2	Applies to Room(s): 345, 380
Demonstration Room	1	Applies to Room(s): 370
Collab Lounge	1	Applies to Room(s): 170
Event & Pre-Function	1	Applies to Room(s): 120

1. This equipment list specifies major systems components and equipment, and should not be interpreted as a "bill of materials". This list may not detail all equipment required for complete, working systems. It is the AV Systems Contractor's responsibility to provide complete, working systems regardless of the completeness of this list.

2. It is the AV Systems Contractor's responsibility to review and confirm any formulas provided in the excel spreadsheet prior to submitting bid documents. Costing discrepancies as a result of excel formula errors will be the responsibility of the AV Systems Contractor.

3. All device colors, accessory options and display sizes and projector lenses are to be confirmed with Consultant and Architect prior to ordering.

4. AV Systems Contractor is required to review all AV equipment models at the time of ordering to ensure that all models are the latest available and the newest generation of equipment from the manufacturers. If newer or next generation model is available at the time of ordering, AV Contractor is to notify Consultant for possible replacement of specified model.

5. AV Contractor to coordinate and work with Owner IT department to register video codec to existing or new owner VCS, VCS Expressway, MCU, and any other relevant systems as required to fully integrate this facility into owner video conferencing environment.

Montclair State University
Interdisciplinary Science Building
1Quad Road

Applies to Room(s):
202,271, 302, 371

Huddle Rooms

AV EQUIPMENT LIST

Item	Description	Manufacturer	Model	Unit Cost	Qty.
	Display Device				
1	55" 4K LED Backlit Flat Panel Display	Samsung	QM55C	$0.00	1
2	Articulating Wall Mount for Flat Panel Display	Chief	TS525TU	$0.00	1
3	Display Backbox - Mount Recessed	Chief	TA500	$0.00	1
	Video Equipment				
1	HDMI TX - 4K [At Instructors Desk]	Crestron	HD-TXC-4KZ-101	$0.00	1
2	HDBT - Receiver	Crestron	HD-RXC-4KZ-101	$0.00	1
3	Wireless Presentation Appliance	Crestron	AM-3000-WF	$0.00	1
	Video Conference Equipment				
1	Video Conference Camera Bar	Crestron	UC-SB1-CAM	$0.00	1
3	USB 3.0 Exender Kit	Crestron	USB-EXT-3 KIT	$0.00	1
	Control				
1	10" Control Touchpanel [Tabletop]	Crestron	TS-1070-B-S	$0.00	1
2	Control Processor	Crestron	RMC4	$0.00	1
	Miscellaneous				
1	Allowance for items including but not limited to Field Cables/ Interconnecting Wiring/ Patch Cables/ Connectors/ Converters/ Adapters/ POE Injectors/ Accessories/ Mounting Hardware/ and Miscellaneous.	By AV Contractor	Custom	$0.00	1
2	Table Top Cable Hatch - Flip Top	Crestron	FT2-202-PTL	$0.00	1
3	Table Top Cable Hatch - HDMI Pass-Through	Crestron	HDMI Pass Through	$0.00	1
4	Table Top Cable Hatch - USB Pass-Through	Crestron	USB Pass Through	$0.00	1
5	Table Top Cable Hatch - CAT6 Pass-Through	Crestron	CAT6 Pass Through	$0.00	1

Montclair State University
Interdisciplinary Science Building
1Quad Road

Applies to Room(s):
249

EQUIPMENT LIST

Medium Conference Room

AV EQUIPMENT LIST

Item	Description	Manufacturer	Model	Unit Cost	Qty.
	Display Device				
1	55" 4K LED Backlit Flat Panel Display	Samsung	QM55C	$0.00	1
2	Articulating Wall Mount for Flat Panel Display	Chief	TS525TU	$0.00	1
3	Display Backbox - Mount Recessed	Chief	TA500	$0.00	1
	Video Equipment				
1	HDMI TX - 4K [At Instructors Desk]	Crestron	HD-TXC-4KZ-101	$0.00	1
2	HDBT - Receiver	Crestron	HD-RXC-4KZ-101	$0.00	1
3	Wireless Presentation Appliance	Crestron	AM-3000-WF	$0.00	1
	Video Conference Equipment				
1	Video Conference Camera Bar	Crestron	UC-SB1-CAM	$0.00	1
3	USB 3.0 Exender Kit	Crestron	USB-EXT-3 KIT	$0.00	1
	Control				
1	10" Control Touchpanel [Tabletop]	Crestron	TS-1070-B-S	$0.00	1
2	Control Processor	Crestron	RMC4	$0.00	1
	Miscellaneous				
1	Allowance for items including but not limited to Field Cables/ Interconnecting Wiring/ Patch Cables/ Connectors/ Converters/ Adapters/ POE Injectors/ Accessories/ Mounting Hardware/ and Miscellaneous.	By AV Contractor	Custom	$0.00	1
2	Table Top Cable Hatch - Flip Top	Crestron	FT2-202-PTL	$0.00	1
3	Table Top Cable Hatch - HDMI Pass-Through	Crestron	HDMI Pass Through	$0.00	1
4	Table Top Cable Hatch - USB Pass-Through	Crestron	USB Pass Through	$0.00	1
5	Table Top Cable Hatch - CAT6 Pass-Through	Crestron	CAT6 Pass Through	$0.00	1

Montclair State University
Interdisciplinary Science Building
1Quad Road

Applies to Room(s):
160, 240, 340

Department & Staff Workrooms

AV EQUIPMENT LIST

Item	Description	Manufacturer	Model	Unit Cost	Qty.
	Display Device				
1	55" 4K LED Backlit Flat Panel Display	Samsung	QM55C	$0.00	1
2	Articulating Wall Mount for Flat Panel Display	Chief	TS525TU	$0.00	1
3	Display Backbox - Mount Recessed	Chief	TA500	$0.00	1
	Video Equipment				
1	HDMI TX - 4K [At Instructors Desk]	Crestron	HD-TXC-4KZ-101	$0.00	1
2	HDBT - Receiver / scaler / switch	Crestron	HD-RX-4K-510-C-E	$0.00	1
3	Wireless Presentation Appliance	Crestron	AM-3000-WF	$0.00	1
4	AV input Wall Plate - Passive - HDMI & USB	By AV Contractor	By AV Contractor	$0.00	1
	Video Conference Equipment				
1	Video Conference Camera Bar	Crestron	UC-SB1-CAM	$0.00	1
2	USB 3.0 Exender Kit	Crestron	USB-EXT-3 KIT	$0.00	1
3	USB 3.0 Switch	Crestron	USB-SW-200	$0.00	1
	Control				
1	10" Control Touchpanel [Tabletop]	Crestron	TS-1070-B-S	$0.00	1
2	10" Control Touchpanel [Wall]	Crestron	TSW-1070-B-S	$0.00	1
2	Control Processor	Crestron	RMC4	$0.00	1
	Miscellaneous				
1	Allowance for items including but not limited to Field Cables/ Interconnecting Wiring/ Patch Cables/ Connectors/ Converters/ Adapters/ POE Injectors/ Accessories/ Mounting Hardware/ and Miscellaneous.	By AV Contractor	Custom	$0.00	1
2	Table Top Cable Hatch - Flip Top	Crestron	FT2-202-PTL	$0.00	1
3	Table Top Cable Hatch - HDMI Pass-Through	Crestron	HDMI Pass Through	$0.00	1
4	Table Top Cable Hatch - USB Pass-Through	Crestron	USB Pass Through	$0.00	1
5	Table Top Cable Hatch - CAT6 Pass-Through	Crestron	CAT6 Pass Through	$0.00	1

Montclair State University
Interdisciplinary Science Building
1Quad Road

Applies to Room(s):
146

Seminar Room

AV EQUIPMENT LIST

Item	Description	Manufacturer	Model	Unit Cost	Qty.
	Display Device				
1	98" 4K LED Backlit Flat Panel Display	Samsung	QM98C	$0.00	1
2	Articulating Wall Mount for Flat Panel Display	Chief	TS525TU	$0.00	1
3	Display Backbox - Mount Recessed	Chief	TA500	$0.00	1
	Video Equipment				
1	**HDMI TX - 4K [At Instructors Desk Supporting PCI(OFE)]**	**Crestron**	**DM-TX-4KZ-100-C-1G-B-**	**$0.00**	**1**
2	**HDMI TX - 4K [At Instructors Desk Supporting Doc Cam & Laptop]**	**Crestron**	**DM-TX-4KZ-302-C**	**$0.00**	**1**
3	HDBT - Video Matrix, Control Processor & Amplifier	Crestron	DMPS3-4K-350-C	$0.00	1
4	**HDBT - Receiver / scaler**	**Crestron**	**DM-RMC-4KZ-SCALER-**	**$0.00**	**1**
5	Wireless Presentation Appliance	Crestron	AM-3000-WF	$0.00	1
6	PC (OFE)	OFE	OFE	$0.00	1
7	**Document Camera**	**WolfVision**	**VZ-2 UHD**	**$0.00**	**1**
	Audio Equipment				
1	Audio DSP	QSC	Core 110F	$0.00	1
2	Audio Amplifier	Crestron	AMP-X300	$0.00	1
3	Audio I/O - [at instructor desk]	QSC	QIO-ML4i	$0.00	1
4	Loudspeaker - Recessed 8"	Crestron	Saros IC8T-W-T	$0.00	4
5	Microphone - Beamforming	Shure	MXA920	$0.00	2
6	Microphone - Desktop Gooseneck	Shure	MX412D/C	$0.00	1
7	Wireless Microphone - Receiver 2ch	Shure	ULXD4D	$0.00	1
8	Wireless Microphone - Antenna	Shure	UA864us	$0.00	2
9	Wireless Microphone - Transmitter - Body Pack	Shure	ULXD1	$0.00	2
10	Wireless Microphone - Lavalier	Shure	WL185m	$0.00	2
11	Wireless Microphone - Battery	Shure	SB900B	$0.00	4
12	Wireless Microphone - Battery Charger	Shure	SBC200US	$0.00	1
13	Assistive Listening System	Listen Technology	LS53-072	$0.00	1
	Video Conference Equipment				
1	PTZ Camera / Tracking	QSC	NC-12x80	$0.00	1
2	USB I/O	QSC	I/O-USB Bridge	$0.00	2
	Control				
1	10" Control Touchpanel [Tabletop]	Crestron	TS-1070-B-S	$0.00	1
	Miscellaneous				
1	Audiovisual Netowrk Switch	As Required	As Required	$0.00	1
2	Power Conditioning / Distribution	By AV Contractor	As Required	$0.00	1
3	Audiovisual Equipment Rack - Full Height	Lagrand	BRG-412TLRD	$0.00	1
4	Audiovisual Equipment Rack - Caster Base	Lagrand	CBS-BRG	$0.00	1
5	Allowance for items including but not limited to Field Cables/ Interconnecting Wiring/ Patch Cables/ Connectors/ Converters/ Adapters/ POE Injectors/ Accessories/ Mounting Hardware/ and Miscellaneous.	By AV Contractor	Custom	$0.00	1
6	Table Top Cable Hatch - Flip Top	Crestron	FT2-202-PTL	$0.00	1
7	Table Top Cable Hatch - HDMI Pass-Through	Crestron	HDMI Pass Through	$0.00	2
8	Table Top Cable Hatch - USB Pass-Through	Crestron	USB Pass Through	$0.00	1
9	Table Top Cable Hatch - CAT6 Pass-Through	Crestron	CAT6 Pass Through	$0.00	1

Montclair State University
Interdisciplinary Science Building
1Quad Road

Applies to Room(s):
140

Computer Lab 140

AV EQUIPMENT LIST

Item	Description	Manufacturer	Model	Unit Cost	Qty.
	Display Device				
1	85" 4K LED Backlit Flat Panel Display	Samsung	QM85C	$0.00	1
2	Articulating Wall Mount for Flat Panel Display	Chief	TS525TU	$0.00	1
3	Display Backbox - Mount Recessed	Chief	TA500	$0.00	1
	Video Equipment				
1	HDMI TX - 4K [At Instructors Desk]	Crestron	HD-TXC-4KZ-101	$0.00	1
2	HDBT - Receiver	Crestron	HD-RXC-4KZ-101	$0.00	1
3	Wireless Presentation Appliance	Crestron	AM-3000-WF	$0.00	1
	Audio Equipment				
1	Audio Amplifier	Crestron	AMP-X75	$0.00	1
2	**Loudspeaker - Recessed 8"**	**Crestron**	**Saros IC8T-W-T**	**$0.00**	**6**
	Control				
1	10" Control Touchpanel [Wall]	Crestron	TSW-1070-B-S	$0.00	1
2	Control Processor	Crestron	RMC4	$0.00	1
	Miscellaneous				
1	Allowance for items including but not limited to Field Cables/ Interconnecting Wiring/ Patch Cables/ Connectors/ Converters/ Adapters/ POE Injectors/ Accessories/ Mounting Hardware/ and Miscellaneous.	By AV Contractor	Custom	$0.00	1

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MONTCLAIR STATE UNIVERSITY

Project

Interdisciplinary Science Building

1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University

1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

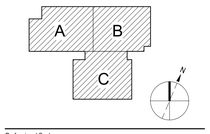
Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
AV/ Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan



Professional Seals

NOT FOR CONSTRUCTION

No.	Description	Date
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No. 24.07023.00

Sheet Title

AUDIOVISUAL EQUIPMENT LIST

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

TA-800

Montclair State University
Interdisciplinary Science Building
1Quad Road

Applies to Room(s):
209, 215, 241, 270

Chemistry Lab

AV EQUIPMENT LIST

Item	Description	Manufacturer	Model	Unit Cost	Qty.
	Display Device				
1	85" 4K LED Backlit Flat Panel Display	Samsung	QM85C	$0.00	1
2	Articulating Wall Mount for Flat Panel Display	Chief	TS525TU	$0.00	1
3	Display Backbox - Mount Recessed	Chief	TA500	$0.00	1
	Video Equipment				
1	HDMI TX - 4K- [At Instructors station]	Crestron	DM-TX-4KZ-100-C-1G-B-	$0.00	1
2	HDBT - Video Matrix, Control Processor & Amplifier	Crestron	DMPS3-4K-350-C	$0.00	1
3	HDBT - Receiver / scaler	Crestron	DM-RMC-4KZ-SCALER-	$0.00	1
4	Wireless Presentation Appliance	Crestron	AM-3000-WF	$0.00	1
5	PC (OFE)	OFE	OFE	$0.00	1
	Audio Equipment				
1	Audio Amplifier	Crestron	AMP-X300	$0.00	1
2	Loudspeaker - Recessed 8"	Crestron	Saros IC8T-W-T	$0.00	9
	Control				
1	10" Control Touchpanel [Wall]	Crestron	TSW-1070-B-S	$0.00	1
	Miscellaneous				
1	Audiovisual Equipment Rack - Millwork	Lagrand	CFR-14-18	$0.00	1
2	Audiovisual Equipment Rack - Cooling fan	procool	SP480X	$0.00	1
3	Power Conditioning / Distribution	By AV Contractor	As Required	$0.00	1
4	Allowance for items including but not limited to Field Cables/ Interconnecting Wiring/ Patch Cables/ Connectors/ Converters/ Adapters/ POE Injectors/ Accessories/ Mounting Hardware/ and Miscellaneous.	By AV Contractor	Custom	$0.00	1

Montclair State University
Interdisciplinary Science Building
1Quad Road

Applies to Room(s):
245, 280

Organic Chemistry Lab

AV EQUIPMENT LIST

Item	Description	Manufacturer	Model	Unit Cost	Qty.
	Display Device				
1	85" 4K LED Backlit Flat Panel Display	Samsung	QM85C	$0.00	2
2	Articulating Wall Mount for Flat Panel Display	Chief	TS525TU	$0.00	2
3	Display Backbox - Mount Recessed	Chief	TA500	$0.00	2
	Video Equipment				
1	HDMI TX - 4K- [At Instructors station]	Crestron	DM-TX-4KZ-100-C-1G-B-	$0.00	1
2	HDBT - Video Matrix, Control Processor & Amplifier	Crestron	DMPS3-4K-350-C	$0.00	1
3	HDBT - Receiver / scaler	Crestron	DM-RMC-4KZ-SCALER-	$0.00	2
4	Wireless Presentation Appliance	Crestron	AM-3000-WF	$0.00	1
	Audio Equipment				
1	Audio Amplifier	Crestron	AMP-X300	$0.00	1
2	Loudspeaker - Recessed 8"	Crestron	Saros IC8T-W-T	$0.00	8
	Control				
1	10" Control Touchpanel [Wall]	Crestron	TSW-1070-B-S	$0.00	1
	Miscellaneous				
1	Audiovisual Equipment Rack - Millwork	Lagrand	CFR-14-18	$0.00	1
2	Audiovisual Equipment Rack - Cooling fan	procool	SP480X	$0.00	1
3	Power Conditioning / Distribution	By AV Contractor	As Required	$0.00	1
4	Allowance for items including but not limited to Field Cables/ Interconnecting Wiring/ Patch Cables/ Connectors/ Converters/ Adapters/ POE Injectors/ Accessories/ Mounting Hardware/ and Miscellaneous.	By AV Contractor	Custom	$0.00	1
5	Table Top Cable Hatch - Flip Top	Crestron	FT2-202-PTL	$0.00	1
6	Table Top Cable Hatch - HDMI Pass-Through	Crestron	HDMI Pass Through	$0.00	1
7	Table Top Cable Hatch - CAT6 Pass-Through	Crestron	CAT6 Pass Through	$0.00	1

3

Montclair State University
Interdisciplinary Science Building
1Quad Road

Applies to Room(s):
345, 380

Advanced & Introduction Teaching Lab

AV EQUIPMENT LIST

Item	Description	Manufacturer	Model	Unit Cost	Qty.
	Display Device				
1	109" 16:10 Motorized Projection Screen	Da-Lite	70095	$0.00	1
2	8000 Lumen Video Projector 4K	Epson	EB-PU1007	$0.00	1
3	Projector Mount	Chief	RPAU	$0.00	1
4	Projector Mount - Ceiling Plate	Chief	CMA330	$0.00	1
5	Projector Mount - Pole Sized By AV Contractor	AV Contractor	Pole	$0.00	1
	Video Equipment				
1	HDMI TX - 4K- [Wall]	Crestron	DM-TX-4KZ-100-C-1G-B-	$0.00	1
2	**HDMI TX - 4K- [At Instructors Desk Supporting PC(OFE)]**	**Crestron**	**DM-TX-4KZ-100-C-1G-B-**	**$0.00**	**1**
3	**HDMI TX - 4K- [At Instructors Desk Supporting Doc Cam & Laptop]**	**Crestron**	**DM-TX-4KZ-302-C**	**$0.00**	**1**
4	HDBT - Video Matrix, Control Processor & Amplifier	Crestron	DMPS3-4K-350-C	$0.00	1
5	HDBT - Receiver / scaler	Crestron	DM-RMC-4KZ-SCALER-C	$0.00	**2**
6	Wireless Presentation Appliance	Crestron	AM-3000-WF	$0.00	1
7	PC (OFE)	OFE	OFE	$0.00	1
8	**Document Camera**	**WolfVision**	**VZ-2.UHD**	**$0.00**	**1**
	Audio Equipment				
1	Loudspeaker - Surface mount 6"	Crestron	Saros SMT6T-AW	$0.00	2
	Control				
1	10" Control Touchpanel [Tabletop]	Crestron	TS-1070-B-S	$0.00	1
2	10" Control Touchpanel [Wall]	Crestron	TSW-1070-B-S	$0.00	1
	Miscellaneous				
1	Audiovisual Equipment Rack - Millwork	Lagrand	CFR-14-18	$0.00	1
2	Audiovisual Equipment Rack - Cooling fan	procool	SP480X	$0.00	1
3	Power Conditioning / Distribution	By AV Contractor	As Required	$0.00	1
4	Allowance for items including but not limited to Field Cables/ Interconnecting Wiring/ Patch Cables/ Connectors/ Converters/ Adapters/ POE Injectors/ Accessories/ Mounting Hardware/ and Miscellaneous.	By AV Contractor	Custom	$0.00	1
5	Table Top Cable Hatch - Flip Top	Crestron	FT2-202-PTL	$0.00	1
6	Table Top Cable Hatch - HDMI Pass-Through	Crestron	HDMI Pass Through	$0.00	2

Montclair State University
Interdisciplinary Science Building
1Quad Road

Applies to Room(s):
370

Demonstration Room

AV EQUIPMENT LIST

Item	Description	Manufacturer	Model	Unit Cost	Qty.
	Display Device				
1	109" 16:10 Motorized Projection Screen	Da-Lite	70095	$0.00	1
2	8000 Lumen Video Projector 4K	Epson	EB-PU1007	$0.00	1
3	Projector Mount	Chief	RPAU	$0.00	1
4	Projector Mount - Ceiling Plate	Chief	CMA330	$0.00	1
5	Projector Mount - Pole Sized By AV Contractor	AV Contractor	Pole	$0.00	1
	Video Equipment				
1	HDMI TX - 4K- [At Instructors Desk]	Crestron	DM-TX-4KZ-100-C-1G-B-	$0.00	3
2	HDBT - Video Matrix, Control Processor & Amplifier	Crestron	DMPS3-4K-350-C	$0.00	1
3	HDBT - Receiver / scaler	Crestron	DM-RMC-4KZ-SCALER-	$0.00	2
4	Wireless Presentation Appliance	Crestron	AM-3000-WF	$0.00	1
5	PC (OFE)	OFE	OFE	$0.00	1
6	**Document Camera**	**WolfVision**	**VZ-2.UHD**	**$0.00**	**1**
	Audio Equipment				
1	Audio DSP	QSC	Core 110F	$0.00	1
2	Audio Amplifier	Crestron	AMP-X300	$0.00	1
3	Audio I/O - [at instructor desk]	QSC	QIO-ML4i	$0.00	1
4	Loudspeaker - Recessed 8"	Crestron	Saros IC8T-W-T	$0.00	12
5	Microphone - Beamforming	Shure	MXA920	$0.00	**4**
6	Microphone - Desktop Gooseneck	Shure	MX412D/C	$0.00	1
7	Wireless Microphone - Receiver 2ch	Shure	ULXD4D	$0.00	1
8	Wireless Microphone - Antenna	Shure	UA864us	$0.00	2
9	Wireless Microphone - Transmitter - Body Pack	Shure	ULXD1	$0.00	2
10	Wireless Microphone - Lavalier	Shure	WL185m	$0.00	2
11	Wireless Microphone - Battery	Shure	SB900B	$0.00	4
12	Wireless Microphone - Battery Charger	Shure	SBC200US	$0.00	1
13	Assistive Listening System	Listen Technology	LS53-072	$0.00	1
	Video Conference Equipment				
1	PTZ Camera / Tracking	QSC	NC-12x80	$0.00	2
2	USB I/O	QSC	I/O-USB Bridge	$0.00	2
	Control				
1	10" Control Touchpanel [Tabletop]	Crestron	TS-1070-B-S	$0.00	1
2	10" Control Touchpanel [Wall Mount]	Crestron	TSW-1070-B-S	$0.00	1
	Miscellaneous				
1	Audiovisual Network Switch	As Required	As Required	$0.00	1
2	Audiovisual Equipment Rack - Full Height	Lagrand	BRG-4127LRD	$0.00	1
3	Audiovisual Equipment Rack - Caster Base	Lagrand	CBS-BRG	$0.00	1
4	Power Conditioning / Distribution	By AV Contractor	As Required	$0.00	1
5	Allowance for items including but not limited to Field Cables/ Interconnecting Wiring/ Patch Cables/ Connectors/ Converters/ Adapters/ POE Injectors/ Accessories/ Mounting Hardware/ and Miscellaneous.	By AV Contractor	Custom	$0.00	1
6	Table Top Cable Hatch - Flip Top	Crestron	FT2-202-PTL	$0.00	1
7	Table Top Cable Hatch - HDMI Pass-Through	Crestron	HDMI Pass Through	$0.00	2
8	Table Top Cable Hatch - USB Pass-Through	Crestron	USB Pass Through	$0.00	1
9	Table Top Cable Hatch - CAT6 Pass-Through	Crestron	CAT6 Pass Through	$0.00	1

Montclair State University
Interdisciplinary Science Building
1Quad Road

Applies to Room(s): 170

Collab Lounge

AV EQUIPMENT LIST

Item	Description	Manufacturer	Model	Unit Cost	Qty.	Ext. Cost
	Display Device					
1	98" 4K LED Backlit Flat Panel Display	Samsung	QM98C	$0.00	1	$0.00
2	Articulating Wall Mount for Flat Panel Display	Chief	TS525TU	$0.00	1	$0.00
3	Display Backbox - Mount Recessed	Chief	TA500	$0.00	1	$0.00
	Video Equipment					
1	Qsys Video Endpoint Encode/Decoder [Behind Display]	QSC	NV-21-HU	$0.00	1	$0.00
2	Qsys HDMI Wall Input	QSC	NV-1-H-WE	$0.00	1	$0.00
	Audio Equipment					
1	Loudspeaker - Pendant [sold as pair]	Extron	SF-3PT	$0.00	2	$0.00
	Control					
1	10" Control Touchpanel [Wall]	Crestron	TSW-1070-B-S	$0.00	1	$0.00
	Miscellaneous					
1	Allowance for items including but not limited to Field Cables/ Interconnecting Wiring/ Patch Cables/ Connectors/ Converters/ Adapters/ POE Injectors/ Accessories/ Mounting Hardware/ and Miscellaneous.	By AV Contractor	Custom	$0.00	1	$0.00

Montclair State University
Interdisciplinary Science Building
1Quad Road

Applies to Room(s):
120

Event & Pre-Function

AV EQUIPMENT LIST

Item	Description	Manufacturer	Model	Unit Cost	Qty.
	Display Device				
1	137" 16:10 Motorized Projection Screen	Da-Lite	21772	$0.00	2
2	16000 Lumen Video Projector 4K	Epson	EB-PU2216	$0.00	2
3	Projector Mount	Chief	VCTUW	$0.00	2
4	Projector Mount - Ceiling Plate	Chief	CMA330	$0.00	2
5	Projector Mount - Pole Sized By AV Contractor	AV Contractor	Pole	$0.00	2
	Video Equipment				
1	Qsys Video Endpoint Encode/Decoder [at Projector]	QSC	NV-21-HU	$0.00	2
2	Qsys Video Endpoint Encode/Decoder	QSC	NV-32-H	$0.00	6
3	Qsys HDMI Wall Input	QSC	NV-1-H-WE	$0.00	3
4	Wireless Presentation Appliance	Crestron	AM-3000-WF	$0.00	3
5	PC (OFE)	OFE	OFE	$0.00	3
6	**Document Camera**	**WolfVision**	**VZ-2.UHD**	**$0.00**	**2**
	Audio Equipment				
1	Audio DSP	QSC	Core 110F	$0.00	1
2	Audio I/O - [at podium]	QSC	QIO-ML4i	$0.00	2
3	Amplifier - 4 Channel	QSC	CX-Q 4k8	$0.00	1
4	Loudspeaker - Recessed 8"	Crestron	Saros IC8T-W-T	$0.00	12
5	Loudspeaker - Pendant [sold as pair] - [Pre-Function]	Extron	SF-3PT	$0.00	10
6	Microphone - Beamforming	Shure	MXA920	$0.00	8
7	Microphone - Desktop Gooseneck [at podium]	Shure	MX412D/C	$0.00	2
8	Wireless Microphone - Receiver 4ch	Shure	ULXD4Q	$0.00	2
9	Wireless Microphone - Antenna	Shure	UA864us	$0.00	4
10	Wireless Microphone - Antenna Splitter	Shure	UA221	$0.00	2
11	Wireless Microphone - Antenna Distribution	Shure	UA844+	$0.00	1
12	Wireless Microphone - Transmitter - Body Pack	Shure	ULXD1	$0.00	4
13	Wireless Microphone - Lavalier	Shure	WL185m	$0.00	4
14	Wireless Microphone - Handheld	Shure	ULXD2/SM58	$0.00	4
15	Wireless Microphone - Battery	Shure	SB900B	$0.00	8
16	Wireless Microphone - Battery Charger	Shure	SBC200US	$0.00	4
17	Assistive Listening System	Listen Technology	LS53-072	$0.00	2
	Video Conference Equipment				
1	PTZ Camera / Tracking	QSC	NC-12x80	$0.00	4
2	USB I/O	QSC	I/O-USB Bridge	$0.00	2
	Control				
1	Control Processor	Crestron	CP4N	$0.00	1
2	10" Control Touchpanel [at podium]	Crestron	TS-1070-B-S	$0.00	2
3	10" Control Touchpanel [Wall]	Crestron	TSW-1070-B-S	$0.00	3
4	Room Partition Sensor	Crestron	CLS-PART-CN	$0.00	1
	Miscellaneous				
1	Audiovisual Network Switch	As Required	As Required	$0.00	1
2	Audiovisual Equipment Rack - Full Height	Lagrand	BRG-4127LRD	$0.00	2
3	Audiovisual Equipment Rack - Caster Base	Lagrand	CBS-BRG	$0.00	2
4	Power Conditioning / Distribution	By AV Contractor	As Required	$0.00	1
5	Allowance for items including but not limited to Field Cables/ Interconnecting Wiring/ Patch Cables/ Connectors/ Converters/ Adapters/ POE Injectors/ Accessories/ Mounting Hardware/ and Miscellaneous.	By AV Contractor	Custom	$0.00	1

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MONTCLAIR
STATE UNIVERSITY

Project

Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For

Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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In Association with

Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

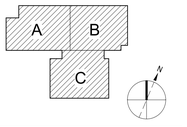
Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/Security
152 Huron Ave
Clifton, NJ 07013

Key Plan



Professional Seals

NOT FOR CONSTRUCTION

No.	Description	Date
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No. 24.07023.00

Sheet Title

AUDIOVISUAL EQUIPMENT LIST

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

TA-801

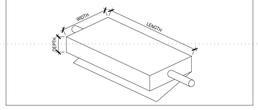
SECURITY DRAWING INDEX

Sheet Number	Sheet Title
T-001	DRAWING INDEX & GENERAL NOTES
T-004	SITE PLAN
T-101	1ST FLOOR DATA PLAN
T-102	2ND FLOOR DATA PLAN
T-103	3RD FLOOR DATA PLAN
T-104	4TH FLOOR DATA PLAN
T-10P	PENTHOUSE DATA PLAN
T-10R	ROOF DATA PLAN
T-201	1ST FLOOR RCP
T-202	2ND FLOOR RCP
T-203	3RD FLOOR RCP
T-204	4TH FLOOR RCP
T-20P	PENTHOUSE SECURITY RCP PLAN
T-300	CONDUIT & SLEEVES TELECOM RISER
T-400	MDF & IDF LAYOUT & ELEVATIONS
T-500	TELECOM SCHEDULES
T-501	TELECOM SCHEDULES
T-600	TELECOM DETAILS
T-601	TELECOM GROUNDING DETAIL
T-602	TELECOM LABELING DETAIL
T-700	MODULAR EVENT SPACE PLAN
T-701	MODULAR IMAGINARIUM PLAN
T-702	MODULAR FLOOR DETAILS

3

PULL BOX SIZING CHART

CONDUIT TRADE SIZE mm (in)	WIDTH mm (in)	LENGTH mm (in)	DEPTH mm (in)	WIDTH INCREASE FOR ADDITIONAL CONDUIT mm (in)	DEPTH INCREASE EACH ADDITIONAL CONDUIT mm (in)
27 (1)	101 (4)	406 (16)	76 (3)	51 (2)	76 (3)
35 (1-1/4)	152 (6)	508 (20)	76 (3)	76 (3)	76 (3)
41 (1-1/2)	203 (8)	686 (27)	101 (4)	101 (4)	101 (4)
50 (2)	203 (8)	914 (36)	101 (4)	127 (5)	101 (4)
63 (2-1/2)	254 (10)	1067 (42)	127 (5)	152 (6)	127 (5)
78 (3)	305 (12)	1220 (48)	127 (5)	152 (6)	127 (5)
91 (3-1/2)	305 (12)	1370 (54)	152 (6)	152 (6)	152 (6)
100 (4)	381 (15)	1525 (60)	203 (8)	203 (8)	203 (8)



CROSS-CONNECTING AND PATCHING SCOPE OF WORK NOTES

1. PATCH CORDS SHALL BE OF THE SAME CABLE QUALITY AND MANUFACTURED BY THE SAME MANUFACTURER AS THE CABLE TO WHICH THEY ARE CONNECTING. LENGTHS SHALL BE DETERMINED FROM PATCHING SCHEDULES PROVIDED BY THE OWNER. FOR BIDDING PURPOSES, THE FOLLOWING SHALL BE CONSIDERED:

   4' - 35%
   6' - 35%
   10' - 25%
   15' - 5%

2. WORKSTATION UNSHIELDED CAT 6 U/UTP PATCH CORDS SHALL HAVE THE FOLLOWING BREAKDOWN:

   6' - 5%
   10' - 15%
   20' - 80%

3. CATEGORY 6A PATCH CORDS SHALL BE PROVIDED IN THE MDF ROOM, EACH IDF ROOM, AND EACH SERVICE ENTRANCE ROOM WHERE REQUIRED, AND SHALL BE FACTORY MANUFACTURED BY THE SAME MANUFACTURER AS THE CABLE IT CONNECTS AND CERTIFIED TO COMPLY WITH CATEGORY 6AA UNSHIELDED SPECIFICATIONS.
4. OPTICAL FIBER DUPLEX 1.6MM PATCH CORDS SHALL BE PROVIDED IN THE MDF ROOM, EACH IDF ROOM, AND EACH SERVICE ENTRANCE ROOM WHERE REQUIRED.
5. PROPER ORIENTATION OF THE LC DUPLEX CONNECTORS AND PATCH CORDS SHALL BE PROVIDED TO ENSURE POLARITY REQUIREMENTS ARE FOLLOWED.
6. ALL CROSS-CONNECTING SHALL BE PERFORMED FROM LEFT TO RIGHT, TOP TO BOTTOM, STARTING IN THE UPPER LEFT HAND CORNER OF THE TERMINATION BLOCK FOR ALL 110-TYPE TERMINATION BLOCKS.
7. PATCH PANEL PATCHING SHALL BE PERFORMED STARTING FROM PATCH PANEL OR EQUIPMENT PORT NUMBER ONE AND CONTINUING IN CONSECUTIVE ORDER TO THE MAXIMUM EXTENT POSSIBLE.
8. CROSS-CONNECTS AND PATCHING CONNECTION RECORDS SHALL BE PROVIDED BY THE CONTRACTOR AS SPECIFIED ELSEWHERE.
9. ALL CROSS-CONNECTS AND PATCHING SHALL BE NEATLY DRESSED AND TIED USING COLOR CODED VELCRO CABLE TIES.

QUANTITIES:

IDF ROOMS/CLOSETS:
OPTICAL FIBER - 8 (SM)
CAT 6 - 1 TIME THE NUMBER OF WORKSTATIONS FOR IDF & 1 TIME THE NUMBER OF WORKSTATIONS AT WORKSTATION, CONTRACTOR TO PROVIDE ADDITIONAL 100 CAT6 PATCH CORDS.

PMO IT ROOM:
OPTICAL FIBER (SM) - 8 TIMES NUMBER OF IDF'S.
CAT 6 - 1 TIME THE NUMBER OF WORKSTATIONS FED FROM MDF & 1 TIMES THE NUMBER OF WORKSTATIONS AT WORKSTATION

10. AS PART OF BASE CONTRACT THE TELECOMM CONTRACTOR SHALL INSTALL 2 COPPER PATCH CORDS FOR EVERY TYPICAL 2 PORT OUTLET WIITHIN ALL IDF ROOMS. AT THE WORKSTATION END THE CONTRACTOR SHALL FURNISH THE CORDS AND TURN THEM OVER TO THE OWNER.

WORK NOTES FOR TELECOMMUNICATIONS WALLFIELDS

1. PLYWOOD BACKBOARDS (BY THE GENERAL CONTRACTOR) SHALL BE PROVIDED ON THE B-MDF, B-POE, AND IDF ROOM PERIMETER WALLS, UNLESS OTHERWISE NOTED. REFER TO THE B-MDF, B-POE, AND IDF ROOM PART PLANS FOR ADDITIONAL INFORMATION.
2. PLYWOOD BACKBOARDS WITHIN THE TELECOM SPACES (B-MDF, B-POE, AND IDF ROOMS) SHALL BE 4'(W) X 8'(H) X 3/4"(D) AND GRADED A-C WITH "A" SIDE FACING OUT. PLYWOOD BACKBOARDS SHALL BE FIRE-RATED WOOD OR PAINTED WITH (2) COATS OF WHITE FIRE RETARDANT PAINT.
3. TELECOM OUTLETS AND ELECTRICAL RECEPTACLES WITHIN THE TELECOM SPACES SHALL BE FLUSH OR SURFACE MOUNTED TO THE PLYWOOD BACKBOARDS AND INSTALLED USING THE APPROPRIATE BACK BOXES.

JUNCTION BOX AND CONDUIT NOTES

1. ALL PULL BOXES, JUNCTION BOXES, AND CONDUITS SHALL BE PROVIDED BY THE ELECTRICAL CONTRACTOR.
2. A PULL BOX SHALL BE PROVIDED WHERE AN AGGREGATE OF CONDUIT RUN BENDS IS EQUAL TO 180° (MAXIMUM).
3. A PULL BOX SHALL BE PROVIDED EVERY 100 FT (MAXIMUM) FOR CONTINUOUS CONDUIT RUNS.
4. JUNCTION BOXES FOR TELECOMMUNICATIONS CABLING SHALL HAVE TAMPER PROOF SCREWS.
5. PROVIDE PULL BOXES FOR ALL VERTICAL AND HORIZONTAL RISER CONDUITS, REGARDLESS OF THE INDICATION OF THE DRAWINGS. ON ANY EXPRESS VERTICAL CONDUIT RUN, ONE PULL BOX SHALL BE PROVIDED EVERY THREE FLOORS.
6. PULL BOX AND JUNCTION BOX SIZES SHOWN ON THE DESIGN DRAWINGS ARE FOR COORDINATION PURPOSES ONLY. THE CONTRACTOR SHALL SIZE ALL PULL BOXES AND JUNCTION BOXES IN ACCORDANCE WITH FIELD CONDITIONS AND APPROVED STANDARDS (SEE ANSI/EIA/TIA-569B SECTION 8.8.2.5 GUIDELINES).
7. PROVIDE ALL REQUIRED JUNCTION AND PULL BOXES NECESSARY, REGARDLESS OF THE INDICATIONS ON THE DRAWINGS.
8. ALL CONDUIT RUNS SHOULD ACHIEVE THE BEST POSSIBLE DIRECT ROUTE BETWEEN END POINTS WITH NO BEND GREATER THAN 90°.
9. THE BEND RADIUS FOR TELECOMMUNICATIONS CONDUITS OF 2" OR LESS IN DIAMETER SHALL BE 6 TIMES (MINIMUM) THE OUTSIDE DIAMETER OF THE CONDUIT.
10. THE BEND RADIUS FOR TELECOMMUNICATIONS CONDUITS IN EXCESS OF 2" IN DIAMETER SHALL BE 10 TIMES (MINIMUM) THE OUTSIDE DIAMETER OF THE CONDUIT.
11. ALL EMPTY CONDUITS SHALL BE PROVIDED WITH A MINIMUM OF (2) PULL CORDS WITH A MINIMUM TEST RATING OF 200LB AND FITTED WITH BUSHED ENDS.
12. UNUSED CONDUITS SHALL BE CAPPED FOR FUTURE USE.
13. EACH PULL BOX/JUNCTION BOX USED FOR TELECOMMUNICATIONS WIRING SHALL BE CLEARLY IDENTIFIED ON THE OUTSIDE AS PER EIA/TIA-606 STANDARDS USING PULL BOX PLATES WITH 1" HIGH LETTERS. IN ADDITION THE EACH PULL BOX SHALL HAVE A P-TOUCH LABEL USING 1" HIGH LETTERS DESIGNATING THE CONDUIT BANK FUNCTION, END POINT, AND START POINT. THE FOLLOWING NOMENCLATURE SHALL BE USED:
14. IDENTIFY INDIVIDUALLY EACH CONDUIT FOR TELECOMMUNICATIONS WIRING WITHIN EACH TELECOM SPACE THAT REPRESENTS A STARTING POINT OR END POINT FOR A CONDUIT BANK. THE CONDUITS SHALL BE IDENTIFIED IN A GRID METHOD - ROWS AND COLUMNS. USE P-TOUCH LABELS USING 1" HIGH LETTERS DESIGNATING THE CONDUIT GRID IDENTIFICATIONS DESCRIBED BELOW.
15. EACH CONDUIT BANK EXITING OR ENTERING A TELECOM SPACE (B-MDF, B-POE, IDF ROOM) SHALL BE LABELLED. THE LABEL SHALL BE ATTACHED TO THE WALL BELOW THE CONDUIT BANK AND SHALL USE 1" HIGH LETTERS. THE NOMENCLATURE USED TO IDENTIFY THE CONDUITS SHALL INCLUDE THE FUNCTION DESIGNATION, START POINT, AND END POINT.
16. EACH SLEEVE SHALL BE LABELLED AS INDICATED BELOW.
17. ALL RACEWAY AND CONDUIT WORK IS GOVERNED BY THE ELECTRICAL SPECIFICATIONS. REFER TO THE ELECTRICAL CONSULTANT SPECIFICATIONS FOR ADDITIONAL INFORMATION.

FIRESTOPPING

1. FIRESTOP SYSTEMS SHALL BE PROVIDED FOR ALL THROUGH PENETRATIONS OF TELECOMMUNICATIONS CABLING, CONDUIT, SLEEVES, CABLE TRAYS, ETC., THROUGH FIRE-RATED WALLS AND FLOORS AND OTHER FIRE-RATED PARTITIONS. FIRESTOP SYSTEMS SHALL CONSIST OF MECHANICAL OR NON-MECHANICAL MATERIALS, OR COMBINATION OF MATERIALS, INSTALLED TO RETAIN THE INTEGRITY OF FIRE RESISTANCE RATED CONSTRUCTION BARRIERS.
2. FIRE-STOPPING SYSTEMS AND SOLUTIONS SHALL BE IN ACCORDANCE WITH NFPA 70: NATIONAL ELECTRIC CODE 2005 ARTICLES AND THE AUTHORITY HAVING JURISDICTION (AHJ).
3. WHERE NON-MECHANICAL FIRESTOP SYSTEMS ARE UTILIZED, CONTRACTOR TO PROVIDE PRODUCTS THAT UPON CURING DO NO RE-EMULSIFY, DISSOLVE, BREAKDOWN OR OTHERWISE DETERIORATE OVER TIME FROM EXPOSURE TO ATMOSPHERIC MOISTURE, SWEATING PIPES, PONDING WATER, OR OTHER FORMS OF MOISTURE CHARACTERISTIC DURING OR AFTER CONSTRUCTION.
4. OPENINGS FOR CABLE TRAYS/LADDER RACKS SHALL BE SEALED USING RE-ENTERABLE INTUMESCENT FIRESTOPPING PILLOWS.
5. PROVIDE ONLY FIRESTOPPING PRODUCTS THAT HAVE BEEN TESTED FOR SPECIFIC FIRE RESISTANCE RATED CONSTRUCTION CONDITIONS CONFORMING TO CONSTRUCTION ASSEMBLY TYPE, PENETRATING ITEM TYPE, ANNULAR SPACE REQUIREMENTS, AND FIRE RATING INVOLVED FOR EACH SEPARATE INSTANCE.
6. UPON COMPLETION OF THE PROJECT, THE CONTRACTOR SHALL CERTIFY THAT ALL THROUGH PENETRATIONS FOR COMMUNICATIONS CABLING HAVE BEEN SATISFACTORILY SEALED AND FIRE-STOPPED.

WIRELESS ACCESS POINT/ACCESS PANEL NOTES

1. TELECOMM. CONTRACTOR TO FURNISH ACCESS PANEL AT ALL WIRELESS ACCESS POINT OUTLETS LOCATED IN INACCESSIBLE CEILING LOCATIONS. TELECOMM. CONTRACTOR TO VERIYFY CEILING CONSTRUCTION IN LOBBY, ALL CONFERENCE ROOMS, TRAINING ROOMS, VIS ROOMS, MEETING ROOMS, COLLABORATION ROOMS, ROOMS, ETC. GC WILL INSTALL PANELS. ALL PANEL LOCATIONS TO BE COORDINATED WITH ARCH.
2. FOR ALL OUTLETS DESIGNATED FOR WAP's, TELECOMM. CONTRACTOR TO PROVIDE ADDITIONAL 10 FEET SERVICE LOOP, COILED AND SECURED ADJACENT TO CEILING MOUNTED OUTLET BOX (OUTLET END ONLY). EXCESS CABLE SLACK SHALL BE USED FOR WAP ADJUSTMENTS BASED ON RF SIGNAL SURVEY.

TELECOMMUNICATIONS HORIZONTAL CABLING AND OUTLET NOTES

1. ALL LOCATIONS IDENTIFIED ON THE FLOOR PLANS WITH A TELECOMMUNICATIONS OUTLET IDENTIFICATION TAG SHALL BE PROVIDED WITH THE APPROPRIATE CABLING AS INDICATED BELOW.
2. ALL LOCATIONS IDENTIFIED ON THE FLOOR PLANS WITH A TELECOMMUNICATIONS SYMBOL SHALL BE PROVIDED WITH THE APPROPRIATE CABLING AS INDICATED BELOW (EVEN IF NO OUTLET TAG HAS BEEN PROVIDED).
3. ALL HORIZONTAL CABLING SHALL ORIGINATE AND TERMINATE ON THE SAME FLOOR, UNLESS OTHERWISE NOTED.
4. HORIZONTAL CABLING THAT ROUTES EXPOSED OVERHEAD, THAT ROUTES WITHOUT CABLE TRAY SUPPORT, OR THAT BRANCHES OFF OF CABLE TRAY AND/OR KINDORF FRAMING SHALL BE SUPPORTED USING J-HOOKS SECURED ON CEILING SUPPORT HANGERS NO MORE THAN 5 FEET APART TO ELIMINATE CABLE STRESS. MAXIMUM CABLE SAG BETWEEN J-HOOK SUPPORTS SHALL NOT EXCEED 12". BUNDLES SHALL NOT EXCEED 3" IN DIAMETER, AND SHALL BE TIE WRAPPED NO MORE THAN 6 FEET ON CENTER.
5. REFER TO TELECOM SYMBOL LIST FOR BACK BOX REQUIREMENTS FOR ALL TELECOMMUNICATIONS OUTLETS. IF A BACK BOX IS SHARED BETWEEN THE ELECTRICAL AND TELECOM TRADES, THEN A DIVIDER SHALL BE PROVIDED BETWEEN THE ELECTRICAL AND TELECOM SECTIONS OF THE BOX. TWO GANGS SHALL BE RESERVED FOR TELECOM USE WITHIN THE COMMON ELEC/TELECOM BACK BOX.
6. REGARDLESS OF THE INDICATIONS ON THE DRAWINGS, THE CONTRACTOR SHALL PROVIDE ONE WALL MOUNTED TELEPHONE OUTLET FOR EACH MAIN ELECTRICAL, MECHANICAL, AND TELECOMMUNICATIONS SPACE (SER, MDF ROOM, IDF ROOM). THE SECONDARY ELECTRICAL AND MECHANICAL ROOMS DO NOT REQUIRE WALL PHONE OUTLETS. THE CABLING SHALL BE RUN TO THE NEAREST HORIZONTAL DISTRIBUTION POINT SERVING THAT PARTICULAR FLOOR.
7. REGARDLESS OF THE INDICATIONS ON THE DRAWINGS, THE CONTRACTOR SHALL PROVIDE (1) TYPICAL WALL MOUNTED TELECOMM. OUTLET FOR EACH ELEVATOR MACHINE ROOM (EMR). IN ADDITION, ONE OUTLET SHALL BE PROVIDED FOR EACH ELEVATOR SERVED BY THAT PARTICULAR EMR. THE CABLING SHALL RUN TO THE CLOSEST HORIZONTAL DISTRIBUTION POINT SERVING THAT PARTICULAR FLOOR.
8. EXACT LOCATION OF FLOOR BOXES TO BE COORDINATED BY TELECOMM CONTRACTOR WITH FURNITURE LAYOUT AND VERIFIED IN FIELD. SEE ELECTRICAL DRAWINGS FOR SPECIFICATIONS OF FLOOR BOXES AND MORE INFORMATION.
9. REFER TO TELECOMMUNICATIONS OUTLET DETAILS FOR FACEPLATE DETAILS, JACK POSITION ASSIGNMENTS, AND MORE INFORMATION.
10. FOR ALL LOCATIONS IDENTIFIED ON THE FLOOR PLANS WITH AN AREA OF REFUGE COMMUNICATIONS DEVICE THE CONTRACTOR SHALL PROVIDE CABLING AND WALL MOUNTED 2-WAY COMMUNICATIONS PHONE. SEE THE SPEC SECTIONS FOR MORE INFORMATION.

GENERAL NOTES:

1. THESE CONTRACT DRAWINGS ARE SCHEMATIC AND DEPICT THE GENERAL LOCATION OF THE TELECOM SYSTEM COMPONENTS.
2. INTEGRATOR SHALL EXAMINE THE CONTRACT DOCUMENTS, FAMILIARIZE THEMSELVES WITH ALL REQUIREMENTS OF THE PROJECT AND NOTIFY THE CONTRACTING OFFICER OF ANY CONFLICTS.
3. THE INTEGRATOR SHALL COORDINATE TELECOM WORK WITH DIFFERENT TRADES TO MINIMIZE CONFLICTS BETWEEN ALL TRADES.
4. IN THE EVENT THAT UNAVOIDABLE INTERFERENCES DEVELOP, THE ARCHITECT / ENGINEER WILL DECIDE WHICH EQUIPMENT SHALL BE RELOCATED REGARDLESS OF WHICH WAS FIRST INSTALLED AND MODIFICATIONS WILL BE MADE WITHOUT ADDITIONAL EXPENSE TO OWNER. ARCHITECTURAL MODIFICATIONS MAY BE ONGOING, LAYOUT MODIFICATIONS TO ADAPT TO THE LATEST ARCHITECTURAL MODIFICATIONS SHOULD BE EXPECTED. IN GENERAL, IN THESE CASES MECHANICAL AND ELECTRICAL COORDINATION WILL BE EXPECTED THROUGH LAYOUT MODIFICATIONS BY THE INTEGRATORS.
5. ALL COORDINATED LAYOUTS MUST BE SUBMITTED AND ALL CONFLICTS SHALL BE RESOLVED PRIOR TO INSTALLATION. PIPING, DUCTS, ETC., SHALL BE KEPT AS CLOSE AS POSSIBLE TO CEILINGS, WALLS, COLUMNS, ETC., IN ORDER TO TAKE UP THE MINIMUM AMOUNT OF SPACE.
6. ALL WORK ON THIS PROJECT SHALL BE INSTALLED IN ACCORDANCE WITH APPLICABLE CODES AND REGULATIONS ADOPTED BY THAT STATE, (BOARD OF BUILDING REGULATIONS AND STANDARDS) AND LOCAL COUNTY AUTHORITY HAVING JURISDICTION.
7. INTEGRATOR SHALL PERFORM ALL WORK IN A NEAT, ORDERLY AND PROFESSIONAL MANNER, WITHOUT DISRUPTION TO THE WORK OF OTHER INTEGRATORS. INTEGRATOR SHALL FOLLOW OWNER'S AND ARCHITECT / ENGINEER'S SAFETY RULES AND THOROUGHLY CLEAN THEIR WORK AREA DAILY. ALL DEBRIS SHALL BE REMOVED FROM THE BUILDING AND GROUNDS. INTEGRATOR SHALL ALSO REMOVE ALL TRASH AFTER COMPLETION OF WORK.
8. BEFORE COMMENCEMENT OF WORK THE INTEGRATOR SHALL VERIFY ALL PERMITS REQUIRED FOR WORK .
9. INTEGRATOR SHALL VERIFY ALL VOLTAGE AND POWER REQUIREMENTS AND COORDINATE WITH ELECTRICAL INTEGRATOR AS REQUIRED.
10. ALL SYSTEMS SHALL BE CLEAN OF FOREIGN MATERIAL AND ROUGH (I.E. METAL BURRS) SPOTS PRIOR TO BEING PLACED IN SERVICE AND BEFORE OPERATIONAL TESTS ARE PERFORMED.
11. INTEGRATOR SHALL BE RESPONSIBLE FOR INSPECTION OF JOB CONDITIONS AFFECTING THE INSTALLATION OF AN ITEM AND FOR TAKING ALL FIELD MEASUREMENTS PRIOR TO THE FABRICATION OR PURCHASE OF THE ITEM. INSTALLED EQUIPMENT TO INTEGRATE PROPERLY WITH ALL ADJACENT MATERIALS AND WILL FIT ALL OTHER CONDITIONS AS THEY EXIST OR WILL EXIST IN THE FINISHED BUILDING. SLEEVES, ANCHORS AND OTHER ITEMS THAT MUST BE EMBEDDED IN OR OTHERWISE AFFECT OTHER PORTIONS OF THE WORK SHALL BE LOCATED AND SET WHILE SUCH PORTIONS OF THE WORK ARE IN PROGRESS.
12. THE INTEGRATOR IS RESPONSIBLE FOR RECEIVING AND SETTING IN PLACE DESIGNATED EQUIPMENT IN ACCORDANCE WITH SPECIFICATIONS AND SHOP DRAWINGS.
13. UNLESS OTHERWISE SPECIFICALLY MENTIONED, ALL ANCHORS, BOLTS, SCREWS, FITTINGS, FILLER, HARDWARE, ACCESSORIES, TRIM AND OTHER PARTS REQUIRED FOR, OR IN CONNECTION WITH, AN ITEM OR MATERIAL TO MAKE A COMPLETE, SERVICEABLE, FINISHED AND FIRST QUALITY INSTALLATION SHALL BE FURNISHED AND INSTALLED AS PART OF THE ITEM OR MATERIAL, WHETHER CALLED FOR OR NOT.
14. MANUFACTURED ITEMS/EQUIPMENT SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S PRINTED DIRECTIONS, SPECIFICATIONS AND/OR WRITTEN RECOMMENDATIONS FOR AN INSTALLATION OF HIGHEST QUALITY. ALL WORKING PARTS SHALL BE PROPERLY ADJUSTED AFTER INSTALLATION AND LEFT IN PERFECT WORKING ORDER. ITEMS IN ALL CASES SHALL BE INSTALLED PLUMB, TRUE AND IN PROPER RELATIONSHIP TO SURROUNDING MATERIALS.
15. NO COMBUSTIBLE MATERIALS WILL BE PERMITTED IN RAISED FLOORS, CEILING PLENUMS AND INTERSTITIAL SPACE.
16. ALL DIMENSIONS INDICATED ON THESE DRAWINGS SHALL BE IN INCHES UNLESS OTHERWISE NOTED, AND SHALL BE "INSIDE CLEAR" DIMENSIONS.
17. ALL ELECTRICAL WORK SHALL BE IN ACCORDANCE WITH THE LATEST REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE.
18. ALL PENETRATIONS THROUGH FIRE RATED WALLS SHALL HAVE FIRE RATED SLEEVES AND SHALL BE CAULKED WITH RTV SILICONE FOAM. FOAM USED IN FIRE RATED WALLS SHALL BE U.L. LISTED.
19. TELECOM CABLING SHALL BE RUN AT LOCATION, ELEVATIONS AND IN CONFIGURATION AS SHOWN ON DRAWINGS.
20. WHERE EQUIPMENT IS INDICATED BY MANUFACTURER AND/OR MODEL NUMBER, EQUIPMENT SUBSTITUTIONS SHALL BE THE RESPONSIBILITY OF THE INTEGRATOR. COSTS ASSOCIATED WITH REENGINEERING OR REDESIGNING SHALL BE BORNE BY THE INTEGRATOR.
21. CABLING MAY NOT BE SUPPORTED FROM ROOF STRUCTURE. PROVIDE SUPPORTS OFF MASONRY WALLS OR INDEPENDENT STRUCTURAL SUPPORTS FROM NEW STEEL FRAME FOR PIPE INSTALLATION. ROOF STRUCTURE IS NOT RATED FOR ANY DEAD LOADS. PROVIDE SUPPORTS AT CODE OR MANUFACTURER REQUIRED INTERVALS.
22. A COMMSCOPE COMPLETE END-TO-END TELECOMMUNICATIONS STRUCTURED CABLING SYSTEM INCLUDING PATHWAY COMPONENTS, COPPER CABLING, FIBER CABLING, RACKS, CONNECTIVITY HARDWARE, PATCH CORDS, TERMINATIONS, AND ASSOCIATED ACCESSORIES.
23. PROVIDE MANUFACTURER 25-YEAR COMMSCOPE SYSTEM WARRANTY COVERING:
    COMPONENTS
    INSTALLATION WORKMANSHIP
    APPLICATIONS ASSURANCE
    MANUFACTURER 25-YEAR WARRANTY SHALL ONLY BE VALID WHEN INSTALLED BY A CERTIFIED COMMSCOPE PARTNER.
24. PANDUIT CERTIFICATION PLUS SYSTEM WARRANTY — INCLUDES A 25-YEAR PERFORMANCE WARRANTY DEPENDING ON SYSTEM DESIGN, COMPONENTS, AND PARTNER REGISTRATION.
25. LEGRAND / ORTRONICS — LEGRAND'S STRUCTURED CABLING BRANDS (ORTRONICS, SUPERIOR ESSEX COMBINATIONS) OFFER 25-YEAR CERTIFIED INSTALLATION WARRANTIES WHEN REGISTERED AND INSTALLED PER PROGRAM REQUIREMENTS.
26. WARRANTIES REQUIRE DOCUMENTATION OF TESTING RESULTS (FLUKE OR EQUIVALENT) FOR ALL WARRANTIES TO BE VALID.

DESCRIPTION	CABLE QUANTITY & TYPE	BOX TYPE (BY ELEC.)	STUB UP (BY ELEC.)
WALL MOUNTED PHONE OUTLET	(1) CAT 6 UTP	2-GANG BOX W/ 1-GANG COLLAR	1" E.C.
WALL MOUNTED "X" PORT DATA OUTLET. "X" DENOTES NUMBER OF PORTS/CABLES	(X) CAT 6 UTP	2-GANG BOX W/ 1-GANG COLLAR	1-1/4" E.C.
CEILING MOUNTED "X" PORT DATA OUTLET. "X" DENOTES NUMBER OF PORTS/CABLES	(X) CAT 6 UTP	2-GANG SURFACE MOUNT BOX	
CEILING MOUNTED WIRELESS ACCESS POINT OUTLET	(2) CAT 6 UTP	1-GANG SURFACE MOUNT BOX	N/A
CEILING/WALL MOUNTED ONE PORT DATA OUTLET FOR SECURITY CAMERAS	(1) CAT 6 UTP	1-GANG SURFACE MOUNT BOX	N/A
TYPICAL OUTDOOR WIRELESS ACCESS POINT OUTLET	(2) CAT 6 UTP	1-GANG SURFACE MOUNT BOX	N/A

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5 Bryant Park
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New York, NY 10018 USA
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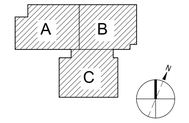
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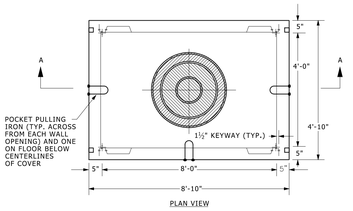
Project No:

Sheet Title
DRAWING INDEX & GENERAL NOTES

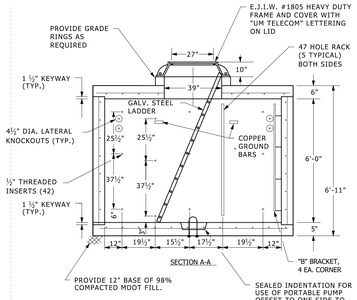
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Sheet Number
T-001

3/20/2026



PLAN VIEW



SECTION A-A

CONCRETE: 4500 P.S.I. @ 28 DAYS

REINF: H-20 HIGHWAY LOADING
GRADE 60 REBAR
SPREAD BARS @ ALL OPENINGS

WALLS: #5 BAR @ 12" O.C. EACH WAY

ROOF AND FLOOR:
#5 BAR @ 12" O.C. LONGITUDINAL
#7 BAR @ 12" O.C. TRANSVERSE

(4) EXTRA #5 DIAGONAL BARS @ ROOF OPENING

PROVIDE HARDWARE PACKAGE

"S" BRACKETS	12
"B" BRACKETS	12
47 HOLE RACKS	10
½" x 13 x 1¾" BOLTS	24
½" x 13 NUTS	24
½" x 13 x 1¾" BOLTS	42
7'-9" HOOKED LADDER (CONFIRM LENGTH)	1
STEP	1

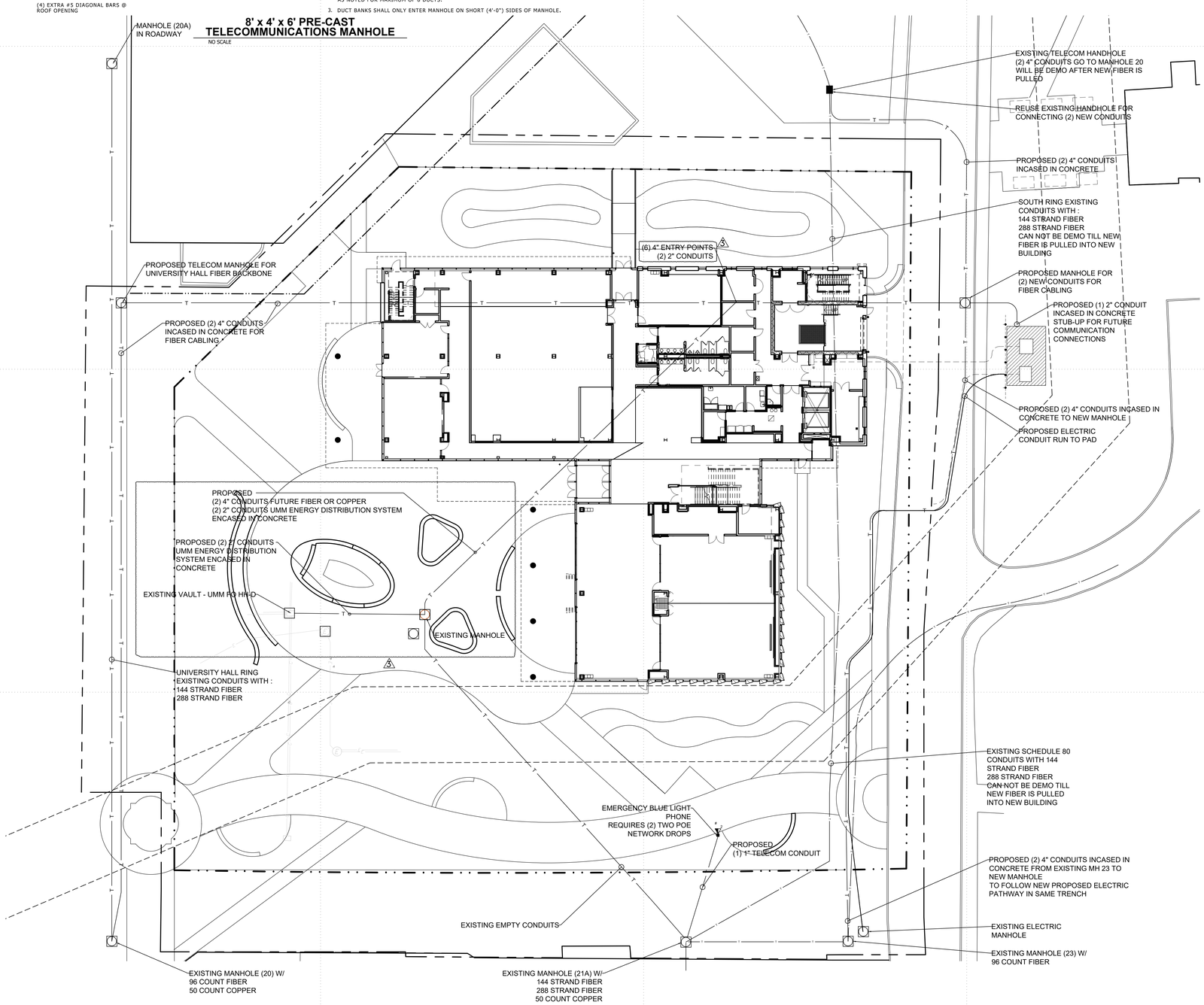
1" DIA. BUTYL RUBBER ROPE MASTICS PROVIDED TO INSURE WATERTIGHT SEALS.

GENERAL NOTES:

1. INSTALL ONE PULLING IRON IN EACH WALL OPPOSITE EACH PRESENT & FUTURE DUCT RUN OUT OF MANHOLE, ALSO ON FLOOR CENTERED UNDER COVER
2. SEE DUCT PLAN DRAWING SHOWING PLANNED & FUTURE DUCT ENTRANCES, ON CURRENTLY PLANNED DUCTS, PROVIDE OPENING SIZED & CONSTRUCTED AS NOTED IN DETAIL 16110015. ON FUTURE DUCT RUNS, PROVIDE KNOCKOUTS SIZED AS NOTED FOR MAXIMUM OF 8 DUCTS.
3. DUCT BANKS SHALL ONLY ENTER MANHOLE ON SHORT (4'-0") SIDES OF MANHOLE.

8' x 4' x 6' PRE-CAST TELECOMMUNICATIONS MANHOLE

NO SCALE



SITE PLAN NOTES:

1. ALL EXISTING CONDUIT LOCATIONS AND DEPTH OF SYSTEM SHALL BE VERIFIED.
2. COORDINATE WITH ARCHITECT AND MSU ON ALL LOCATIONS.
3. LOCATION OF NEW MANHOLES FOR TELECOMMUNICATIONS CABLING TO BE COORDINATED.
4. WHERE POSSIBLE NEW TELECOM CONDUITS SHOULD BE PROTECTED IN CONCRETE.

TELECOMMUNICATIONS MANHOLES GENERAL REQUIREMENTS

ALL WORK SHALL COMPLY WITH PROJECT SPECIFICATIONS, LOCAL AUTHORITY HAVING JURISDICTION (AHJ) REQUIREMENTS, AND UTILITY OWNER STANDARDS.

MANHOLES SHALL BE INSTALLED IN LOCATIONS SHOWN ON DRAWINGS, WITH FIELD ADJUSTMENTS COORDINATED AND APPROVED BY THE ENGINEER PRIOR TO INSTALLATION.

CONTRACTOR SHALL VERIFY ALL UNDERGROUND UTILITIES PRIOR TO EXCAVATION. CALL AND FOLLOW ALL APPLICABLE "CALL BEFORE YOU DIG" REGULATIONS.

FRAME AND COVER SHALL BE CAST IRON WITH "COMMUNICATIONS" LETTERING, MEETING ASTM A48 CLASS 30B MINIMUM.

ALL HARDWARE, PULLING IRONS, RACKS, AND STEPS SHALL BE CORROSION-RESISTANT GALVANIZED STEEL OR STAINLESS STEEL.

ALL PENETRATIONS SHALL HAVE APPROVED DUCT TERMINATORS, BUSHINGS, OR BOOTS TO PREVENT CABLE SHEATH DAMAGE AND TO PROVIDE A WATERTIGHT SEAL.

EXCAVATION & BASE PREPARATION

EXCAVATE TO DIMENSIONS PER MANUFACTURER REQUIREMENTS, ALLOWING CLEARANCE FOR SETTING AND ALIGNMENT.

PROVIDE A LEVEL, COMPACTED CRUSHED STONE BASE (MINIMUM 6" THICKNESS, ¾" MINUS AGGREGATE) OVER UNDISTURBED SOIL OR ENGINEERED FILL.

ENSURE BASE IS FREE OF STANDING WATER BEFORE PLACEMENT.

PLACE MANHOLE SECTIONS LEVEL AND PLUMB USING APPROVED LIFTING DEVICES.

SEAL ALL JOINTS WITH MANUFACTURER-RECOMMENDED BUTYL RUBBER MASTIC OR PREFORMED JOINT SEALANT TO PREVENT WATER INFILTRATION.

INSTALL RACKING SYSTEMS, PULLING EYES, AND OTHER HARDWARE PRIOR TO SETTING FINAL SECTIONS.

ALL CONDUIT AND DUCT BANK ENTRIES INTO MANHOLES SHALL BE GROUTED WATERTIGHT USING NON-SHRINK HYDRAULIC GROUT.

DUCT ENDS INSIDE MANHOLES SHALL BE FITTED WITH BELL ENDS OR TERMINATOR BUSHINGS.

MAINTAIN MINIMUM 4" SEPARATION BETWEEN DUCT BANK ENTRIES UNLESS OTHERWISE SPECIFIED.

PROVIDE SPARE DUCTS AS INDICATED ON DRAWINGS AND CAP ALL UNUSED DUCTS WITH WATERTIGHT PLUGS.

IF SPECIFIED, CONNECT MANHOLE GROUNDING SYSTEM TO TELECOMMUNICATIONS GROUND RING OR BUILDING GROUNDING ELECTRODE CONDUCTOR PER TIA-607.

BOND ALL METALLIC HARDWARE INSIDE MANHOLE TO THE GROUNDING SYSTEM USING #6 AWG MINIMUM COPPER.

BACKFILL AROUND STRUCTURE WITH GRANULAR FILL IN 6" LIFTS, COMPACTED TO 95% OF MAXIMUM DRY DENSITY PER ASTM D698.

PROTECT MANHOLE STRUCTURE FROM DISPLACEMENT DURING BACKFILL OPERATIONS.

ADJUST FRAME AND COVER TO FINISHED GRADE.

FRAME SHALL BE SET IN FULL BED OF NON-SHRINK MORTAR.

ENSURE COVER IS FLUSH WITH PAVEMENT OR TOPSOIL, WITH NO ROCKING OR RATTLING.

TESTING & ACCEPTANCE

CONTRACTOR SHALL INSPECT ALL JOINTS, DUCT TERMINATIONS, AND HARDWARE FOR COMPLIANCE PRIOR TO ACCEPTANCE.

ENGINEER OR OWNER'S REPRESENTATIVE SHALL PERFORM FINAL INSPECTION BEFORE MANHOLE IS PUT INTO SERVICE.

SAFETY

PROVIDE PROPER TRENCH SHORING, BARRICADES, AND WARNING SIGNAGE DURING INSTALLATION.

ALL CONFINED SPACE ENTRY WORK SHALL COMPLY WITH OSHA 29 CFR 1910.146.

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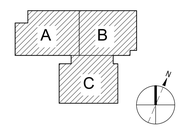
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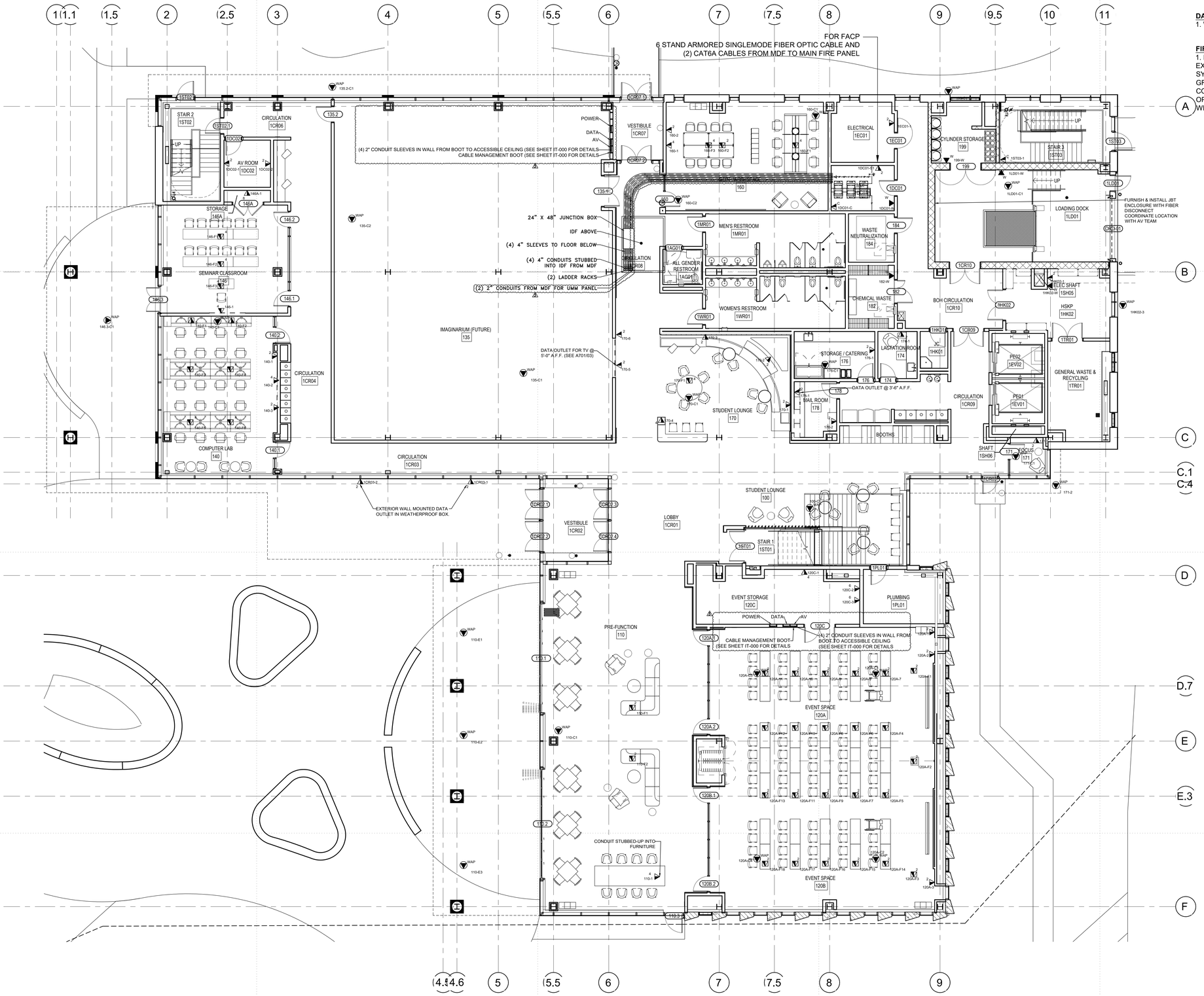
SITE PLAN

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Sheet Number

T-004

3/20/2026



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1. WAPS SHOWN ON THIS ARE ALSO SHOWN ON RCP PLAN FOR CEILING PLACEMENT.

FIRE ALARM NOTE:
1. FIBER OPTIC NETWORK CONNECTION TO EXISTING CAMPUS FIRE ALARM HEAD-END SYSTEM (ONYXWORKS FIRE ALARM GRAPHICAL REPORTING SYSTEM.) COORDINATE FIBER OPTIC CABLING AND INTERCONNECTIONS WITH MSU IT DEPARTMENT.

1 1ST FLOOR DATA PLAN
SCALE: 1/8" = 1'-0"

TELECOM LEGEND	
▼ # #	DATA WALL MOUNTED OUTLET
▼ # #	DATA FLOORBOX MOUNTED OUTLET
◭ # #	DATA CEILING MOUNTED OUTLET
▼ W #	WALL MOUNTED OUTLET (WALL PHONE)
▼ WAP #	DATA WIRELESS ACCESS POINT OUTLET

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1 Quad Road
Montclair, New Jersey

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Montclair State University
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HOK Architects, Inc.
5 Bryant Park
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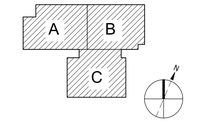
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Sheet Title
1ST FLOOR DATA PLAN

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Sheet Number
T-101

3/20/2026

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1 2ND FLOOR DATA PLAN
SCALE: 1/8"=1'-0"

TELECOM LEGEND	
▼ # #	DATA WALL MOUNTED OUTLET
▼ # #	DATA FLOORBOX MOUNTED OUTLET
◢ # #	DATA CEILING MOUNTED OUTLET
▼ W #	WALL MOUNTED OUTLET (WALL PHONE)
▼ WAP #	DATA WIRELESS ACCESS POINT OUTLET

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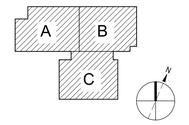
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Sheet Title
2ND FLOOR DATA PLAN

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Sheet Number
T-102

DATA / WAP NOTE:
1. WAPS SHOWN ON THIS ARE ALSO SHOWN ON RCP PLAN FOR CEILING PLACEMENT.



1 3RD FLOOR DATA PLAN
SCALE: 1/8"=1'-0"

TELECOM LEGEND	
#/#	DATA WALL MOUNTED OUTLET
#/#	DATA FLOORBOX MOUNTED OUTLET
#/#	DATA CEILING MOUNTED OUTLET
W/#	WALL MOUNTED OUTLET (WALL PHONE)
WAP/#	DATA WIRELESS ACCESS POINT OUTLET

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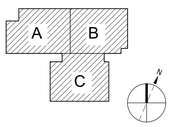
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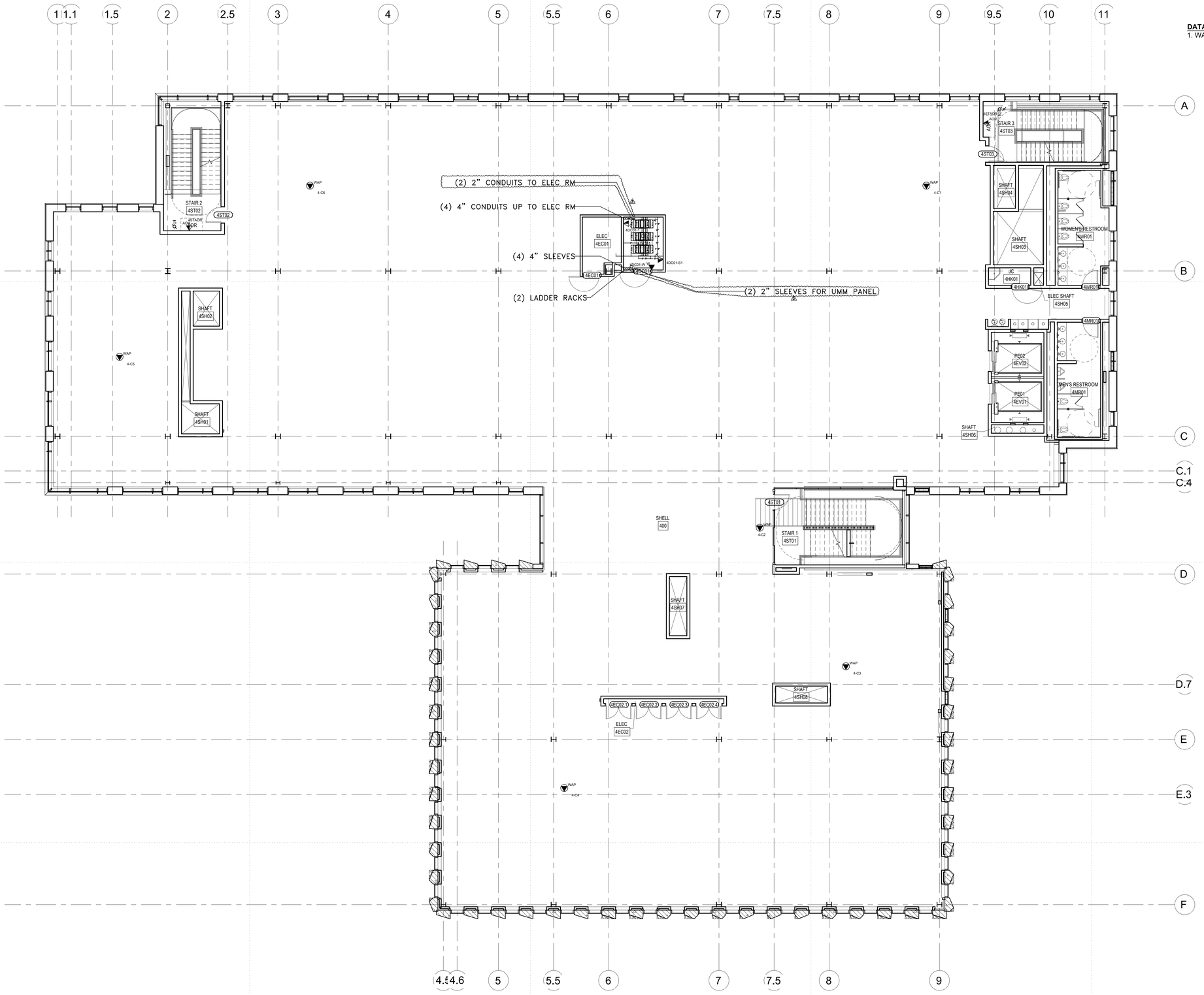
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Sheet Title
3RD FLOOR DATA PLAN

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Sheet Number
T-103



DATA / WAP NOTE:
1. WAPS SHOWN ON THIS ARE ALSO SHOWN ON RCP PLAN FOR CEILING PLACEMENT.

1 4TH FLOOR DATA PLAN
SCALE: 1/8"=1'-0"

TELECOM LEGEND	
#/#	DATA WALL MOUNTED OUTLET
#/#	DATA FLOORBOX MOUNTED OUTLET
#/#	DATA CEILING MOUNTED OUTLET
W/#	WALL MOUNTED OUTLET (WALL PHONE)
WAP/#	DATA WIRELESS ACCESS POINT OUTLET

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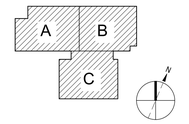
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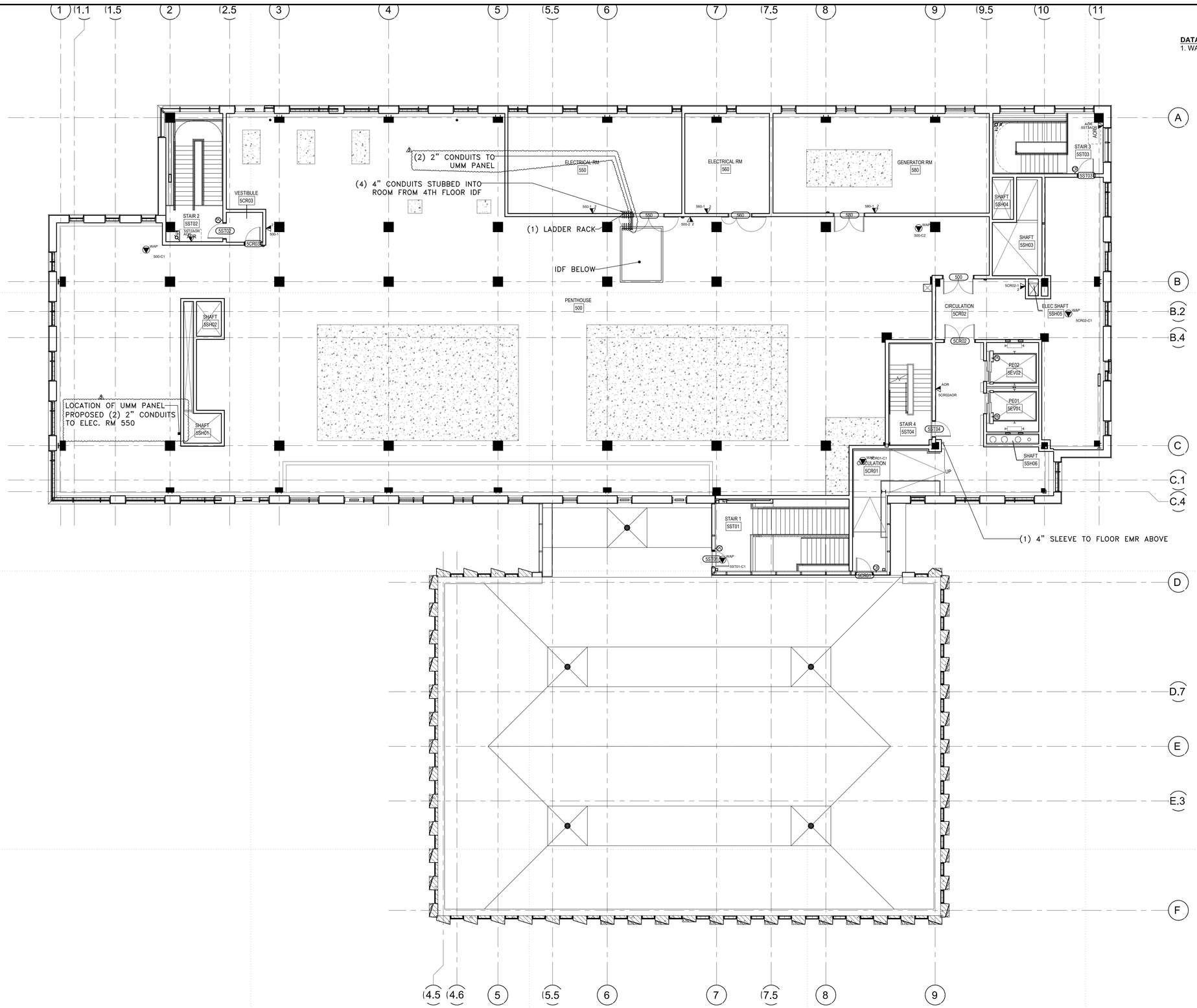
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1 PENTHOUSE DATA PLAN
SCALE: 1/8"=1'-0"

TELECOM LEGEND	
#/#	DATA WALL MOUNTED OUTLET
#/#	DATA FLOORBOX MOUNTED OUTLET
#/#	DATA CEILING MOUNTED OUTLET
W#/#	WALL MOUNTED OUTLET (WALL PHONE)
WAP#/#	DATA WIRELESS ACCESS POINT OUTLET

3/20/2026

MONTCLAIR STATE UNIVERSITY

Project
Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For
Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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Landscape
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Jersey City, NJ 07302

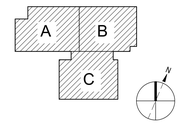
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A/V Engineer
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New York, NY 10016

Commercial Technology Contractors, Inc.
IT/TELECOM
152 Huron Ave
Clifton, NJ 07013

Key Plan



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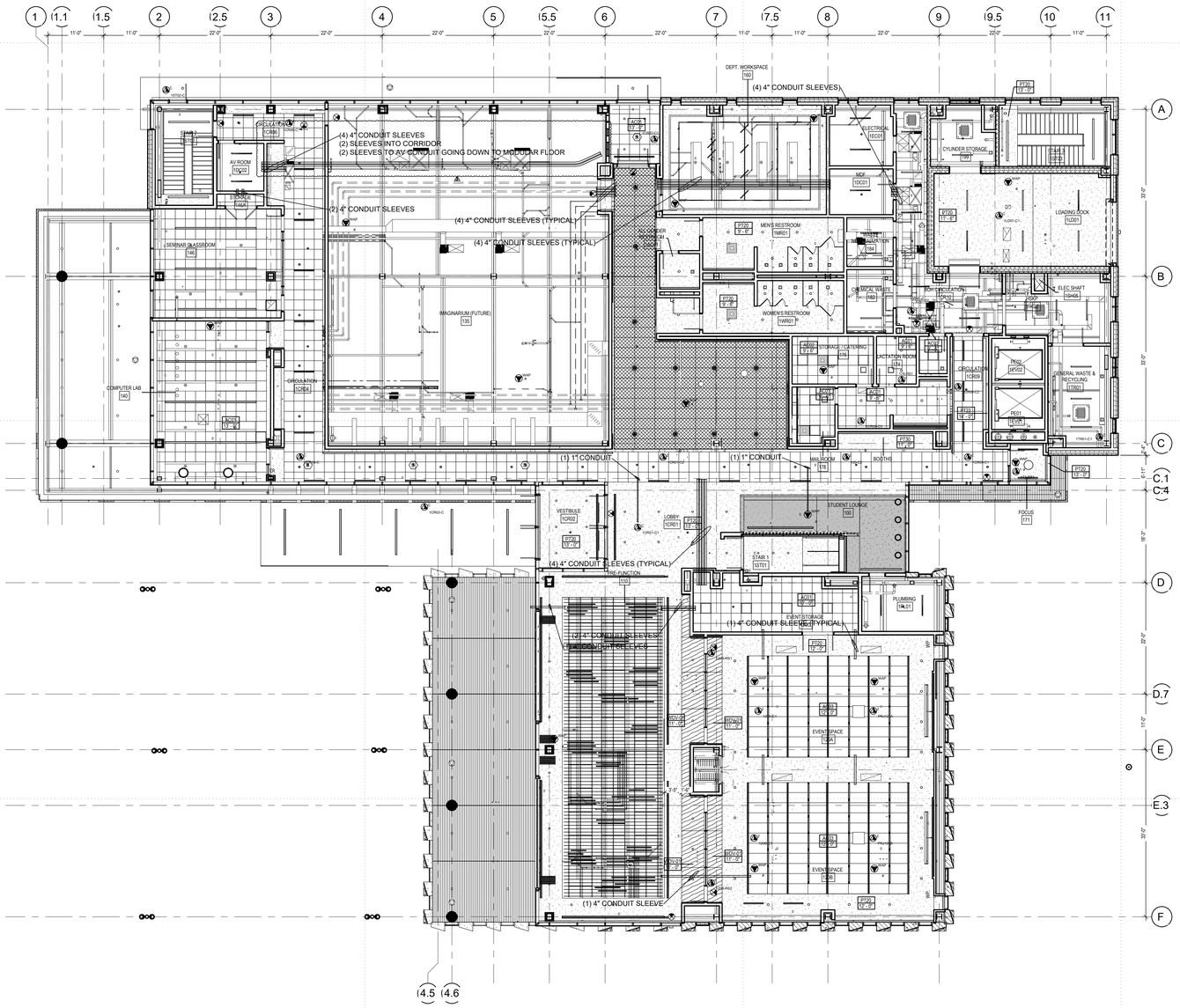
No.	Description	Date
1	ISSUED FOR CONTRACT DOCUMENTS	2025-08-14
2	ISSUED FOR BID	2026-01-19
3	ADDENDUM #5	2026-03-23

Project No:

Sheet Title
PENTHOUSE DATA PLAN

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number
T-10P



1 1ST FLOOR RCP
SCALE: NTS

TELECOM LEGEND	
#/#	DATA WALL MOUNTED OUTLET
#/#	DATA FLOORBOX MOUNTED OUTLET
#/#	DATA CEILING MOUNTED OUTLET
W/#	WALL MOUNTED OUTLET (WALL PHONE)
WAP/#	DATA WIRELESS ACCESS POINT OUTLET

3/20/2026

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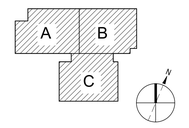
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Key Plan



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Project No:

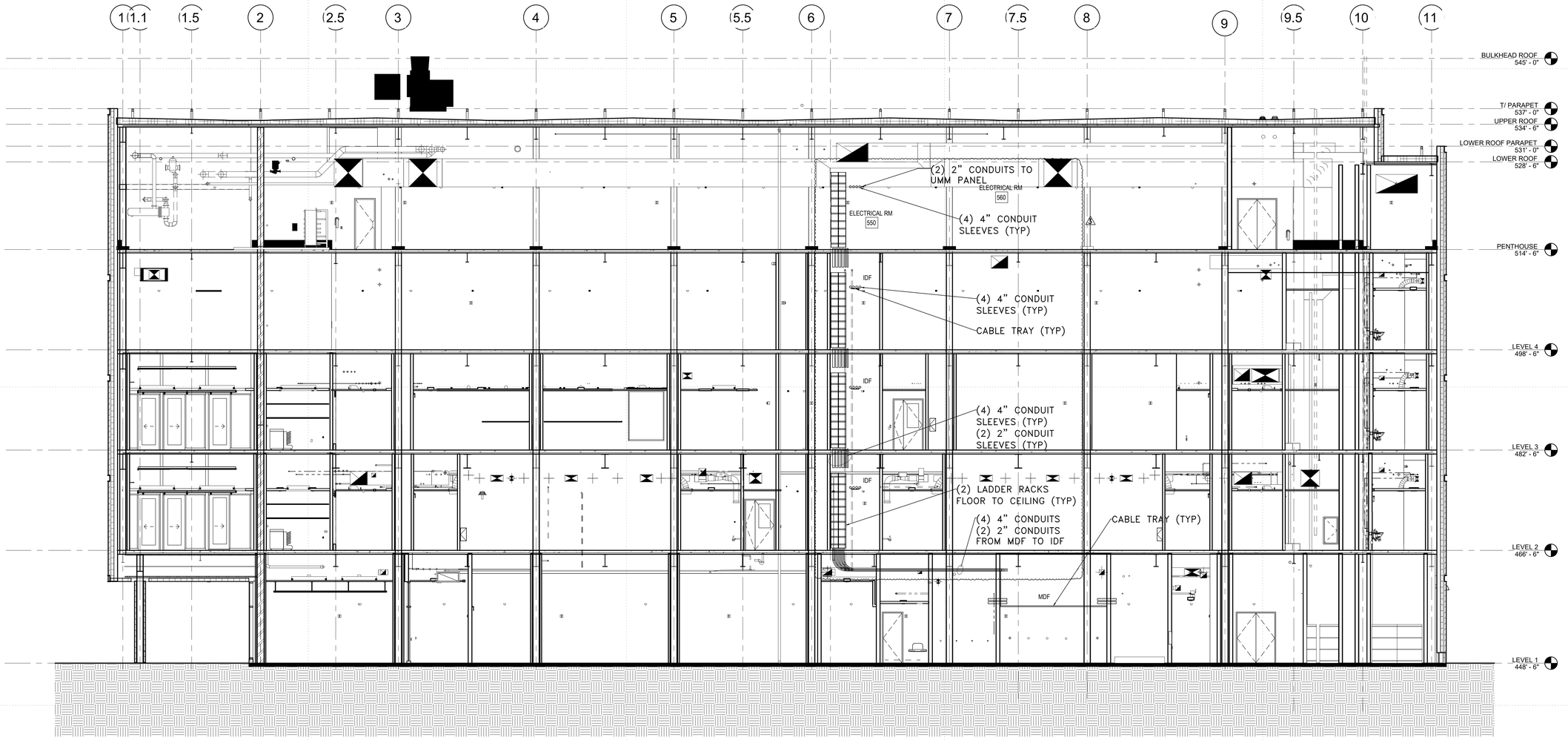
Sheet Title

1ST FLOOR RCP

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

T-201



3/20/2026

MONTCLAIR STATE UNIVERSITY

Project

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Prepared For

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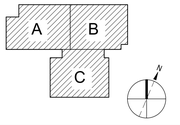
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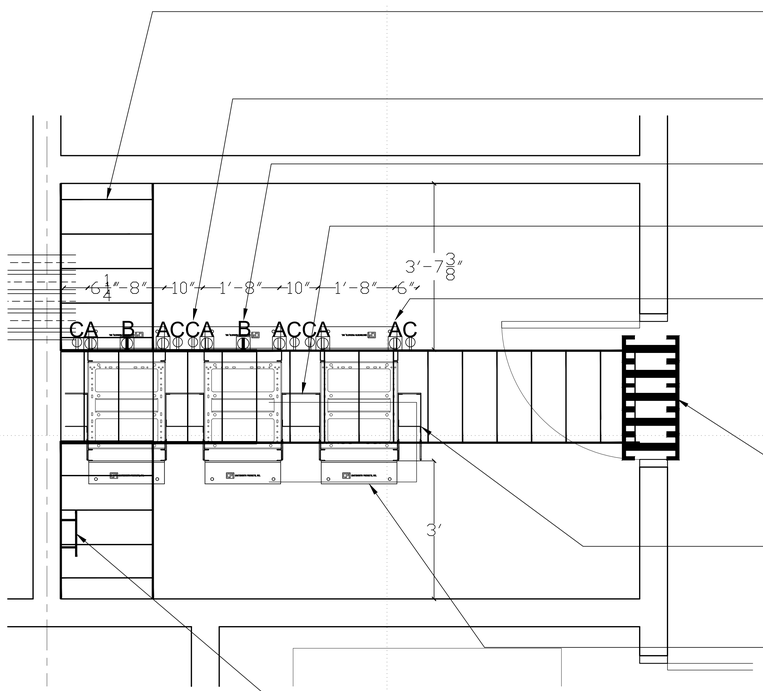
Sheet Title

CONDUIT & SLEEVES TELECOM RISER

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

T-300



FURNISH & INSTALL
24" WIDE OVERHEAD LADDER RACK
@ 8'-6" AFF (TYPICAL)

FURNISH AND INSTALL (C) 120V, 20 AMP DUPLEX
CONVENIENCE RECEPTACLE 5-20R (TYPICAL)

FURNISH AND INSTALL (B) 120V, 30 AMP DEDICATED
UPS CIRCUIT SIMPLEX RECEPTACLE NEMA 5-30R
(TYPICAL)

FURNISH AND INASTALL
10" VERTICAL WIRE MANGER
(TYPICAL)

FURNISH & INSTALL (A) 120V, 20 AMP DEDICATED
UPS CIRCUIT SIMPLEX RECEPTACLE NEMA 5-20R
HARDWIRED TO 10 OUTLET POWER STRIP MOUNTED
TO BACK OF RACK (BY ELECTRICAL CONTRACTOR)
(TYPICAL)

FURNISH & INSTALL
(4) 4" SLEEVES WITH BUSHINGS
(BY ELECTRICAL CONTRACTOR)

FURNISH & INSTALL
6" VERTICAL WIRE MANAGER
AT ROW ENDS
(TYPICAL)

FURNISH AND INSTALL
4-POST RACK 8'-0" 51U
(TYPICAL)

FURNISH & INSTALL
GROUND BUS BAR
(BY ELECTRICAL CONTRACTOR)

1 MDF PLAN
SCALE: 3/4"=1'-0"

MDF NOTES:

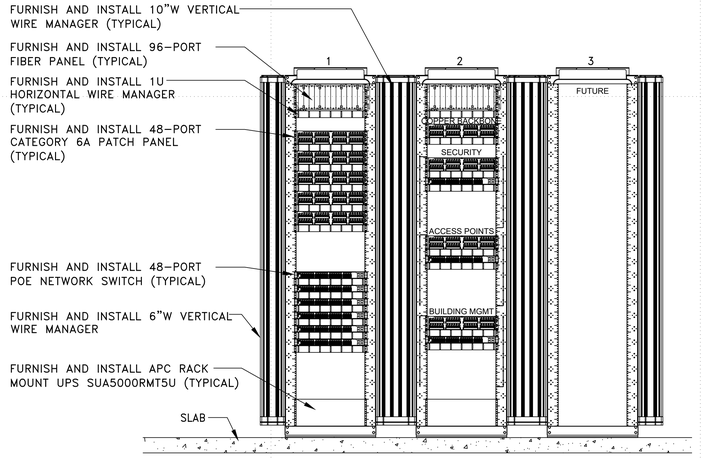
96 STRANDS COMING IN FROM (2) TWO DIFFERENT POINTS OF ENTRY.

24 STRANDS SINGLE MODE TERMINATED WITH LC CONNECTORS, BOTH ENDS BETWEEN MDF AND EACH IDF.

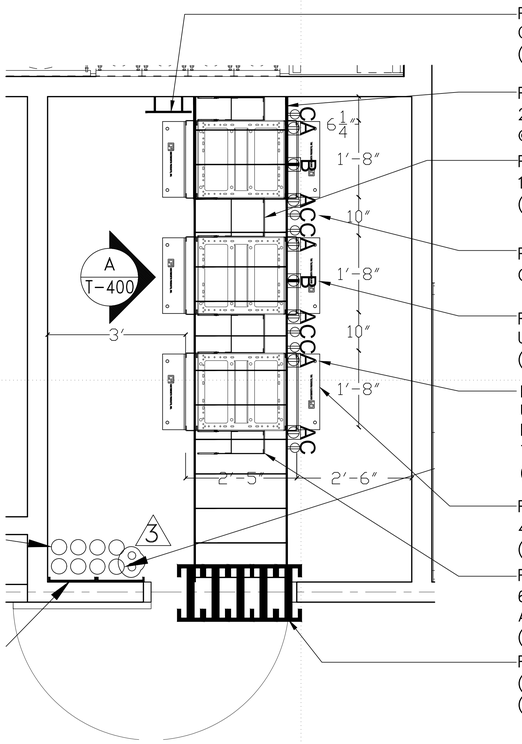
12 CAT 6A COPPER CABLES BETWEEN MDF AND EACH IDF, COPPER BACKBONE

50 PAIR CAT 3 COPPER FEED FROM SCIENCE BUILDING INTO THE MDF. TERMINATE 48 PAIRS.

ONE 96 STRANDS FROM COLE HALL.
ONE 96 STRANDS FROM ?



A MDF 4-POST RACK ELEVATION
SCALE: 3/4"=1'-0"



FURNISH & INSTALL
GROUND BUS BAR
(BY ELECTRICAL CONTRACTOR)

FURNISH & INSTALL
24" WIDE OVERHEAD LADDER RACK
@ 8'-6" AFF (TYPICAL)

FURNISH AND INASTALL
10" VERTICAL WIRE MANGER
(TYPICAL)

FURNISH AND INSTALL (C) 120V, 20 AMP DUPLEX
CONVENIENCE RECEPTACLE 5-20R (TYPICAL)

FURNISH AND INSTALL (B) 120V, 30 AMP DEDICATED
UPS CIRCUIT SIMPLEX RECEPTACLE NEMA 5-30R
(TYPICAL)

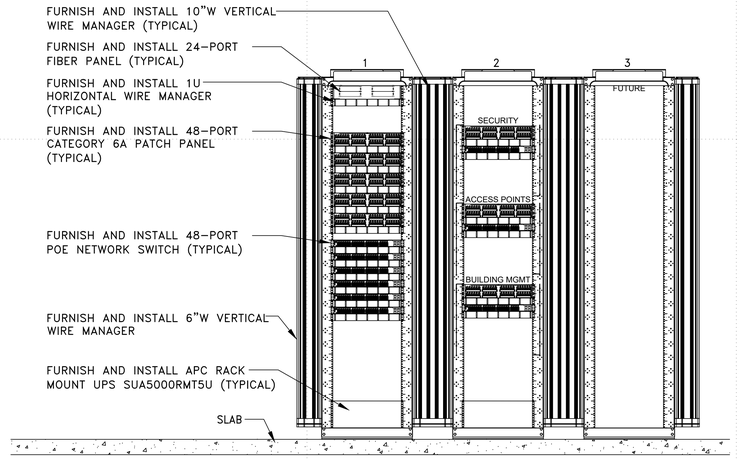
FURNISH & INSTALL (A) 120V, 20 AMP DEDICATED
UPS CIRCUIT SIMPLEX RECEPTACLE NEMA 5-20R
HARDWIRED TO 10 OUTLET POWER STRIP MOUNTED
TO BACK OF RACK (BY ELECTRICAL CONTRACTOR)
(TYPICAL)

FURNISH AND INSTALL
4-POST RACK 8'-0" 51U
(TYPICAL)

FURNISH & INSTALL
6" VERTICAL WIRE MANAGER
AT ROW ENDS
(TYPICAL)

FURNISH & INSTALL
(4) 4" SLEEVES WITH BUSHINGS
(BY ELECTRICAL CONTRACTOR)

2 IDF TYPICAL PLAN
SCALE: 3/4"=1'-0"



B IDF 4-POST RACK ELEVATION
SCALE: 3/4"=1'-0"

3/20/2026

MONTCLAIR STATE UNIVERSITY

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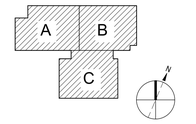
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Key Plan



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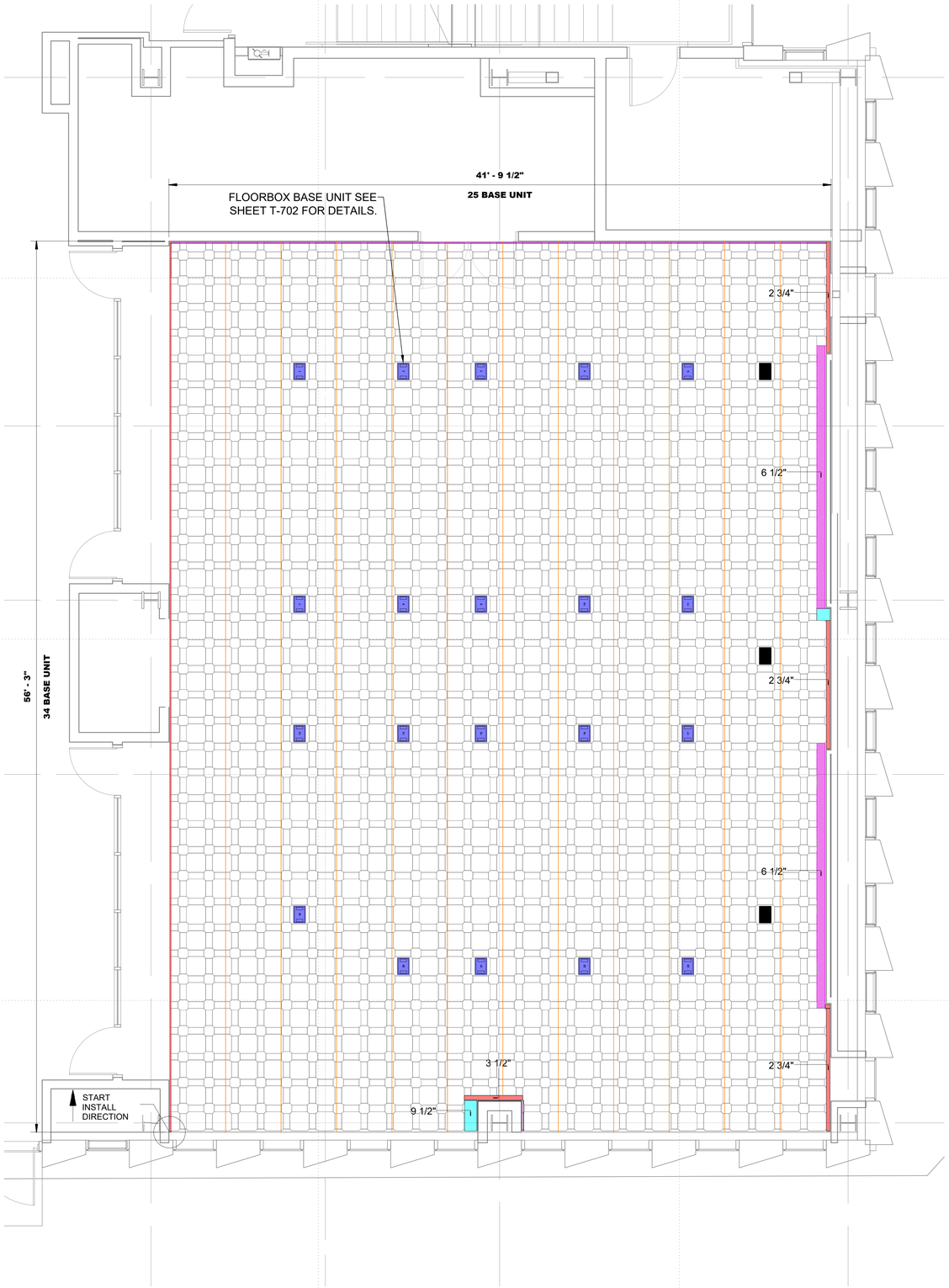
Sheet Title

MDF & IDF LAYOUT & ELEVATIONS

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number

T-400



1 GRIDD INSTALL PLAN - LEVEL 1 EVENT SPACE
NTS

KEYNOTES

GENERAL NOTES

01: LOCATION OF BASE UNITS MAY VARY DEPENDING UPON ACTUAL FIELD CONDITIONS.

02: RECESSED FLOOR, RAMP TRANSITION NOT REQUIRED.

03: SEE SHEET G-D FOR BORDER COMPONENT DETAILS

BORDER COMPONENT CONDITIONS

OPTION	END PART	GAP	PARTS
	1/2 OR FULL BASE	1/2" - 2"	E
	1/2 OR FULL BASE	2" - 4 1/2"	E + R
	1/2 BASE	4" - 6 1/2"	E + R + L
	FULL BASE	4 1/2" - 5 3/4"	E + L
	FULL BASE	5 3/4" - 8 1/2"	E + R + L
	FULL BASE	8 1/2" - 10 1/2"	E + (2) L
	FULL BASE	10 1/2" - 12"	E + R + (2) L

L=L-TYPE BORDER, E=END COVER, R=REINFORCING BAND

SYMBOL LEGEND

FIELD CUT COMPONENT

POWER GENERAL NOTES

FIELD WIRED

01: POWER AND DATA PORTS PER SPECIFICATION.

02: FLOOR BOXES ARE TYPICALLY LOCATED IN A BASE UNIT. LOCATION OF BASE UNITS MAY VARY DEPENDING UPON FIELD CONDITIONS.

03: ELECTRICAL COMPONENTS TO BE INSTALLED AFTER GRIDD FLOOR.

04: ELECTRICAL CONTRACTOR IS RESPONSIBLE TO COORDINATE CIRCUITRY AND EXACT LOCATION OF FLOOR BOXES, IN-FLOOR GROMMETS, PENETRATIONS, CABLE WHIPS, AND RELATED GRIDD FLOOR AND GRIDD POWER COMPONENTS WITH THE PLANS, GC, ALL INVOLVED VENDORS, AND TECHNICIANS.

05: EC SHALL MOVE, RELOCATE, OR OTHERWISE ADJUST THE POSITION OF RELATED GRIDD FLOOR AND GRIDD POWER COMPONENTS AS NEEDED TO COORDINATE THE INSTALLATION WITH THE FINAL PLACEMENT OF WALLS, FURNITURE, ETC.

06: LOW VOLTAGE CONTRACTOR IS RESPONSIBLE FOR EXACT LOCATION OF LOW VOLTAGE-ONLY GRIDD POWER COMPONENTS AND RELATED BASE UNITS WITH THE PLANS, GC, ALL INVOLVED VENDORS, AND TECHNICIANS.

07: LOW VOLTAGE CONTRACTOR SHALL MOVE, RELOCATE, OR OTHERWISE ADJUST THE POSITION OF LOW VOLTAGE-ONLY GRIDD POWER COMPONENTS AND RELATED BASE UNITS AS NEEDED TO COORDINATE THE INSTALLATION WITH THE FINAL PLACEMENT OF WALLS, FURNITURE, ETC.

SYMBOL LEGEND

FB-1 POWER AND LOW VOLTAGE FLOOR BOX FIELD WIRED
FB4000004
[4] NEMA 5-20R
[2] RJ45 KO

FB-2 POWER AND LOW VOLTAGE FLOOR BOX FIELD WIRED
FB4000004
[4] NEMA 5-20R
[X] LOW VOLTAGE TBD

Floor Box Paint

FB Type	Paint Color
FB-1	
FB-2	

FREEAXEZ LLC
1805 UNDERWOOD BLVD
DELRAN, NJ 08075
856-764-0400

MONTCLAIR STATE UNIVERSITY

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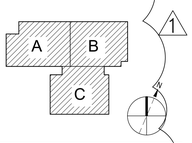
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Clifton, NJ 07013

Key Plan



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No.	Description	Date
1	ADDENDUM #5	2026-03-23

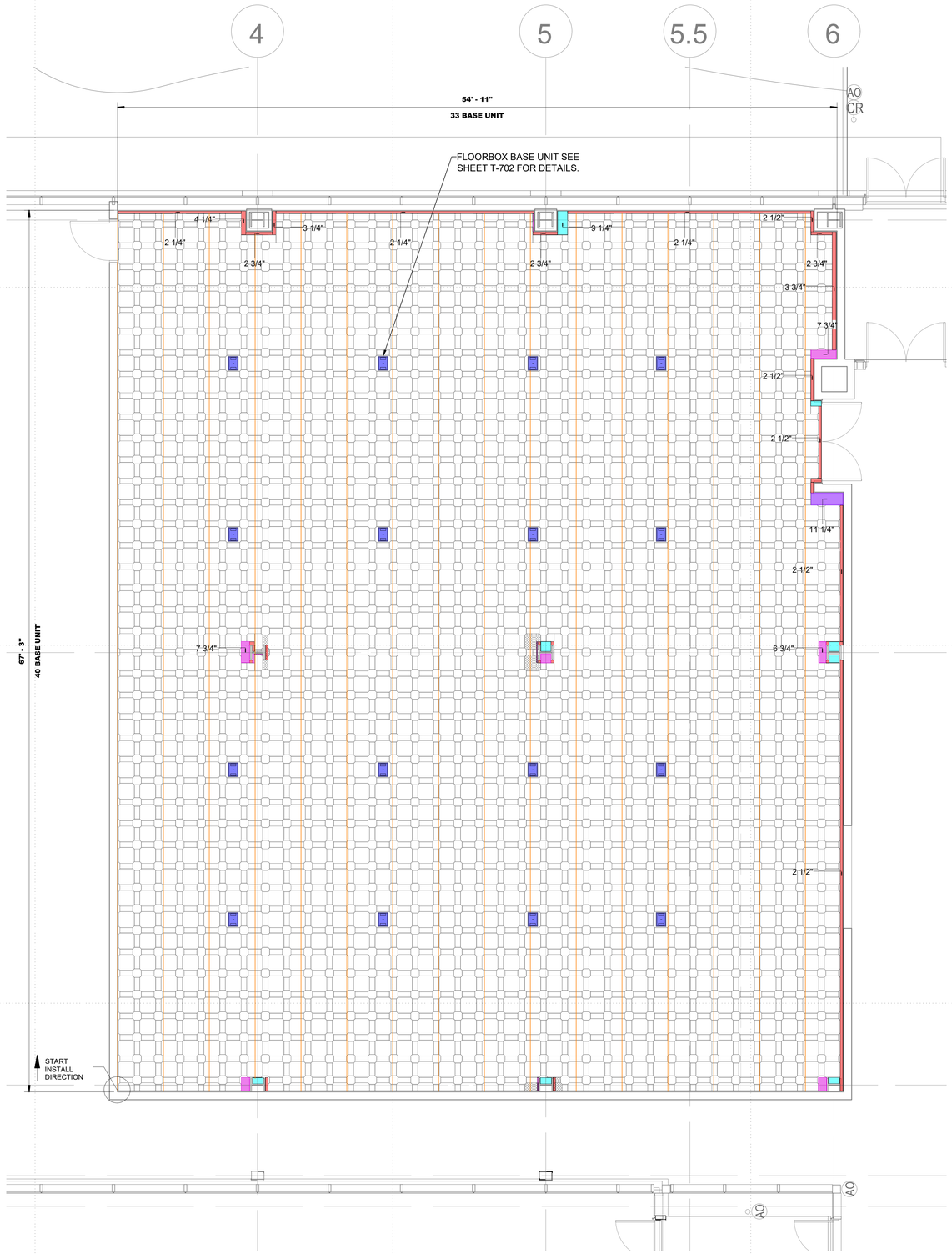
Project No:

Sheet Title
MODULAR EVENT SPACE PLAN

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number
T-700

3/20/2026



1 GRIDD INSTALL PLAN - LEVEL 1 IMAGINARIUM
NTS

KEYNOTES

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03: SEE SHEET G-D FOR BORDER COMPONENT DETAILS

BORDER COMPONENT CONDITIONS

OPTION	END PART	GAP	PARTS
	1/2 OR FULL BASE	1/2" - 2"	E
	1/2 OR FULL BASE	2" - 4 1/2"	E + R
	1/2 BASE	4" - 6 1/2"	E + R + L
	FULL BASE	4 1/2" - 5 3/4"	E + L
	FULL BASE	5 3/4" - 8 1/2"	E + R + L
	FULL BASE	8 1/2" - 10 1/2"	E + (2) L
	FULL BASE	10 1/2" - 12"	E + R + (2) L

L=L-TYPE BORDER, E=END COVER, R=REINFORCING BAND

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FIELD CUT COMPONENT

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SYMBOL LEGEND

FB-1 POWER AND LOW VOLTAGE FLOOR BOX
FIELD WIRED
FB4000004
[4] NEMA 5-20R
[2] RJ45 KO

FB-2 POWER AND LOW VOLTAGE FLOOR BOX
FIELD WIRED
FB4000004
[4] NEMA 5-20R
[X] LOW VOLTAGE TBD

Floor Box Paint

FB Type	Paint Color
FB-1	
FB-2	

FREEAXEZ LLC
1805 UNDERWOOD BLVD
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856-764-0400

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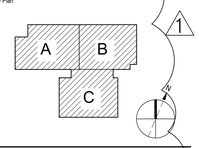
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A/V Engineer
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IT/TELECOM
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Clifton, NJ 07013

Key Plan



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No.	Description	Date
1	ADDENDUM #5	2026-03-23

Project No:

Sheet Title

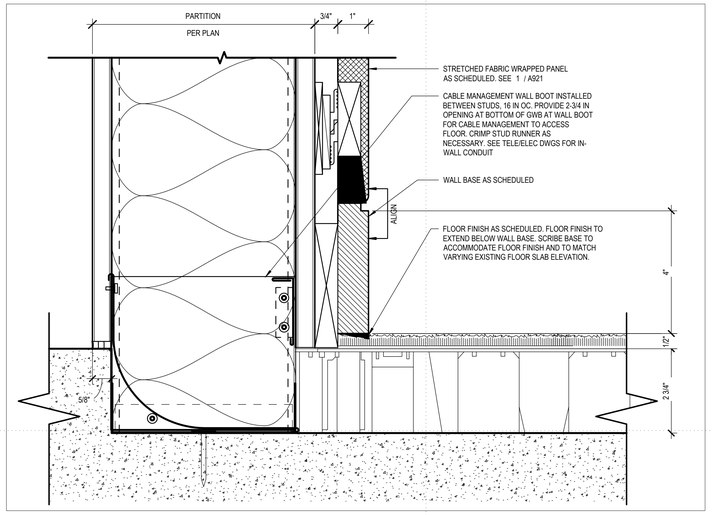
MODULAR IMAGINARIUM PLAN

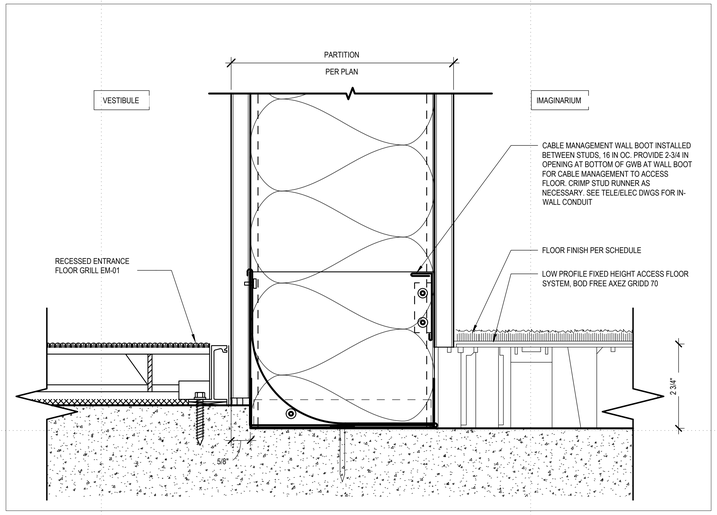
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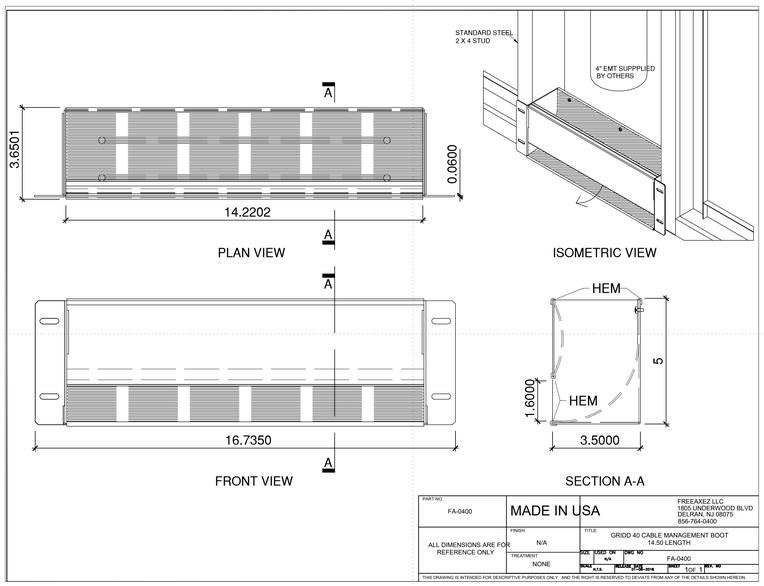
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T-701

3/20/2026

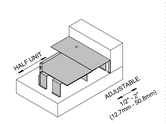




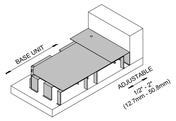


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	SCALE: N.T.S.	DRAWN: WILLIAM JOB	SHEET: 1 OF 1 REV: 00

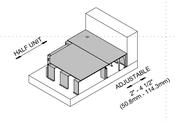
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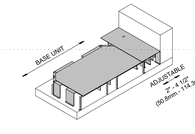
DETAIL - OPTION-A HALF BASE UNIT
1 1/2" = 1'-0"



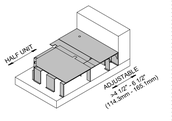
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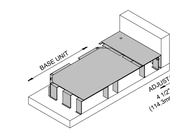
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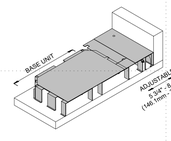
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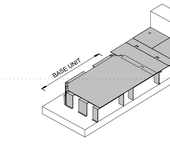
DETAIL - OPTION-C HALF BASE UNIT
1 1/2" = 1'-0"



DETAIL - OPTION-D BASE UNIT
1 1/2" = 1'-0"



DETAIL - OPTION-E BASE UNIT
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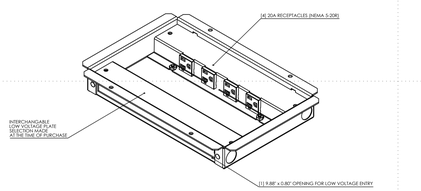


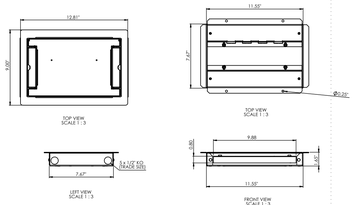
DETAIL - OPTION-F BASE UNIT
1 1/2" = 1'-0"

OPTION	CLOSEST BASE UNIT	GAP	REQUIRED COMPONENTS			
A	HALF OR BASE UNIT	1/2" - 2" (12.7mm - 50.8mm)	END COVER			
B	HALF OR BASE UNIT	2" - 4 1/2" (50.8mm - 114.3mm)	END COVER + REINFORCING BAND			
C	HALF UNIT	4 1/2" - 6 1/2" (114.3mm - 165.1mm)	L-TYPE BORDER + END COVER + REINFORCING BAND			
D	BASE UNIT	4 1/2" - 5 3/4" (114.3mm - 146.1mm)	L-TYPE BORDER + END COVER			
E	BASE UNIT	5 3/4" - 8 1/2" (146.1mm - 215.9mm)	L-TYPE BORDER + END COVER + REINFORCING BAND			
F	BASE UNIT	8 1/2" - 10 1/2" (215.9mm - 266.7mm)	[2] L-TYPE BORDER + END COVER			
G	BASE UNIT	10 1/2" - 12" (266.7mm - 304.8mm)	[2] L-TYPE BORDER + END COVER + REINFORCING BAND			
IF GAP IS 8" (203.2mm) OR GREATER WITH HALF BASE, USE FULL BASE				L-TYPE BORDER	END COVER	REINFORCING BAND

GRIDD BORDER COMPONENT CONDITIONS

This drawing is a controlled document: FB4000004

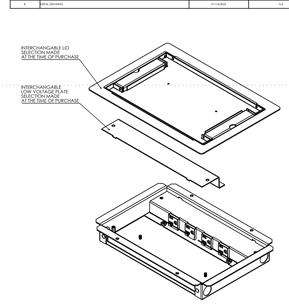




NOTES:
1. SOME COMPONENTS NOT SHOWN IN ALL VIEWS.
2. MOUNTING HARDWARE INCLUDED IN ALL CONFIGS
3. SEE SHEET 2 FOR LOW VOLTAGE PLATE OPTIONS
4. REFER TO LED LARGE OVERVIEW FOR LED OPTIONS

FB4000004-A03.4R.CPT

REVISIONS				
REV.	DESCRIPTION	DATE	DRAWN BY	APPROVED BY
A	INITIAL RELEASE	01/14/2026	HLS	TJG



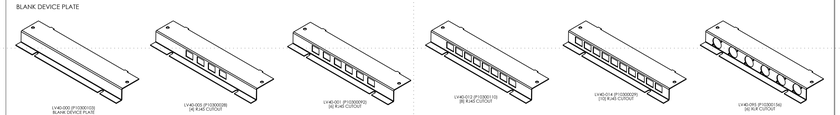
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UNLESS OTHERWISE SPECIFIED : DIMENSIONS ARE IN INCHES	TITLE: 40 LARGE FLOOR BOX FIELD WIRED [4] 20A RECEPTACLES; [1] CABLE PASS THRU (9.88" X 0.8")		
ALL DIMENSIONS ARE FOR REFERENCE ONLY	FINISH: N/A	SIZE: D	DWG NO: FB4000004 REV: A
	WEIGHT: N/A	SCALE: 1:10	SHEET: SHEET 1 OF 1

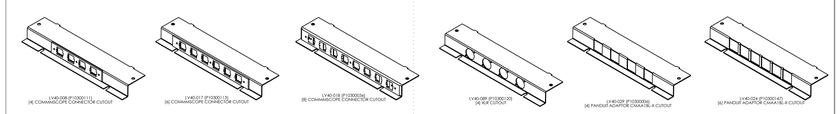
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LOW VOLTAGE DEVICE PLATES

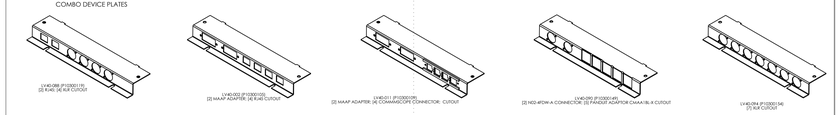
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REV.	DESCRIPTION	DATE	DRAWN BY	APPROVED BY
1	INITIAL RELEASE	10/13/2025	HLS	

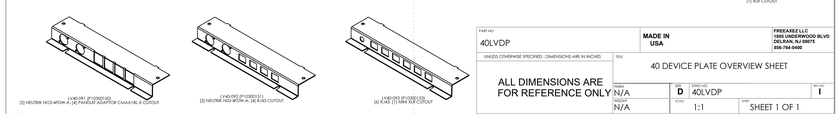
BLANK DEVICE PLATE





COMBO DEVICE PLATES





40 LV DP

PART NO: 40LVDP	MADE IN USA		FREEAXEZ LLC 1805 UNDERWOOD BLVD DELRAN, NJ 08075 856-764-0400
UNLESS OTHERWISE SPECIFIED : DIMENSIONS ARE IN INCHES	TITLE: 40 DEVICE PLATE OVERVIEW SHEET		
ALL DIMENSIONS ARE FOR REFERENCE ONLY	FINISH: N/A	SIZE: D	DWG NO: 40LVDP REV: 1
	WEIGHT: N/A	SCALE: 1:1	SHEET: SHEET 1 OF 1

3/20/2026

MONTCLAIR STATE UNIVERSITY

Project
Interdisciplinary Science Building
1 Quad Road
Montclair, New Jersey

Prepared For
Montclair State University
1 Normal Avenue Montclair, NJ 07043

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas, 6th Floor
New York, NY 10018 USA
t +1 212 741 1200 www.hok.com

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In Association with

Langan Engineering & Environmental Services, LLC
Civil Engineer
300 Kimball Drive, 4th floor
Parsippany, NJ 07054

Melillo Bauer Carman Landscape Architecture
Landscape
295 Newark Ave, 4th Floor
Jersey City, NJ 07302

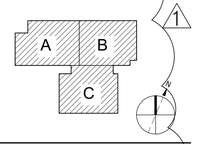
Office of Engineering & Construction Inspection Services, Inc.
Structural Engineer
485 Rt. 1 South, Building E Suite 220
Iselin, NJ 08830

Concord Engineering
MEPFP Engineer
100 Overlook Center, 2nd Floor
Princeton, NJ 08540

Shen Milsom & Wilke LLC
A/V Engineer
275 Madison Avenue, 14th Floor
New York, NY 10016

Commercial Technology Contractors, Inc.
IT/TELECOM
152 Huron Ave
Clifton, NJ 07013

Key Plan



Professional Seals

NOT FOR CONSTRUCTION

No.	Description	Date
1	ADDENDUM #5	2026-03-23

Project No:

Sheet Title
MODULAR FLOOR DETAILS

Original is 42 x 30. Do not scale contents of this drawing.

Sheet Number
T-702

PROJECT MANUAL

MONTCLAIR
STATE UNIVERSITY

INTERDISCIPLINARY SCIENCE BUILDING

1 Quad Road
Montclair, New Jersey

Project Manual

Prepared For
Montclair State University

Addendum #5
March 23, 2026

HOK Architects, Inc.
5 Bryant Park
1065 Avenue of the Americas
New York, NY 10018

Owner:	**Montclair State University** 1 Normal Avenue Montclair, NJ 07043
Architect:	**HOK Architects, Inc.** 5 Bryant Park 1065 Avenue of the Americas New York, NY 10018
Civil Engineer:	**Langan Engineering & Environmental Services, LLC** 300 Kimball Drive 4th Floor Parsippany, NJ 07054
Landscape Architect:	**Melillo Bauer Carman Landscape Architecture** 295 Newark Avenue 4th Floor Jersey City, NJ 07032
Structural Engineer:	**Office of Engineering & Construction Inspection Services, Inc.** 485 US Route 1 South, Building E Suite 220 Iselin, NJ 08830
Mechanical, Electrical, Plumbing, Fire Protection Engineers:	**Concord Engineering** 100 Overlook Center 2nd Floor Princeton, NJ 08540
Acoustical and Audiovisual Consultant:	**Shen Milsom & Wilke LLC** 275 Madison Avenue 14th Floor New York, NY 10016
Information Technology Consultant:	**Commercial Technology Contractors, Inc.** 152 Huron Avenue Clifton, NJ 07103

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INDEX OF DESIGN PROFESSIONALS AND CONSULTANTS

A **Architect:** HOK Architects, Inc.
C **Civil Engineer:** Langan Engineering & Environmental Services, LLC
L **Landscape Architect:** Melillo Bauer Carman Landscape Architecture
S **Structural Engineer:** Office of Engineering & Construction Inspection Services, Inc.
M **Mechanical Engineer:** Concord Engineering
E **Electrical Engineer:** Concord Engineering
P **Plumbing Engineer:** Concord Engineering
F **Fire Protection Engineer:** Concord Engineering
V **Vertical Transportation Consultant:** VDA Associates
AC **Acoustic Consultant:** Shen Milsom & Wilke LLC
AV **Audiovisual Consultant:** Shen Milsom & Wilke LLC
IT **Information Technology Consultant:** Commercial Technology Contractors, Inc.
W **Wind Analysis Consultant:** CPP Wind Engineering Consultants

VOLUME 1

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		Deleted for Addendum #5	**03-23-2026**
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SECTION 017410 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide the work of this Section in accordance with requirements of the Contract Documents.

B. This section includes, but is not limited to administrative and procedural requirements for the following:

1. Recycling nonhazardous demolition and construction waste.
2. Disposing of nonhazardous demolition and construction waste.

C. Related Requirements:

1. Owner's Construction Waste Management Plan.
2. Division 02 Section**s** "~~Structure~~ Demolition **and Debris Removal" and "Selective Site Demolition"** for disposition of waste resulting from demolition of buildings, structures, and site improvements.
3. Division 04 Section "Unit Masonry" for disposal requirements for masonry waste.
4. Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

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1.4 ACTION SUBMITTALS

A. Waste Management Plan: Contractor's LEED Compliance Officer/Construction Sustainability Manager shall be responsible for the development and implementation of a Construction Waste Management Plan for the Project. Submit plan to collect, sort, deposit waste and recyclable materials in accordance with the approved plan within 30 working days of date established for the Notice to Proceed.

1.5 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-5 for construction waste and Form CWM-6 for demolition waste. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons (tonnes).
4. Quantity of waste recycled, both estimated and actual in tons (tonnes).
5. Total quantity of waste recovered (recycled) in tons (tonnes).
6. Total quantity of waste recovered (recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for recycling, waste diversion and disposal as a percentage of total waste generated by the Work, to demonstrate compliance with required overall Diversion rate percentage set forth in this Section.

C. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

D. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

E. LEED Submittal: Submit documentation to USGBC, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met. Respond to questions and requests from USGBC regarding construction waste management and disposal until the USGBC has made its determination on the Project's LEED certification application. Document correspondence with USGBC as informational submittals.

F. Qualification Data: For LEED Compliance Officer/Waste Management Coordinator and Refrigerant Recovery Technician.

G. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

~~H. Refrigerant Recovery: Comply with requirements in Division 02 Section "Structure Demolition" for refrigerant recovery submittals.~~

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1.6 QUALITY ASSURANCE

A. Waste Management Officer Qualifications: Experienced firm, or individual employed and assigned by Contractor, with a record of successful waste management coordination of projects with similar requirements**.**

1. Firm employs a LEED-Accredited Professional, certified by the USGBC, as waste management coordinator.
2. Waste management coordinator may also serve as LEED Compliance Officer.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program and appropriate for types of appliances. ~~Comply with requirements in Division 02 Section "Structure Demolition."~~

C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of LEED Compliance Officer/Waste Management Coordinator as it pertains to waste management. The Waste Management Plan will be shared with subcontractors and requirements for handling plans will be discussed.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

A. General: Develop a Construction Waste Management Plan (CWMP) according to requirements in this Section. Plan shall consist of waste identification, and waste reduction work plan. Distinguish between demolition and construction waste. The CWMP will indicate quantities by weight or volume but use same units of measure throughout construction waste quality management plan CWQMP to meet the performance requirements specified in this Section.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be recycled or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.

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2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling of materials including demolition and construction waste, including the following:

1. Demolition Waste:

   a. Civil ~~and Structure~~ Construction Demolition Waste:

      1) Asphalt paving.
      2) Concrete **sidewalks, site bollards, trees, and utilities**.
      3) Concrete reinforcing steel.
      4) Structural and miscellaneous steel.

   ~~b. Exterior and Interior Demolition Waste:~~

      ~~1) Brick.~~
      ~~2) Concrete masonry units.~~
      ~~3) Wood studs.~~
      ~~4) Wood joists.~~
      ~~5) Plywood and oriented strand board.~~
      ~~6) Wood paneling.~~
      ~~7) Wood trim.~~
      ~~8) Rough hardware.~~
      ~~9) Roofing.~~
      ~~10) Insulation.~~
      ~~11) Doors and frames.~~
      ~~12) Door hardware.~~
      ~~13) Windows.~~
      ~~14) Glazing.~~
      ~~15) Metal studs.~~
      ~~16) Gypsum board.~~
      ~~17) Acoustical tile and panels.~~
      ~~18) Carpet.~~
      ~~19) Carpet pad.~~
      ~~20) Demountable partitions.~~
      ~~21) Equipment.~~
      ~~22) Cabinets.~~

   ~~c.~~**b.** Mechanical Demolition Waste:

      1) Plumbing fixtures.
      2) Piping.
      3) Supports and hangers.
      4) Valves.

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5) Sprinklers.
6) Mechanical equipment.
~~7) Refrigerants.~~

~~d.~~c. Electrical Demolition Waste:

1) Electrical conduit.
2) Copper wiring.
3) Lighting fixtures.
4) Lamps.
5) Ballasts.
6) Electrical devices.
7) Switchgear and panelboards.
8) Transformers.
~~9) <Insert materials required>.~~

2. Construction Waste:

a. Masonry and CMU.
b. Lumber.
c. Wood sheet materials.
d. Wood trim.
e. Metals.
f. Roofing.
g. Insulation.
h. Carpet and pad.
i. Gypsum board.
j. Piping.
k. Electrical conduit.
l. Packaging: Regardless of recycle goal indicated in "General" Paragraph above, recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Wood Pallets
8) Plastic pails.

m. Construction Office Waste: Regardless of recycle goal indicated in "General" Paragraph above, recycle 100 percent of the following construction office waste materials:

1) Paper.
2) Aluminum cans.
3) Glass containers.

B. All fluorescent lamps, HID lamps and mercury-containing thermostats removed from the site shall be recycled.

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PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Division 01 Section "Temporary Facilities and Controls."
2. Comply with additional requirements of Owner's Construction Waste Management Plan.

B. LEED Compliance Officer/Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three (3) working days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be recycled.
2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE

A. General: Recycle paper and beverage containers used by on-site workers.

B. Web Resources (Information only; no warranty or endorsement is implied.)

1. www.usgbc.org Site of the United States Green Building Council, with a description of the LEED certification process and requirements for C&D waste recycling
2. http://www.epa.gov/epaoswer/non-hw/debris-new Site of the U.S. Environmental Protection Agency that discusses construction and demolition waste issues, and links to other resources.

C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

D. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

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E. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.3 DISPOSAL OF WASTE

A. General: Except for items or materials to be recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

3.4 ATTACHMENTS

A. Form CWM-1 for Construction Waste Identification.

B. Form CWM-2 for Demolition Waste Identification.

C. Form CWM-3 for Construction Waste Reduction Work Plan.

D. Form CWM-4 for Demolition Waste Reduction Work Plan.

E. Form CWM-5 for Construction Waste Reduction Progress Report.

F. Form CWM-6 for Demolition Waste Reduction Progress Report.

END OF SECTION 017410

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SECTION 033543 – POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. **Section is hereby deleted in its entirety. Concrete floor slabs will be sealed as specified in Section , and replaced with Sealer SC-01 as specified in Division 07 Section "Concrete Sealer".**

END OF SECTION 033543

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SECTION 042000 – UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 CONTROLLING DOCUMENTS

A. This specification is controlled by Division 08 Section “Exterior Enclosure System Requirements”. In addition to the requirements of this document, all requirements of Controlling Documents must also be met. The more onerous conditions of this document or the Controlling Document must be met.

1.3 SUMMARY

A. Provide the work of this Section in accordance with requirements of the Contract Documents

B. Section Includes but is not limited to:

1. Concrete masonry units.
2. Face brick.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Miscellaneous masonry accessories.
8. Masonry-cell insulation.
9. Cavity-wall insulation.

C. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for installing dovetail slots for masonry anchors.
2. Division 07 Section "Flashing and Trim" for sheet metal flashing and furnishing manufactured reglets installed in masonry joints.
3. Division 07 Section "Thermal Insulation" for insulation panels.
4. Division 07 Section “Membrane Air Barriers” for fluid-applied membrane air barriers in cavity walls.

1.4 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced (Engineered) Masonry: Masonry containing reinforcing steel in grouted cells.

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1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures for erecting masonry walls and partitions including, but not limited to, the following:

1. Wiring devices in unit masonry.
2. Doors and other items built-in to unit masonry.
3. Items supported by or within unit masonry.

1.6 ACTION SUBMITTALS

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

B. Sustainable Design Submittals:

1. Building Product Disclosure and Optimization:
    a. Leadership Extraction Practices
        1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
        2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
            a) Include statement indicating costs for each product having recycled content.
    b. Sourcing of Raw Materials: For products that are sourced responsibly within 100 miles of project site, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.
        1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.
2. Indoor Environmental Quality, Low Emitting Materials:
    a. For paintings and coatings, wet applied, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure for Architectural Coatings or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016.

C. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

D. Samples for Initial Selection:

1. Colored mortar.
2. Weep holes/vents.

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E. Samples for Verification: For each type and color of the following:

1. Face brick, in the form of straps of five or more bricks.
2. Special brick shapes.
3. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
4. Accessories embedded in masonry.

1.7 SUSTAINABLE DESIGN SUBMITTALS

A. Comply with requirements specified in Section 018113.

1.8 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For firms and persons specified in the "Quality Assurance' Article in this Section, to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Sustainable Design Informational Submittals:

1. Building Product Disclosure and Optimization - Material Ingredients
    a. Material Ingredient Optimization: Submit manufacturer's Environmental Product Declaration (EPD) and at least one of the following:
        1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
        2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo.
        3) International Alternative Compliance Path - REACH Optimization
        4) Declare: Manufacturer's completed Product Declaration Form
        5) Other programs approved by USGBC.

D. Material Certificates: For each type and size of the following:

1. Masonry units:
    a. Include data on material properties and material test reports substantiating compliance with requirements.
    b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
    c. For exposed brick, include test report for efflorescence according to ASTM C67.
    d. For masonry units, include data and calculations establishing average net-area compressive strength of units.

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2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Mortar admixtures.
4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
5. Grout mixes. Include description of type and proportions of ingredients.
6. Reinforcing bars.
7. Joint reinforcement.
8. Anchors, ties, and metal accessories.

E. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/for air content.
2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

F. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

G. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.9 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C1093 for testing indicated.

B. Reference Standards: Work shall comply with requirements of local jurisdictions and the following reference standards, unless modified by the Contract Documents:

1. American Concrete Institute (ACI): ACI 530.1/ASCE 6/TMS 602.
2. National Concrete Masonry Association (NCMA): "TEK" Information Series."
3. American Society for Testing and Materials (ASTM): ASTM C1586 "Standard Guide for Quality Assurance of Mortars".

C. Pre-Construction Testing: The independent testing agency shall perform the following pre-construction testing to establish compliance of proposed materials and construction with specified requirements:

1. Prism Test: For each type of wall construction indicated, test masonry prisms per ASTM E 447, Method B.
2. Test mortar properties per test methods of ASTM C 270.
3. Evaluate mortar composition and properties per ASTM C 780.
4. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.

D. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 01 Section "Quality Requirements" for mockups.

1. Build sample panels for typical brick veneer exterior wall construction in sizes indicated on Drawings by full thickness.
2. Clean one-half of exposed faces of panels with masonry cleaner indicated.
3. Protect approved sample panels from the elements with weather-resistant membrane.

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4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
    a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.
5. Demolish and remove sample panels when directed.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build integrated mockup(s) of typical exterior wall assemblies as shown on Drawings, including all components and materials specified for the work.
2. Clean one-half of exposed faces of masonry elements included in integrated mockups with masonry cleaner as indicated.
3. Protect accepted mockups from the elements with weather-resistant membrane.
4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
    a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
5. Demolish and remove mockups when directed.

1.10 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

1. Clay Masonry Unit Test: For each type of unit required, according to ASTM C67 for compressive strength.
2. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C140 for compressive strength.
3. Mortar Test (Property Specification): For each mix required, according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91 for air content.
4. Mortar Test (Property Specification): For each mix required, according to ASTM C780 for compressive strength.
5. Grout Test (Compressive Strength): For each mix required, according to ASTM C1019.
6. Prism Test: For each type of construction required, according to ASTM C1314.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

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B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.12 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 degrees F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths (F'm) at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C1314.

2.2 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.3 MASONRY UNITS, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

C. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners, unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for units exposed to the exterior environment and within high humidity interior spaces.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

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a. Basis of Design: Subject to compliance with requirements, provide "Dry-Block"; GCP Applied Technologies Inc., or approved equal.

C. **CMU-01**: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi
2. Density Classification:

a. Normal weight; 125 lb/cu. ft., except as otherwise indicated.
b. Fire Rated Assemblies: Light Weight, less than 105 lb./cu ft.

1) Aggregate: Expanded clay or shale or other material complying with ASTM C33 or UL 618.

3. Initial Rate of Absorption: 13 pounds per cubic foot for all exterior concrete unit masonry and 15 pounds per cubic foot for all interior concrete masonry.
4. Provide concrete masonry units with the following characteristics:

a. Maximum linear shrinkage: 0.035 percent.
b. Maximum moisture content: 35 percent.

5. Size: (Actual Dimensions): Nominal width shown by 7-5/8 inches high by 15-5/8 inches long.
6. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.5 CONCRETE AND MASONRY LINTELS

A. General: Provide one of the following:

B. Concrete Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than CMUs.

C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification; with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured. Use bond beam blocks. Knock out block will not be accepted.

~~C.~~ **D. Specialty Fabricated Shelf Angles: As specified in Division 05 Section "Metal Fabrications".**

2.6 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

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3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: Facing brick complying with ASTM C216.

1. Basis of Design:

a. **BRK-01**: Custom mix of 3 colors/textures; Custom gray brick mix to be selected by Architect from 40% stone, 40% Urban and 20% Steel Gray, with Wire Cut Finish. Glen-Gery Corporation, Klay coat (Hanley Plant), or approved equal. Norman size 11-5/8 inch x 3-5/8 inch x 2-1/4 inch.
b. **BRK-02**: Brick size, mix and mortar to match BRK-01. 50% of BRK-02 to be solid brick (not cored_ and installed at an ancle with max 1-1/2 inch projection (See **EWS-03** wall system drawings).

2. Grade: SW (Severe Weathering).
3. Type: FBX.
4. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 4950 psi.
5. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C67.
6. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
7. Modular Size (Actual Dimensions): As indicated on Drawings.
8. Application: Use where brick is exposed unless otherwise indicated.

2.7 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar cement and masonry cements are not permitted.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Davis Colors; True Tone Mortar Colors.
b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
c. Solomon Colors, Inc.; SGS Mortar Colors.
d. Or approved equal.

E. Portland Cement-Lime Mix: Packaged blend made from Portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Products: Subject to compliance with requirements, provide one of the following:

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a. Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
b. Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
c. Lafarge North America Inc.; Eaglebond Portland & Lime.
d. Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
e. Or approved equal.

2. Formulate blend as required to produce color indicated.
3. Pigments shall not exceed 10 percent of Portland cement by weight.

F. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick and pointing mortar, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural-colored sand or crushed stone of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C404.

H. Cold-Weather Admixture: Not permitted.

I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent by same manufacturer.

1. Basis of Design: Subject to compliance with requirements, provide "Dry-Block Mortar Admixture"; GCP Applied Technologies Inc., or approved equal.

J. Water: Potable, non-alkaline, clear, and free of deleterious materials which would impair the quality of the Work.

2.8 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A615 or ASTM A996/A996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A951/A951M.

1. Interior and Exterior Walls: Hot dip galvanized, carbon steel.
2. Wire Size for Side Rods: 0.148-inch (3.77-mm diameter.
3. Wire Size for Cross Rods: 0.148-inch (3.77-mm diameter.
4. Wire Size for Veneer Ties: 0.148-inch (3.77-mm diameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches on center.
6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Vertically Reinforced Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry:

1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

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2.9 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M; with ASTM A153, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A 1008M, Commercial Steel, with ASTM A153, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A36.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
2. Where wythes do not align or are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
3. Wire: Fabricate from 3/16-inch-diameter, hot-dip galvanized steel wire.

D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel wire.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch-diameter, hot-dip galvanized steel wire.

E. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 01.05-inch-thick, steel sheet, galvanized after fabrication.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch-diameter, hot-dip galvanized steel wire.

F. Partition Top anchors: Model PTA420, or Model PTA422 Partition Top Anchor by Homann and Barnard Inc.) 0.105-inch-thick metal plate with 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot dip galvanized after fabrication.

G. Partition Top anchors: Model PTA-RN and Nut by Hohmann and Barnard; 305 Dovetail Slot, zinc plated with 3/8-inch- diameter threaded rod with beveled nut, zinc plated 6 inches long, with PTA tube with compressible filler, or approved equal. Fabricate from steel, hot dip galvanized after fabrication.

H. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot dip galvanized to comply with ASTM A153.

I. Adjustable Masonry-Veneer Anchors:

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1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to cold-formed metal framing, and as follows:

    a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.

2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.

    a. Basis of Design: Subject to compliance with requirements, provide " 2-Seal Thermal Wing Nut Anchor"; Hohmann & Barnard, Inc., or approved equal.
    b. Anchor Section: Gasketed thermal 2 seal wing nut anchor barrel with air barrier washers and built in 1/2 inch adjustability, with steel reinforced plastic coated wings to create a thermal break, and accommodate @X-Hook stainless steel connector, or approved equal.
    c. Connector Section: 2-X Hook with compressed leg anchors consisting of 9 gage stainless steel wire. Size wire tie to extend at least halfway through veneer but with at least 5/8-inch cover on outside face, or approved equal.

3. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 (0.19 inch diameter by length required to penetrate steel stud flange with not less than three exposed threads.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) Atlas Fasteners; 304SS Series.
        2) Dayton Superior Corporation, Dur-O-Wal Division; Stainless Steel SX Fastener.
        3) ITW Buildex; Scots long life Teks.
        4) or approved equal.

2.10 MISCELLANEOUS ANCHORS

A. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch, galvanized steel sheet.

B. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A153/A 153M, Class C; of dimensions indicated.

C. Postinstalled Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.
2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5 unless otherwise indicated.
3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 or Group 2 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

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2.11 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Fabricate flashings from Stainless Steel: ASTM A240, Type 304, minimum 0.016 inch thick.
2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
4. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
5. Fabricate through-wall flashing with sealant stop where indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
6. Metal Expansion-Joint Strips: Fabricate to shapes indicated.

B. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed, use metal flashing with a drip edge unless otherwise indicated.

C. Solder and Sealants for Sheet Metal Flashings:

1. Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Elastomeric Sealant: ASTM C920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.12 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or urethane.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

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D. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
b. Heckmann Building Products Inc.; No. 85 Cell Vent.
c. Hohmann & Barnard, Inc.; Quadro-Vent.
d. or approved equal.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Products: Subject to compliance with requirements, provide the following:

a. Mortar Net USA, Ltd.; Mortar Net., or approved equal.

2. Configuration: Strips, full depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.

F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Products: Subject to compliance with requirements, provide one of the following :

a. Dayton Superior Corporation, Dur-O-Wal Division; D/A810, D/A812 or D/A817.
b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
d. Or approved equal.

2.13 CAVITY-WALL INSULATION

A. Insulation: as specified in Division 07 Section "Thermal Insulation".

B. Crack Sealer: Single component or two component expanding polyurethane foam sealant.

1. Basis of Design: Subject to compliance with requirements, provide "Great Stuff Pro Insulating Foam Sealant"; Dow Chemical Company, or approved equal.

2.14 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use Portland cement-lime mortar unless otherwise indicated.

B. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.

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3. For exterior, above-grade, load-bearing and non-load-bearing walls, and parapet walls; for interior load-bearing walls; and for other applications where another type is not indicated, use Type N.
4. For interior non-load-bearing partitions, use Type N.

C. Pigmented Mortar: Use only packaged Portland cement-lime mix product. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of Portland cement by weight.
2. Mix to match Architect's sample.
3. Application: Use pigmented mortar for exposed mortar joints with the following units:

   a. Face brick.

D. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C 143M.

2.15 SOURCE QUALITY CONTROL

A. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested for strength, absorption, and moisture content per ASTM C140.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that dovetail slots are properly placed in concrete.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with TMS 602/ACI 530.1/ASCE 6 and other requirements indicated applicable to each type of installation included in Project.

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B. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

C. Build chases and recesses to accommodate items specified in this and other Sections.

D. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

E. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

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C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above. At fire-rated partitions, coordinate with requirements in Division 07 Section "Fire Resistive Joint Systems" for firesafing and fire sealant required at rated partitions.
2. Fasten partition top anchors to structure above and build into top of partition. Space anchors 48 inches on center, unless otherwise indicated.

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J. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems", and treat penetrations to comply with requirements specified in Division 07 Section "Through-Penetration Firestop Systems".

K. At the course of concrete masonry units immediately below all windowsills provide solid units or solid grout cores where expansion anchors or provisions of other work requires.

L. Set units with care around frames so as not to bulge the sides or change the position of the frames. Set units tightly against metal frames and fill voids completely. Build frame anchors into joints. Cut units accurately to fit around pipes, ducts, and openings, and fill voids full.

M. Where pipes, conduits, etc., are embedded into CMU walls match jointing pattern of adjacent CMU masonry work.

N. All courses of exposed masonry work shall be lined up so as to result in a uniform appearance.

O. Holes made in exposed units for attachment of items shall be neatly drilled. Provide necessary special jamb, irregular and regular angle units where required to obtain smooth, evenly jointed, and regular patterns throughout exposed surfaces. Provide solid units or solid grout cores where expansion anchors or provisions of other work requires.

3.5 MORTAR BEDDING AND JOINTING

A. Lay brick and hollow CMUs as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
5. With entire units, fully bedded in mortar at anchors, ties and reinforcements as needed to fully embed anchors, ties, and reinforcements in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

E. Cut joints flush where indicated to receive waterproofing, cavity wall insulation, or air barriers unless otherwise indicated.

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3.6 COMPOSITE MASONRY

A. Bond wythes of composite masonry together using one of the following methods:

1. Masonry Joint Reinforcement: Installed in horizontal mortar joints.

a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes .
b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.

B. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

C. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.

1. Provide continuity with masonry joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.

D. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.

3.7 CAVITY WALLS

A. Cavity Wall Construction: Construct cavity walls as shown; consisting of an air space, insulation, air barrier, flashing, reinforcing and a back-up wall of concrete masonry units and/or cast-in-place concrete.

B. Bond wythes of cavity walls together using the following methods:

1. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

D. Apply air barrier to face of backup wythe to comply with Division 07 Section "Membrane Air Barriers."

E. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches on center both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Seal perimeter, of each insulation board and fill cracks and open gaps in insulation with specified crack sealer, ensuring compatibility with insulation and masonry.

F. Coordinate with the related flashing work specified elsewhere. Provide end dams at flashing terminations, extending the full height of the flashing.

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G. At bottom terminations of cavity, install flashing continuously with weep holes ventilators. Provide weep holes at bottom of cavity, not more than 16 inches on center in the vertical joint resting on the horizontal leg of the relieving angle above the flashing.

3.8 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches on center.
2. Space reinforcement not more than 8 inches on center in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:

1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches on center vertically and 36 inches on center horizontally.

3.10 ANCHORING MASONRY VENEERS

A. Concrete Backup: Anchor masonry veneers to concrete backup to allow maximum vertical differential movement of ties up and down.

1. Space anchors as indicated, but not more than 16 inches on center vertically and 16inches on center horizontally, with not less than one anchor for each 1.77sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 16inches, around perimeter.

B. Masonry Backup: Anchor masonry veneers to concrete masonry unit backup using specified ties to allow maximum vertical differential movement of ties up and down.

1. Space anchors as indicated, but not more than 16 inches on center vertically and 16inches on center horizontally, with not less than one anchor for each 1.77sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 16inches, around perimeter.

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C. Cold Formed Metal Framing and Sheathing: Anchor masonry veneers to wall framing with masonry veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated.
2. Embed tie sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches on center vertically and 16inches on center horizontally, with not less than one anchor for each 1.77sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 16inches, around perimeter.

3.11 CONTROL JOINTS

A. General: Install control joints in unit masonry as masonry progresses and where indicated on the Drawings in accordance with requirements of NCMA TEK 10-02 or Engineer locations in accordance with NCMA TEK 10-03. Do not allow masonry materials to span control joints without provision to allow for in-plane wall or partition movement.

1. If not indicated, locate control joints at the lesser of the following:
    a. A distance of 25 feet on center.
    b. A distance equal to 1-1/2 times the height of the wall.
2. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
3. In addition to the above requirements and unless otherwise indicated on the drawings, provide vertical control joints in masonry walls as follows:
    a. Within 10 feet of wall corners and intersections,
    b. Adjacent to and over openings:
        1) On one side of openings less than 6’-0” at end of lintel.
        2) On both sides of openings 6’-0” wide and greater at both ends of lintel.
    c. Changes in wall height or wall thickness, such as at pipe and duct chases and pi-lasters.
    d. At movement construction joints in foundations, in roofs, and in floors.

B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

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3.12 EXPANSION JOINTS

A. General: Install expansion joint materials in clay masonry as masonry progresses and where indicated on the Drawings. Do not allow masonry materials to span expansion joints without provision to allow for in-plane wall movement.

1. If not indicated, locate expansion joints at the lesser of the following:
    a. A distance of25 feet on center in brick walls without openings.
    b. A distance of 20 feet (6.1 m) on center in brick walls with openings.
    c. A distance of 15 feet (4.6 m) on center in brick parapets.
2. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
3. In addition to the above requirements and unless otherwise indicated on the Drawings, provide vertical expansion joints in clay masonry walls as follows:
    a. Within 10 feet of wall corners and intersections,
    b. Adjacent to and over openings:
        1) On one side of openings less than 6’-0” (1.8 m) at end of lintel.
        2) On both sides of openings 6’-0” (1.8 m) wide and greater at both ends of lintel.
    c. Changes in wall height or wall thickness, such as at pipe and duct chases and pilasters.
    d. Changes in support or backup systems for brick veneer.
    e. At movement construction joints in foundations, in roofs, and in floors.

B. Form expansion joints in brick as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build in compressible joint fillers.
3. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.13 LINTELS

A. Install galvanized steel lintels where indicated.

B. Provide concrete or masonry lintels where shown and where openings of more than 8 inches for brick-size units and 16 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

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3.14 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe.
3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under building paper or building wrap, lapping at least 4 inches.
4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
5. Seal ends of sheet metal flashing by overlapping not less than 4inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
6. Turn down sheet metal flashings at exterior face of masonry to form a drip.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

E. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Space weep holes 16 inches on center unless otherwise indicated.

F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.15 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

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B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

D. Low-Lift Grouting Method: Provide low lift grouting as the laying of masonry and placement of reinforcement progresses.

1. Limit height of vertical grout pours to not more than 60 inches.
2. Allow setting mortar to cure at least 4 hours prior to grouting of cells in adjacent hollow masonry units.
3. Provide grout keys by terminating grout lifts a minimum of 1-1/2 inch below mortar joints or 1-1/2 inches above bed joint when one course is laid above horizontal reinforcing.
4. Consolidate each grout lift with a rod to provide uniform flow into all spaces of voids.
5. Place grout in cells up to top masonry course at a maximum 48 inches height above preceding pour.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "South Carolina Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C67 for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

I. Prism Test: For each type of construction provided, according to ASTM C1314 at 7 days and at 28 days.

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3.17 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
4. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.18 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION 042000

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SECTION 044000 - EXTERIOR DIMENSION STONEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 CONTROLLING DOCUMENTS

A. This specification is controlled by Division 08 Section “Exterior Enclosure System Requirements”. In addition to the requirements of this document, all requirements of Controlling Documents must also be met. The more onerous conditions of this document or the Controlling Document must be met.

1.3 SUMMARY

A. Provide the work of this Section in accordance with requirements of the Contract Documents.

B. This Section includes, but is not limited to the following:

1. Dimension stone panels and trim set with individual anchors.
2. Anchors, fastenings, and accessories.

C. Related Requirements:

1. Division 03 Section "Cast-In-Place Concrete" for installing inserts in concrete for anchoring dimension stonework.
2. Division 04 Section "Unit Masonry" for installing inserts in unit masonry for anchoring stonework.
3. Division 07, Section "Joint Sealants" for sealing joints in exterior dimension stonework with elastomeric sealants.
4. Division 08 Section "Exterior Enclosure System Requirements" for wind loads, seismic loads and other loads acting upon exterior enclosure systems including exterior dimension stonework.

1.4 DEFINITIONS

A. Definitions contained in ASTM C119 apply to this Section.

B. IBC: International Building Code.

C. Dimension Stonework Assembly: An exterior wall covering system consisting of dimension stone panels and trim together with anchors, backup structure, membrane air barrier, flashings, mortar, fasteners, and sealants used to secure the stone to building structure and to produce a weather-resistant covering.

1. Backup structure includes concrete and masonry wall elements and miscellaneous steel members required to secure stone to the building structure.

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1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Attendees: The Contractor, the Owner, the Owner's Commissioning Agent, the Architect, Representatives of Stone Quarries and Fabricators, Stone Installers, and installers of exterior envelope items that interface with or affect stonework specified in this Section.
2. Agenda:
    a. Review and finalized construction schedule.
    b. Verify availability of materials, installers' personnel, equipment, and facilities needed to maintain schedule.
    c. Review means and methods related to fabrication and installation, including manufacturer's written instructions.
    d. Review pre-installation testing reports, source quality control reports, mockup and testing reports and modifications required for stone and anchor safety factors and anchorage recommendations.
    e. Examine support conditions for compliance with requirements including alignment and attachment to structural members.
    f. Review flashings, stonework details, wall penetrations, openings, and conditions of other construction affecting the Work.
    g. Review temporary protection requirements during and after installation of the Work.

1.6 ACTION SUBMITTALS

A. Product Data: Submit product data for each variety of stone, stone accessory, and manufactured product.

1. Include data on physical properties required by referenced ASTM standards.

B. Sustainable Design Action Submittals:

1. Building Product Disclosure and Optimization:
    a. Leadership Extraction Practices
        1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
        2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
            a) Include statement indicating costs for each product having recycled content.
    b. Sourcing of Raw Materials: For products that are required to comply with requirements for regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.
        1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

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2. Indoor Environmental Quality, Low Emitting Materials: Building Products must be tested and compliant with the California Department of Public-Health (CDPH) Standard Method V1.1-2010, using the applicable exposure scenario.

    a. For paints, and coatings, wet applied, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure for Architectural Coatings or the South Coast Air Quality Management District (SCAQMD) Rule 113-2011.

C. Shop Drawings: Show fabrication and installation details for exterior dimension stonework assembly, including dimensions and profiles of stone units.

1. Show locations and details of joints both within exterior dimension stonework assembly and between exterior dimension stonework assembly and other construction.
2. Include details of mortar joints and sealant joints.
3. Show locations and details of anchors and backup structure.
4. Show direction of veining, grain, or other directional pattern.
5. Include large-scale shaded elevations and details of decorative surfaces and inscriptions.
6. Indicate location and dimensions of all cutouts required to accommodate penetrants of other work.

    a. Obtain templates of all items penetrating stone surfaces and other items indicated on drawings.
    b. Locate cutouts accurately in relation to scheduled location of these items, coordinating with the work of other trades and contractors as required.
    c. All cutouts shall be performed by fabricator in his shop.

7. Include plans, elevations, sections, details, and attachments to other Work. Shop drawings and dimensions shown on shop drawings shall be based on actual field measurements to determine exact dimension of each stone piece and anchorage required.

    a. Wall elevations at 1/4 in. scale; with typical unit elevation at 1 in. scale.

D. Samples:

1. Stone Samples for Verification: Sets for each variety, color, and finish of stone required; not less than 12 inches square.

    a. Sets shall consist of at least three Samples, exhibiting extremes of the full range of color and other visual characteristics expected and will establish the standard by which stone will be judged.

2. Colored Pointing Mortar Samples: For each color required, showing full range of exposed color and texture expected in the completed work.
3. Sealant Samples: For each type and color of joint sealant required.
4. Each type of fastening device, anchors, shims and setting pads.

E. Fabrication Engineering and Design Submittal: Submit structural analysis calculations for stonework assembly including materials and all components, indicated to comply with design loads; signed and sealed by the New Jersey State licensed professional engineer responsible for their preparation.

1. Submit complete design data for products specified.
2. For each stone variety proposed for use on the Project, submit test reports for results of the physical properties testing for modulus of rupture, density, and compressive strength of stone.

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3. Submit structural calculations for stone stress, deflections, and anchorages. Calculations to be stamped by Professional Engineer licensed in the State of New Jersey. Calculations to show any necessary reinforcements or increases in thicknesses required to be made to the nominal stone thickness in order to meet the wind loads as shown.
4. Submit a statement certified by the registered Professional Engineer that the design of the exterior veneer and its components and connections is in compliance with all provisions of the Contract Documents and the New Jersey building code and is in keeping with generally accepted engineering practice.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: Submit for Installer, fabricator, professional engineer, and testing agency to demonstrate their capabilities and experience and show compliance with requirements listed in Paragraph "Quality Assurance. Include lists of completed projects with project names and addresses, names and addresses of architects and owners and other information specified.

B. Sustainable Design Informational Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:
    a. Raw Material Sources and Extraction Reporting: Submit Raw materials supplier corporate Sustainability Reports (CSRs); documenting responsible extraction; including extraction locations, long term ecologically responsible land use, commitment to reducing environmental harms from extraction and manufacturing processes, and a commitment to meeting applicable standards or programs that address responsible sourcing criteria.
        1) Submit manufacturers' self-declared reports.
        2) Submit third party verified corporate sustainability reports (CSR) using one of the following frameworks."
            a) Global Reporting Initiative (GRI) Sustainability Report
            b) Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises
            c) UN Global Compact
            d) ISO 26000
            e) USGBC approved program.
2. Building Product Disclosure and Optimization - Material Ingredients
    a. Material Ingredient Optimization: Submit manufacturer's Environmental Product Declaration (EPD) and at least one of the following:
        1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
        2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo.
        3) International Alternative Compliance Path - REACH Optimization
        4) Declare: Manufacturer's completed Product Declaration Form
        5) Other programs approved by USGBC
    b. Product Manufacturer Supply Chain Optimization: Submit documentation from manufacturers for products that go beyond material ingredient optimization as follows:
        1) No GreenScreen Benchmark 1 materials
        2) Cradle to cradle gold or platinum certification
        3) REACH

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4) Other programs approved by USGBC

C. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, supply sources, and other information as required to identify materials used.

1. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents contained in mockups unless Architect approves such deviations in writing.

D. Material Test Reports: From a qualified independent testing agency indicating and interpreting test results of the following for compliance with requirements indicated:

1. Stone Test Reports: For each stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, other than abrasion resistance, according to referenced ASTM standards performed on specimens representative of the minimum thickness and finish of installed stone in both wet and dry conditions. Base reports on testing done within previous five years.
2. Anchorage Test Reports: For each combination of stone variety and anchor type, based on testing according to ASTM C1354, performed on specimens representative of minimum thickness and finish of installed stone.

a. For metal components, by a qualified testing agency, indicating chemical and physical properties of metal.

3. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer complying with requirements in Division 07 Section "Joint Sealants" and indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.

E. Preconstruction test reports.

F. Preconstruction Sealant Field Test Report: From Installer, complying with requirements in Division 07 Section "Joint Sealants."

G. Source quality-control reports.

H. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

I. Certificate of substrate acceptance: Report examination and acceptability of surfaces to receive dimension stonework.

J. Welding certificates.

K. Warranty: Copies of warranty of terms specified.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: Include Product Data for stone-care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

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1.9 QUALITY CONTROL SUBMITTALS

A. Provide duplicate full-size quality control sample slabs of stone in each finish required and incorporating notches, edge conditions and reveals, indicative of the entire range of materials and respective finishes.

B. Prior to fabrication, provide a visual display of these samples at the quarry or stone fabricator's plant for the Owner's and Architect's review.

C. These samples will serve as the control for limiting the acceptable range of appearance.

D. The samples will be signed and dated by the Owner, Architect, Contractor, and the stone supplier.

E. Ship one set of signed stones to the job site for use as quality control samples.

F. Retain the other set of samples at the quarry or stone fabricators facility for their quality control.

1.10 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate exterior dimension stonework assemblies similar to that required for this Project and whose products have a record of not less than five (5) consecutive year successful in-service performance.

1. Fabricator's responsibilities include fabricating exterior dimension stonework and providing professional engineering services needed to assume engineering responsibility.
2. Fabrication Engineering Responsibility: Comprehensive engineering analysis by a qualified professional engineer, licensed in the State of New Jersey.

B. Installer Qualifications: A firm or individual with experienced in installing exterior dimension stonework assemblies similar in material, design, and extent to that indicated for this Project, whose work has a record of not less than five (5) consecutive year successful in-service performance.

1. Installer's responsibilities include engineering, fabricating, and installing dimension stonework, including the following:

   a. Preparation of stonework including submittals, site erection, and mock-ups
   b. Anchors, supports, inserts, and fasteners.
   c. Sealants and joint fillers.
   d. Flashings.

2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer licensed to practice in the State of New Jersey.

C. Stone Support System Manufacturer: Provide stone support systems anchors and accessories manufactured by a comply specializing in the design and fabrication of stone approved by the Architect.

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D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of dimension stone cladding systems that are similar to those indicated for this Project in material, design, and extent.

E. Testing Agency Qualifications: An independent agency qualified according to ASTM E329 for testing indicated.

F. Certifications:

1. Contractor's Certification: By commencing the work, the Contractor warrants that items and components specified or required to satisfactorily complete the installation are compatible with each other, with the conditions of installation and expected use, and warrants the effective integration and correctness of individual parts and the whole of the installation.
2. Supplier's Certification: After review of samples by the Owner and Architect, and prior to fabrication, certify in writing, and submit additional evidence indicating that a sufficient quantity of materials within the range of accepted mock-up materials is available from a single quarry to satisfy the total requirements of the project. The stone supplier is responsible for costs incurred if he fails to comply with this certification.

G. Anchorage System: The anchorage system shown is suggested for installation. Final anchorage design is the sole responsibility of the Contractor. Coordinate the location of connectors to be placed in stone with connectors to be built into cast-in-place concrete and unit masonry assemblies backup.

H. Reference Standards: Except as modified by requirements of the New Jersey Building Code, and requirements of authorities having jurisdiction, comply with the requirements and guidelines of the following industry reference standards:

1. GNBQA "Specifications for Architectural Granite.
2. MIA's "Dimensional Stone-Design Manual IV."

I. Field Samples:

1. Make quarried blocks available for inspection by the Owner and Architect at their request.
2. Make production units available for inspection by the Owner and Architect at their request. Advise Architect when production will begin and of the earliest possible opportunity to inspect a representative sampling of production work.
3. Owner or Architect's inspection of the stone does not relieve the Contractor from responsibility to provide stonework in accordance with the Contract Documents, final approved samples and shop drawings.
4. Examinations, selections, and approvals are for the purpose of achieving final appearance of stone with the greatest possible uniformity, based on the following criteria:

    a. Conformance with accepted control samples.
    b. Conformance with approved shop drawings and details with specified dimensions and tolerances.
    c. Where designated, sequence matching of adjacent stone units as approved by the Architect.

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J. Drylay Sample Installation (In lieu of Mockup):

1. Following review of stone samples and shop drawings, and after fabrication of stone but prior to stone delivery to site, construct drylay sample installation for stonework, complete with stone proposed for the project arranged as shown on the final accepted shop drawings.
2. The purpose of the drylay installation is to avoid the potential for on-site rejection of installed stonework, where the reason for rejection would be solely for unsatisfactory stone blending (unsatisfactory color, texture, or veining selection or orientation).
3. The Architect will review drylay sample installations for acceptance of the fabricators stone blending. The Architect shall alter the blending of the fabricated material, of like size stone pieces, to the Architect's satisfaction.
4. Following Architect's review of drylay sample installations, submit setting drawings with each piece of stone numbered on the drawings to correspond to the identification number on the back of each stone in the accepted drylay installation.

K. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of typical exterior wall area as shown on Drawings not less than 6 feetlong by 4 feet high.
    a. Include typical components, attachments to building structure, and methods of installation.
    b. Include sealant-filled joint complying with requirements in Division 07 Section "Joint Sealants."
    c. Include an area that has been damaged and repaired.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Alter or revise mockup, as directed to obtain Architect's approval of mockups before starting installation.
4. The approved mock-ups shall serve as a standard of quality for stonework for the project and may remain as a permanent part of the Work if in same condition as new at time of final acceptance.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
6. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.11 PRECONSTRUCTION TESTING

A. Preconstruction Stone Testing: Engage a qualified independent testing agency to perform preconstruction testing.

1. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
2. Furnish test specimens randomly selected from blocks representative of materials proposed for incorporation into the Work.
    a. A minimum of one set of test specimens (3 samples) will be required for each stone variety proposed for use on the Project, of number and size indicated in referenced standards.

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3. Physical Property Tests: For each stone variety proposed for use on Project, tested for compliance with physical property requirements, other than abrasion resistance, according to referenced ASTM standards.
4. Absorption and Density: ASTM C97, "Absorption and Bulk Specific Gravity of Natural Building Stone: one set of 3 tests for each stone variety.
5. Compressive Strength: ASTM C170, "Compressive Strength of Natural Building Stone"; one set of 3 tests for wet and dry conditions, perpendicular and parallel to rift.
6. Modulus of Rupture: ASTM C99 "Modulus Rupture of Natural Building Stone". Conduct 20 tests overall: 5 tests wet and dry, with loading applied parallel to rift plane of stone, and 5 tests wet and dry perpendicular to the rift plane of the stone, which ever will be the loaded condition of stone for the Work.
7. Flexural Strength Tests: For each stone variety, thickness, orientation of cut, and finish, proposed for use on Project, tested according to ASTM C880/C880M "Flexural Strength of Natural Building Stone", one set of 3 samples in both wet and dry conditions tested perpendicular and parallel to rift.
8. Durability and Freeze-Thaw Resistance:
    a. ASTM C666 "Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing" in accordance with Natural Stone Institute Protocol as follows:
        1) Test 12 specimens of each stone type, according to Procedure A, with bottom of stone including edges immersed 1/3 to 1./2 specimen depth in water and subject to temperature cycles from 50 deg F(20 deg C) Thaw temperature to 5 deg F (-15 deg C) freeze temperature for cycles of ±6 hrs.
            a) Stones designated for vertical application shall be subject to cycle where specimens are frozen in air, thawed submerged.
            b) Stones for horizontal application shall be emersed in water through freeze and thaw cycles.
        2) Specimen Size: 12t x 1.5t x t, where t is the thickness of stone selected for the building.
        3) Remove and test 2 specimens at each of 6 intervals: 25, 50, 75,100, 125, and 150 thermal cycles according to ASTM C880 for flexure strength.
        4) Chart degradation in flexural strength to verify if equilibrium has been reached before 150 cycles.
        5) Degradation failure is measured as flexural strength that has not leveled off (reached equilibrium) or is in excess of 30% less than original value.
            a) Adjust anchor spacing safety factor for tested aged flexural strength of stone.
9. Anchorage Tests: For each stone variety, orientation of cut, finish, and anchor type proposed for use on Project, tested according to ASTM C1354/C1354M.

B. Preconstruction Sealant Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for compatibility and adhesion testing according to sealant manufacturer's standard testing methods and Division 07 Section "Joint Sealants," samples of materials that will contact or affect joint sealants.

C. Preconstruction Field Testing of Sealants: Before installing joint sealants, field test their adhesion to joint substrates per requirements specified in Division 07 Section "Joint Sealants."

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1.12 DELIVERY, STORAGE, AND HANDLING

A. Protect stone and cementitious materials and stonework accessories during storage and construction against moisture, soiling, staining and physical damage and as required to prevent deterioration due to contaminants, corrosion, or other causes.

B. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, and other causes.

1. Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.
2. Store stone on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to stone. Ventilate under covers to prevent condensation.

C. Mark stone units, on surface that will be concealed after installation, with designations used on Shop Drawings to identify individual stone units. Orient markings on vertical panels so that they are right side up when units are installed.

D. Deliver sealants to Project site in original unopened containers labeled with manufacturer's name, product name and designation, color, expiration period, pot life, curing time, and mixing instructions for multicomponent materials.

E. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

F. Store aggregates in locations where grading and other required characteristics can be maintained and where contamination can be avoided.

1.13 FIELD CONDITIONS

A. Protect stonework during erection and doing the following:

1. Cover tops of stone cladding installation with nonstaining, waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress. Extend cover a minimum of 24 inches down both sides and hold securely in place.
2. Prevent staining of stone from mortar, grout, sealants, and other sources. Immediately remove such materials without damaging stone.
3. Protect base of walls from rain-splashed mud using coverings spread on the ground and over the wall surface.
4. Protect sills, ledges, and projections from sealant droppings.
5. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes.
6. Turn scaffold boards near the wall on edge at end of each day to prevent rain from dirt on completed stone masonry.

B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Remove and replace stone cladding damaged by frost or freezing conditions. Comply with cold-weather construction and protection requirements for masonry contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than seven days after completing cleaning.

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C. Hot-Weather Requirements: Comply with hot-weather construction and protection requirements for masonry contained in ACI 530.1/ASCE 6/TMS 602 and with the following:

1. Maintain temperature of materials below 100 deg F.
2. Do not apply mortar to substrates with temperatures of 100 deg F and above.
3. When the ambient temperature exceeds 90 deg F, fog spray installed stone flooring until damp at least three times a day until flooring is three days old.

D. Environmental Limitations for Sealants: Do not install sealants when ambient and substrate temperatures are outside limits permitted by sealant manufacturer or below40 deg F or when joint substrates are wet.

E. Field Measurements: Verify dimensions of construction to receive stone by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabrication without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.14 COORDINATION

A. Coordinate installation of inserts that are to be embedded in concrete or masonry, flashing reglets, and similar items to be used by exterior dimension stonework Installer for anchoring, supporting, and flashing of exterior dimension stonework assembly. Furnish setting drawings, templates, and directions for installing such items and deliver to Project site in time for installation.

B. Time delivery and installation of exterior dimension stonework to avoid extended on-site storage and to coordinate with work adjacent to exterior dimension stonework.

1.15 WARRANTY

A. Special Warranty: Provide a written special warranty, agreeing to repair or replace defective materials and workmanship of stonework during warranty period.

1. Defective materials and workmanship include:

a. Abnormal deterioration, aging, or weathering of the work,
b. Significant leakage of water or air, excessive deflections,
c. Structural failure of components resulting from exposure to normal loads and forces,
d. Deterioration or discoloration of materials in excess of normal weathering and aging
e. Deterioration of sealants including loss of adhesion and cohesive failures
f. Failure of the work to fulfill other specified performance requirements.

2. Stones shall be considered defective if they are chipped, discolored, cracked, or exhibit any other defect in the opinion of the Architect.

a. A representative of the stone fabricator and installer shall inspect the substrate as specified in Paragraph "Submittals" above and shall inspect installed stonework and shall note on the warranty that no provisions have been nullified in the manufacture, substrate preparation, and installation of stone.

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3. Warranty shall provide for removal of defective stone units, finishing and replacement.
4. The warranty period is for five (5) years from the date of substantial completion.
5. Warranty shall be signed by the Contractor, stone supplier, stone fabricator, stone Installer, and Installer(s) of stone support systems (to the extent above are different entities).

B. This warranty is in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from single quarry with resources to provide materials of consistent quality in appearance and physical properties.

1. For stone types that include same list of varieties and sources, provide same variety from same source for each.
2. Make quarried slabs available for examination by Architect.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

C. Source Limitations for Other Materials: Obtain each type of stone accessory, sealant, and other material from single manufacturer for each product.

2.2 PERFORMANCE REQUIREMENTS

A. Fabrication Engineering and Design: The Contractor is responsible for engaging a qualified professional engineer for the engineering design of all components and materials, the installation of exterior dimension stonework assembly and related support systems to comply with performance criteria specified in Division 08 Section "Exterior Enclosure Performance Requirements" and in this Section.

1. Coordinate engineering of the stone and anchorages to the primary support construction as indicated.

B. General: Fabricate and install stonework to withstand loads imposed by building movement and other loads as required, as well as to resist deterioration under conditions of normal use without failure.

1. Select stone anchors and anchoring systems according to ASTM C1242.
    a. Stone anchors shall withstand not less than two times the weight of the stonework in both compression and tension.

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C. Structural Performance: Stonework assembly shall withstand the effects of gravity and the following loads and stresses within limits and under conditions indicated. Determine performance loads and pressures applicable to Project according to ASCE/SEI 7, and the New Jersey Building Code, based on heights above grade indicated on Drawings. Comply with the following:

1. Dead Loads: Weights of materials and construction.
2. Wind Loads: Stonework shall withstand the effects of wind pressures based on the provisions of the American Society of Civil Engineers, "Minimum Design Loads for Buildings and Other Structures", ASCE 7-16 and design criteria and loads indicated on the Structural Drawings.
3. Seismic Loads: Stonework shall withstand the effects of earthquake motions determined according to the Building Code based upon design criteria and loads indicated on the Structural Drawings.
4. Snow Loads: Stonework shall withstand the effects of ground snow loads determined according to the Building Code based upon design criteria and loads indicated on the Structural Drawings.

D. Thermal Movements: Provide dimension stonework that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperature ranges by preventing displacement of stone, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and night-time sky heat loss in the range as follows:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

E. Horizontal Building Movement (Interstory Drift): Allow for maximum horizontal building movement equal to quotient resulting from dividing floor-to-floor height at any floor by 400.

F. Shrinkage and Creep: Allow for progressive vertical shortening of building frame indicated on Structural Drawings.

G. Safety Factors for Stone: Design exterior dimension stonework assembly to withstand loads indicated without exceeding stone's allowable working stress determined by dividing stone's average ultimate strength, as established by testing, by the following safety factors:

1. Safety Factor for Granite: 3.
2. Safety Factor for Concentrated Stresses: 4.

H. Physical and Mechanical Properties: Engineering of stone support system shall be based on the mechanical and physical properties of the selected stone. Performance data for these properties shall have been derived from tests conducted by an independent engineering laboratory acceptable to the Architect and shall be furnished by the Contractor to the Architect for the stone selected. This performance data shall include:

1. ASTM C95, "Petrographic Analysis".
2. ASTM C97, "Absorption and Bulk Specific Gravity of Natural Building Stone".
3. ASTM C170, "Compressive Strength of Natural Building Stone".
4. ASTM C99, "Modulus of Rupture of Natural Building Stone".
5. ASTM C880, "Flexural Strength of Natural Building Stone."

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I. Engineer stone anchors to withstand loads indicated without exceeding allowable working stresses established by the following:

1. For Structural Steel: AISC's AISC 360, "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design."
2. For Cold-Formed Steel: AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
3. For Cold-Formed Stainless Steel: ASCE/SEI 8, "Specification for the Design of Cold-Formed Stainless Steel Structural Members."
4. For Cast-in-Place and Postinstalled Fasteners in Concrete: One-fourth of tested capacity when installed in concrete with compressive strength indicated.
5. For Post-Installed Fasteners in Masonry: One-sixth of tested capacity when installed in masonry units indicated.

J. Provision for Deflection of Building Structure: Allow for the following:

1. Deflection due to Weight of Exterior Dimension Stonework Assembly: 1/4-inch vertical deflection in 20-foot span of structural members supporting stonework assembly.
2. Live Load Deflection: Allow for 1/4-inch vertical deflection, in 20-foot span of structural members supporting stonework assembly, due to live loads imposed on building's structural frame after stone installation.

K. Provisions for Fabrication and Erection Tolerances: Allow for fabrication and erection tolerances of building's structural system.

1. Concrete fabrication and erection tolerances are specified in Division 03 Section "Cast-in-Place Concrete."

L. Control of Corrosion and Staining: Prevent galvanic and other forms of corrosion as well as staining by isolating metals and other materials from direct contact with incompatible materials. Use materials that do not stain exposed surfaces of stone and joint materials.

2.3 STONE, GENERAL

A. General: Comply with ASTM C119, Natural Building Stone. Provide stone of hardness and density, to satisfy performance criteria specified, and shall have texture, graining, finish, crystal patterning, color, and tone as approved by the Architect.

B. Stone shall be of sound stock and uniform texture, free from holes, shakes, cracks, starts, seams, clay pockets, spalls, stains, starts and other defects which would impair strength, durability, finish appearance.

1. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
2. Provide stone from a single quarry for each variety of stone required. Fabricator shall recommend quarries and locations within the quarries that are able to provide high quality stone which visually matches the specified stones. Recommended quarries and locations shall be reviewed by and subject to acceptance by the Architect.
3. For each Stone variety, provide matched blocks extracted from contiguous locations in a single bed of quarry stratum unless the Architect approved stone from blocks randomly selected for aesthetic effect.
4. All stone material shall be subject to culling as required to match Architect's samples.

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C. Quarry stone in a manner to ensure that as quarried block orientations yield finished stone with required characteristics.

D. Visual Criteria for Dimension Stone: All portions of the dimension stonework shall comply with the following criteria as reviewed as accepted by the Architect through sample submissions, mock-ups, and on-site observations:

1. Color Range: Dimension Stone shall have a uniform color with no discernable variations between pieces in any contiguous area.
2. Imperfections (defined as mineral inclusions occurring as pockets or veins):
    a. Veined Imperfections: Veined imperfections will not be permitted in any dimension stone material.
    b. Pocket Imperfections:
        1) High Contrast Imperfections: High contrast imperfections will not be permitted, regardless of size of imperfection.
        2) Low Contrast Imperfections: Low contrast imperfections may be permitted when such imperfections cannot be seen when viewed at a distance of 15 feet in ordinary daylight, the imperfections do not exceed 1 inch in diameter, and the occurrence of imperfections is not considered excessive by the Architect.

2.4 GRANITE

A. Material Standard: Comply with ASTM C615/C615M and NBGQA's "Specifications for Architectural Granite" and as follows.

B. Basis of Design **ST-01**: Jet Mist; Swenson Stone**, or approved equal**.

1. Description: Fine-grained, black stone with subtle veining.
2. Finish: Thermal finish.
3. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

C. Cut stone from one block or contiguous, matched blocks in which natural markings occur.

D. Thickness: Not less than 2 inches unless otherwise indicated.

2.5 ANCHORS AND FASTENERS

A. Fabricate anchors from stainless steel, ASTM A240/A240M or ASTM A666, Type 304 or Type 316; temper as required to support loads imposed without exceeding allowable design stresses. Fabricate dowels and pins for anchors from stainless steel, ASTM A276, Type 304 or Type 316.

B. Fabricate shelf angles from either of the following, except as otherwise indicated:

1. Stainless steel, ASTM A240/A240M or ASTM A666, Type 304 or Type 316.
2. Hot-dip galvanized steel, ASTM A36/A36M for materials and ASTM A123/A123M for galvanizing.

B. Cast-in-Place Concrete Inserts: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel, with capability to sustain, without failure, a load equal to 4 times the loads imposed as determined by

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testing per ASTM E488, conducted by a qualified independent testing agency. Provide bolts, washers, and shims as needed, all hot dip galvanized per ASTM F2329.

1. Adjustable Inserts Embedded in Concrete: Steel, cast iron, or malleable iron, with bolts, nuts, washers, and shims; all hot dip galvanized or mechanically zinc coated.

C. Postinstalled Anchor Bolts for Concrete and Masonry: Chemical anchors or torque-controlled expansion anchors made from stainless-steel components complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 for bolts and nuts; ASTM A240/A240M, ASTM A276, or ASTM A666, Type 304 or 316, for anchors, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E488/E488M, conducted by a qualified independent testing agency.

D. Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers.

1. For stainless steel, use annealed stainless-steel bolts, nuts, and washers; for bolts, ASTM F593; and for nuts, ASTM F594, Alloy Group 1 Group 2.
2. For galvanized-steel shelf angles, use carbon-steel bolts, nuts, and washers; for bolts, ASTM A307, Grade A; for nuts, ASTM A563, Grade A; and for washers, ASTM F436; all hot-dip or mechanically zinc coated.

2.6 MORTAR MATERIALS

A. Portland Cement: ASTM C150, Type I or Type II, except Type III may be used for cold-weather construction, natural color or white as required to produce mortar color indicated.

B. Mortar cement and masonry cements are not permitted.

C. Hydrated Lime: ASTM C07.

D. Sand: ASTM C144, natural white sand or ground white stone.

E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979. Pigments shall have a record of satisfactory performance in mortar.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Davis Colors; True Tone Mortar Colors.
   b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
   c. Solomon Colors; SGS Mortar Colors.
   ~~c.~~**d. Or approved equal.**

F. Portland Cement-Lime Mix: Packaged blend made from Portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
   b. Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
   c. Lafarge North America Inc.; Eaglebond Portland & Lime.
   d. Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

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~~d.~~ **e. Or approved equal.**

2. Formulate blend as required to produce color indicated.
3. Pigments shall not exceed 10 percent of Portland cement by weight.

G. Aggregate: ASTM C144; except for joints narrower than 1/4 inch and pointing mortar, 100 percent shall pass No. 16 sieve.

1. For mortar that is exposed to view, use washed aggregate.
2. White Aggregates: Natural white sand or ground white stone.
3. Colored Aggregates: Natural-colored sand or ground marble, granite, or other durable stone; of color necessary to produce required mortar color.

H. Water: Potable, non-alkaline, clear, and free of deleterious materials which would impair the quality of the Work.

2.7 STONE VENEER ANCHORS

A. General: Provide anchors and attachments of type and size to support stonework complying with the requirements of "Performance Criteria", fabricated from the following stainless steel members. Embed anchors within stone in sizes, configurations and profiles as shown or as required to sustain imposed loads as well as be free from rattle or displacement.

B. Materials:

1. Stainless-Steel Wire: ASTM A580, Type 316.
2. Stainless-Steel Sheet: ASTM A240 or ASTM A666, Type 316.
3. Stainless Steel Anchors: ASTM A666, Type 316temper as required to support imposed loads without exceeding allowable design stresses and in no case less than 0.187 inch thick.
4. Fasteners: Annealed stainless-steel bolts, nuts, and washers, ASTM F593 for bolts and ASTM F594 for nuts, Alloy Group 1.

C. Size: Sufficient to extend at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least a 5/8-inchcover on exterior face.

D. Cast-in-Place and Postinstalled Fasteners for Concrete and Masonry: Type indicated below, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Adjustable Inserts Embedded in Concrete: Steel, cast iron, or malleable iron, with bolts, nuts, washers, and shims; all hot dip galvanized or mechanically zinc coated.
2. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 316, for anchors. Do not use lead shield expansion bolts or cinch anchors.

2.8 STONE ACCESSORIES

A. Setting Shims: Strips of resilient plastic or vulcanized neoprene, Type A Shore durometer hardness of 50 to 70, nonstaining to stone, of thickness needed to prevent point loading of stone on anchors and of depths to suit anchors without intruding into required depths of pointing materials.

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B. Setting Buttons: Resilient plastic buttons, nonstaining to stone, sized to suit joint thicknesses and bed depths of stone units without intruding into required depths of pointing materials and of joint sealants or causing third-side adhesion between sealant and setting button.

C. Cushions: Clear plastic shims and 50 Durometer neoprene pads, 1 inch x 2 inch by thickness required.

D. Stainless Steel Dowels: Fabricate dowels and pins for anchors from stainless steel, ASTM A276, Type 316.

E. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A185 and ASTM A82 except for minimum wire size.

F. Concealed Sheet Metal Flashing: Fabricated from stainless steel in thicknesses indicated, but not less than 0.0156 inch thick, and complying with Division 07, Section "Sheet Metal Flashing and Trim."

G. Cellular Plastic Weep Hole/Vents: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, of length required to extend from exterior face of stone to cavity behind, in color selected from manufacturer's standard.

2.9 ADHESIVES AND SEALANTS

A. General: Use only adhesives formulated for stone and recommended by their manufacturer for the application indicated.

B. Sealants for Joints in Exterior Dimension Stonework: Manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated below that comply with applicable requirements in Division 07, Section "Joint Sealants" and do not stain stone:

1. Silicone joint sealant.

C. Preformed Joint Seals: Preformed silicone joint seals that comply with applicable requirements in Division 07 Section "Preformed Joint Seals" and do not stain stone.

D. Sealant for Filling Kerfs: Same sealant specified for joints in dimension stonework that comply with applicable requirements in Division 07 Section "Joint Sealants" and that do not stain stone.

2.10 CLEANING MATERIALS

A. Water: Potable

B. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. of solution required.

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2.11 FABRICATION OF STONE

A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated, including details on Drawings and Shop Drawings.

1. For Granite, comply with recommendations in the NBGQA "Specifications for Architectural Granite.

B. Cut and drill sinkages and holes in stone for anchors, fasteners, supports, and lifting devices as indicated or needed to set stone securely in place.

C. Stone thicknesses indicated are preliminary selections made by the Architect for detailing only and do not represent thickness required for the project. Stone fabricator shall engineer stone thickness based on recommendations made by applicable stone association for stone panel size.

1. Cut stone to produce pieces of thickness, size, and shape indicated and to comply with fabrication and construction tolerances recommended by applicable stone association or, if none, by stone source, for faces, edges, beds, and backs.

a. Provide greater stone thickness than indicated where thicknesses indicated are insufficient for the sizes or where extent of cut-outs shown decreases effective strength of the remaining material, or for proper and sufficient anchorage, suitable and adequate bearing areas, or surfaces.
b. The use of liners properly sized and secured to stone facing will be permitted only where shown on drawings and/or final shop drawings and are to be mechanically secured in addition to adhesive connection.

D. Control depth of stone and back check to maintain minimum clearance of 1-1/2 inches between backs of stone units and surfaces or projections of structural members, fireproofing (if any), backup walls, and other work behind stone.

E. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.

1. Fabrication Tolerances:

a. Thickness: Plus 1/16-inch, minus 0-inch.
b. Overall length and width of piece: Plus, or minus 1/32-inch in 12 inches and plus or minus 1/16 inch in 48 inches in overall unit dimension.
c. Deviation from flat surface in exposed faces: Plus, or minus 1/16-inch in 48-inches for polished and honed finishes.
d. Face variation from rectangular (maximum out of square): Plus, or minus 1/32-inch in 12 inches, plus or minus 1/16 inch in 48 inches overall unit dimension.
e. Anchor mortise tolerances:

1) Centers of all back and edge anchors: Plus, or minus 1/8-inch.
2) Depth of back, edge, and kerf anchors: Plus 1/16-inch, minus 0-inch.
3) Slot or kerf width dimensions for edge anchors: Plus, or minus 1/16-inch.
4) Slot or kerf edge anchor centerline location in stone thickness: Plus, or minus 1/16-inch.

2. Clean sawn backs of stones to remove rust stains and free iron particles.

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3. Dress joints (bed and vertical) straight and at 90 degree right angle to face unless otherwise indicated. Cut kerfs, reveals, and rustications as shown. Make arrises straight, sharp, true, and continuous at joints.
    a. Where overlapped stone joints occur, finish stone edges to match panel face.
4. Cut and drill stones as required for shims, anchors, supports, lifting devises and other inserts as required for rigid and secure installation.
    a. Predrilled holes for the attachment of mechanical anchors shall be diamond cored jig drilled; dry (impact) drilling of holes shall not be permitted.
    b. Backcheck kerfs as required to accept stone supports and to provide maximum working joint clearance at panel to panel joints.
    c. The bottom of any hole or slot for anchor insertion shall not be less than ½-inch from exposed panel face.
5. Provide openings, reveals, and similar features as needed to accommodate adjacent work.
6. Make exposed surfaces straight, sharp, true, and continuous at joints within tolerances specified.

F. Butt joint corners as indicated on Contract Drawings.

G. Cut stone to produce uniform joints 3/8 inch wide, except as otherwise indicated.

H. Contiguous Work: Provide chases, reveals, reglets, openings, and similar features as required to accommodate contiguous work.

I. Fabricate molded work, including washes and drips, to produce stone shapes with a uniform profile throughout entire unit length, with precisely formed arris slightly eased to prevent snipping, and with matching profile at joints between units.

1. Produce moldings and molded edges with machines that use abrasive shaping wheels made to reverse contour of molding shape.

J. Carve and cut inscriptions and decorative surfaces. Use skilled stone carvers experienced in the successful performance of work similar to that indicated.

K. Clean backs of stone to remove rust stains, iron particles, and stone dust.

L. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.

1. Grade and mark stone for overall uniform appearance when assembled in place. Natural variations in appearance are acceptable if installed stone units match range of colors and other appearance characteristics represented in approved samples and mockups.

M. Finish exposed faces and edges of stone to comply with requirements indicated for finish under each type and application of stone required and to match approved samples and field constructed and approved mockups.

N. Pattern Arrangement: Fabricate and arrange panels with veining and other natural markings to comply with the following requirements:

1. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
2. Arrange panels with veining as indicated on Drawings in blend pattern.

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2.12 MORTAR MIXES

A. General: Comply with ASTM C270, and with manufacturers' instructions relative to mix proportions, mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars of uniform quality and with optimum performance characteristics.

1. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated. Do not use calcium chloride.
2. Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer, unless otherwise indicated. Discard mortar when it has reached initial set.

B. Setting and Pointing Mortars: Comply with ASTM C270, Proportion Specification, for types of mortar indicated. Provide mortar mixed to match Architect's sample and complying with the following:

1. Packaged Portland Cement-Lime Mix Mortar: Use only Portland cement-lime mix of selected color.
2. For setting mortar, use Type S.
3. For pointing mortar, use Type S.

2.13 FINISHES FOR STONE

A. Finish exposed surfaces and edges free from cracks, broken corners, chipped edges, scratches, or other defects affecting appearance. No hiding of defects will be permitted. Units having flaws or imperfections beyond that accepted in sample submittal and review are not acceptable and will be rejected. Replace with acceptable units without additional compensation. Patch stone only in accordance with the specified criteria herein and with approval of the Architect.

B. Visually examine finished stone for potential micro-cracking. Report instances of excessive or potentially damaging cracks in crystalline structure.

C. Finish exposed-to-view edges to match face finish.

D. Provide finishes, range of texture uniformity, and the range of color and value of all material matching or otherwise conforming to the properties as evidenced in quality control approval samples and full size mock-ups.

2.14 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing agency to perform source quality-control testing indicated below:

1. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
2. Furnish test specimens randomly selected from same blocks as actual materials proposed for incorporation into the Work.

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3. Flexural Strength Tests: ASTM C880/C880M, performed on specimens of same thickness, orientation of cut, and finish as installed stone. One set of test specimens is required to be tested for every 5000 sq. ft., but not fewer than two sets for each stone variety.

B. Testing agency will report test results in writing to Architect and Contractor.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive exterior dimension stonework and conditions under which exterior dimension stonework will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of exterior dimension stonework.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of exterior dimension stonework.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Advise installers of other work about specific requirements for placement of inserts, flashing reglets, and similar items to be used by dimension stonework Installer for anchoring, supporting, and flashing of dimension stonework. Furnish installers of other work with Drawings or templates showing locations of these items.

B. Protect dimension stonework during erection as follows:

1. Cover tops of dimension stonework installation with nonstaining, waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress. Extend cover a minimum of 24 inches down both sides and hold securely in place.
2. Prevent staining of stone from mortar, grout, sealants, and other sources. Immediately remove such materials without damaging stone.
3. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.
4. Protect sills, ledges, and projections from mortar and sealant droppings.

C. Clean stone surfaces that are dirty or stained by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

1. Vacuum clean or sweep concrete substrates to remove dirt, dust, debris, and loose particles.
2. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

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3.3 INSTALLATION OF DIMENSION STONEWORK, GENERAL

A. Before setting stone, clean surfaces that are dirty or stained by removing soil, stains, and foreign materials. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

B. Execute exterior dimension stonework using skilled mechanics and employ skilled stone fitters at Project site to do necessary field cutting as stone is set.

1. Use power saws with diamond blades to cut stone. Produce lines cut straight and true, with edges eased slightly to prevent snipping.

C. Contiguous Work: Provide reveals, reglets, and openings as required to accommodate contiguous work.

1. Give particular attention to the location and size of cut-outs required to accommodate other work or adjoining construction, in accordance with the reviewed shop drawings for such trade.

D. Set stone to comply with requirements indicated. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure exterior dimension stonework in place. Shim and adjust anchors, supports, and accessories to set stone accurately in locations indicated, with uniform joints of widths indicated, and with edges and faces aligned according to established relationships and indicated tolerances.

E. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.

1. Sealing expansion and other joints is specified in Division 07, Section "Joint Sealants."
2. Keep expansion joints free of any rigid materials.

F. Install concealed flashing at continuous shelf angles, lintels, ledges, and similar obstructions to downward flow of water, to divert water to building exterior. Extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.

G. Keep cavities open where unfilled space is indicated between back of stone units and backup wall; do not fill cavities with mortar or grout.

1. Place weep holes in joints where moisture may accumulate, including at base of cavity walls and above shelf angles and flashing. Locate weep holes at intervals not exceeding 24 inches. Use plastic weep hole/vents.
2. Place vents in cavity walls at tops of cavities, below shelf angles and flashing, and at intervals not exceeding 20 feet vertically. Locate vents in joints at intervals not exceeding 60 inches horizontally. Use plastic weep hole/vents.

3.4 SETTING MECHANICALLY ANCHORED DIMENSION STONEWORK

A. Set stonework with mechanical anchors as indicated.

B. Attach anchors securely to stone and to backup surfaces. Comply with recommendations in ASTM C1242.

1. Install joints to exclude water or to permit its escape to building exterior, at locations where water could accumulate because of condensation or other causes.

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2. Provide at least 4 anchors per piece of stone and spaced not more than 18-inches o.c. at the edges of stone units.

C. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with sealant indicated for filling kerfs.

D. Fill anchor holes with sealant.

1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.

E. Set stone supported on clips or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths and to prevent point loading of stone on anchors. Hold shims back from face of stone a distance at least equal to width of joint.

F. Masonry Anchors: Anchor units to the supporting concrete wall\curb with non-corrosive anchors, dowels, pins, or cramps.

1. Provide a minimum of four (4) anchors per 8 square feet of unit area face, with a minimum of two (2) additional anchors per each additional 6 square feet of unit area.
2. Securely attach anchors to the supporting masonry construction and the unit.

3.5 SETTING DIMENSION STONEWORK WITH MORTAR

A. Set stonework with mortar and mechanical anchors as indicated.

B. Set stone in full bed of mortar with head joints filled unless otherwise indicated.

1. Use setting buttons of adequate size, in sufficient quantity, and of thickness required to maintain uniform joint width and to prevent mortar from extruding. Hold buttons back from face of stone a distance at least equal to width of joint, but not less than depth of pointing materials.
2. Do not set heavy units or projecting courses until mortar in courses below has hardened enough to resist being squeezed out of joint.
3. Support and brace projecting stones until wall above is in place and mortar has set.
4. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with mortar.

C. Embed ends of sills in mortar; leave remainder of joint open until final pointing.

D. Rake out joints for pointing with mortar to depths of not less than 1/2 inch. Rake joints to uniform depths with square bottoms and clean sides.

E. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply first layer of pointing mortar in layers not more than 3/8 inch until a uniform depth is formed.

F. Point stone joints by placing pointing mortar in layers not more than 3/8 inch. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.

G. Tool joints with a round jointer having a diameter 1/8 inch larger than width of joint, when pointing mortar is thumbprint hard.

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H. Rake out mortar from sealant-pointed joints to depths required for sealant and sealant backing, but not less than 1/2 inch. Rake joints to uniform depths with square bottoms and clean sides.

I. Set the following stone cladding with unfilled head joints for installing joint sealants:

1. Cornices.
2. Copings.
3. Sills.
4. Belt and other projecting courses.

3.6 SETTING DIMENSION STONEWORK WITH SEALANT JOINTS

A. Set stonework with sealant joints where indicated.

B. Attach anchors securely to stone and to back-up surfaces.

C. Fill anchor holes with sealant.

D. Where dowel holes occur at pressure-relieving joints, provide compressible material above and below dowels.

E. For stone supported on clip set on setting buttons, setting shims, or sheets of resilient, low-durometer material.

1. Use setting buttons of adequate size, in sufficient quantity, and of thickness required to maintain uniform joint widths. Hold buttons back from face of stone a distance at least equal to width of joint.

3.7 INSTALLATION OF JOINT-SEALANTS

A. Prepare joints and apply sealants of type and at locations indicated to comply with applicable requirements in Division 07, Section "Joint Sealants."

3.8 INSTALLATION TOLERANCES

A. Variation from Plumb:

1. For vertical lines and surfaces of walls, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more.
2. For external corners, corners, and jambs within 20 feet of an entrance, expansion joints, and other conspicuous lines, do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 3/8 inch in 40 feet or more.

B. Variation from Level: For lintels, sills, water tables, parapets, horizontal bands, horizontal grooves, and other conspicuous lines, do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 3/8 inch maximum.

C. Variation of Linear Building Line: For positions shown in plan and related portions of walls and partitions, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

D. Variation in Cross-Sectional Dimensions: For thickness of walls from dimensions indicated, do not exceed plus or minus 1/4 inch.

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E. Variation in Joint Width:

1. Do not vary from average joint width more than plus or minus 1/8 inch or a quarter of nominal joint width, whichever is less.
2. For joints within 60 inches of each other, do not vary more than 1/8 inch or a quarter of nominal joint width, whichever is less from one to the other.

F. Variation in Horizontal Surface Plane: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 3/8 inch maximum from level or slope indicated.

G. Variation in Plane between Adjacent Stone Units (Lipping): Do not exceed 1/16-inch difference between planes of adjacent units.

3.9 FIELD QUALITY CONTROL

1. FieldQuality-Control Water Leakage Test: Test exterior dimension stonework according to AAMA 501.2.
2. Notify Architect seven days in advance of dates and times when testing will be done.
3. Perform test at two locations as directed by Architect.
4. Report test results in writing to the Owner and Architect.

3.10 ADJUSTING AND CLEANING

A. Remove and replace broken, chipped, stained, or otherwise damaged stone, defective joints, and exterior dimension stonework that does not match approved samples and mockups. Damaged stone may be repaired if Architect approves methods and results.

B. Replace in a manner which results in exterior dimension stonework's matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean exterior dimension stonework as work progresses. Remove mortar fins and smears before tooling joints. Remove excess sealant and smears as sealant is installed.

D. Final Cleaning: Clean exterior dimension stonework no fewer than six days after completion of pointing and sealing, using clean water and stiff-bristle fiber brushes. Do not use wire brushes, acid-type cleaning agents, cleaning agents containing caustic compounds or abrasives, or other materials or methods that could damage stone.

3.11 PROTECTION

A. After initial cleaning, provide non-staining temporary wood guards at corners and other surfaces subject to damage, and cover and protect wall surfaces with protective materials until final acceptance of the work.

B. Protect stone surfaces, edges, and corners from construction damage.

C. Before inspection for Substantial Completion, remove protective coverings and clean surfaces.

END OF SECTION 044000

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SECTION 055000 – METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide the work of this section in accordance with requirements of the Contract Documents.

B. This Section includes the following:

1. Steel framing and supports for operable partitions.
2. Steel framing and supports for overhead coiling doors.
3. Steel framing and supports for countertops.
4. Steel tube reinforcement for low partitions.
5. Steel framing and supports for mechanical and electrical equipment.
6. Steel framing and supports for applications where framing and supports are not specified in other Sections.
7. Elevator machine beams, hoist beams, and divider beams.
8. Steel shapes for supporting elevator door sills.
9. Slotted channel framing.
10. Shelf angles.
11. **Steel sleeves and link seal closures to accommodate future utility connections.**
~~11.~~**12.** Metal ladders.
~~12.~~**13.** Personal fall arrest systems for ladders.
~~13.~~**14.** Metal floor plate and supports.
~~14.~~**15.** Elevator pit sump covers.
~~15.~~**16.** Miscellaneous steel trim including steel angle corner guards, steel edgings, and loading-dock edge angles.
~~16.~~**17.** Metal bollards.
~~17.~~**18.** Pipe guards.
~~18.~~**19.** Abrasive metal nosings.
20. Safety tie-offs at roof
~~19.~~**21.** Loose bearing and leveling plates for applications where they are not specified in other Sections.
~~20.~~**22.** Trench drain grating and frames.
~~21.~~**23.** Bar gratings

C. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

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D. Related Requirements:

1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Division 05 Section "Structural Steel Framing" for steel framing, supports, elevator machine beams, hoist beams, divider beams, door frames, and other steel items attached to the structural-steel framing.
4. Division 05 Section "Metal Pan Stairs".
5. Division 05 Section "Tube Railings."
6. Division 05 Section "Decorative Metal."
7. Division 07 Section "Metal Plate Wall Panels" for interior metal soffit panels suspended from secondary framing system specified in this section
8. Division 07 Section "Roof Accessories" for manufactured metal roof walkways and metal roof stairs.
9. Division 07 Section "Joint Sealants".
10. Division 10 Section "Toilet Compartments".
11. Division 10 Section "Wall and Door Protection" for aluminum checker plates for wall protection.
12. Division 10 Section "Foldign Panel Partitions".
~~3.~~13.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: Submit product data for products used in miscellaneous metal fabrications, including the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Metal nosings and treads.
~~1.~~3. Fasteners.
~~2.~~4. Paint products.
~~3.~~5. Grout.
~~4.~~6. Slotted channel framing.
~~5.~~7. Manufactured metal ladders.
~~6.~~8. Personal fall arrest systems for ladders.
~~7.~~9. Metal ships' ladders.
~~8.~~10. Metal bollards.
~~9.~~11. Vehicular barrier cable systems.
~~10.~~12. Pipe guards.
~~11.~~13. Abrasive metal nosings.

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B. Sustainable Design Action Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:
    a. Leadership Extraction Practices
        1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
        2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
            a) Include statement indicating costs for each product having recycled content.
    b. Sourcing of Raw Materials: For products that are responsibly sourced within 100 miles of project site, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.
        1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.
2. Indoor Environmental Quality:
    a. Laboratory Test Reports: For paints, coatings wet applied on site, indicating testing and compliance with the California Department of Public-Health (CDPH) Standard Method V1.2-2017, using the applicable exposure scenario.
    b. Paints and Coatings: For wet applied on-site products, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective Feb. 5, 2016.
    c. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants.

C. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for ceiling-hung toilet compartments.
~~1.~~**2.** Steel framing and supports for ~~operable~~ **folding** partitions.
~~2.~~**3.** Steel framing and supports for overhead coiling doors.
~~3.~~**4.** Steel framing and supports for countertops.
~~4.~~**5.** Steel tube reinforcement for low partitions.
~~5.~~**6.** Steel framing and supports for mechanical and electrical equipment.
~~6.~~**7.** Steel framing and supports for applications where framing and supports are not specified in other Sections.
~~7.~~**8.** Elevator machine beams, hoist beams, and divider beams.
~~8.~~**9.** Steel shapes for supporting elevator door sills.
~~9.~~**10.** Slotted channel framing.
~~10.~~**11.** Shelf angles.
~~11.~~**12.** Metal ladders.
~~12.~~**13.** Personal fall arrest systems for ladders.
~~13.~~**14.** Metal floor plate and supports.
~~14.~~**15.** Elevator pit sump covers.
~~15.~~**16.** Miscellaneous steel trim including steel angle corner guards, steel edgings, and loading-dock edge angles.
~~16.~~**17.** Metal bollards.

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~~17.~~**18.** Pipe guards.
~~18.~~**19.** Abrasive metal nosings.
~~19.~~**20.** Loose bearing and leveling plates for applications where they are not specified in other Sections.
~~20.~~**21.** Trench drain grating and frames.

D. Samples for Verification: For each type and finish of ~~extruded nosing~~.

1. Extruded nosing and tread.
2. Grating Assemblies: 24 inch square sample of each type
3. Abrasive Castings and Steel treads: 12 inch lengths of each type
4. Iron Castings: Each type.
5. Brackets, Flanges and Anchors: Each type and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.

B. Sustainable Design Informational Submittals:

1. Building Product Disclosure and Optimization - Environmental Product Declarations
   a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.
2. Building Product Disclosure and Optimization - Material Ingredients
   a. Material Ingredient Optimization: Submit at least one of the following:
      1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
      2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle-to-Cradle logo, with gold or platinum certification.
      3) International Alternative Compliance Path - REACH Optimization
      4) Declare: Manufacturer's completed Product Declaration Form
      5) Other programs approved by USGBC.

C. Fabrication Engineering and Design: For metal fabrications indicated to comply with performance requirements and criteria, provide comprehensive engineering analysis, including calculations, structural analysis data and details of anchorage and supports indicating compliance with performance requirements, signed and sealed by the qualified professional engineer responsible for their preparation.

D. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.

E. Welding Certificates **and Procedures: Submit for record written data on the materials, welding procedures and qualifications of welders in accordance with requirements of AWS D1.1 and local building code. Submit all welding and welder qualification certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article to the Special Inspection Agency for approval before submitting to the Design Professionals**.

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F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

G. Research Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Qualified Professional Engineer: Professional Engineer licensed to practice in the State of New Jersey, engaged by the Contractor to provide engineering services and responsible for the engineering of metal fabrications with loads from performance criteria.

~~A.~~**B.** Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project for a minimum of 5 years, with sufficient production capacity to produce required units without causing delay in the Work.

C. Gratings Manufacturer: A manufacturer specializing in the fabrication of the type of units required who has tested the units for load-bearing strength and deflection and has currently published load tables based on recognized test procedures.

~~B.~~**D.** Welding:

1. Qualify procedures and personnel according to the following:
   a. AWS D1.1, "Structural Welding Code--Steel."
   b. AWS D1.3, "Structural Welding Code--Sheet Steel."
   c. AWS D1.6, "Structural Welding Code--Stainless Steel."
2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

~~C.~~**E.** Reference Standards: Comply with requirements of the following referenced standards, except as modified by local codes:

1. National Association of Architectural Metal Manufacturers
   a. ANSI/NAAMM MBG 532 "Heavy Duty Metal Bar Grating Manual."
   b. ANSI/NAAMM-MBG-531 "Metal Bar Grating Manual".
2. Steel Structures Painting Council (SSPC): SSPC "Steel Structures Painting Manual, Volume 2, Systems and Specifications".
3. Industrial Fasteners Institute (IFC): "Fastener Standards Book".

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. ~~General~~**Fabrication Engineering**: **Engage a qualified professional engineer as defined in Division 01 "Quality Requirements" to provide comprehensive engineering analysis for performance and design criteria specified as required to** fabricate and install ~~the following~~ metal fabrications to withstand the specified structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections**. Provide calculations for items specified below and elsewhere in this Section, that have performance requirements**.

~~B. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.~~

~~1. Fabricate and install to support a live load of 250 lbs. per rung.~~

B. Fixed Steel Ladders: Design and construct to support at least two dead loads of 300 lbs. concentrated between any two consecutive attachments, plus anticipated loads caused by ice buildup, winds, rigging and impact loads resulting from use of ladder safety devices.

1. Each step or rung shall be capable of supporting a single concentrated load of 300 lbs. applied in the middle of the step or sung, without deformation.
2. Provide steel landing platforms designed to support a live load of 100 psf. and a concentrated load of 300 lbf.
3. Where side rails of fixed ladders extend above a floor or platform at the top of the ladder, each side rail extension shall resist a single concentrated load of 100 lbs.
4. Provide rail and harness personal fall arrest system that limit free fall distance to 2 feet or less and support a tensile load of 3,000 pounds applied to the devise with lifeline or lanyard in fully extended position.

C. Structural Performance of Personal Fall Arrest Systems for Ladders: Provide personal fall arrest systems for ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in OSHA 1910.~~27~~**28**, FAA RR-S-001301, and ANSI A14.3.

1. Fabricate and install to support a minimum static working load of 1,000 lbf. In any direction. Fabricate and install to withstand a minimum load of 5,000 lbf. In any direction without detachment, fracture, or failure.

D. Gratings

1. Areaway and Sidewalk Gratings: Unless otherwise shown, design gratings capable of withstanding a uniform load of 600 lbf/sq. ft. or a concentrated load of 8000 lbf, whichever produces the greater stress. Limit deflection to L/360 or 1/4 in., whichever is less.
2. Catwalks, Walkways, Elevated Platforms with Light Duty Gratings: Unless otherwise shown, design gratings for a uniform load of 60 psf and a concentrated load of 300 lbf on an area of 4 sq. in., whichever produces the greater stress. Limit deflection to L/360 or 1/4 in., whichever is less.

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~~D. Public Toilet Room Countertops: Fabricate and install countertop framing so that, when installed, they are capable of withstanding the following structural loads without exceeding the allowable design working stress of materials, including anchors and connections, or of exhibiting excessive deflections in any of the components making up the countertop:~~

~~1. All deadloads.~~
~~2. 500-lb live load placed on the countertop.~~
~~3. Deflection at Midspan: L/1000 times span or 1/8-inch, whichever is less.~~

E. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): Base fabrication on a temperature of plus 70 deg F at time of installation with allowance made for an exposed metal surface temperature range of minus 5 deg F to plus 180 deg F. Make all necessary adjustments and provisions for concealed expansion control.

F. Slip Resistance for Walking Surfaces: top surface to provide minimum wet dynamic coefficient of Friction (DCOF) of 0.42 for interior, and 0.5 for exterior in accordance with ANSI A326.3.

G. ADA Compliant Grating Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

1. Per ADA section 302.1, walking surfaces shall have a slip-resistant surface with sufficient frictional counterforce to the forces exerted in walking to permit safe ambulation.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, pitting, or blemishes.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

~~B.~~**C.** ~~1.~~ Steel Sheet: Provide steel sheet materials without variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.

~~C.~~**D.** Steel Plates, Shapes, and Bars: ASTM A36/A36M.

~~D.~~**E.** Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A240/A240M or ASTM A666, Type 304.

~~E.~~**F.** Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.

~~F.~~**G.** Cold Finished Steel Bars: ASTM A108, grade as selected by fabricator.

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~~G.~~**H.** Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

~~H.~~**I.** Steel Tubing: ASTM A500/A500M, cold-formed steel tubing. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A153/A153M.

~~I.~~**J.** Steel Pipe: ASTM A53/A53M, standard weight (Schedule 40), unless another weight is otherwise required by performance requirements.

1. Type S, Grade A, suitable for close coiling.
2. Black finish, unless otherwise indicated.
3. Galvanized finish for exterior installations.

K. Metal Sleeve Filler:

1. Basis of Design: Provide filler type "Link –Seal" as manufactured by PSI-ThunderLine; 6525 Goforth Street, Houston, TX 77021 Tel: 713-747-6948, Toll Free: 800-423-2410, Fax: 713-747-6029 email: info@psipsi.com or equal product from FleXicraft Industries, The Metraflex Company or another manufacturer acceptable to the authority.

2. Modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening. The elastomeric element shall be sized and selected per manufacturer's recommendations and have the following properties as designated by ASTM. Coloration shall be throughout elastomer for positive field inspection. Each link shall have a permanent identification of the size and manufacturer's name molded into it.

a. For Standard Service Applications = Model C -40 to +250ºF (-40 to +121ºC) EPDM = ATSM D2000 M3 BA510 Color = Black
b. For Thin Walled Pipe Applications = Model L -40 to +250ºF (-40 to +121ºC) EPDM = ATSM D2000 M3 BA510 Color = Blue
c. For Hydrocarbon Service Applications = Model O -40 to +210ºF (-40 to +99ºC) Nitrile = ASTM D2000 M1BF510 Color = Green
d. For High Temperature or Fire Seal Applications = Model T -67 to +400ºF (-55 to +204ºC) Silicone = ASTM D2000 M1GE505 Color = Gray Reference shall always be made to the latest published Link-Seal® modular seal selection guide for the service intended.

~~J.~~**L.** Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: As indicated.
2. Material: Galvanized steel complying with ASTM A653/A653M, structural steel, Grade 33, with G90 coating; thickness as required by performance requirements.

~~K.~~**M.** Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

~~L.~~**N.** Uncoated Structural Steel Sheet: Product type (manufacturing method), quality, and grade, as follows:

1. Cold-Rolled Structural Steel Sheet: ASTM A611, grade as follows:
   a. Grade A, unless otherwise indicated or required by performance requirements.

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2. Hot-Rolled Structural Steel Sheet: ASTM A570/A570M, grade as follows:

   a. Grade 30, unless otherwise indicated or required by performance requirements.

~~M.~~**O.** Uncoated Steel Sheet: Commercial quality, product type (method of manufacture) as follows:

1. Cold-Rolled Steel Sheet: ASTM A366/A366M.
2. Hot-Rolled Steel Sheet: ASTM A569/A569M.

~~N.~~**P.** Galvanized Steel Sheet: Quality as follows:

1. Commercial Quality: ASTM A526/A526M, G90 coating designation.

~~O.~~**Q.** Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening stainless steel.
2. Use countersunk flat-head Phillips type machine screws for exposed fasteners, except where Allen head screws are required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Structural Steel Bolts and Nuts: Structural bolts, ASTM A325, Type 3; with hex nuts, ASTM A 563; and, where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.

E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot dip galvanized per ASTM F2329/F2329M.

H. Post-Installed Anchors: Torque-controlled expansion anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

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2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1stainless steel bolts, ASTM F593, and nuts, ASTM F594.

I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

J. Roof tie-offs: provide permanent roof anchor points at locations where indicated on the drawings, and anchored to roof structure. Provide loading capacity as calculated to meet local codes. Provide universal stainless steel baseplate (16 inch x 16 inch) with 12 inch posts and eyelets for use with horizontal lifeline.

1. Basis of design: Simplified Safety CB-12 anchor plate and post.

~~J.~~**K.** Eyebolts: ASTM A489.

~~K.~~**L.** Machine Screws: ASME B18.6.3.

~~L.~~**M.** Lag Bolts: ASME B18.2.1.

~~M.~~**N.** Wood Screws: Flat head, ASME B18.6.1.

~~N.~~**O.** Plain Washers: Round, ASME B18.22.1.

~~O.~~**P.** Lock Washers: Helical, spring type, ASME B18.21.1.

~~P.~~**Q.** Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class, and style as required.

~~Q.~~**R.** Lock Washers: Helical spring type carbon steel, FS FF-W-84.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. VOC and Emissions Requirements: Paints and Coatings, adhesives and sealants, wet applied on site shall comply with VOC limits found in Division 01 Section"Sustainable Design Requirements" and CDPH Standard v1.2-2017

C. Field Applied Epoxy Zinc-Rich Primer: Complying with SSPC Paint 20, with VOC less than 100 g/l, and compatible with topcoat.

1. Products: Subject to compliance with requirements, provide one of the following :

a. Carboline Company; "Carbozinc 859 VOC".
b. PPG "Americoat 68 HS VOC".
c. Sherwin Williams "Zinc Clad III HS 100".

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D. Shop Applied Zinc-Rich Primer: Class B Slip Coefficient Critical. Following SSPC-SP6/NACE 3 commercial blast cleaning surface, apply the following low VOC system compatible with field applied epoxy zinc rich primer specified below:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Carboline Company; “Carbozinc 859”.
b. PPG “Americoat 68 HS”.
c. Tnemec Company, Inc.; "90-97 Tneme-Zinc"
d. Sherwin Williams “Zinc Clad IV”.

~~B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.~~

~~1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.~~

E. Universal Field Primer: Provide LEED v4 compliant, GreenGuard Cold Certified universal field primer complying with MPI 107 X-Green, as follows:

1. "Pro-Cryl Universal Primer" (Sherwin Williams) with vocs of less than 50 g/l.

F. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated, and complying with SSPC Paint 5.

~~C.~~G. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

~~D.~~H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

~~E.~~I. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

~~F.~~J. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.5 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32-inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

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E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

F. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flathead (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

H. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

I. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

J. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

K. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inchembedment and 2-inchhook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

L. Galvanize all exterior ferrous miscellaneous metal items embedded in concrete. Galvanize all other items where specified or shown.

1. Exterior miscellaneous metal items are defined as those items which are indicated to be installed in areas exposed to conditions which are not controlled by building heating and cooling systems.
2. Interior miscellaneous metal items are defined as those items which are indicated to be installed in areas exposed to conditions which are controlled by building heating and cooling systems.

2.6 FABRICATION TOLERANCES

A. Squareness: 1/8-inch maximum difference in diagonal measurements.

B. Maximum offset between components at joints: 1/16-inch except that at welded joints no offset is allowed.

C. Maximum misalignment of adjacent members: 1/16-inch.

D. Maximum bow: 1/8-inch in 48 inches.

E. Maximum deviation from plane: 1/16-inch in 48 inches.

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~~2.6~~2.7 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures.

~~2.7~~2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work, including, but not limited to the following:

1. Steel framing and supports for overhead coiling doors.
2. Steel tube reinforcement for low partitions.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Elevator machine beams, hoist beams, and divider beams.
6. Steel shapes for supporting elevator door sills.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts if units are installed after concrete is placed.
3. Equip units with integrally welded anchors for casting into concrete or building into masonry.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated **or if not indicated as recommended by partition manufacturer** with attached bearing plates, anchors, and braces as indicated **including provisions for partition track anchorage as required to sustain imposed loads and to limit deflections to L/360 between hangers or as otherwise required by operable partition manufacturer**. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Steel Tube Supports for Vanities and Floating Countertops not supported by cabinetry below: Coordinate with Division 06 Section "Architectural Woodwork", Division 09 "Gypsum Board Assemblies" and appropriate finish sections and as follows:

1. Utilize steel tube supports, steel angles, moment clips, steel clip angles and vertical steel tubes sized to support dead loads of countertops, and in addition the following loads:

a. A uniform live load of 100 lbs. per linear foot and a concentrated point load of 300 pounds at any point.

2. Where exposed in the finish work, provide welded connections, ground smooth.
3. Where concealed, utilize bolts and connectors of capacity required to support
4. Prime paint for field painting specified in Division 09 Section "Painting" or clad with stainless steel cladding as detailed. imposed live and dead loads.
5. Anchor steel tubes to structural walls and slabs as required to support imposed loads specified and provide a secure and rigid installation.

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6. **Fasten tubes to countertops with fasteners applied through the tubes into the underside of tops, in sufficient quantity for a secure installation.**

~~D. Countertop Framing: Custom fabricate countertop framing, using miscellaneous steel shapes and plates, and cold finished mild steel bars at exposed conditions, for support framing and plywood, to the thicknesses, sizes and shapes shown, and as required to produce work of adequate strength and durability, without objectionable deflections. Use proven details of fabrication, as required, to achieve proper assembly and alignment of the various components of the work. Provide countertop framing in the following areas:~~

~~1. Public toilet rooms.~~
~~2. Locker rooms.~~
~~3. Reception desk.~~

E. Framing For Suspended Toilet Compartments

1. **Provide continuous steel framing for toilet partition supports, coordinated with the toilet partitions and including provisions for partition anchorage as required to sustain imposed loads and to limit deflections to L/360 between hangers.**
2. **Provide steel rods, 1/2 in. dia., spaced not more than 36 in. o.c. Thread rods to receive anchor and stop nuts. Fit hangers with wedge shape washers for full bearing on sloping flanges of support beam.**
3. **Coordinate installation with toilet partition manufacturer's written instructions and recommendations.**

F. Fabricate supports for partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

G. Supports for Hoods: Provide engineering for miscellaneous metal supports for overhead mounted hoods coordinated with mechanical specifications and food service specifications. Provide mounting separate from suspended ceiling system, with neoprene isolators to mitigate vibrations and sounds of exhaust hoods. Coordinate with drawings for details and MEPF and food service specifications for complete requirements.

~~E.~~**H.** Galvanize miscellaneous framing and supports in exterior locations.

~~2.8~~2.9 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inchbolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

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D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

1. Wedge-type inserts shall be HW-340 as manufactured by Hohmann and Barnard, or approved equal, with askew-head bolt, nut, and washer.

a. Wedge Insert Finish: Hot dip galvanized.
b. Askew Bolt, Washer, and Nut Finish: Hot dip galvanized.

E. Furnish full-depth steel shims, minimum 3-inch width.

1. Finish: Hot dip galvanized.

F. Specialty Fabricated Shelf Angles: Provide proprietary manufactured systems, engineered by the manufacturer to support imposed dead and live loads of exterior wall construction, as well as performance requirements for exterior wall systems. Engineering shall determine thickness, structural quality, size and length. Coordinate with Division 07 Section "Building Insulation" for thickness of insulation and details for airspace to determine depth required. Provide shelf angles in longest lengths, with extended lengths as required to support exterior walls from edge of slab and structure beyond. Provide brackets, angles, plates, washers, shims, bolts, pressure screws, cast-in anchor channels, cast-in connectors, adjustable bumper angles and other accessories required for a complete installation

1. Material and Quality: [ASTM A666 stainless steel alloy Type 316,] [ASTM A1008 Carbon Steel, hot dip coated after fabrication per ASTM A153, G60 min,] 3/16-inch thick plate
2. Manufacturers and Systems: Provide one of the following systems:

a. Halfen "HK4" Adjustable Brickwork Support.
b. Hohmann & Barnard, Inc. "TBS-Thermal Brick System".
c. Modersohn MOSO Façade Fixings "WK-D Bracket Anchors".
d. Fero Fast Thermal Bracket and shelf angle system.

2.10 METAL SLEEVES

A. Metal Sleeves: Fabricate metal sleeves from steel tubes of size required to accommodate penetrating utilities. Coordinate with the work mechanical, electrical, plumbing and fire protection specifications and drawings as required to size and place metal sleeves.

~~2.9~~2.11 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, **and OSHA 29 CFR 1910.28,** unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
~~3. Space siderails 18 inchesapart, unless otherwise indicated.~~
~~4. Support each ladder at top and bottom and not more than 60 incheso.c. with welded or bolted brackets, made from same metal as ladder.~~

~~a. Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 7 inches.~~
~~b. Extend side rails 42 inches above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not~~

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~~extend above the top rung, goose-neck the extended rails back to the structure to provide secure ladder access.~~

B. Steel Ladders: **Standing off the building surface a minimum of 7 inches (perpendicular clearance).**

1. Space siderails 18-inches apart, unless otherwise indicated.
~~1.~~**2.** Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges**, extending a minimum of 42 inches above the access level**.
~~2.~~**3.** Rungs: ~~3/4~~1-inch diameter steel bars, spaced maximum 12 inches on center.
~~3.~~**4.** Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
~~4.~~**5.** Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung by a proprietary process.
6. Support each ladder at top and bottom and not more than 60-inches o.c. with welded or bolted brackets, made from same metal as ladder.

a. Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 7-inches.
b. Extend side rails 42-inches above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, goose-neck the extended rails back to the structure to provide secure ladder access.

~~5.~~**7.** Galvanize exterior ladders, including brackets and fasteners, and prime paint with primer specified in Division 09 Section "Exterior Painting."
~~6.~~**8.** Prime paint interior ladders, including brackets and fasteners, with primer specified in Section 099123 "Interior Painting."

C. Steel Ladder Security Guard: Provide galvanized steel ladder security guard directly over climbing rungs to prevent unauthorized use. Provide manufacturer's standard 8-foot long ladder security guard with one piece continuous piano hinge, lock-open hasp, and lock-close hasp.

~~2.10~~2.12 PERSONAL FALL ARREST SYSTEMS FOR LADDERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide either the named product or an approved equal product by another qualified manufacturer.

1. Pro-Bel Enterprises; Ladder Fall Protection System, or approved equal.

B. General:

1. Fabricate personal fall arrest systems for ladders to comply with OSHA 1910.27, FAA RR-S-001301, and ANSI A14.3. Provide for ladders over 24 feet in height.
2. Provide tensioned vertical cable system for the height of the climbing area.
3. Fasten personal fall arrest system to ladder and adjacent construction with stainless-steel fasteners unless otherwise indicated.

C. Personal Fall Arrest Systems for Ladders:

1. Cable: 7-by-19 wire cable made from wire complying with ASTM A492, Type 316.
2. Cable Diameter: 3/8 inch.
3. Cable Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.
4. Cable Supports: Stainless steel supports, brackets, and fasteners.

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D. Fabrication:

1. Fabricate personal fall arrest systems for ladders in the shop to field-measured dimensions with fittings machine swaged.

~~2.11~~2.13 METAL SHIPS' LADDERS

A. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers, pipe and tube railings, and bar grating treads, unless otherwise indicated. Provide brackets and fittings for installation.

1. Treads shall be not less than 5 inches exclusive of nosing or less than 8-1/2 inches including the nosing, and riser height shall be not more than 9-1/2 inches.
2. Fabricate ships' ladders, including treads and railings from steel.

B. Galvanize exterior steel ships' ladders, including treads, railings, brackets, and fasteners.

~~2.12~~2.14 GRATINGS

A. General: Provide galvanized steel gratings or aluminum gratings where indicated, including supplementary framing and supports. Verify depth of existing shelf supports at ADA compliant sidewalk gratings, and modify grating selection as required to fit depth of support, ADA compliant spacing, and loading criteria specified in "Performance Criteria" article.

B. Provide gratings of pressure lock type construction, rectangular pattern, with plain surface top bars in the same plane; accurately fabricated free from warps, twists or other defects affecting their serviceability or appearance.

C. Provide removable grating sections where shown, with end-banding bars for each panel and each opening, saddle clip anchors designed to fit over bearing-bars, and stud bolts with washers and nuts, unless otherwise shown.

D. Provide cutouts in grating sections for penetrations indicated. Edge band openings in grating that interrupt 4 or more bearing bars with bars of same size and material as bearing bars.

E. Catwalk and Other Light Duty Gratings (**MBG-01**); Provide the following welded steel gratings:

1. Grating Frame: Provide hot dipped galvanized steel frame unless otherwise shown, consisting of 2 inch x 2 inch x 1/4 inch thick steel angle continuously welded to a 1 inch x 1/2 inch steel bar with anchors welded to backs of angles at 2 ft. centers with a minimum of eight (8) anchors per unit.
2. Grating: "11-W-4" (Ohio Gratings) or approved equal; 1 inch x 3/16 inch bars spaced 11/16 inch on center with 3/8 inch diameter cross bars spaced 4 inches on center for grilles, held down with recessed lock down anchors to grating frame embedded in concrete surround. Entire assembly shall withstand performance loads specified in Performance Criteria.

F. Catwalks and Adjacent Framing: Provide catwalks and adjacent framing, complete with gratings, toe guards, railings, steel framing, bracing and support members. Comply with requirements specified for railings in Division 05 Section "Pipe and Tube Railings".

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~~2.13~~2.15 METAL FLOOR PLATE

A. Fabricate from rolled-steel floor plate of thickness indicated below:

1. Thickness: Thickness as required to comply with performance requirements, but not less than 1/4 inch.

B. Provide steel angle supports as indicated.

C. Include steel angle stiffeners, and fixed and removable sections as indicated.

D. Provide flush steel bar drop handles for lifting removable sections, one at each end of each section.

E. Galvanize exterior steel floor plates, angle supports, and fasteners.

~~2.14~~2.16 ELEVATOR PIT SUMP COVERS

A. Fabricate from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 1 inch in least dimension.

B. Provide steel angle supports unless otherwise indicated.

C. Galvanize elevator pit sump covers, angle supports, and fasteners.

~~2.15~~2.17 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

~~2.16~~2.18 CORNER GUARDS, PIT ANGLES, AND EDGE ANGLES

A. Provide corner guards fabricated from angles of size as shown, or if not shown of minimum 4-1/2-inch by 4-1/2-inch by 1/4-inch thick equal leg angles. Drill and countersink legs of angles, for fastening to substrates indicated, with holes spaced 24 inches on center. Provide corner guard lengths of 42-inches if not otherwise indicated.

B. Provide edge angles, and pit angles, fabricated from angles of size as shown, or required, with welded-on stud anchors spaced 24-inches on center. Provide pit and edge angles in as long lengths as possible. Miter and weld corners and provide splice plates for alignment between sections.

C. Hot dip galvanize corner guards, pit angles, and edge angles.

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~~2.17~~2.19 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe.

1. Cap bollards with 1/4-inch-thick, steel plate with flat top.
2. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.

B. Fabricate bollards with 3/4-inch-thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inchanchor bolts.

1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

C. Galvanize exterior metal bollards.

~~2.18~~2.20 STAINLESS STEEL BOLLARDS USED AT BUILDING ENTRY

A. Provide stainless steel bollards of profiles and dimension shown, at building entries, for mounting of handicap push plates.

1. Basis of design for bollard: Wikk Industries, Model B-6SQ-RT-32D-CS-SQ25, or approved equal.
2. Dimensions: 6-inch x 6 inch x 48 inch tall, unless otherwise indicated
3. Mounting: Removable Bollard for in ground mounting with concealed sleeve and base plate.
4. Material and Finish: Alloy 304 Stainless steel with satin finish US32D (BHMA 630).
5. Top: Removable Black marine board cap.

B. Push Plate: Universal symbol of accessibility push plate: Wikk “S-4x4-3 US32D" or approved equal.

1. Material and finish: type ~~304~~ **316** stainless steel with brushed finish

C. Types:

1. **BL-01**: Exterior grade, prepped with Hi/Lo Wave Actuator and Card Reader
2. **BL-02**: Interior prepped for Hi/~~Ki~~ **Lo** Wave Actuator.
3. **BL-03**: Exterior grade, prepped for card reader and Knox Box.

D. Coordination:

1. Coordinate with door entry at building entry locations.
2. Coordinate wiring location with electrical access.

~~2.19~~2.21 PIPE GUARDS

A. Fabricate pipe guards from 3/8-inch-thick by 12-inch-wide, steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inchclearance between pipe and pipe guard. Drill each end for two 3/4-inchanchor bolts.

B. Galvanize steel pipe guards.

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~~2.20~~2.22 ABRASIVE METAL NOSINGS

A. Cast-Metal Units: Cast iron, with an integral-abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Source Limitations: Obtain units from single source from single manufacturer.
2. Nosings: Cross-hatched units, 4 inches wide with 1/4-inch lip, for casting into concrete.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Drill for mechanical anchors and countersink. Locate holes not more than 4 inches from ends and not more than 12 inches o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.

D. Apply bituminous paint to concealed surfaces of cast-metal units.

~~2.21~~2.23 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

~~2.22~~2.24 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

~~2.23~~2.25 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

~~2.24 INSTALLING GRATINGS~~

~~A. Gratings: Install grating in accordance with requirements of ANSI/NAAMM MBG 531 "Metal Bar Grating Manual" including installation clearances and standard anchoring details. Weld gratings to supporting steel, except for sections which are hinged or required to be removable. Secure removable units to supporting members with type and size of clips and fasteners as recommended by grating manufacturer for type of installation conditions shown. Do not notch bearing bars at supports to maintain elevation. Secure toe plates to gratings by welding.~~

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~~2.25~~2.26 TRENCH DRAIN GRATINGS AND FRAMES

A. Heavy duty ductile iron trench drain gratings and frames, designed for vehicular loads. Provide units with integral anchors, bolts, and machined joints.

B. Product and Manufacturer: Series R-4900-DX, Type A grate opening with standard Type X support frame; Neenah.

~~2.26~~2.27 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

~~2.27~~2.28 STEEL AND IRON FINISHES

A. Galvanizing: Hot dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless primers specified in Section 099600 "High-Performance Coatings" are indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

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~~2.28~~2.29 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Satin Finish: No. 4.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine the areas to receive the Work and the conditions under which the Work would be performed. Contractor shall remedy conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

~~3.1~~3.2 PREPARATION

A. Substrate Acceptability: Commencement of installation shall constitute acceptance of substrate conditions by the Installer

~~A.~~**B.** Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

~~B.~~**C.** Set sleeves in concrete; protect sleeves from water and concrete entry.

~~3.2~~3.3 INSTALLATION, GENERAL

A. General: Install all metal fabrication items in strict accordance with the manufacturers' instructions and approved shop drawings.

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

C. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot dip galvanized after fabrication and are for bolted or screwed field connections.

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D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

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

F. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

~~3.3~~3.4 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for ceiling hung toilet partitions, operable partitions, and overhead coiling doors, securely to and rigidly brace from building structure.

C. Anchor shelf angles securely to existing construction with expansion anchors or anchor bolts.

D. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

E. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

F. Secondary Framing System: Remove spray fireproofing to allow beam clamp connection to steel beam legs with tight friction fit and a secure, rigid installation. Connect clamps to slotted channels sized and spaced to support imposed loads of ceiling panels, coordinated with work specified in related sections. Following anchorage coordinate with Applied Fireproofing work for restoration and replacement of sprayed on fireproofing. Verify that fireproofing completely encapsulates anchors to maintain fire rating requirements.

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3.5 INSTALLING METAL SLEEVES

A. Position metal sleeves in place with concrete footings. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.

B. Place link filler within sleeves to fully seal sleeve openings and prevent water, soil and other items from breaching the opening. Provide a watertight installation. Where sealant is required, complying with Division 07 Section "Joint Sealants" to provide a watertight installation.

3.6 INSTALLING LADDERS

A. Vertical Ladders, Industrial Type Ladders Provide vertical ladders, industrial type ladders at all locations requiring access to equipment, catwalks or gratings.

B. Securing Vertical Ladders: Secure vertical ladders to masonry or concrete with a minimum of two 1/2 in. diameter expansion bolts at each bracket, unless additional attachments are required to sustain imposed loads. At walls with cold formed metal panels, provide metal plate backup and anchor vertical ladders to metal plate reinforcement.

~~3.4~~3.7 INSTALLATION OF PERSONAL FALL ARREST SYSTEMS FOR LADDERS

A. Anchor personal fall arrest systems for ladders to ladder in accordance with manufacturer's written instructions, and as shown on the Drawings.

3.8 INSTALLING GRATINGS

A. Gratings: Install grating in accordance with requirements of ANSI/NAAMM MBG 531 "Metal Bar Grating Manual" including installation clearances and standard anchoring details. Weld gratings to supporting steel, except for sections which are hinged or required to be removable. Secure removable units to supporting members with type and size of clips and fasteners as recommended by grating manufacturer for type of installation conditions shown. Do not notch bearing bars at supports to maintain elevation. Secure toe plates to gratings by welding.

~~3.5~~3.9 INSTALLATION OF METAL BOLLARDS

A. Fill metal-capped steel bollards solidly with concrete and allow concrete to cure seven days before installing.

1. Do not fill removable bollards with concrete.

B. Anchor bollards to existing construction with post installed expansion anchors or anchor bolts. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.

1. Embed anchor bolts at least 4 inches in concrete.

C. Anchor bollards to be cast in place with concrete footings not less than 48 inches deep. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

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D. Coordinate with access control system for building entry bollards to tie bollard into building security and notification system. Provide push panels and touch free Hi/Low Wave activation where shown.

~~3.6~~3.10 INSTALLATION OF PIPE GUARDS

A. Provide pipe guards at exposed vertical pipes in parking garage and at locations indicated on Drawings where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inchbolts at each pipe guard. Mount pipe guards with top edge 26 inches above driving surface.

~~3.7~~3.11 INSTALLATION OF NOSINGS

A. Center nosings on tread widths unless otherwise indicated.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 079200 "Joint Sealants" to provide a watertight installation.

~~3.8~~3.12 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

~~3.9~~3.13 INSTALLING SHELF ANGLES

A. Install inserts at spacing shown on the Drawings.

1. Provide minimum 6-inches clear between insert and post-tension anchor or other embedded item.

B. Install shelf angles to proper line and level.

C. Shim shelf angles with full-depth steel shims as required.

1. Where slab edge deviations are in excess of plus or minus 1/2 inch, submit proposed repair in lieu of shimming for approval.

D. Torque bolts to 150-ft-lbf, or as recommended by the wedge-type insert manufacturer.

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~~3.10~~3.14 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Bolt and insert size, spacing, and location, horizontally and vertically.
2. Verification of shelf angle installation, including the following:

a. Angle size.
b. Shimming in accordance with installation requirements.
c. Soft joint dimensions and clearances.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

1. Inspect and test shelf angle bolt torque for conformance to manufacturer's recommendations.

D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.

~~3.11~~3.15 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with ~~same material as used for shop painting~~**field primer compatible with shop primer** to comply with SSPC-**SP2**~~PA 1~~ for touching up shop-painted surfaces.

a. Paint and coatings shall comply with VOC limits found in Division 01 Section "Sustainable Design requirements" and emissions criteria meeting CDPH Standard Method v1.2

~~a.~~**b.** Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

2. The maximum allowable VOC content for field applied anti-corrosive touch-up paint shall be 100 grams/liter.

~~2.~~**3.** Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

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SECTION 055113 – METAL PAN STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide the work of this section in accordance with requirements of the Contract Documents.

B. Section Includes:

1. ~~Preassembled~~ Steel stairs with concrete-filled treads.
~~1.~~2. **Architectural quality Stair 1.**
~~2.~~3. Steel tube railings attached to metal stairs.
~~3.~~4. Steel tube handrails attached to walls adjacent to metal stairs.
~~4.~~5. Railing gates at the level of exit discharge.

C. Related Sections:

1. **Division 03 Section "Cast-In-Place Concrete" for concrete fill for stair treads and platforms.**
2. **Division 06 Section "Miscellaneous Rough Carpentry" for wood blocking for anchoring railings.**
3. **Division 09 Section "Gypsum Board Assemblies" for metal backing for anchoring railings.**

1.3 DEFINITION

A. Category AESS 4: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 4 and is designated as AESS 4 or Category AESS 4 in the Contract Documents.

1. **These are showcase elements with special surface and edge treatment beyond fabrication. The intent is the form and is the only feature showing in an element.**

1.4 PREINSTALLATION MEETINGS

A. Review shop and field quality control testing procedures, including Special Inspections, which are different than Quality Control testing.

1. **Review installation and coordination procedures. Address scheduling, preparation of surfaces contiguous with this work, adjacent construction and interferences, if any.**

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~~1.3~~1.5 COORDINATION

A. Do not install enclosing or concealing construction until after welds have been inspected, and tested and corrections have been made to defective applications.

~~A.~~**B.** Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

~~B.~~**C.** Coordinate installation of anchorages for metal stairs and railings.

1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall-mounted handrails, and items with integral anchors, that are to be embedded in concrete or masonry.
2. Deliver such items to Project site in time for installation.

~~C.~~**D.** Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.

~~D.~~**E.** Schedule installation of railings so wall attachments are made only to completed walls.

1. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

~~1.4~~1.6 ACTION SUBMITTALS

A. Product Data: For metal pan stairs and the following:

1. Shop primer products.
2. Handrail wall brackets.
3. **Shrinkage-resistant** Grout.
4. **Submit a complete written description of the shop coating and touch-up painting of the "Architecturally Exposed Structural Steel". Itemize materials, methods (including specific substrate preparation), procedures and sequence to be followed for exposed painted steel components, and arrange the description to correspond with the fabrication and erection schedule**

B. Sustainable Design Action Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:

a. Leadership Extraction Practices

1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.

2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.

a) Include statement indicating costs for each product having recycled content.

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b. Sourcing of Raw Materials: For products that are responsibly sourced within 100 miles, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.

1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

2. Indoor Environmental Quality, Low Emitting Materials:

a. Laboratory Test Reports: For adhesives, sealants, paints, coatings wet applied on site, indicating testing and compliance with the California Department of Public-Health (CDPH) Standard Method V1.2-2017, using the applicable exposure scenario.
b. Paints, and Coatings: For wet applied on site products, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5. 2016.
c. Adhesives and Sealants: For wet applied on site products, submit printed statement showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005 and rule amendment date of October 6, 2017.
d. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants

~~B.~~C. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.
5. Indicate orientation of mill marks and HSS seams.
~~4.~~6. Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS provided items of AESS and connections, including transitions between AESS categories and between AESS and non-AESS are specifically identified for each category and requirements below are met for AESS
7. Samples: Submit Samples to set quality standards for AESS. Samples shall demonstrate the following AESS characteristics:

a. Continuous weld appearance.
b. Sharp edges ground smooth.
c. Surface preparation[, primer and intermediate and finish paint system].
d. Fabrication mark removal.
e. Weld show through.

~~1.5 SUSTAINABLE DESIGN SUBMITTALS~~

~~A. Comply with requirements specified in Section 018113.~~

~~1.6~~1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing fabrication engineering and design services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.

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B. Fabrication Engineering and Design: For stairs, railings and guards indicated to comply with performance requirements and criteria, provide comprehensive engineering analysis, including calculations, structural analysis data and details of anchorage and supports indicating compliance with performance requirements, signed and sealed by the qualified professional engineer responsible for their preparation.

1. Review technical details of metal stairs, landings, and railings with respect to design performance criteria, and be responsible for engineering modifications or revisions to details of the stair, landings, and railings as well as details for connections and members not specifically shown on the Drawings. Submit calculations for the following:

a. Straight runs.
b. Platforms and landings.
c. Railings and handrails

C. Sustainable Design Informational Submittals:

1. Building Product Disclosure and Optimization - Environmental Product Declarations

a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.
b. EPD Optimization: For materials, indicating embodied carbon/LCA optimization report or action plan.

2. Building Product Disclosure and Optimization - Material Ingredients

a. Material Ingredient Optimization: Submit at least one of the following:

1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo, with gold or platinum certification.
3) International Alternative Compliance Path - REACH Optimization
4) Declare: Manufacturer's completed Product Declaration Form
5) Other programs approved by USGBC

~~C.~~ D. Welding Certificates and Procedures: Submit for record written data on the materials, welding procedures and qualifications of welders in accordance with requirements of AWS D1.1 and the New Jersey State Building Code.

1. For stainless steel welds or bimetallic welds between stainless and carbon steels, submit for review welding procedures and processes per AWS D1.6 requirements.

~~D.~~ E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

~~1.7~~1.8 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator/Installer of products with a minimum five (5) consecutive year experience in the successful fabrication and installation of steel stair and railing systems of the type indicated for this project.

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~~A.~~1. For AESS, a qualified Installer who participates in the AISC Quality Certification Program, is designated an AISC-Certified Erector, Category ACSE, and is experienced in erecting AESS similar to that indicated on this Project.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of New Jersey, and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of metal pan stairs that are similar to those indicated for this Project in material, design, and extent.

~~B.~~C. Welding Qualifications: Qualify procedures and personnel including shop welders, field welders, welding operators and tackers for the following periods of effectiveness according to the following:

1. Welding Standards:
   ~~1.~~a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   ~~2.~~b. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
   c. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

2. Certification and qualification, including period of effectiveness of welding personnel shall be as specified by AWS D1.1. Certification shall remain in effect for duration of work provided welders are continuously engaged in performing the type of welding for which they are certified. Certification and re-certification of welding personnel is the [Contractor's][Subcontractor's]responsibility to maintain.

D. Reference Standards: Except as governed by requirements of local building codes, provide metal pan stair in accordance with applicable requirements and recommendations of the following organizations and standards:

1. American Institute of Steel Construction (AISC): Code of Practice for Structural Steel Buildings, and Bridges". Where a conflict exists between the AISC Code of Standard Practice and the Contract Documents, the Contract Documents shall govern.
2. AISC Section 10 "Specification for Architecturally Exposed Structural Steel".
3. AISC "Code of Standard Practice for Steel Buildings and Bridges", except in Paragraph 4.2.1, delete the first and second sentences.
4. American Iron and Steel Institute (AISI) "Specification for the Design of Cold–Formed Steel Structural Members".
5. AWS D1.1 "Structural Welding Code".
6. AISC "Specifications for Structural Joints Using High Strength Bolts".
7. AWS C7.2M:2010 "Recommended Practices for Laser Beam Welding, Cutting, and Allied Processes".
8. National Association of Architectural Metal Manufacturers (NAAMM):
   a. "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
      1) Fire Stairs: Commercial class
      2) Decorative Stair 1: Architectural class
   b. "Metal Stairs Manual".
   c. "Pipe Railing Manual".
   d. "Metal Finishes Manual
9. Industrial Fasteners Institute (IFI): IFI "Fastener Standards".

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10. Steel Structures Painting Council (SSPC): "Steel Structures Painting Manual, Volume 2, Systems and Specifications".
11. Where the language in any of the documents referred to herein is in the form of a recommendation or suggestion, such recommendations or suggestions shall be deemed to be mandatory under this Contract. Where a conflict exists between the AISC Code of Standard Practice and the Contract Documents, the Contract Documents shall govern.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Provide in place first installation mockup of one segment of each stair type with intermediate landing, and stringers, and railing specified. Include one run of stairs from post to post including handrail and bracket, steel railings and in fill, plus 4 complete treads.
2. Replace unsatisfactory work as directed until final acceptance by the Architect. Maintain accepted mock-ups throughout Project construction. Mock-up assemblies will be used as a standard for judging acceptability of Work on the Project.
3. Subject to compliance with the requirements, approved mockups may become part of the completed work if undisturbed at time of substantial completion.

~~1.8~~1.9 DELIVERY, STORAGE, AND HANDLING

A. Do not handle architecturally exposed structural steel until paint has thoroughly dried. Care shall be exercised to avoid abrasions and other damage. Use special care in handling AESS to prevent twisting, warping, nicking, and other damage during fabrication, delivery, and erection. Store materials to permit easy access for inspection and identification. Keep AESS members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect AESS members and packaged materials from corrosion and deterioration.

~~A.~~B. Store materials to permit easy access for inspection and identification.

1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
2. Protect steel members and packaged materials from corrosion and deterioration.
3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.

    a. Repair or replace damaged materials or structures as directed.

4. Handle in such a manner so as to protect surfaces and to prevent distortion of, and any other type of damage to, fabricated pieces.

PART 2 - PRODUCTS

2.1 SUSTAINABLE DESIGN REQUIREMENTS

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than

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1. Steel tubes, hollow sections, deck, posts, railings and woven wire mesh: 50%
2. Steel plates, bars, sheets, angles and channels: 70%.

B. VOC and Emissions Requirements: Paints and coatings, adhesives and sealants, wet applied on site shall comply with:

1. VOC limits (g/L) found in tables in Division 01 Section "Sustainable Design Requirements."

~~A. Comply with requirements specified in Section 018113.~~

2.2 PERFORMANCE REQUIREMENTS

A. Fabrication Engineering and Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to provide fabrication engineering and design of stairs, railings, and guards, including attachment to building construction, using performance requirements and criteria indicated. Review the technical details of the metal stairs and landings with respect to performance criteria, and engineer modifications or revisions to details of the stair and landings as well as the details for connections and members not specifically shown on the Drawings.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Steel: 72 percent of minimum yield strength.
2. Aluminum: The lesser of minimum yield strength divided by 1.65, or minimum ultimate tensile strength divided by 1.95.
3. Stainless Steel: 60 percent of minimum yield strength.

~~B.~~C. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Loads:
   ~~1.~~a. Uniform Load: 100 lbf/sq. ft.
   ~~2.~~b. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
   ~~3.~~c. Uniform and concentrated loads need not be assumed to act concurrently.

~~4.~~2. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.

3. Deflection: Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less. Total load L/240. Global total defection of 3/4 inch for entire system.

4. Vibration: Limit frequency of entire system to min. vertical natural frequency of 5 Hz and a minimum lateral frequency of 2.5 Hz, in accordance with recommendations of the AISC Steel Construction Design Guide 11 "Vibrations of Steel-Framed Structural Systems Due to Human Activity", Section 2.3.

   a. Apply a 600 pound load vertically and limit deflection under this load to 1/8 in.
   b. Apply a 200 pound load laterally and limit deflection under this load to 1/8 inch.

5. Internal Pressure Loads: 5 psf internal pressure loading.
6. Camber: Camber for dead load of stair shall be used in order for stairs to be installed level.

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~~C.~~ **D.** Structural Performance of Railings: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
   a. Uniform load of 50 lbf/ft. applied in any direction **at the top and to transfer load through supports to structure**.
   b. Concentrated load of 200 lbf applied in any direction **direction at any point and have supporting structure to transfer this loading to appropriate structural elements of the building**.
   c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Infill of Guards:
   a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
   b. Infill load and other loads need not be assumed to act concurrently.
3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   a. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.

E. Dynamic Coefficient of Friction: Provide finish to provide a minimum dynamic coefficient of friction. determined by testing identical products in accordance with ANSI A137.1 and A326.3 using the BOT-3000 to measure slip resistance of flooring, with the following minimum classification, reference category and performance:

1. Level Surfaces and Treads
   a. Interior, Dry (ID): ≥0.42 dry DCOF.
   b. Interior, Wet (IW): > 0.42 wet DCOF
   c. Interior, Wet Plus (IW+): Manufacturer declared, minimum DCOF of 0.50.
   d. Exterior Wet Classification (EW): Manufacturer declared, minimum DCOF of 0.55.
   e. Oils/Greases (O/G): Manufacturer Declared, minimum DCOF of 0.55.

2. Ramp Surfaces: 0.50 minimum DCOF

2.3 METALS

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

1. Surface Flatness and Edges: For exposed Work provide materials which have been produced to the highest commercial standard for fire stairs and highest architectural standard for ornamental stairs for flatness with edges and corners sharp and true to angle or curvature as required.
2. Alloys and Tempers: Provide the specific alloy which will weld and machine properly, and will finish to match the Architect's sample. Use the temper or hardness which will provide the greatest strength and durability, consistent with necessary forming, fabrication and finishing processes.
3. Exposed Surfaces: For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

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B. Structural Steel Wide Flange and Structural Steel Tee Rolled Shapes: ASTM A992.

~~B.~~**C.** Steel Plates, Shapes, and Bars: **ASTM A572 Grade 50**~~ASTM A36/A36M~~.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

~~C.~~**D.** Steel Tubing for Railings: ASTM A500/A500M (cold formed)**, Grade B**.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

~~1.~~**2.** Provide galvanized finish for exterior installations and where indicated.

E. Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

~~D.~~**F.** Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.

~~E.~~**G.** Uncoated, Hot-Rolled Steel Sheet: ASTM A1011/A1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.

~~F.~~**H.** Galvanized-Steel Sheet: ASTM A653/A653M, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.

~~G.~~**I.** Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.4 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls.

1. Select fasteners for type, grade, and class required.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for exterior stairs, stairs indicated to be galvanized, and stairs indicated to be shop primed with zinc-rich primer.

E. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

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1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

A. Handrail Wall Brackets: Cast stainless steel, center of rail 2-1/2 inches from face of wall.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Blum, Julius & Co., Inc.
b. The Wagner Companies., R&B Wagner, Inc.
~~b.~~**c. or approved equal.**

B. Welding Electrodes: Comply with AWS requirements.

C. Metallic Filler for AESS: 2 component composition of 90% ground metal and 10% epoxy binder, solvent resistant compound suitable for repair of steel. Provide one of the following, or approved equal:

1. "Scotch-Weld Adhesive 1751" (3M Company).
2. "Plastic Steel" (ITW Devcon Corp.).

D. Zinc-Rich Primer: Comply with SSPC-Paint 20, with VOC less than 100 g/l, and compatible with topcoat.

1. Products: Subject to compliance with requirements, provide one of the following :

a. Carboline Company; "Carbozinc 859 VOC".
b. PPG "Americoat 68 HS VOC".
c. Sherwin Williams "Zinc Clad III HS 100".

~~C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.~~

~~1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.~~

~~D.~~**E.** Shop Primer for Galvanized Steel: **Zinc-dust, zinc-oxide** primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated**, and complying with SSPC-Paint 5**.

~~E.~~**F.** Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and ASTM A780/A780M and compatible with paints specified to be used over it.

~~F.~~**G.** Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

~~G.~~**H.** Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

I. For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

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J. Non-metallic Shrinkage Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining, shrinkage resistant product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with CE-CRD-C621 and ASTM C1107, free of gas-producing or gas-releasing agents, oxidizing catalysts, inorganic accelerators and chlorides. Provide one of the following:

1. "Five Star Grout" (U.S. Grout Corp.).
2. "Masterflow 713" (Master Builders Co.).
3. "Crystex" (L&M Construction Chemicals, Inc.).
4. "Sure Grip Grout" (Dayton Superior).

2.6 FABRICATION, GENERAL

A. General: Provide metal stairs and platforms of the design shown. Comply with specified "Performance Criteria". Include supplementary parts necessary to complete commercial and architectural metal stair work though not definitely shown or specified.

B. Architecturally exposed structural steel members including built-up members shall conform to one-half (1/2) the tolerance requirements specified in AISC "Code of Standard Practice for Steel Buildings and Bridges, Section 10, "Specifications for Architecturally Exposed Structural Steel", at a minimum, without gaps and visual distortions of any kind. Correct damaged members to meet the above referenced specification. Grind abrasions and other defects where finished appearance will be affected.

C. Shop fabricate and assemble AESS to the maximum extent possible. Fabricate items of architecturally exposed structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection

~~A.~~D. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

~~B.~~E. Assemble stairs and railings in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.
2. Clearly mark units for reassembly and coordinated installation.

~~C.~~F. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

G. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work. Ease exposed edges to a radius of approximately 1/32 inch unless otherwise shown. Miter exposed corner joints and machine fit to a hairline joint

~~D.~~H. Form exposed work true to line and level, with accurate angles and surfaces and straight edges.

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I. Completely assemble and weld members before milling of surfaces.

J. Fabricate members with the natural camber pointing up. Provide shop–induced camber for members as indicated.

K. Assemble built–up sections by welding and make free of warpage with axes in true alignment.

~~E.~~**L.** Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of welded joint.

~~F.~~**M.** Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flathead (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.
3. Fabricate joints that will be exposed to weather in a manner to exclude water.
4. Provide weep holes where water may accumulate internally.

2.7 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Commercial Class, **for fire stairs and Architectural Class for Stair 1** unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers of steel plates or steel channels or steel rectangular tubes as indicated on Drawings.

    a. Stringer Size: As required to comply with "Performance Requirements" Article.
    b. Provide closures for exposed ends of channel and rectangular tube stringers.
    c. Finish: Shop primed for interior stairs, galvanized for exterior stairs.

2. Construct platforms of steel plate or channel or rectangular tube headers and miscellaneous framing members as required to comply with "Performance Requirements" Article and as indicated on Drawings.

    a. Provide closures for exposed ends of channel and rectangular tube framing.
    b. Finish: Shop primed for interior stairs and galvanized for exterior stairs.

3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
4. Where stairs are enclosed by gypsum board shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below.

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a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.

1. Fabricate treads and landing subplatforms of exterior stairs so finished walking surfaces slope to drain.
2. Steel Sheet: Uncoated, cold, or hot-rolled steel sheet.
3. Steel Sheet: Galvanized-steel sheet, where indicated.
4. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
5. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
6. Shape metal pans to include nosing integral with riser **and allow application of nonslip coating**.
7. Attach abrasive nosings to risers.
8. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication.
9. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

    a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

10. **Coordinate with Division 09 Sections for finish and coordinate with details for nosing installation.**

2.8 FABRICATION OF STAIR RAILINGS

A. Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.

1. Rails and Posts: 1-1/2-inch-square top and bottom rails and 1-1/2-inch-square posts.
2. Picket Infill: 1/2-inch-square pickets spaced less than 4 inches clear.
3. Intermediate Rails Infill: 1-1/2-inch-square intermediate rails spaced less than 21 inches clear.
4. Gates: Form gates from steel tube of same size and shape as top rails, with infill to match guards. Provide with cam-type, self-closing hinges for fastening to wall and overlapping stop with rubber bumper to prevent gate from opening in direction opposite egress.

B. Welded Connections: Fabricate railings with welded connections.

1. Fabricate connections that are exposed to weather in a manner that excludes water.

    a. Provide weep holes where water may accumulate internally.

2. Cope components at connections to provide close fit, or use fittings designed for this purpose.
3. Weld all around at connections, including at fittings.

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4. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
5. Obtain fusion without undercut or overlap.
6. Remove flux immediately.
7. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of a welded joint as shown in NAAMM AMP 521.

C. Form changes in direction of railings as follows:

1. By bending.

D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

1. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

G. Connect posts to stair framing by direct welding unless otherwise indicated.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.

1. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
2. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
3. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
4. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.

1. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.9 FINISHES

A. Finish metal stairs after assembly.

B. Galvanizing: Hot dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

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C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:

1. Exterior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interior Stairs: SSPC-SP 3, "Power Tool Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

E. Apply finish coats as required under Division 09 Sections “Painting” and "High Performance Painting".

2.10 SOURCE QUALITY CONTROL

A. The Owner's Special Inspector shall perform periodic inspections during welding of the following items, provided the materials, welding procedures and qualifications of welders are verified prior to the start of the work; periodic inspections are made of the work in progress and a visual inspection of all welds is made prior to completion or prior to shipment of shop welding.

B. Inspect AESS pieces before shipping to the project side and provide additional inspection of AESS pieces before erection on the project site. Do not install damaged pieces. Remove damaged pieces from the project site. Site repairs will only be acceptable if specifically reviewed by the Architect, and after submission of methods used to repair.

1. Welding:

a. Full penetration welds: Test all full penetration welds for soundness by means of either radiographic or ultrasonic testing in accordance with AWS D1.1 and ASTM E164 procedures. Repair all flaws in plate or flange material revealed during such tests.
b. Partial penetration welds: Test all partial penetration welds for soundness by means of visual and magnetic particle inspection, unless other methods are specified in the Contract Documents. Repair all flaws in plate or flange material revealed during such tests.
c. Fillet welds: Visually inspect all fillet welds by AWS certified welding inspector. In addition, test ten percent (10%) of all fillet welds using a non-destructive method, such as dye penetrant or magnetic particle. Select test locations randomly throughout the structure, but test at least one weld in each location with 6 or more welds per connection. If, in the opinion of the , this testing discloses a large ratio (10% or more) of unacceptable welds, the required percentage of tested welds may be increased to 100%, all at the Stair Subcontractor's expense. All defects found visually in fillet welds shall be non-destructively tested by magnetic particle or dye-penetrant methods

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings and conditions to which the stairs are to be attached and confirm that openings are square and in compliance with shop drawings and installation tolerances.

~~A.~~B. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.

1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

~~B.~~C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare in place steel framing to receive stairs. If spray fireproofing is in place do not remove more than is necessary to accomplish the welded or bolted connections.

~~3.2~~3.3 INSTALLING METAL PAN STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Erection of Category AESS 4:

1. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
2. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
3. Remove weld spatter, slivers, and similar surface discontinuities.
4. Grind off butt and plug weld projections larger than 1/16 inch (1.6 mm).
5. Continuous welds shall be of uniform size and profile.
6. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
7. Splice members only where indicated on Drawings.
8. No torch cutting or field fabrication is permitted.
9. Weld profiles, quality, and finish shall be as approved by Architect.
10. Make joint welds, including tack welds, appear continuous by filling intermittent welds.
11. Grind welds smooth.
12. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.
13. Oversize welds where ground, contoured, or blended, and grind to provide a smooth transition, matching profile approved by Architect.

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~~B.~~**C.** Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

~~C.~~**D.** Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.

    a. Clean bottom surface of plates.
    b. Set plates for structural members on wedges, shims, or setting nuts.
    c. Tighten anchor bolts after supported members have been positioned and plumbed.
    d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
    e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.

        1) Neatly finish exposed surfaces; protect grout and allow to cure.
        2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

~~D.~~**E.** Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

~~E.~~**F.** Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
2. Do not weld, cut, or abrade surfaces of exterior units that have been hot dip galvanized after fabrication and are for bolted or screwed field connections.
3. Comply with requirements for welding in "Fabrication, General" Article.

~~F.~~**G.** Place **wire mesh in concrete** and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."

1. Install abrasive nosings with anchors fully embedded in concrete.
2. Center nosings on tread width.
3. **Broadcast abrasive aggregate to tops of treads and landings.**

H. Coordinate with Division 09 Sections for installation of finish flooring

~~G. Install precast concrete treads with adhesive supplied by manufacturer.~~

~~3.3~~3.4 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.

1. Space posts at spacing indicated or, if not indicated, as required by design loads.
2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.
4. Secure posts and rail ends to building construction as follows:

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a. Anchor posts to steel by welding or bolting to steel supporting members.
b. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with post-installed anchors and bolts.

B. Install railing gates level, plumb, and secure for full opening without interference.

1. Attach hardware using tamper-resistant or concealed means.
2. Adjust hardware for smooth operation.

C. Attach handrails to wall with wall brackets.

1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
2. Secure wall brackets to building construction as follows:

a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
b. For hollow masonry anchorage, use toggle bolts.
c. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.5 FIELD QUALITY CONTROL

A. Inspections: Owner will engage a qualified independent Special Inspection Agency (SIA) to perform the following:

1. Inspect the metal pan stair steel fabrication and associated railing construction for field welding, as Work progresses in accordance with IBC Chapter 7 as applicable to steel pan stair and associated railing construction. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the Architect/Engineer for final acceptance.

a. Field inspection of steel shall include connections, levelness, plumbness and alignment of the stair and railing systems in conformance with AWS welding methods, for inspection of completed welds.

2. If testing finds welds are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.
3. Welds will be considered defective if they do not pass tests and inspections.

a. Remove and replace welds that does not pass tests and inspections, and retest.
b. Additional testing and inspection, shall be at Contractor's expense, and be performed to determine compliance of replaced or additional work with specified requirements.

B. Railing Testing: If installation of railings is not in compliance with approved shop drawings and calculations, stair and railing Subcontractor shall test railings in the presence of the Special Inspector in accordance with ASTM E894 and ASTM E935 to verify compliance with railing performance requirements and to validate fabrication engineering.

C. Prepare test and inspection reports and submit to the Owner and Architect.

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~~3.4~~3.6 REPAIR

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055113

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SECTION 055116 - METAL FLOOR PLATE STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. This section is hereby deleted in entirety for Addendum #5. All stairs for the project shall be steel pan stairs.

END OF SECTION 055116

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SECTION 055213 – TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide the work of this section in accordance with requirements of the Contract Documents.

B. Section Includes:

1. Steel tube railings.

C. Related Requirements:

1. Section 055113 "Metal Pan Stairs" for steel tube railings associated with metal pan stairs.
2. **Division 05 Section "Glazed Decorative Metal Railings" for glass supported handrails and railings.**
3. **Division 08 Section "Exterior Enclosure System Requirements" for exterior performance requirements acting on railings.**
4. **Division 09 Section "Gypsum Board Assemblies" for metal backing for anchoring handrails and railings.**

1.3 COORDINATION

A. Do not install enclosing or concealing construction until after welds have been inspected and tested and corrections have been made to defective applications.

~~A.~~**B.** Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

~~B.~~**C.** Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

~~C.~~**D.** Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Fasteners.
3. Post-installed anchors.

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4. Handrail brackets.
5. Shop primer.
6. Bituminous paint.
7. Nonshrink, nonmetallic grout.
8. Anchoring cement.
9. Paint products.

B. Sustainable Design Action Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:

a. Leadership Extraction Practices

1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.

2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.

a) Include statement indicating costs for each product having recycled content.

b. Sourcing of Raw Materials: For products that are responsibly sourced within 100 miles of project site, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.

1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

2. Indoor Environmental Quality, Low Emitting Materials:

a. Laboratory Test Reports: For adhesives, sealants, paints, coatings wet applied on site, indicating testing and compliance with the California Department of Public-Health (CDPH) Standard Method V1.2-2017, using the applicable exposure scenario.

b. Paints, and Coatings: For wet applied on site products, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016.

c. Adhesives and Sealants: For wet applied on site products, submit printed statement showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005 and rule amendment date of October 6, 2017.

d. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants

~~B.~~**C.** Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. **Where railings are provided in conjunction with stairs, coordinate shop drawings.** Show assembly of components, including the following:

1. Railings, handrails, guardrails, and brackets.
2. Reinforcements, anchors, welded and bolted field and shop connections (size and location), and other supplemental information.

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~~C.~~ **D.** Samples: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

    a. Show method of connecting and finishing members at intersections.

~~1.5 SUSTAINABLE DESIGN SUBMITTALS~~

~~A. Comply with requirements specified in Section 018113.~~

~~1.6~~1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing fabrication engineering and design services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.

B. Fabrication Engineering and Design: For railings and guards indicated to comply with performance requirements and criteria provide comprehensive engineering analysis, including calculations, structural analysis data and details of anchorage and supports indicating compliance with performance requirements, signed and sealed by the qualified **State of New Jersey** professional engineer responsible for their preparation.

C. Sustainable Design Informational Submittals:

1. Building Product Disclosure and Optimization - Environmental Product Declarations

a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.

2. Building Product Disclosure and Optimization - Material Ingredients

a. Material Ingredient Optimization: Submit at least one of the following:

1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo, with gold or platinum certification.
3) International Alternative Compliance Path - REACH Optimization
4) Declare: Manufacturer's completed Product Declaration Form
5) Other programs approved by USGBC

D. Welding Certificates **and Procedures: Submit for record written data on the materials, welding procedures and qualifications of welders in accordance with requirements of AWS D1.1 and the New Jersey State Building Code.**

E. Shop and field quality-control reports and Inspection reports.

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~~C. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.~~

~~D.~~**F.** Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

~~E.~~**G.** Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E894 and ASTM E935.

~~F.~~**H.** Evaluation Reports: For post-installed anchors, from ICC-ES.

~~1.7~~1.6 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of handrails and railings that are similar to those indicated for this Project in material, design, and extent.

B. Manufacturer Qualifications: Provide pipe and tube handrails and railings fabricated by a firm with at least 10 years' experience specializing in custom railing fabrication as indicated and specified.

C. Installer Qualifications:

1. Minimum five consecutive years' experience in the successful installation of railing systems of the type indicated for this project.
2. Installer shall be acceptable to the Manufacturer of the railing system.

~~A.~~**D.** Welding Qualifications: Qualify procedures and personnel according **including shop welders, field welders, welding operators and tackers for the following periods of effectiveness** to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. **Certification and qualification, including period of effectiveness of welding personnel shall be as specified by AWS D1.1. Certification shall remain in effect for duration of work provided welders are continuously engaged in performing the type of welding for which they are certified. Certification and re-certification of welding personnel is the Contractor's responsibility to maintain.**

E. Reference Standards: Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the following organizations and Standards:

1. American Institute of Steel Construction (AISC) "Manual of Steel Construction".
2. American Iron and Steel Institute (AISI) "Cold Formed Steel Design Manual".
3. National Association of Architectural Metal Manufacturers (NAAMM):

a. AMP-521 "Pipe Handrails and railing systems Manual including Round Tube."

4. Industrial Fasteners Institute (IFI): IFI "Fastener Standards".
5. Steel Structures Painting Council (SSPC): "Steel Structures Painting Manual, Volume 2, Systems and Specifications".

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F. Regulatory Requirements: Comply with the requirements of Part 1910 of the Occupational Safety and Health Standards (OSHA), and the American Disabilities Act (ADA) as applicable to handrails and the protection of openings.

G. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Provide in place first installation mockup of one segment of railing specified. Include handrail and bracket.
2. Replace unsatisfactory work as directed until final acceptance by the Architect.
3. Maintain accepted mock-ups throughout Project construction.
4. Mock-up assemblies will be used as a standard for judging acceptability of Work on the Project.
5. Subject to compliance with the requirements, approved mockups may become part of the completed work if undisturbed at time of substantial completion.

~~1.8~~1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Store handrails and railings in a dry, well-ventilated, weathertight place.

1. Handle in such a manner so as to protect surfaces and to prevent distortion of, and any other type of damage to, fabricated pieces.

~~1.9~~1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

~~2.1 SUSTAINABLE DESIGN REQUIREMENTS~~

~~A. Comply with requirements specified in Section 018113.~~

~~2.2~~2.1 PERFORMANCE REQUIREMENTS

A. Fabrication Engineering and Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to provide fabrication engineering and design of railings and guards, including attachment to building construction, using performance requirements and criteria indicated. Review the technical details of the railings with respect to performance criteria, and engineer modifications or revisions to details of the railings as well as the details for connections and members not specifically shown on the Drawings.

B. General: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Steel: 72 percent of minimum yield strength.

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~~B.~~**C.** Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
   a. Uniform load of 50 lbf/ ft. applied in any direction **at the top and to transfer load through supports to structure**.
   b. Concentrated load of 200 lbf applied in any direction **at any point and have supporting structure to transfer this loading to appropriate structural elements of the building**.
   c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Infill of Guards:
   a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
   b. Infill load and other loads need not be assumed to act concurrently.
3. **When railings, balusters and components are subject to wind loads in excess of 50 lbs, design for anticipated wind load complying with ASCE 7-16 and Division 08 Section "Exterior Enclosure System Requirements".**

~~C.~~**D.** Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

~~2.3~~2.2 MANUFACTURERS

A. Steel Pipe and Tube Railings:

1. **Manufacturers: Subject to compliance with requirements, provide products by one of the following:**
   a. **Hollaender Mfg. Co.**
   b. **R & B Wagner, Inc.**
   c. **Tuttle, a Dant Clayton Division.**
   d. **VIVA Railings, LLC.**

~~A.~~**B.** Source Limitations: Obtain each type of railing from single source from single manufacturer.

~~2.4~~2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

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~~2.5~~2.4 STEEL AND IRON

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Tubing: ASTM A500 (cold formed).

1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A36/A36M.

D. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

~~2.6~~2.5 FASTENERS

A. General: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329 for zinc coating.
3. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

~~2.7~~2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

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B. VOC and Emissions Requirements: Paints and coatings, adhesives and sealants, wet applied on site shall comply with:

1. VOC limits (g/L) found in tables in Division 01 Section "Sustainable Design Requirements."
2. Emissions testing criteria of CHPH Standard v1.2-2017.

~~B.~~**C.** Etching Cleaner for Galvanized Metal: Complying with MPI#25.

~~C.~~**D.** Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Epoxy Zinc-Rich Primer: Complying with MPI#20, with VOC less than 100 g/l, and compatible with topcoat.

1. Products: Subject to compliance with requirements, provide one of the following :

a. Carboline Company; "Carbozinc 859 VOC".
b. PPG "Americoat 68 HS VOC".
c. Sherwin Williams "Zinc Clad III HS 100".

~~D. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.~~

~~1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.~~

~~E.~~**F.** Shop Primer for Galvanized Steel: **Zinc-dust, zinc oxide** primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated **and complying with SSPC-Paint 5**.

~~F.~~**G.** Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

~~G.~~**H.** Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

~~H.~~**I.** Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

~~2.8~~2.7 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

1. Rails and Posts: 1-1/2-inch-square top and bottom rails and 1-1/2-inch-square posts.
2. Picket Infill: 1/2-inch- square pickets spaced less than 4 inches clear.
3. Intermediate Rails Infill: 1-1/2-inch-square intermediate rails spaced less than 21 inches clear.

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4. Gates: Form gates from steel tube of same size and shape as top rails, with infill to match guards. Provide with cam-type, self-closing hinges for fastening to wall and overlapping stop with rubber bumper to prevent gate from opening in direction opposite egress.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces **in accordance with NJOMMA's "Voluntary Joint Finish Standards" for Finish #1 No evidence of welded joint**.

I. Form Changes in Direction as Follows:

1. By bending.

J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of railing members with prefabricated end fittings.

L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

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N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

O. For railing posts set in concrete, provide galvanized steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

P. For removable railing posts, fabricate slip-fit sockets from stainless-steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

~~2.9~~2.8 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.
4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:

1. Exterior Railings: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Other Railings: SSPC-SP 3, "Power Tool Cleaning."

F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop prime uncoated railings with ~~universal~~ **zinc rich** shop primer.
2. Do not apply primer to galvanized surfaces.

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2.9 SOURCE QUALITY CONTROL

A. The Owner's Special Inspector shall have the option to perform periodic inspections during welding of the following items, provided the materials, welding procedures and qualifications of welders are verified prior to the start of the work; periodic inspections are made of the work in progress and a visual inspection of all welds is made prior to completion or prior to shipment of shop welding.

B. Welding:

1. Full penetration welds: Test all full penetration welds for soundness by means of either radiographic or ultrasonic testing in accordance with AWS D1.1 and ASTM E164 procedures. Repair all flaws in plate or flange material revealed during such tests.
2. Partial penetration welds: Test all partial penetration welds for soundness by means of visual and magnetic particle inspection, unless other methods are specified in the Contract Documents. Repair all flaws in plate or flange material revealed during such tests.
3. Fillet welds: Visually inspect all fillet welds by AWS certified welding inspector. In addition, test ten percent (10%) of all fillet welds using a non-destructive method, such as dye penetrant or magnetic particle. Select test locations randomly throughout the structure, but test at least one weld in each location with 6 or more welds per connection. If, in the opinion of the Welding Inspector this testing discloses a large ratio (10% or more) of unacceptable welds, the required percentage of tested welds may be increased to 100%, all at the Subcontractor's expense. All defects found visually in fillet welds shall be non-destructively tested by magnetic particle or dye-penetrant methods.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

B. For pipe and tube railings to be installed on roofing, coordinate with steel deck and structural steel work to ensure that post stub ups are properly secured to structure below and adequate for support of railing posts through roofing.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

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C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

F. Install gates.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Cover anchorage joint with flange of same metal as post, attached to post with set screws.

C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

D. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

A. Attach railings to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

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3.6 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified Special Inspection Agency to perform the following Special Inspections:

1. Inspect the metal railing steel fabrication for field welding as Work progresses in accordance with New Jersey State Building Code, Chapter 17as applicable to pipe and tube railing fabrication. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the Architect/Engineer for final acceptance.

    a. Field inspection of steel shall include connections, levelness, plumbness and alignment of the railing systems in conformance with AWS welding methods, for inspection of completed welds.

2. If inspection finds welds are not in compliance with requirements, Special Inspecting Agency will perform additional random testing to determine extent of noncompliance.
3. Welds will be considered defective if they do not pass tests and inspections.

    a. Remove and replace welds that does not pass tests and inspections, and retest.
    b. Additional testing and inspecting, shall be at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

B. Railing Testing: If installation of railings is not in compliance with approved shop drawings and calculations, Subcontractor shall test railings in the presence of the special inspector in accordance with ASTM E894 and ASTM E935 to verify compliance with railing performance requirements and validate fabrication engineering.

C. Prepare test and inspection reports and submit to the Owner and Architect.

~~3.6~~3.7 ADJUSTING AND CLEANING

A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with ~~the same material as~~Leed v4.1 compliant primer, compatible with primer used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

1. Paints and coatings shall comply with VOC limits found in Division 01 Section "Sustainable Design requirements" and emissions criteria meeting CDPH Standard Method v1.2
~~1.~~2. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
3. The maximum allowable VOC content for field applied anti-corrosive touch-up paint shall be 100 grams/liter.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

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~~3.7~~3.8 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

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SECTION 057313 - GLAZED DECORATIVE METAL RAILINGS

PART 1 - SUMMARY

1.1 CONTROLLED SECTION

A. This specification is controlled by Division 08 Section "Exterior Enclosure System Requirements". In addition to the requirements of this document, all requirements of Controlling Documents must also be met.

1.2 SUMMARY

A. Provide the Work of this Section in accordance with requirements of the Contract Documents.

B. This Section includes, but is not limited to:

1. Exterior post-supported railings with glass-infill panels.

C. Related Requirements:

1. Division 05 Section "Structural Steel" for structural steel supports
2. Division 05 Section "Metal Pan Stairs" for commercial metal stairs to receive railings in this Section.
3. Division 05 Section "Tube Railings" for railings fabricated from pipe and tube components.
4. Division 08 Section "Glazing" and "Decorative Glass Glazing" for glass and glazing.

1.3 DEFINITIONS

A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor and exterior deck areas and for pedestrian guidance and support, visual separation, or wall protection.

1.4 COORDINATION AND SCHEDULING

A. Do not install enclosing or concealing construction until after welds have been inspected and tested and corrections have been made to defective applications.

B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

C. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

D. Schedule installation so attachments are made only to completed construction. Do not support railings temporarily by any means that do not suit structural performance requirements.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data:

1. Metal railings assembled from standard components.
2. Glass products.
3. Glazing cement and accessories for structural glass railings.
4. Sealant and accessories for structural glass railings.
5. Fasteners.
6. Bituminous paint.
7. Anchoring cement.

B. Sustainable Design Action Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:
    a. Leadership Extraction Practices
        1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
        2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
            a) Include statement indicating costs for each product having recycled content.
    b. Sourcing of Raw Materials: For products that are sustainably sourced within 100 miles of project site, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.
        1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.
2. Indoor Environmental Quality, Low Emitting Materials:
    a. Laboratory Test Reports: For adhesives, sealants, paints, coatings wet applied on site, indicating testing and compliance with the California Department of Public-Health (CDPH) Standard Method V1.2-2017, using the applicable exposure scenario.
    b. Paints, and Coatings: For wet applied on site products, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016.
    c. Adhesives and Sealants: For wet applied on site products, submit printed statement showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005, and rule amendment date of October 6, 2017.

C. Shop Drawings: Include plans, elevations, sections, and attachment details. Provide dimensioned drawings of assemblies, indicating hardware locations, transitions, and terminations to adjacent railings.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, and posts.
2. Base channel.
3. Each type of glass and glass edge required.
4. Fittings and brackets, including samples of design fabrication rail brackets and guard brackets.
5. Finishes.
6. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, glass-infill panels. Show method of finishing members at intersections. Samples need not be full height.

E. Fabrication Engineering and Design: For installed products indicated to comply with performance requirements and criteria, including analysis data signed and sealed by the qualified New Jersey State licensed professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Fabrication Engineering and Design New Jersey State licensed professional engineer.

B. Sustainable Design Informational Submittals:

1. Building Product Disclosure and Optimization - Environmental Product Declarations
    a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.
2. Building Product Disclosure and Optimization - Material Ingredients
    a. Material Ingredient Optimization: Submit at least one of the following:
        1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
        2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo, with gold or platinum certification.
        3) International Alternative Compliance Path - REACH Optimization
        4) Declare: Manufacturer's completed Product Declaration Form
        5) Other programs approved by USGBC

C. Welding Certificates and Procedures: Submit for record written data on the materials, welding procedures and qualifications of welders in accordance with requirements of AWS D1.1 and the Building Code. Submit all welding and qualification procedures to the Special Inspection Agency for approval before submitting to the Architect/Engineer.

D. Product Test Reports: For tests performed by a qualified testing agency, in accordance with ASTM E894, ASTM E935, ASTM E2353, and ASTM E2358.

E. Shop and field quality-control reports and inspection reports.

F. Evaluation Reports: From ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1. For glazed decorative metal railings.
2. For post-installed anchors.

G. Preconstruction test reports.

1.8 QUALITY ASSURANCE

A. Professional Engineer, Qualifications: A professional engineer who is licensed to practice in the State of New Jersey who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of glazed decorative metal railings that are similar to those indicated for this Project in material, design and extent.

B. Welding Qualifications: Qualify the welding procedures and personnel including shop welders, field welders, welding operators and tackers for the following periods of effectiveness according to the following:

1. Welding Reference Standards:

a. AWS D1.1, "Structural Welding Code--Steel."

2. Certification and qualification, including period of effectiveness of welding personnel shall be as specified by AWS D1.1, AWS D1.2 and AWS D1.6. Certification shall remain in effect for duration of work provided welders are continuously engaged in performing the type of welding for which they are certified, unless welders fail to perform acceptable welding, as determined by the Independent Special Inspection Agency. Certification and re-certification of welding personnel is subject to verification by the Testing Agency. Re-testing for re-certification will be the Subcontractor's responsibility.

C. Mockup: Build mockup installations to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build first article installation for each form and finish of structural glass railing consisting of top rail, structural glass, base channel, and anchorage system components that are full height and are not less than 24 inches in length, for review by the Architect.
2. Subject to compliance with requirements, approved first article installations may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: If railing has not been previously tested by fabricator/manufacturer, the Railing Subcontractor shall engage a qualified testing agency to perform preconstruction testing. Retesting of products that fail to meet specified requirements shall be done at Subcontractor’s expense.

1. Build testing mockups at testing agency facility; use personnel, materials, and methods of construction that will be used at Project site.
2. Test railings in accordance with ASTM E894, ASTM E935, ASTM E2353, and ASTM E2358.
3. If railing has been tested in accordance with the ASTMs above, submit copies of product test reports with submittals.

1.10 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.11 WARRANTY

A. Manufacturer's Special Warranty for Laminated Glass: Glazed decorative metal railing manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: "CRL P9 Series" by CRLawrence has been selected as the basis of design for this project. Equivalent railings by one of the following will be reviewed subject to compliance with requirements:

1. Livers Bronze Co;
2. Newman Hollaender Mfg. Co.
3. R & B Wagner, Inc.
4. Viva Railings, LLC.

B. Source Limitations for Laminated Glass: Obtain from single source from single manufacturer.

C. Source Limitations for Decorative Metal Railing Components: Obtain from single source from single manufacturer for each component and installation method.

D. Product Options: Information on Drawings and in the Specifications establishes requirements for railing system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

2.2 PERFORMANCE REQUIREMENTS

A. Fabrication Engineering and Design: Engage a qualified professional engineer, licensed to practice in the State of New Jersey, as defined in Division 01 Section "Quality Requirements," to engineer glazed decorative metal railings, including attachment to building construction.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Steel: 72 percent of minimum yield strength.
2. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA CW-12, "Structural Properties of Glass."

C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

    a. Uniform load of 50 lbf/ft. applied in any direction at the top and to transfer load through supports to structure.
    b. Concentrated load of 200 lbf applied in any direction at any point and have supporting structure to transfer this loading to appropriate structural elements of the building.
    c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Structural Glass Railings and Glass-Infill Panels:

    a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft. and a concentrated upward load of 50 lbs. applied at the most critical location
    b. Infill load and other loads need not be assumed to act concurrently.

3. Structural Glass Railings: Support each section of top rail by a minimum of three glass panels or by other means so railings will remain in place if any one glass panel fails.

    a. Support top rail ends such that railings remains in place if end glass panel fails.

4. In addition to loads above, if railings are installed on the exterior of the building, they will be subject to wind and seismic loads. For exterior railings comply with requirements specified in Division 08 Section "Exterior Enclosure System Requirements".

D. Wind Loads: For exterior glazed decorative metal railings, capable of withstanding the following wind loads in accordance with the New Jersey State Building Code and ASTM E1300:

1. Wind Load: Determine loads based on pressures specified in the Cladding Wind Load Study and in Division 08 Section “Exterior Enclosure System Requirements”.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

F. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Recycled Content: Provide steel products with an average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

C. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.4 STEEL AND IRON

A. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M.

B. Bars: Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.

C. Plates and Shapes: ASTM A36/A36M.

D. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.5 GLASS AND GLAZING

A. Glazing Publications: Comply with written instructions of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA/GANA Publications: "GANA Laminated Glazing Reference Manual" and "GANA Glazing Manual."

B. Safety Glazing: Glazing shall comply with 16 CFR 1201, Category II.

C. Safety Glazing Labeling: Permanently mark glass with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

D. VOC and Emissions Requirements: Paints and Coatings, adhesives and sealants, wet applied on site shall comply with:

1. VOC limits (g/L) found in tables in Division 01 Section "Sustainable Design Requirements."
2. Emissions testing criteria of CHPH Standard v1.2-2017.

E. Glazing Cement and Accessories for Structural Glass Railings: Glazing cement, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal base channels.

F. Sealant and Accessories for Structural Glass Railings: Sealant, gaskets, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal base channels.

G. Glazing Gaskets for Glass-Infill Panels: Glazing gaskets and related accessories as recommended or supplied by railing manufacturer for installing glass-infill panels in post-supported railings.

2.6 GLASS HANDRAILS AND GUARDS

A. Laminated Glass Handrails and Guards: ASTM C1172, Type II with two plies of glass bonded together by an interlayer.

1. Construction: 9/16 inch thick, laminated glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: 0.060 inch.
3. Kind: LT (laminated tempered).
4. Glass Color: Inner-ply clear; outer-ply clear.
5. Interlayer Color: Clear.
6. Glass Plies for Glass-Infill Panels: Thickness required by structural loads, but not less than 6.0 mm each.

2.7 FASTENERS

A. Fastener Materials: Use fasteners of same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined. Unless otherwise indicated, provide the following:

1. Steel Components: Type 316 stainless steel fasteners.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable.

1. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless steel bolts, ASTM F593, and nuts; ASTM F594.

2.8 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Anchoring Cement: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.9 FABRICATION OF METAL RAILINGS

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

1. Rails and Posts: 1-inch x 2 inch posts and steel tup top rails.

B. Shop assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed welds to comply with NAAMM's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.

I. Form changes in direction by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

J. Close exposed ends of hollow railing members with prefabricated end fittings.

K. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inchor less.

L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, handrail brackets, miscellaneous fittings, and anchors to interconnect railing members to other work where indicated.

M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

N. For railing posts set in concrete, provide steel sleeves not less than 6 incheslong with inside dimensions not less than 1/2 inchgreater than outside dimensions of post, with metal plate forming bottom closure.

1. Coordinate with cast-in-place concrete work to provide embed plates for installation by the concrete contractor.

2.10 FABRICATION OF GLASS PANELS AND BALUSTERS

A. General: Fabricate glass to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.

B. Glass-Infill Panels: Provide laminated, tempered glass-infill panels for both straight and curved sections.

1. Edge Finish: Clean-cut or flat-grind edges to produce smooth, square edges with slight chamfers at junctions of edges and faces Edges of glass indicated to be exposed in the finish work, shall be in full alignments, with zero mismatch, zero tolerance and full alignment.

2.11 METAL FINISH REQUIREMENTS, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.12 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.
4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:

1. Exterior Railings: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Other Railings: SSPC-SP 3, "Power Tool Cleaning."

E. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop prime uncoated railings with universal shop primer.
2. Do not apply primer to galvanized surfaces.

F. Powder-Coat Finish for Galvanized Metal: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:

1. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness of not less than 1.5 mils.
4. Color: Match Architect's sample.

2.13 SOURCE QUALITY CONTROL

A. The Owner's Special Inspection Agency shall have the option to perform periodic inspections during welding of the following items, provided the materials, welding procedures and qualifications of welders are verified prior to the start of the work; periodic inspections are made of the work in progress and a visual inspection of all welds is made prior to completion or prior to shipment of shop welding.

1. Welding:

a. Full penetration welds: Test all full penetration welds for soundness by means of either radiographic or ultrasonic testing in accordance with AWS D1.1 and ASTM E164 procedures. Repair all flaws in plate or flange material revealed during such tests.
b. Partial penetration welds: Test all partial penetration welds for soundness by means of visual and magnetic particle inspection, unless other methods are specified in the Contract Documents. Repair all flaws in plate or flange material revealed during such tests.
c. Fillet welds: Visually inspect all fillet welds by AWS certified welding inspector. In addition, test ten percent (10%) of all fillet welds using a non-destructive method, such as dye penetrant or magnetic particle. Select test locations randomly throughout the structure, but test at least one weld in each location with 6 or more welds per connection. If, in the opinion of the Welding Inspector this testing discloses a large ratio (10% or more) of unacceptable welds, the required percentage of tested welds may be increased to 100%, all at the Subcontractor's expense. All defects found visually in fillet welds shall be non-destructively tested by magnetic particle or dye-penetrant methods

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Comply with Drawings and manufacturer's written instructions for installing glazed decorative metal railings, accessories, and other components.

B. Perform cutting, drilling, and fitting required for installing metal railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line, without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of metal railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints. Comply with the following tolerances:

1. Panel to Panel Joint Alignment: maximum 1/16 inch vertically, and maximum 1/8 inch out of plane.
2. Plumb: 1/8 inch in 10 ft., 1/4 inch in 40 ft.
3. Level: 1/8 inch in 20 ft., 1/4 inch in 40 ft.
4. Location: Limit variation from plane to 1/8 inch in 12 ft.; 1/4 inch overall.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 METAL RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Nonwelded Connections:

1. Use mechanical or adhesive joints for permanently connecting railing components.
2. Use wood blocks and padding to prevent damage to railing members and fittings.
3. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

C. Expansion Joints: Install expansion joints at locations indicated, but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 METAL ANCHORING POSTS

A. Anchor posts to metal surfaces with fully welded base plates bolted through thermal isolation pads. Provide size of base plate, number of fasteners and depth required to comply with wind loading and other performance requirements.

3.5 ANCHORING RAILING ENDS

A. Anchor railing ends to concrete and masonry with brackets on underside of rails connected to railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.

3.6 ATTACHING HANDRAILS TO WALLS

A. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

B. Attach handrails to walls with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed gypsum board partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.7 POST-SUPPORTED RAILINGS WITH GLASS-INFILL PANELS

A. Install assembly to comply with railing manufacturer's written instructions and with requirements in other Part 3 articles, final shop drawings and calculations.

B. Install plumb, level, in alignment with panels across elevation

C. Separate metal from glass contact with silicone gaskets. Use silicone washers and bushings around stainless steel fasteners used to secure pressure plates to stainless steel post supports.

D. Erect posts and other metal railing components, and set factory-cut glass-infill panels.

E. Do not cut, drill, or alter glass-infill panels in field. Protect edges from damage.

F. Secure glass to glass joints between glass panels with structural silicone sealant, unless otherwise shown.

3.8 FIELD QUALITY CONTROL

A. Inspections: The Owner's Special Inspection Agency (SIA) to perform the following.

1. Inspect the glazed decorative metal railing fabrication welding as Work progresses, in accordance with New Jersey State Building Code as applicable to glazed decorative railings. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the Architect/Engineer for final acceptance.
    a. Field inspection of steel shall include connections, levelness, plumbness and alignment of the stair and railing systems in conformance with AWS welding methods, examination of surface before welding, examination and testing of completed welds.
2. If testing finds welds are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.
3. Welds will be considered defective if they do not pass tests and inspections.
    a. Remove and replace welds that does not pass tests and inspections, and retest.

b. Additional testing and inspecting, will be conducted until all defective conditions are repaired and signed off by the SIA.

4. Railing Testing: If installation of decorative metal railings is not in compliance with approved shop drawings and calculations, decorative metal railings in accordance with ASTM E894, ASTM E935, ASTM E2353, and ASTM E2358 for compliance with performance requirements.

B. Prepare test and inspection reports and submit to the Owner and Architect.

3.9 CLEANING

A. Clean and polish glass as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.

3.10 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 071905- CONCRETE SEALER

PART 1 - GENERAL

1.1 SUMMARY

A. Provide the work of this Section in accordance with requirements of the Contract Documents

B. Section includes penetrating sealer for horizontal concrete walking surfaces, used at existing conditions. Verify gloss required and locations. For new construction, see Concrete section in Division 03.

C. Related Work

1. Division 03 Sections "Concrete Formwork", "Concrete Reinforcement", and "Cast-in-Place Concrete", "Concrete Finishing and Curing", for concrete including formwork, reinforcement, concrete materials, mixture design, placement procedures, initial finishing, and curing other than specified in this section.
2. Division 03 Section "Hydraulic Cement Underlayment" for self-leveling hydraulic cement underlayment systems.
3. Division 09 Section "Moisture Vapor Emission Control" for moisture mitigation of substrate slabs.
4. Division 09 Flooring Sections for other flooring systems that are poured/cast.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site. If possible, review what products have been applied to the slab.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's printed statement of VOC content.
2. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

B. Sustainable Design Action Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:

a. Leadership Extraction Practices

1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
2) Bio-Based Materials: Meeting the sustainable Agriculture Network's Sustainable Agriculture Standard and tested per ASTM D6866.
3) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.

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a) Include statement indicating costs for each product having recycled content.

b. Sourcing of Raw Materials: For products that are responsibly sourced within 100 miles of project site, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.

1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

2. Indoor Environmental Quality, Low Emitting Materials:

a. Laboratory Test Reports: For adhesives, sealants, paints, coatings wet applied on site, indicating testing and compliance with the California Department of Public-Health (CDPH) Standard Method V1.2-2017, using the applicable exposure scenario.

b. Adhesives and Sealants: For wet applied on site products, submit printed statement showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005 and rule amendment date of October 6, 2017.

c. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants

C. Samples: For each type of substrate indicated, 12 by 12 inches (300 by 300 mm) in size, with specified water-repellent treatment applied to half of each Sample.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Applicator.

B. Product Certificates: For each type of concrete sealer.

C. Sustainable Design Informational Submittals:

1. Building Product Disclosure and Optimization - Environmental Product Declarations

a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.

b. EPD Optimization: For materials indicating embodied carbon/LCA optimization report or action plan

2. Building Product Disclosure and Optimization - Material Ingredients

a. Material Ingredient Optimization: Submit at least one of the following:

1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.

2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo, with gold or platinum certification.

3) International Alternative Compliance Path - REACH Optimization

4) Declare: Manufacturer's completed Product Declaration Form

5) Other programs approved by USGBC

D. Field quality-control reports.

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E. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

B. Mockups: Prepare mockups of each required product on each type of substrate required to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Locate mockups on existing surfaces where directed by Architect.
   a. Size: 10 sq. ft. (9.3 sq. m) each.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

A. Limitations: Proceed with application only when the following existing substrate conditions permit concrete sealers to be applied according to manufacturers' written instructions and warranty requirements:

1. Concrete surfaces and mortar have cured for not less than 28 days.
2. Building has been closed in for not less than 30 days before treating wall assemblies.
3. Ambient temperature is above 40 deg F (4.4 deg C) and below 100 deg F (37.8 deg C) and will remain so for 24 hours.
4. Not less than seven days have passed since surfaces were last wet.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Performance: Concrete sealers shall meet the following performance requirements as determined by preconstruction testing on manufacturer's standard substrates representing those indicated for this Project.

B. Water Absorption: Minimum 80 percent reduction of water absorption after 24 hours for treated compared to untreated specimens when tested according to the following:

1. Cast-in-Place Concrete: ASTM C 642.

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C. VOC and Emissions Requirements: Paints and coatings, adhesives and sealants, wet applied on site shall comply with:

1. VOC limits (g/L) found in tables in Division 01 Section "Sustainable Design Requirements."
2. Emissions testing criteria of CHPH Standard v1.2-2017.

2.2 PENETRATING CONCRETE SEALER SC-01

A. Penetrating liquid floor treatment: clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components. Provide solution that is odorless, penetrating, and that hardens and densifies concrete existing concrete surfaces.

1. Curecrete Distribution Inc; “Ashford Formula”
2. Dayton Superior Corporation: “Sure Hard Densifier J17”
3. Euclid Chemical Company, “Eucosil”
4. L&M Construction Chemicals, Inc “Seal Hard”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of sealer.
3. Verify that required repairs are complete, cured, and dry before starting application.

B. Test pH level according to sealer manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cleaning: Before application of concrete sealer, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions and as follows:

1. Cast-in-Place Concrete: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of sealers according to ASTM E 1857.
2. Remove any existing flooring treatments, adhesives, or coatings.

B. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of floor coating. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of sealer being deposited on surfaces.

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3.3 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of concrete sealer and to instruct Applicator on the product and application method to be used.

B. Apply coating of sealer on surfaces to be treated using pressure spray with a fan-type spray nozzle, or roller to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

A. Testing of Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when sealer is being applied:

1. The Concrete Sealer's Testing agency will perform tests for compliance of concrete sealer material with product requirements.

3.5 CLEANING

A. Immediately concrete sealer from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION

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SECTION 072150- SPRAYED THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. **This Section is hereby deleted in its entirety for Addendum #5.**

END OF SECTION 072150

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SECTION 072720 - MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 CONTROLLING DOCUMENTS

A. This specification is controlled by Division 08 Section “Exterior Enclosure System Requirements”. In addition to the requirements of this document, all requirements of Controlling Documents must also be met. The more onerous conditions of this document or the Controlling Document must be met.

1.3 SUMMARY

A. Provide the work of this section in accordance with requirements of the Contract Documents.

B. This Section includes, but is not limited to the following:

1. Vapor-retarding, fluid-applied air barriers.
2. Vapor-permeable, fluid-applied air barriers.
3. Vapor retarding sheet air barriers.
4. Vapor permeable sheet air barriers.

C. Related Requirements:

1. Division 03 Section "Cast-In-Place Concrete".
2. Division 04 Section "Unit Masonry" for embedded flashings.
~~1.~~**3.** Division 06 Section "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.
~~2.~~**4.** Division 07 Section "Flashing and Trim" for sheet flashings.
~~3.~~**5.** Division 07 Section "Joint Sealants" for joint-sealant materials and installation.

1.4 DEFINITIONS

A. ABAA: Air Barrier Association of America.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

D. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

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1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Agenda: Review air-barrier requirements and installation procedures, including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, sequence of installation, special details and fluid applied and sheet membrane flashings, mockups, air-leakage and bond testing and special inspection procedures, air-barrier protection and repair recommendations, and work scheduling that covers air barriers.
2. Attendees: Include installers of other construction connecting to air barrier, including roofing, waterproofing, architectural precast concrete, masonry, sealants, windows, glazed curtain walls, and door frames.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

B. Sustainable Design Action Submittals:

1. Building Product Disclosure and Optimization:
    a. Leadership Extraction Practices
        1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
        2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
            a) Include statement indicating costs for each product having recycled content.
    b. Sourcing of Raw Materials: For products that are responsibly sourced within 100 miles of project site, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.
        1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.
2. Indoor Environmental Quality, Low Emitting Materials:
    a. Laboratory Test Reports: For adhesives, sealants, paints, coatings wet applied on site, indicating testing and compliance with the California Department of Public-Health (CDPH) Standard Method V1.2-2017, using the applicable exposure scenario.
    b. For paints, and coatings, wet applied, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure for Architectural Coatings or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016

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c. Adhesives and Sealants: For wet applied on site products, submit printed statement showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005, and rule amendment date of October 6, 2017.
d. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants.

C. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.
4. Include details of mockups

1.7 INFORMATIONAL SUBMITTALS

A. Manufacturer's Technical Representative: For each system installed, provide manufacturer's technical representative on site to observe the first 5 days of installation, observe 5 other full days on installation, inspect completed installations, and provide written acceptance of each completed installation.

B. Qualification Data: For Installer. Provide letter from membrane manufacturer indicating that installer is trained and approved by manufacturer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.

C. Sustainable Design Informational Submittals:

1. Building Product Disclosure and Optimization - Environmental Product Declarations

a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.
b. EPD Optimization: For materials indicating embodied carbon/LCA optimization report or action plan.

2. Building Product Disclosure and Optimization - Material Ingredients

a. Material Ingredient Optimization: Submit manufacturer's Environmental Product Declaration (EPD) and at least one of the following:
1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo.
3) International Alternative Compliance Path - REACH Optimization
4) Declare: Manufacturer's completed Product Declaration Form
5) Other programs approved by USGBC.

D. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come into contact with the barrier.

E. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

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F. Field quality-control reports.

1.8 QUALITY ASSURANCE

A. Manufacturer: Company with full time technical representatives that can attend preinstallation meetings, field testing, first installation and periodically during installation to ensure that installation is acceptable for manufacturer warranty.

B. Installer Qualifications: An entity with a minimum of 5 year successful experience applying specified air barrier materials on projects of equivalent size and scope, and that employs installers and supervisors who are trained and approved by manufacturer.

1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

C. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.

1. Build integrated mockups of exterior wall assembly as indicated on Drawings, or if not indicated, at least 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
    a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
    b. Field test mockup in accordance with requirements specified in Part 3 "Field Quality Control".
    c. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
    d. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on field mockups.

B. Laboratory Mockup Testing: Air-barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.

1. Air-Leakage-Location Testing: Mockups will be tested for evidence of air leakage according to ASTM E1186, chamber pressurization or depressurization with smoke tracers or with detection liquids.
2. Air-Leakage-Volume Testing: Mockups will be tested for air-leakage rate according to ASTM E783 or ASTM E2357.
3. Adhesion Testing: Mockups will be tested for required air-barrier adhesion to substrate according to ASTM D4541.

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4. Notify Architect seven days in advance of the dates and times when mockups will be tested.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.

B. Remove and replace liquid materials that cannot be applied within their stated shelf life.

C. Protect stored materials from direct sunlight.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

1.12 WARRANTY

A. Material Warranty: Provide the manufacturer's 5 year air barrier material warranty.

B. Special Warranty: Provide installation warranty win installer's agreement to replace membrane air barriers and components that do not comply with requirements, or that fails to remain air tight, watertight, exhibit loss of adhesion, cohesion, do not cure within the specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Air barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration.

1. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
2. Air barrier membranes shall be compatible with substrates, including glass faced gypsum sheathing, concrete masonry units, concrete, preservative treated plywood sheathing, and fire-retardant treated cants, blocking, and furring strips.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E2357.

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2.2 MATERIALS

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

B. VOC Content: 100 g/L or less.

2.3 FLUID APPLIED HIGH-BUILD AIR BARRIERS, VAPOR RETARDING

A. High-Build, Vapor-Retarding Air Barrier (**AB-01**): Synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils or thicker over smooth, void-free substrates.

1. Synthetic Polymer Type:

a. Products: Subject to compliance with requirements, provide one of the following:

1) Carlisle Coatings & Waterproofing Inc; Fire Resist Barritech NP.
2) Grace Construction Products; W.R. Grace & Co. -- Conn.; Perm-A-Barrier Liquid **NPL 10**.
3) Henry Company; Air-Bloc 16MR.
4) Or approved equal.

2. Physical and Performance Properties:

a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
b. Vapor Permeance: Maximum 0.1 perm; ASTM E96/E96M, Desiccant Method, Procedure A.
c. Ultimate Elongation: Minimum 500 percent; ASTM D412, Die C.
d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D4541.
e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
f. UV Resistance: Can be exposed to sunlight for 90 days according to manufacturer's written instructions.

~~2.4 FLUID APPLIED AIR BARRIERS, VAPOR PERMEABLE~~

~~A. Vapor-Permeable Air Barrier (**AB-02**): Synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 20 (0.9 mm) or thicker over smooth, void-free substrates.~~

~~1. Synthetic Polymer Type:~~

~~a. Products: Subject to compliance with requirements, provide one of the following:~~

~~1) Grace Construction Products; W.R. Grace & Co. -- Conn.; Perm-A-Barrier VP, Perm-A-Barrier VP LT or Perm-A-Barrier VPL 50RS UV Stable based on project conditions.~~
~~2) Henry Company, Sealants Division; 17MR.~~
~~3) Carlisle Coatings & Waterproofing; Barriseal-R.~~
~~4) Or approved equal.~~

~~2. Physical and Performance Properties:~~

~~a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.~~

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~~b. Vapor Permeance: Minimum 20 perms; ASTM E96/E96M, Wet Method, Procedure B.~~
~~c. Ultimate Elongation: Minimum 200 percent; ASTM D412, Die C.~~
~~d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D4541.~~
~~e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.~~
~~f. UV Resistance: Can be exposed to sunlight for 90 days according to manufacturer's written instructions.~~

~~2.5~~2.4 SHEET MEMBRANE AIR BARRIERS, VAPOR RETARDING

A. Modified Bituminous Sheet, Vapor Retarding (**AB-03**): 40-mil-thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4-mil-thick, cross-laminated polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Carlisle Coatings & Waterproofing Inc; CCW-705.
   b. GCP Applied Technologies Inc. (formerly Grace Construction Products); Perm-A-Barrier **AI** Wall Membrane.
   c. Henry Company; Blueskin SA.
   d. Or approved equal.

2. Physical and Performance Properties:
   a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
   b. Tensile Strength: Minimum 250 psi; ASTM D412, Die C.
   c. Ultimate Elongation: Minimum 200 percent; ASTM D412, Die C.
   d. Puncture Resistance: Minimum 40 lbf; ASTM E154/E154M.
   e. Water Absorption: Maximum 0.15 percent weight gain after 48-hour immersion at 70 deg F; ASTM D570.
   f. Vapor Permeance: Maximum 0.1 perm; ASTM E96/E96M, Desiccant Method, Procedure A.
   g. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D4541 as modified by ABAA.
   h. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
   i. UV Resistance: Can be exposed to sunlight for 60 days according to manufacturer's written instructions.

~~2.6 SHEET MEMBRANE AIR BARRIERS, VAPOR PERMEABLE~~

~~A. Nonbituminous Sheet (**AB-04**): Minimum 20-mil-thick, self-adhering sheet consisting of a breathable carrier film or fabric and an adhesive with release liner on adhesive side and formulated for application with primer that complies with VOC limits.~~

~~1. Products: Subject to compliance with requirements, provide one of the following:~~
~~a. Carlisle Coatings & Waterproofing Inc; Fire Resist 705 VP.~~
~~b. GCP Applied Technologies Inc. (formerly Grace Construction Products); Perm-A-Barrier VPS30~~
~~c. Henry Company Blueskin VP160.~~
~~d. Or approved equal.~~

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~~2. Physical and Performance Properties:~~

~~a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.~~
~~b. Puncture Resistance: Minimum 40 lbf; ASTM E154.~~
~~c. Vapor Permeance: Minimum 15 perms; ASTM E96, Wet Method, Procedure B.~~
~~d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D4541 as modified by ABAA.~~
~~e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.~~
~~f. UV Resistance: Can be exposed to sunlight for 150 days according to manufacturer's written instructions.~~

~~2.7~~2.5 ACCESSORY MATERIALS

A. General: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Primer: Liquid primer recommended for substrate by air-barrier material manufacturer.

C. Stainless-Steel Sheet Flashing: ASTM A240, Type 304, 0.0250 inch thick, and Series 300 stainless-steel fasteners.

D. Preformed Silicone Extrusion Flashing: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Dow Corning Corporation; Dow Corning® 123 Silicone Seal.
   b. GE Construction Sealants; Momentive Performance Materials Inc.; US11000 UltraSpan.
   c. Pecora Corporation; Sil-Span.
   d. Or approved equal.

E. Provide joint sealants that are compatible with membrane and adjacent materials, comply with requirements specified in Division 07 Section "Joint Sealants" and that are recommended by selected manufacturer of membrane air barriers for intended use.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.

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3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D4263.
4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

H. Bridge ~~[~~isolation joints~~]~~, ~~[~~expansion joints~~]~~ ~~[~~and~~]~~ discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 JOINT TREATMENT

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D4258 before coating surfaces.

1. Prime substrate and apply a single thickness of preparation coat strip extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of air barrier membrane and embed a joint reinforcing strip in preparation coat.

B. Gypsum Sheathing: Ensure joints are filled with sealant as specified in Division 06 Section “Sheathing” and according to ASTM C1193 and air barrier manufacturer's written instructions. Apply first layer of fluid air barrier membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air barrier membrane over joint reinforcing strip.

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3.4 INSTALLATION, GENERAL

A. Install materials according to air-barrier manufacturer's written instructions and details and according to recommendations in ASTM D6135 to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. When ambient and substrate temperatures range between 25 and 40 degrees F, install self-adhering, modified bituminous air-barrier membranes produced for low-temperature application. Do not install low-temperature membrane if ambient or substrate temperature is higher than 60 degrees F.
2. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.

B. Prepare, treat, and seal inside and outside corners and vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D6135.

3.5 ACCESSORIES INSTALLATION

A. Install transition strips and accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
    a. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials as required to provide continuity of air barrier.

C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

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E. Continuity at Wall Openings and Transitions: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip or preformed silicone extrusion at transitions between sheathing and edge of slabs, sheathing and CMU backup and at non-moving joints, so that a minimum of 4 inches of coverage is achieved over each substrate. Maintain 4 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

1. Transition Strip: Roll firmly to enhance adhesion.
2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.

F. Install membranes bottom up, in a method recommended by manufacture to shingle and direct water away from openings. Use manufacturer's prefabricated inside and outside corners. Apply 8 in wide air barrier transition strips extending 4 inches onto sides of window frames and 4 inches onto adjacent sheathing substrates. Apply manufacturer's recommended silicone sealant/adhesive to overlap a minimum of 1 inch at junctures between preformed corners and vertical/horizontal transitions. Apply silicone lap sealant over exposed edges and on cavity side of flashing sheet. Verify that overlaps are bonded with silicone and that laps are fully embedded without fishmouths, skips, or misalignments of any kind.

G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

I. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.

J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction. At fasteners and other penetrations required to support exterior wall panels and skins, apply manufacturer recommended seals necessary to maintain continuity of air barriers.

3.6 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

A. General: Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.

1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
4. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

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B. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties. Detail and seal penetrants to comply with manufacturer's recommendations for each type of penetration as required to maintain membrane continuity.

1. Vapor-Retarding, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 40 mils, applied in one or more equal coats.
2. Vapor-Permeable, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils, applied in one or more equal coats.
3. Apply fluid applied membrane air barriers to form a continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Sheet Membrane Application: Apply and firmly adhere air-barrier sheets over area to receive air barrier. Accurately align sheets and maintain uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.

1. Apply sheets in a shingled manner to shed water.
2. Roll sheets firmly to enhance adhesion to substrate.

D. Apply continuous air-barrier sheets over accessory strips bridging substrate cracks, construction, and contraction joints.

E. CMU: Install air-barrier sheet horizontally against the CMU beginning at base of wall. Align top edge of air-barrier sheet immediately below protruding masonry ties or joint reinforcement or ties, and firmly adhere in place.

1. Overlap horizontally adjacent sheets a minimum of 2 inches and roll seams.
2. Apply overlapping sheets with bottom edge slit to fit around masonry reinforcing or ties. Roll firmly into place.
3. Seal around masonry reinforcing or ties and penetrations with termination mastic.
4. Continue the sheet into all openings in the wall, such as doors and windows, and terminate at points to maintain an airtight barrier that is not visible from interior.

F. Seal top of through-wall flashings to air-barrier sheet with an additional 6-inch-wide, transition strip.

G. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

H. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches beyond repaired areas in all directions.

I. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.

J. Do not cover air barrier until it has been tested and inspected by testing agency.

K. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

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3.7 FIELD QUALITY CONTROL

A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program. ABAA audit inspection and testing is performed at the following rate:

1. Up to 10,000 Sq. Ft. of Air Barrier: One audit.
2. 10,000 to 35,000 Sq. Ft. of Air Barrier: Two audits.
3. 35,000 to 75,000 Sq. Ft. of Air Barrier: Three audits.
4. 75,000 to 125,000 Sq. Ft. of Air Barrier: Four audits.
5. 125,000 to 200,000 Sq. Ft. of Air Barrier: Five audits.
6. 200,000 Sq. Ft. and Over of Air Barrier: Six audits.

B. Testing Agency: Engage a qualified testing agency to **witness tests and** perform ~~tests and~~**progress** inspections**, in compliance with Energy Code Requirements for air sealing and insulation visual inspection**.

1. Coordinate with Division 08 Section "Exterior Enclosure System Requirements" for other required testing, and with Division 01 "Building Enclosure Commissioning Requirements" for commissioning of exterior walls.

C. Manufacturer's representative shall be present at preinstallation meeting, first installation, and periodically during installation. Manufacturer's representative shall provide on-site training of installers for the initial installation crew.

D. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Air-barrier dry film thickness.
3. Continuous structural support of air-barrier system has been provided.
4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
5. Site conditions for application temperature and dryness of substrates have been maintained.
6. Maximum exposure time of materials to UV deterioration has not been exceeded.
7. Surfaces have been primed, if applicable.
8. Laps in sheet materials, strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
9. Termination mastic has been applied on cut edges.
10. Sheets, Strips and transition strips have been firmly adhered to substrate.
11. Compatible materials have been used.
12. Transitions at changes in direction and structural support at gaps have been provided.
13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
14. All penetrations have been sealed.
15. Dry film thickness of installed membrane

E. Tests: Field testing shall be performed on the first installation of air barriers. Testing requirements shall be determined by testing agency from among the following tests:

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1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E1186, chamber pressurization or depressurization with smoke tracers or using detection liquids.
2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E783.
3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D4541**-17 as modified by ABAA "T0002-2019 Standard Test Method for Pull-Off Strength of Adhered Air and Water Resistive Barriers Using an Adhesion Tester"** ~~for each 600 sq. ft. of installed air barrier or part thereof~~ **and schedule specified in ABAA Quality Assurance Program above. Field pull test for sheathing substrates shall pass if membrane bond to substrate is maintained at 2.5 psi per GWB Association Position Document "*An Examination of Wind Loads Across Various Standards and the Use for Pull-Off Adhesion testing to ASTM D4541 and ABAA T002 to Meet a Designed Wind Load Target*" dated July 2024. CMU and Concrete Substrates shall be tested to 16 psi**. Each test is an average of three pulls within a 3 meter area, with the following conditions requiring additional pull tests:
    a. When there is a crew change during installation.
    b. When there was a weather change that could affect adhesion of air barriers.
    c. If formulation changed (due to weather or other reasons).
    d. If there are multiple substrate types, each substrate requires separate testing.
    e. Frequency of testing may be increased or reduced based on track record of leaks/failures reported by ABAA inspections at the discretion of the Architect.

F. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

G. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

H. Prepare test and inspection reports.

3.8 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

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END OF SECTION 072720

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SECTION 074213 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 CONTROLLING DOCUMENTS

A. This specification is controlled by Division 08 Section “Exterior Enclosure System Requirements”. In addition to the requirements of this document, all requirements of Controlling Documents must also be met. The more onerous conditions of this document or the Controlling Document must be met.

1.2 SUMMARY

A. Provide the Work of this Section in accordance with requirements of the Contract Documents.

B. Section Includes but is not limited to:

1. Exposed-fastener, lap-seam metal wall panels.
2. Concealed-fastener, butt-seam metal wall panels.
3. Concealed-fastener, lap-seam metal wall panels.
4. Metal liner panels.
5. Metal soffit panels.

C. Related Sections:

1. Division 05 Section "Cold-Formed Metal Framing" for support framing, including girts, studs, and bracing.
2. Division 06 Section "Sheathing" for sheathing support.
3. Division 07 Section "Membrane Air Barriers" for continuous air barrier systems.
4. Division 07 Section "Thermal Insulation" for building insulation.
5. Division 07 Section "Plate Metal Wall Panels" for MTP-01.
6. Division 07 Flashing Sections for flashing and other sheet metal work that is not part of metal wall panel assemblies.
7. Division 07 Section "Joint Sealants" for installation of joint sealants between metal panel system and adjacent exterior wall systems.
8. Division 08, Section "Exterior Enclosure System Requirements" for coordinating with requirements for exterior wall mockups.
9. Division 08 Section "Louvers" for louvers.

1.3 DEFINITION

A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight wall system.

B. Oil Canning: As defined by ASTM A1030, the term “oil canning” is an aesthetic issue, not a structural problem or a defect. Oil canning is a perceived waviness across the flat areas of metal panels. Oil canning is more apparent under shallow cross lighting so its presence is more discernible during certain seasons or times of day. Also, differing thermal forces can create waviness either temporary or sustained as the sun moves across the sky.

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1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site, in compliance with Division 08 Section "Exterior Enclosure Requirements.

1. Attendees: Meet with Owner, Architect, Owner's insurer if applicable, formed metal panel Installer, formed metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
2. Agenda: Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    a. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
    b. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
    c. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
    d. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
    e. Review temporary protection requirements for metal panel assembly during and after installation.
    f. Review of procedures for repair of metal panels damaged during transport and after installation.
    g. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Sustainable Design Actionable Submittal:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:
    a. Leadership Extraction Practices
        1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
        2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
            a) Include statement indicating costs for each product having recycled content.
    b. Sourcing of Raw Materials: For products that are sustainable sourced within 100 miles of project site, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.
        1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

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2. Indoor Environmental Quality, Low Emitting Materials:

    a. Laboratory Test Reports: For adhesives, sealants, paints, coatings wet applied on site, indicating testing and compliance with the California Department of Public-Health (CDPH) Standard Method V1.2-2017, using the applicable exposure scenario.
    b. For paints, and coatings, wet applied, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure for Architectural Coatings or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016.
    c. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants

C. Fabrication Engineering and Design: Submit comprehensive engineering analysis and Shop Drawings signed and sealed by a qualified Professional Engineer licensed to practice in the project jurisdiction, responsible for their preparation, indicating compliance with performance requirements specified. Submission shall include:

1. Analysis for applicable loads on framing members including backup cold formed metal wall.
2. Analysis for applicable loads on anchors and support system for the project.
3. Structural calculations and details of anchoring system, including type, size, and spacing of fasteners.

D. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; project specific interfaces with other systems and components, details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

    a. Distinguish between factory, shop, and field assembled work

2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

E. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.
2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch-long Samples for each type of accessory.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items. Show the following:

1. Wall panels and attachments.
2. Girts and Stud framing.
3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
4. Penetrations of wall by pipes and utilities.
5. Details of gutter, flashing, roofing, air/water barrier systems.
6. Interface with other systems and components.

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B. Qualification Data: For Installer and professional engineer.

C. Sustainable Design Informational Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:

a. Raw Material Sources and Extraction Reporting: Submit Raw materials supplier corporate Sustainability Reports (CSRs); documenting responsible extraction; including extraction locations, long term ecologically responsible land use, commitment to reducing environmental harms from extraction and manufacturing processes, and a commitment to meeting applicable standards or programs that address responsible sourcing criteria

1) Submit manufacturers' self-declared reports
2) Submit third party verified corporate sustainability reports (CSR) using one of the following frameworks"

a) Global Reporting Initiative (GRI) Sustainability Report
b) Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises
c) UN Global Compact
d) ISO 26000
e) USGBC approved program.

2. Building Product Disclosure and Optimization - Material Ingredients

a. Material Ingredient Optimization: Submit manufacturer's Environmental Product Declaration (EPD) and at least one of the following:

1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo.
3) International Alternative Compliance Path - REACH Optimization
4) Declare: Manufacturer's completed Product Declaration Form
5) Other programs approved by USGBC

b. Product Manufacturer Supply Chain Optimization: Submit documentation from manufacturers for products that go beyond material ingredient optimization as follows:

1) No GreenScreen Benchmark 1 materials
2) Cradle to cradle gold or platinum certification
3) REACH
4) Other programs approved by USGBC

D. Product Test Reports: For each product, based on evaluation of compression tests performed by a qualified testing agency.

1. Provide lab test data (performed within 4 years prior to the date of submission) on structural air and water penetration tests per AAMA 509, evidencing compliance with requirements for exterior metal panel rainscreen systems to control water flow within the exterior envelope.

E. Certification for High Performance Organic Finishes: Manufacturer's and fabricator's certification indicating that PVDF coating complies with the Contract Documents and AAMA 2605.

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F. Field quality-control reports.

G. Sample Warranties: For special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A firm with a minimum of 10 years successful experience installing formed metal wall panels similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and that employs installers and supervisors who are trained and approved by manufacturer for installation of specified formed metal wall panels.

1. Provide a list of at least ten completed projects including names of owners, architects and the areas and types of formed metal wall panels for each of these projects.
2. Installer shall have a full time, senior, qualified foreman at the Project site to direct the work of this Section.

B. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for design and installation of metal wall panel assemblies that are similar to those indicated for this Project in material, design, and extent

D. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

E. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
2. All panels that incorporate foam plastic insulation must be tested and comply with NFPA-285. Provide test results to Architect.

F. Mockups: Prior to installing exterior wall systems, furnish materials and install formed metal wall panels as part of composite mockup indicated on Mockup Elevation Drawing Sheets. Incorporate exterior wall construction and finish to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Include formed metal panels in the PMU and VMU, coordinated with Exterior wall sections listed in Summary Paragraph of Division 08 Section "Exterior Enclosure System Requirements". Furnish and install materials provided in this section to create the composite testing mockup indicated.

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2. Build mockup of typical metal panel assembly, including corner, soffits, supports, attachments, and accessories. Build mockup to full thickness of wall design with insulation, girts, supports, and attachments.

    a. Include four-way joint for metal panels, with finish for Architect's selection.
    b. Include exterior metal soffit and coping.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

G. Repair procedure: Provide a sample panel of minimum 36” x 36” size. Demonstrate repair procedure for scratches, dents and discoloration. Review with Architect and make determination which repair procedures will be acceptable on the project. Repairs will be viewed in natural light, 8 feet from panel and viewed at 60 degree angle.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, formed metal wall panels, and other manufactured items so as not to be damaged or deformed. Package formed metal wall panels for protection during transportation and handling.

B. Unload, store, and erect formed metal wall panels in a manner to prevent bending, warping, twisting, and surface.

C. Store formed metal wall panels as recommended by manufacturer, off the ground and covered with suitable weathertight and ventilated covering. Store formed metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store formed metal wall panels in contact with other materials that might cause staining, corrosion, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish framing and opening dimensions and proceed with fabricating metal wall panels without field measurements. Coordinate wall construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

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1.11 COORDINATION

A. Coordinate formed metal wall panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

A. Formed Metal Wall Panel System Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of metal panel systems that fail in materials or product workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.
c. Damage to panel surface that cannot be repaired in the field successfully.

2. Warranty Period: Ten (10) years from date of Substantial Completion.

B. Installer’s Warranty: Installer’s warranty against defects or deficiencies, in which installer agrees to repair or replace components of formed metal wall panel systems that fail in materials and workmanship including failures specified above, within specified warranty period.

1. Warranty Period: Two (2) years from the date of Substantial Completion.

C. Panel Finish Warranty: Manufacturer's standard form in which manufacturer agrees to replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance for Exterior Wall System **EWS-05**: Formed metal panel assemblies composed of corrugated concealed fastener metal panels installed in a rainscreen application, with insulation, air barrier, sheathing, supported on cold formed metal studs for building enclosure. System shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Fabrication Engineering and Design: Engineer metal wall panel assembly, including cold formed steel framing supports, sheathing, air/water barrier and insulation, to comply with performance requirements specified. Provide acomprehensive engineering analysis by a qualified professional engineer, licensed to practice in the state of New Jersey and responsible for preparation of the design, using performance requirements and design criteria indicated.

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C. Structural Performance: Provide formed metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592, structural requirements of New Jersey State Building Code, Chapter 16, Structural Design and as follows:

1. Structural Loads: Except as modified by requirements specified in this Section, formed metal panels shall be engineered, fabricated, and installed to withstand design wind loads, seismic loads, sideway, live, and dead loads, structural movement, deflections, and tested performance requirements specified in Division 08 Section "Exterior Enclosure System Requirements".
2. Rain, Snow and Wind Loads: As specified in Division 08 Section "Exterior Enclosure System Requirements". Increased attention shall be paid to areas subject to increased pressure at the eaves, canopies and external corners. Special care shall also be taken to identify and design for any situation not clearly defined in the design requirements where the Subcontractor believes the geometry of the building may cause increased wind, rain and build-up loads due to vortex or eddy conditions.
3. Dimensional tolerances of building frame and other adjacent construction.
4. Deflection Limits: Design metal wall panel assemblies to withstand test pressures with deflection no greater than l/240 of the span and no evidence of material failure, structural distress, or permanent deformation exceeding 0.2 percent of the clear span.
    a. Test Pressures: 150 percent of inward and outward wind-load pressures.
5. When calculating loads, ensure that the worst combination load cases have been considered.

D. Air Infiltration: Air leakage of not more than when tested according to ASTM E283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24

E. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120, ambient; material surfaces.

G. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

H. Thermal Performance: Provide metal panel exterior Rainscreen assemblies (including Insulation, air space, and air barriers within cavity) with total Composite U factor of 0.048 Btu/sq. ft x h x deg F, and a minimum insulation R value of 21 or as shown on specific wall sections types whichever is greater, when tested according to ASTM C1363 or ASTM C518.

I. Single Source Responsibility: Use one manufacturer for each type of metal panel system used on the project, so that there is single source responsibility.

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J. Coping Performance: Design and test copings for wind resistance in accordance with ANSI/SPRI ES-1, except the basic wind speed shall be determined from IBC Figure 1609.

2.2 PANEL MATERIALS

A. Recycled Content of Products: Provide products with an average recycled content of products so postconsumer recycled content plus one-half of preconsumer recycled content not less than percentages listed below:

1. Aluminum: 40 percent pre-consumer; 14 percent post-consumer.
2. Steel: 75 percent.
3. Decorative Metals: 25 percent.

B. Metal Panel Thickness: Select metal panel thickness and widths to minimize “oil canning” in accordance with the requirements of the SMACNA “Architectural Sheet Metal Manual”. Pay careful attention to the causes of “oil canning” within all the phases of design, fabrication, handling and installation of formed metal panels to reduce its occurrence. Employ industry accepted and recognized methods of design, handling, fabrication, and installation to minimize “oil canning” of the metal plate panels. Comply with ASTM A1030 for measuring flatness characteristics of sheet metal products.

C. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653, G90 coating designation; structural quality.

D. Aluminum Sheet: Tensioned leveled, smooth coil-coated aluminum sheet, ASTM B209 stretcher-leveled standard of flatness, minimum thickness, alloy and temper required to suit forming operations and meet design and structural performance requirements for formed metal panels of larger dimensional sizes.

1. Perforated Patterns (interior locations where indicated): Perforation type patterns shall of custom sizes, shapes, arrangements and spacings with finished ends as indicated on the Drawings, using water jet or laser cutting methods. Deburr all exposed edges of perforated patterns.

E. Aluminum Welding Rods and Electrodes: Select according to AWS specifications for metal alloy welded.

F. Panel dimensional criteria:

1. Flatness: maximum allowable distortion of 1/32 inch in 24 inches in any direction. Form panel lines and breaks sharp and straight; make all surfaces free from warp or buckle.
2. Panel joints: Joints shall not vary in width more than 1/16th inch over 10 feet.

2.3 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

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B. Flush-Profile, Concealed-Fastener Metal Wall Panels (~~**MTP-02**~~**MTP-03**): Formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.

1. Basis-of-Design Product: Provide “Matrix Integrity MX-10” Morin; a Kingspan Group Company. Subject to compliance with requirements, equivalent products by one the following will be considered:

   a. Alcoa Inc.
   b. Fabral.
   c. MBCI; a division of NCI Building Systems, L.P.
   d. Centria.

2. Material: Aluminum sheet, 0.040 inch

   a. Surface: Smooth, flat finish.
   b. Exterior Finish: Fluoropolymer.
   c. Color: Medium Grey

3. Panel Width: 12 inches.
4. Panel Depth: 1-1/2-inches
5. Lengths: 5 ft. - 30 ft. panels, fabricate to lengths required and shown for building module.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653, G90 coating designation. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

1. Subgirts: C- or Z-shaped sections fabricated from 0.0598-inch bare steel thickness, shop-painted.
2. Zee Clips: 0.079-inch bare steel thickness.
3. Base or Sill Angles: 0.079-inch bare steel thickness.
4. Hat-Shaped, Rigid Furring Channels: ASTM C645.

   a. Minimum Base Metal Thickness: 0.0312 inch.
   b. Depth: As indicated.

B. Z-Shaped Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation, with slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, and depth required to fit insulation thickness indicated.

1. Nominal Thickness: As required to meet performance requirements but no less than 0.025 inch.

C. Specialty Clip Fasteners: Manufacturer's special clips for long runs to secure panels to support framing.

D. Stainless Steel Thermal Isolation Clips and Spacers with Thermal Separators:

1. Basis of Design: H&B "EZClad Rainscreen Support System, with RS FLEXbracket Rainscreen Support Bracket" Type 304 stainless steel universal bracket and Alodine/anodize finished aluminum rails with non-metallic separator pads.
2. Alternates:

   a. EJOT Crossfix System
   b. ECO Cladding Sigma VCI System with Sigma U Brackets
   c. Hilti MFT-VSI Stainless steel Brackets

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d. Non-Metallic Thermal Isolation Clips and Spacers: Fiberglass reinforced polyamide thermal isolator clip with "Bi-Flex Series Bi-Metal Self Drilling Screws, Stainless Steel Head and Shank with Stalgard GB Coating" structural screws (or equivalent) and extruded aluminum anchor clip used to support girt system of exterior wall cladding materials and maintain continuous insulation (CI requirements for the wall:

1) Fiberglass reinforced polyamide spacer block (ISO 66396-PA 66, GF40, E2C2, S14-080.
2) Steel: Elco Dril-Flex or SFS Flex 5 self-drilling structural screws; or stainless steel: Elco Bi-Flex or SFS Bi-Metal self-drilling structural screws
3) Extruded aluminum hat channel
4) Basis of Design: Technoform, "Thermal Isolator Clip (TIC)"; https://www.technoform.com/en/clip.

3. Cascadia Windows Inc., "Cascadia Clip", www.cascadiaclip.com; 100% Pultruded glass fiber and thermoset polyester resin insulation clip, min. 3/16-inch-thick for top base and web, of depth required for exterior wall installation detailed.
4. Smartci "GREENgirt Clips, and GREENgirts" http://smartcisystems.com; Composite framing support, consisting of polyester and vinyl ester bioresin matrix with recycled materials, ultra-violet inhibitor, fire retardant adhesives and integral continuous metal inserts the length of the profile, reinforced with glass strand rovings for longitudinal and continuous strand glass mats for stitched reinforcements used for transverse strength.
5. Surface Burning Characteristics:

a. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84.
b. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

6. Spacer thermal clips, spacers, sub-girts and fasteners as recommended by the manufacturer for application shown and performance requirements specified. Provide stainless steel fasteners of depth and diameter necessary to fully engage members and transfer stresses from cladding to structural supports.
7. Assembly to have an NFPA 285 assembly test with all components of exterior wall assembly. Engineering Judgement, if required to be based on equal system and be sign & sealed by a Fire Protection Engineer licensed in the State of New Jersey. Clip to accommodate varying angles o substrate wall and exterior panel facing as indicated on drawings.

E. Miscellaneous Metal Subframing and Furring: Alloy 6061-T5 aluminum cold formed channels and studs manufactured by awarded stainless steel thermal isolation clips specified, and engineered to interface with thermal clip system. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

F. Fasteners for Miscellaneous Metal Subframing and Furring: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

1. For fasteners outside of the Air and Water Barrier, use self-tapping 300 Series stainless steel screws with bimetallic heads equal to Bi-Flex "300 Series Stainless Steel Self-Drilling Fasteners", designed to withstand loads.

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G. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

H. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, end walls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

I. Fasteners for Wall and Soffit Panels: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.

1. Fasteners for Wall Panels: Self-tapping 410 stainless or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on the weather side of metal wall panels.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
3. Blind Fasteners: High-strength stainless-steel rivets.
4. For fasteners outside of the Air and Water Barrier, use self-tapping 300 Series stainless steel screws with bimetallic heads equal to Bi-Flex 300 Series stainless steel self-drilling fasteners, designed to withstand loads.

J. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

K. Bituminous Coating: Cold-applied asphalt mastic, SSPC paint 12, compounded for dry film thickness of 15 mils per coat.

L. Touchup Paint: Air-dried flouropolymer finish coating in color to match coil-coated finishes. Use the same paint as used for panel repair sample in Part 1.

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2.5 FIELD-INSTALLED THERMAL INSULATION

A. Field-installed insulation is specified in Division 07 Section "Thermal Insulation."

B. Insulation Retainer Strips: 0.019-inch-thick, formed galvanized steel or PVC retainer clips colored to match insulation facing.

2.6 FABRICATION

A. General: Fabricate and finish formed metal wall panels and accessories at the factory, to greatest extent practicable, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

1. Fabricate wall panels with panel stiffeners as required to maintain fabrication tolerances, to withstand design loads, and to minimize oil-canning.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

F. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from the same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

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2.7 FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1. Physical damage to panels, including dents and scratches, are not acceptable.

D. Finishes Application: Apply high performance organic coatings to exposed exterior surfaces of exterior enclosure system components. Apply thermosetting acrylic enamel coatings to exposed and concealed interior surfaces of exterior enclosure system components.

1. Concealed surfaces outside the weather barrier shall receive Alodine or anodized finishes.
2. During production, maintain large size color range samples for use in comparing against production material.
3. Adhesion and Compatibility Testing: Test samples of high-performance coatings on aluminum shall be provided for compatibility and adhesion testing of joint sealants proposed for use on exterior enclosure system components prior to installations. Refer to Section Division 07 Section "Joint Sealants.'

E. Aluminum Panels and Accessories: Prepare, pretreat, and apply fluoropolymer coating systems to exposed aluminum surfaces to comply with coating and resin manufacturers' written instructions and the physical properties and coating performance requirements of AAMA 620.

1. Resin Manufacturers: Subject to compliance with requirements, provide fluoropolymer coating systems containing resins produced by one of the following manufacturers:

   a. Arkema, Inc. (Kynar 500)
   b. Solvay Solexis, Inc. (Hylar 5000)

2. High Performance Organic Finish: Three-coat fluoropolymer; consisting of corrosion inhibitive primer, fluoropolymer color coat and clear topcoat complying with AAMA 2605 and AA-C12C42R1x, containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat, with a minimum dry film thickness of 1.6 mils.
3. Color and Gloss (**MTL-01**): PPG "Duranar -Sunstorm, Gray Velvet UC126244F" .

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances as follows:
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances as follows:

a. Maximum substrate and framing deviations from flat plane acceptable:

1) 1/4-inch in 20 feet vertically or horizontally.
2) 1/2-inch across building elevation.
3) 1/8-inch in 5 feet.

b. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Examine panels to verify that panel surfaces are unmarred, smooth, and free from discoloration and scratches. Do not install panels that have been damaged.

D. Examine for out-of-tolerance work and other deficient conditions prior to starting installation of metal panels.

E. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Attachment Assembly: Install attachment assembly required to support formed metal wall panels, including subframing, subgirts, base angles, sills, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

1. Soffit Framing: Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

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3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Commence metal panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative.
2. Field cutting of metal wall panels by torch is not permitted.
3. Shim or otherwise plumb substrates receiving metal panels.
4. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
5. Install screw fasteners in predrilled holes.
6. Locate and space fastenings in uniform vertical and horizontal alignment.
7. Install flashing and trim as metal panel work proceeds.
8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
9. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
10. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
2. Aluminum Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Butt Joined Metal Wall Panels: Fasten formed metal wall panels to supports with fasteners at each joint at location and spacing recommended by manufacturer to achieve performance requirements specified.

1. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
3. Flash and seal panels with weather closures at perimeter of all openings.

E. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
3. Flash and seal panels with weather closures at perimeter of all openings.

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F. Rain Screen Systems: Do not apply sealants to joints unless otherwise indicated. Where sealant is indicated, install sealant in accordance with requirements of Division 07 Section “Joint Sealants”.

1. Install using manufacturer's standard assembly with vertical channel that provides support and secondary drainage assembly, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach formed metal wall panels by inserting horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.
2. Install formed metal wall and soffit panels to allow individual panels to be installed and removed without disturbing adjacent panels.
3. Do not apply sealants to joints unless otherwise indicated.

G. Watertight Installation of lap seam panel systems:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

3.4 ACCESSORY INSTALLATION

A. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.5 THERMAL INSULATION INSTALLATION

A. Insulation: Install insulation concurrently with metal wall panel installation, in thickness indicated to cover entire wall, according to manufacturer's written instructions and as follows:

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1. Install insulation straight and true in one-piece lengths. Comply with the following installation method:

    a. Over-Framing Installation: Extend insulation over and perpendicular to top flange of framing members.

2. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with framing to hold insulation in place.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Formed metal wall panel subcontractor shall coordinate with Division 08 Section "Exterior Enclosure System Requirements" for other required laboratory and field testing including testing the air barrier prior to installation of metal plate wall panels, and with Division 01 "Building Enclosure Commissioning Requirements" for commissioning of exterior walls.

B. Manufacturer's Field Service: Formed metal wall panel subcontractor shall engage a factory-authorized service representative to test and inspect formed metal wall panel installation, including accessories and write reports at the startup, midpoint and completion of exterior wall work.

1. Be responsible for carrying out all recommendations of the manufacturer to ensure a total and complete exterior wall finish system.
2. The manufacturer's final inspection report shall be made directly to the Owner, Design Builder, Architect, and Commissioning Agent prior to the acceptance of the work.

C. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements. Remove and replace metal panels where field applied repairs are not acceptable.

1. Scratches longer than 2” and located in the center of the panel are not acceptable for field repairs.

D. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Touchup up exposed edges of field-cut panels with air dried paint materials matching original coil coating.

C. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

D. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

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END OF SECTION

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SECTION 078123 – INTUMESCENT FIRE ~~PROTECTION~~RESISTIVE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide the work of this Section in accordance with requirements of the Contract Documents.

B. Section Includes:

1. Mastic and intumescent fire-resistive coatings.

C. Related Requirements:

1. Section 078100 "Applied Fireproofing" for sprayed fire-resistive materials (SFRM).
2. **Division 07 Section "Fire Resistive Joint Systems" for intumescent firestop sealant that is part of perimeter fire-safing assemblies.**

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: **Submit manufacturer's product data, specifications, typical installation details and other data necessary to demonstrate compliance with specified requirements** For the following:

1. Mastic and intumescent fire-resistive coatings.
2. Substrate primers.
3. Reinforcing fabric.
4. Reinforcing mesh.
5. Topcoat.

B. Sustainable Design Action Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:

a. Leadership Extraction Practices

1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.

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2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
   a) Include statement indicating costs for each product having recycled content.

b. Sourcing of Raw Materials: For products that are sustainably sourced within 100 miles of project site, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.
   1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

2. Indoor Environmental Quality, Low Emitting Materials:
   a. Laboratory Test Reports: For adhesives, sealants, paints, coatings wet applied on site, indicating testing and compliance with the California Department of Public-Health (CDPH) Standard Method V1.2-2017, using the applicable exposure scenario.
   b. Paints, and Coatings, Wet Applied on Site: Include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5. 2016.
   c. Adhesives and Sealants, Wet Applied on Site: Submit printed statement showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005, and rule amendment date of October 6, 2017.
   d. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants

~~B.~~C. Shop Drawings: Framing plans or schedules, or both, indicating the following:

1. Extent of fire protection for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. Minimum mastic and intumescent fire-resistive coating thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4. Treatment of mastic and intumescent fire-resistive coating after application.

~~C.~~D. Samples: For each exposed product and for each color and texture specified, 12 inches square in size.

1. Provide a stepped sample of the proposed fire protection system for each specified component, including primer, separately identified by manufacturer's name, and the finish range expected.
2. Range Sample: Provide four 12 x 12 sample panels with fire resistive coating showing full range of finish, texture and color, for Architect's approval.

E. Intumescent Coating Schedule/Certification: Submit schedule and certification from the intumescent Coating Manufacturer, indicating size and thickness of each structural element to be receive intumescent coatings, the hourly rating, the W/D or A/P ratio, dry film thickness, requirement for mesh (if any), and UL tested rating assembly used to derive dry film thickness. Manufacturer shall certify that UL assembly is applicable and will be acceptable to the independent inspection agent/AHJ. Architect's review shall not absolve the manufacturer from responsibility for applicability or compliance.

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1. Extrapolation of member size and/or material thickness will not be permitted.

~~1.5 SUSTAINABLE DESIGN SUBMITTALS~~

~~A. Comply with requirements specified in Section 018113.~~

~~1.6~~1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Sustainable Design Informational Submittals:

1. Building Product Disclosure and Optimization - Environmental Product Declarations

a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.

2. Building Product Disclosure and Optimization - Material Ingredients

a. Material Ingredient Optimization: Submit at least one of the following:

1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo.
3) International Alternative Compliance Path - REACH Optimization
4) Declare: Manufacturer's completed Product Declaration Form
5) Other programs approved by USGBC

C. Product Certificates/Test Reports: For each type of ~~fireproofing~~fire resistive coating. For each type, submit testing reports or affidavit signed by the manufacturer evidencing that products selected comply with specified requirements, have been tested and certified by UL Laboratories (UL) or Intertek's ETL SEMKO Division or other testing lab acceptable to local authorities having jurisdiction.

D. Include manufacturer's certification stating that products are chemically and adhesively compatible with substrates, primers, coatings, and adjacent materials and accessories with which they will come into contact, and will not cause adhesive or cohesive failure, deterioration, premature aging, damage or other deleterious effects that would negatively affect the quality of installation, durability or performance of either the furnished material, or other intumescent fire-resistive coating or adjacent materials.

E. Identify primers or coatings by manufacturer and product name that have been found to be incompatible with manufacturer's intumescent fire-resistive coating materials.

~~B.~~F. Evaluation Reports: For ~~fireproofing~~fire-resistive coating, from ICC-ES.

~~C.~~G. Product Test Reports: For the following:

1. Hardness: STM D2240.
2. Dry Density: ASTM E605.
3. Compressive Strength: ASTM D695.

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4. Cohesive/Adhesion Strength: ASTM D4541.
5. Abrasion Resistance: ASTM D1044.
6. Impact Resistance: ASTM D1044.

~~D.~~ **H.** Field quality-control reports.

~~1.7~~1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual **with a minimum of 5 consecutive year experience in the installation of specified products, on projects of similar material, design, complexity, and extent as required for this project, who is** certified, licensed, ~~or otherwise qualified~~ by mastic and intumescent fire-resistive coating manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

1. Provide installer's list of installations that can be visited to determine if the installer has performed intumescent fire-resistive coatings with the level of finish required.

B. Regulatory requirements: Provide materials and products identical those products that have been tested in compliance with CAN/ULC-S101 and will result in fire resistive ratings equivalent to ASTM E119 or UL263 by a qualified testing and inspecting agency, or qualified national testing organization, acceptable to authorities having jurisdiction, and are listed in the UL or ULC "Building Materials Directory" with each coating container bearing a UL or ULC Label.

C. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1 "Polarized Light Microscopy.

~~B.~~ **D.** Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockup approximately 100 sq. ft. of each type of ~~fireproofing~~ **fire resistive coating** and different substrate and each required finish as shown on Drawings.
2. **Locate the mock-up where directed.**
3. **Alter or revise mock-up, as directed, to obtain the acceptance of the Architect.**
4. **The accepted mock-up shall serve as a standard of quality for specified item(s) for the project and may remain as a permanent part of the Work if undisturbed and in same condition as new at time of substantial Completion.**

~~2.~~ **5.** Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

~~3.~~ **6.** Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

~~1.8 PRECONSTRUCTION TESTING~~

~~A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on fireproofing.~~

~~1. Provide test specimens and assemblies representative of proposed materials and construction.~~

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~~B. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.~~

~~1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.~~
~~2. Density: Test for density according to ASTM E605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.~~
~~3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.~~
~~4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.~~
~~5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.~~

~~1.9~~1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply ~~fireproofing~~ **fire resistive coating** when ambient or substrate temperature is 50 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

1. Do not apply water-based intumescent coating materials when temperature of substrate or surrounding air is below 50 degrees F. Use electric heat if supplemental heat is required.
2. Relative humidity in work areas shall not exceed 75 percent throughout the total period of application and drying of the water-based intumescent mastic fire resistive coating and shall not exceed 65 percent throughout the application and drying for the protective decorative finish coat. Relative humidity of 40 to 60 percent is recommended in the work areas.

B. Ventilation: Ventilate building spaces during and after application of ~~fireproofing~~**fire resistive coating**, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until ~~fireproofing~~ **fire resistive coating** dries thoroughly.

1.8 HANDLING

A. Delivery: Deliver materials to the Project site in original unopened packages or containers clearly marked with identification labels intact and legible, indicating the name, brand, and trademark of the manufacturer, material type, grade and lot or batch number, ASTM designation or UL classification, and shelf life and expiration date.

B. Storage: Store materials as shipped, in their original containers, and in compliance with their manufacturer's instructions for storage.

1. Protect against contact with damp or wet surfaces.

C. Immediately remove from the Project site any materials that become deteriorated, contaminated or otherwise damaged, and legally dispose of off the Project site. Replace with undamaged new materials.

D. Handling: Handle materials to avoid contamination and damage to their containers.

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1. Rotate inventory. Do not use products whose shelf life has expired.

~~1.10~~1.9 WARRANTY

A. Installer Special Warranty: ~~Manufacturer's standard form,~~ Signed by ~~Contractor and by~~ Installer~~, in which manufacturer~~ ~~agrees~~ agreeing to repair or replace intumescent ~~fireproofing~~ fire-resistive coatings that fail in materials or workmanship within specified warranty period.

~~A.~~1. Failures include, but are not limited to, the following:

~~1.~~a. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of intumescent ~~fireproofing~~ fire resistive coating from substrates.

~~2.~~b. Not covered under the warranty are failures due to damage by occupants and Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.

~~B.~~2. Warranty Period: Two years from date of Substantial Completion.

B. Manufacturer's Material Warranty: Signed by the manufacturer agreeing to replace intumescent fire resistive coatings that fail in materials during the specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

~~2.1 SUSTAINABLE DESIGN REQUIREMENTS~~

~~A. Comply with requirements specified in Section 018113.~~

~~2.2~~2.1 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide ~~fireproofing~~fire protection, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain ~~fireproofing~~ fire protection for each fire-resistance design from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E119 or UL 263; full scale testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency. Testing chamber must reach 2000 degrees during testing.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.
2. Extrapolation of member size and/or material thickness will not be permitted for the purposes of fire rating design.

D. VOC Content: For field applications, coatings shall comply with VOC content limits of authorities having jurisdiction.

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Primers, Sealers, and Undercoaters: 100 g/L.

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E. Asbestos: Provide products containing no detectable asbestos.

~~2.3~~2.2 ~~MASTIC AND~~INTERIOR INTUMESCENT FIRE-RESISTIVE COATINGS

A. Mastic and Intumescent Fire-Resistive Coating – ~~FP-04~~ **IFP-02** (Interior Exposed to View): Manufacturer's standard, factory-mixed formulation or factory-mixed, multicomponent system consisting of **primer,** intumescent base coat and topcoat, **in thicknesses** and complying with indicated fire-resistance design **shown on the drawings**.

B. Manufacturers and Systems: Provide one of the following systems:

1. Carboline:

a. Primer: "Carbocoat 115/150".
b. Intumescent Mastic Coating: "Thermosorb VOC".
c. Topcoat: "Carbocrylic 3350".

2. International Paint LLC:

a. Primer: "Intergard 251".
b. Intumescent Coating: "Interchar 1120-HY".
c. Topcoat: "Integral 525".

3. PPG

a. Primer: "Amercoat 68HS".
b. Intumescent Coating: "Steelguard 951"
c. Topcoat: "Amershield" (PPG), 4.0 - 5.0 mils d.f.t. per coat.

~~1. Products: Subject to compliance with requirements, provide one of the following.~~

~~a. A/D Fire Protection Systems Inc.; Firefilm III and Colorcoat.~~
~~b. Albi Manufacturing, Division of StanChem Inc.; Albi Clad TF.~~
~~c. Carboline Co., Fireproofing Products Div.; Thermo-Sorb VOC and Topseal.~~
~~d. Or approved equal.~~

~~2.~~**4.** Application: Designated for "interior general purpose" use by a qualified testing agency acceptable to authorities having jurisdiction.

~~3.~~**5.** Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.

~~4.~~**6.** Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 50 or less.

~~5.~~**7.** Hardness: Not less than ~~60~~**80**, Type D durometer, according to ASTM D2240.

~~6. Dry Density: 85 lbs/cu. ft. average, according to ASTM E605.~~
~~7. Compressive Strength: 300 lbf/sq. in. average, according to ASTM D695.~~
~~8. Cohesive/Adhesion Strength: 190 lbf/sq. in. (cohesive failure), according to ASTM D4541.~~
~~9. Abrasion Resistance: 0.30 gm. Loss, according to ASTM D1044.~~
~~10. Impact Resistance: 85 in/lbs., according to ASTM D2794.~~

~~11.~~**8.** Finish: **Level 4** High quality architectural finish, spray applied, back rolled, and sanded smooth.

a. Color and Gloss: Match Architect's sample.

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~~2.4~~2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with ~~fireproofing~~ **intumescent fire resistive coatings** and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by **fire resistive coating**~~fireproofing~~ manufacturer **for each substrate** and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Primer's bond strength complies with requirements specified in UL's "Fire Resistance Directory" for coating materials based on a series of bond tests per ASTM E736.

C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by ~~fireproofing~~ **the intumescent fire-resistive coating** manufacturer.

D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by ~~fireproofing~~ **intumescent fire resistive coating** manufacturer. Include pins and attachment.

E. Topcoat: Suitable for application over ~~applied fireproofing~~**intumescent fire resistive coating**; of type recommended in writing by ~~fireproofing~~ **fire resistive coating** manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.

1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of ~~fireproofing~~ **fire protection** with substrates under conditions of normal use or fire exposure.
2. Verify that objects penetrating ~~fireproofing~~**fire protection**, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
3. Verify that substrates receiving ~~fireproofing~~ **fire protection** are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with **fire protection**~~fireproofing~~ application.

B. Conduct tests according to ~~fireproofing~~ **fire protection** manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of ~~fireproofing~~ **fire protection** materials during application.

B. Clean substrates **according to manufacturer's recommendations** of substances that could impair bond of ~~fireproofing~~**fire protection and as follows:** ~~.~~

1. **Clean bare metal surfaces thoroughly of foreign matter such as mortar, plaster, grease, rust, scale and dirt before priming coat is applied. Remove oil, grease and similar contaminants in accordance with SSPC SP-1 "Solvent Cleaning", prior to additional surface preparation specified.**
2. **Following cleaning, provide surface preparation of steel to comply with SSPC-SP 6 "Commercial Blast Cleaning".**
3. **Verify that substrates are free of substances capable of interfering with bond, in accordance with manufacturer's requirements for acceptance of substrates.**

C. Repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of intumescent fire protection. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

D. Prior to application, allow materials to reach same temperature as surface temperature of steel by storing unopened containers in area where application is to take place.

~~C.~~**E.** Prime substrates where included in fire-resistance design and where recommended in writing by ~~fireproofing~~ **intumescent fire resistive** manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive ~~fireproofing~~**fire protection**.

~~D.~~**F.** For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of ~~fireproofing~~**fire rpotection**. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Manufacturer's Representative: Do not use intumescent fire protection system until the manufacturer has a qualified representative at the project site at the start of the work to ensure proper installation of their materials and to verify that the selected applicator has been trained in its application.

1. **Do not start work until mockup of system has been approved.**

~~A.~~**B.** Construct ~~fireproofing~~ **fire protection** assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, **densities,** primers, topcoats, finishing, and other materials and procedures affecting ~~fireproofing~~ **fire protection** work.

~~B.~~**C.** Comply with ~~fireproofing~~ **fire-resistive coating** manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply ~~fireproofing~~**fire protection**; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

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1. **Thoroughly mix intumescent fire resistive coatings and apply in thickness sufficient to achieve the fire resistance rating. Apply in several passes necessary to cover, with uniformed texture. Do not add water or solvent to material.**

~~C.~~**D.** Coordinate application of ~~fireproofing~~ **fire protection** with other construction to minimize need to cut or remove ~~fireproofing~~**fire protection**.

1. Do not begin applying ~~fireproofing~~ **fire protection** until clips, hangers, supports, sleeves, and other items penetrating ~~fireproofing~~**fire protection** are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying ~~fireproofing~~**fire protection** until application of ~~fireproofing~~**fire protection** is completed.

~~D.~~**E.** Install auxiliary materials as required, as detailed, and according to fire-resistance design and ~~fireproofing~~ **intumescent fire resistive coating** manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by **fire resistive coating** ~~fireproofing~~ manufacturer.

1. **Install reinforcing fabric as required to obtain designated fire-resistance rating and where indicated.**

F. Apply exposed intumescent mastic fire-resistive coatings in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition.

1. **Apply intumescent fire resistive coatings identical to tested installations substantiated by test reports, with respect to rate of application, method of application, and procedures affecting test results.**
2. **Install reinforcing fabric as required to obtain designated fire-resistance rating and where indicated.**

~~E.~~**G.** Spray apply ~~fireproofing~~ **fire protection** to maximum extent possible**, using an airless spray gun, in film thicknesses to achieve scheduled fire resistance rating. Apply successive coats only when previous coat is dry to touch. Allow 24 hours between application of final coat and application of protective topcoat**. After the spraying operation in each area, complete the coverage by trowel application or ~~other placement~~ **equivalent** method recommended in writing by ~~fireproofing~~ **fire resistive coating** manufacturer **to achieve approved finish**.

~~F.~~**H.** Extend ~~fireproofing~~**fire protection** in full thickness over entire area of each substrate to be protected.

~~G.~~**I.** Install body of ~~fireproofing~~**fire protection** in a single course unless otherwise recommended in writing by ~~fireproofing~~ **fire resistive coating** manufacturer.

~~H.~~**J.** Provide a uniform finish complying with description indicated for each type of ~~fireproofing~~**fire protection** material and matching finish approved for required mockups.

~~I.~~**K.** Cure ~~fireproofing~~**fire protection** according to ~~fireproofing~~**fire protection** manufacturer's written instructions.

~~J.~~**L.** Do not install enclosing or concealing construction until after ~~fireproofing~~**fire protection** has been applied, inspected, and tested and corrections have been made to deficient applications.

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~~K.~~**M.** Finishes: **Finish levels are based on Carboline's Thermo-lag 100 finish levels.** Where indicated, apply ~~fireproofing~~**fire protection** to produce the following finishes:

1. Level 4: High Quality Architectural Finish: Spray applied **to specified dft requirements,** ~~finish,~~ back rolled with a damp paint roller, and sanded**. No texture visible, uniform** smooth **appearance with no surface defects**. **Surface shall be smooth and free of tool marks and ridges.**

N. Apply topcoat by spray method. Thickness of protective finish coat shall not exceed 4 mils dry per coat. Apply even, spray-textured finish produced by lightly rolling flat surfaces of fire-protected members before fire-resistive material dries, to smooth out surface irregularities.

1. Do not apply topcoat until it has been determined that the required dry film thickness of intumescent fire resistive coating has been provided.

O. Sanding: Provide rolled and sanding of final coat as required to achieve smooth, flat finish matching [sample on file in the Architect's office][level of finish specified].

P. Repair: Correct deficiencies in materials, finish, color and sheen, that do not comply with specified requirements, or remove, repair substrates, and reinstall fire protection that cannot be satisfactorily repaired to match approved finish, as determined and directed by the manufacturer's field representative and the Architect.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Test and inspect **in accordance with AWCI 12-B, *Standard Practice for Testing and Inspection of Field Applied Thin-Film Intumescent Fire Resistive Materials*,** as required by the Building Code, Section 1704 and Section 1705.~~15~~**16** "Mastic and Intumescent Fire-Resistant Coatings."

~~2. Test and inspect intumescent fireproofing applied to structural elements and decks in accordance with AWCI 12-B.~~

B. Field Inspection: Test random samples, as applied to verify thickness of intumescent fire-resistive material, in accordance with AWCI's Technical Manual 12-B, Standard Practice for Testing and Inspection of Field Applied Thin-Film Intumescent Fire Resistive Materials" using methods in ASTM D7091, and SSPC-PA2 *Steel Structures Painting Council, Paint Application Specification No. 2 - Measurement of Dry Paint thickness with magnetic gages*. Inspection shall be carried out prior to application of protective topcoat.

~~B.~~**1.** Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of ~~fireproofing~~**fire protection** for the next area until test results for previously completed applications of ~~fireproofing~~**fire protection** show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

a. Required thickness shall be as detailed in the fire-resistance design or report published by a nationally recognized testing agency as appropriate for the fire-resistance rating required for the structural member or assembly

2. Visual Inspection: Intumescent film shall not upon complete drying or curing exhibit deep or wide cracks, voids, blisters, bubbles, delamination or any exposure

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of the substrate. The condition of substrates, thickness of application, condition of finished application and condition of patching work are subject to visual and physical inspection

3. Thickness Measurement for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM D7091, or SSPC-PA2.

   a. Calibrate gauge and follow procedures outlined in AWCI's Technical Manual 12-B, Standard Practice for Testing and Inspection of Field Applied Thin-Film Intumescent Fire Resistive Materials"
   b. Each thickness measurement shall consist of the average of three separate gauge readings within the area of a 1/2 inch diameter circle. As the probe is moved within 1/2 inch diameter circle, discard any unusually high or low readings that cannot be repeated.
   c. Make readings at least 1 inch away from any edge or corner of the substrate.
   d. Testing Frequency: Thickness determinations shall be made on structural elements on a random basis in at least one bay per floor or for each 10,0000 sf of floor area, whichever provides the greatest number of tests, but not to exceed one test per 10,000 sf. Tests shall be conducted on each of the following structural elements present in each randomly selected bay; one column, one primary beam, one secondary beam and one truss. A series of thickness determinations shall be conducted in a specific pattern as detailed below;

      1) Beams: Nine (9) locations around the column, at each end of a 12 inch length.
      2) W-Shape Columns: Twelve (12) locations around the column, at each end of a 12 inch length.
      3) Tube and Pipe Columns: A minimum of four (4) locations around the column at each end of a 12 inch length.
      4) Trusses: Seven (7) locations around the truss at each end of a 12 inch length.

C. Additional testing: ~~Fireproofing~~Fire protection will be considered defective if it does not pass tests and inspections.

   1. Remove and replace ~~fireproofing~~ intumescent fire resistive coatings where test results indicate that fire resistive coating does not comply with specified requirements for adhesion, does not pass tests and inspections, and retest.
   2. Apply additional intumescent ~~fireproofing~~fire resistive coating, per manufacturer's written instructions, where test results indicate ~~insufficient~~ that the thickness does not comply with specified requirements, and retest.
   3. Where intumescent fire resistive coatings are removed and replaced or repaired, inspection and testing agency shall perform additional testing to determine compliance with specified requirements.

D. Prepare test and inspection reports to the Contractor, Installer and Architect.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

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B. Protect **fire protection**~~fireproofing~~, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so ~~fireproofing~~ **fire protection** is without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect ~~fireproofing~~ **fire protection** and repair damaged areas and ~~fireproofing~~ **fire protectionn** removed due to work of other trades.

D. Repair ~~fireproofing~~ **fire protection** damaged by other work before concealing it with other construction.

E. Repair ~~fireproofing~~ **fire protection** by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078123

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SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 CONTROLLING DOCUMENTS

A. This specification is controlled by Division 08 Section “Exterior Enclosure System Requirements”. In addition to the requirements of this document, all requirements of Controlling Documents must also be met. The more onerous conditions of this document or the Controlling Document must be met.

1.3 SUMMARY

A. Provide the Work of this Section in accordance with requirements of the Contract Documents.

B. This Section includes, but is not limited to the following:

1. Aluminum-framed storefront systems.
2. Aluminum-framed entrance door systems.

C. Related Requirements:

1. Division 07 Section "Flashing."
2. Division 07 Section "Joint Sealants" for sealants and accessories.
3. **Division 08 Section "Exterior Enclosure System Requirements" for performance requirements.**
4. **Division 08 Section "Aluminum Framed Folding Storefronts" for operable folding storefronts.**
3. **5.** Division 08 Section "Glazed Aluminum Curtain Wall."
4. **6.** Division 08 Section "Door Hardware” for swing door hardware.
5. **7.** Division 08 Section "Glazing" for additional material and installation requirements for glazing of aluminum framed entrance doors and storefronts.

1.4 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

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B. Sustainable Design Action Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:

a. Leadership Extraction Practices

1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.

a) Include statement indicating costs for each product having recycled content.

b. Sourcing of Raw Materials: For products that are responsibly sourced within 100 miles of project site, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.

1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

2. Indoor Environmental Quality, Low Emitting Materials:

a. Laboratory Test Reports: For adhesives, sealants, paints, and coatings wet applied on site, indicating testing and compliance with the California Department of Public-Health (CDPH) Standard Method V1.2-2017, using the applicable exposure scenario
b. Adhesives and Sealants: For wet applied on-site products, submit printed statement showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005, and rule amendment date of February 6, 2017.
c. Alternative tests for VOC above include ASTM D2369-10; ISO 11890 part 1; ASTM D6886-03; or ISO 11890-2
d. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants.

C. Shop Drawings: For aluminum-framed entrances and storefronts.

1. Include plans, elevations, sections, full-size details, and attachments to other work.
2. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
3. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

4. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

a. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations

5. Include point-to-point wiring diagrams showing the following:

a. Power requirements for each electrically operated door hardware.

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b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

F. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.6 INFORMATIONAL SUBMITTALS

A. Fabrication Engineering and Design: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, submit comprehensive engineering analysis including data signed and sealed by the qualified professional engineer responsible for their preparation, indicating compliance with performance requirements specified. Submission shall include:

1. Analysis for applicable loads on framing members.
2. Analysis for applicable loads on anchors, support systems, and building structure.
3. Structural calculations and details of anchoring system, including type, size, and spacing of fasteners.

B. Informational Sustainable Design Submittals:

1. Building Product Disclosure and Optimization - Environmental Product Declarations

   a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.

2. Building Product Disclosure and Optimization - Material Ingredients

   a. Material Ingredient Optimization: Submit at least one of the following:

      1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
      2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo, with gold or platinum certification.
      3) International Alternative Compliance Path - REACH Optimization
      4) Declare: Manufacturer's completed Product Declaration Form
      5) Other programs approved by USGBC

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C. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.

1. Provide lab testing data results (performed within 4 years prior to the date of submission) providing structural, air, and water penetrating testing data.

D. Field Quality-Control Reports.

E. Sample Warranties: For special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is licensed and legally qualified to practice in the State of New Jersey where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of aluminum-framed entrances and storefronts that are similar to those indicated for this Project in material, design, and extent.

B. Manufacturer’s Qualifications: Provide aluminum storefront, entrances and associated items by a firm having undivided responsibility for the entire storefront, entrance and glazing installation, except as otherwise specified herein.

1. The Storefront and Entrance Manufacturer's Representatives is required to inspect the storefront and entrance door installation to ensure conformance with this Section and to ensure warrantability of the storefront, doors, hardware, paint finish and their installation
2. Engineering Responsibility: Manufacturer shall have inhouse engineering to prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

C. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project, with not less than five (5) consecutive years of experience installing storefront and entrances similar that required for the project.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

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1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver aluminum framed entrances and storefronts and other exposed elements in padded blankets or other approved protective wrapping.

B. Protect finish surfaces from damage during handling and installation.

1.10 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.11 WARRANTY

A. Special Warranty: Manufacturer and Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fabrication Engineering and Design: Engage a qualified licensed professional engineer, as defined in Division 01, Section "Quality Requirements", to engineer aluminum-framed entrances and storefronts using structural performance requirements specified. Be responsible for engineering of aluminum entrances and storefront components and materials, fabrication and installation.

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B. System Description: The entrance and storefront system described in this Section is an integral portion of the facade that comprises materials, components and assemblies between the internal and the external surfaces at the entrance level. Provide aluminum entrances and storefronts as a complete system, with high quality, watertight, airtight and structurally sound entrance and storefront enclosure fabricated and installed according to specified standards. The work of this Section includes, but is not limited to, the following:

1. Aluminum entrance doors and storefront components including finish coatings.
2. Metal trim as may be necessary to join adjoining materials to the metal and glass assemblies including finish coatings.
3. Reinforcing (stiffeners, brackets, etc.) required to strengthen or reinforce members, not specifically called out as structural steel or miscellaneous metal fabrications.
4. Sealants, joint fillers, gaskets, etc. necessary to produce a watertight installation including sealants and joint fillers at the junction of the entrance and storefront metal and glass elements and contiguous facade components.
5. Weeps, baffles, thermal breaks, flashings, etc. necessary to meet performance requirements.
6. Anchors, inserts, embedded devices, etc. necessary to support the entrance and storefront system. This shall include but not be limited to design, engineering, coordination, manufacture, supply, layout, field checking, installation and any necessary repair of the fixing anchors and their attachment to the embedded anchorage and the anchorage embeds.
7. Coordination with other trade Contractors that have components of their work installed on or within the entrance and storefront system.
8. Shop drawings, structural calculations, manufacturer’s data, certifications of compliance and selected samples of materials and warranties pertaining to the entrance and storefront enclosure.
9. Field measurements of adjacent and/or supporting construction and verification of existing conditions.
10. Field testing of assemblies for water penetration.
11. Protection and cleaning of finished work.
12. Participation in coordination meetings throughout the course of the Work.
13. Preparation of "as-built" shop drawings reflecting changes (from original "approved" shop drawings) that may have occurred during the course of the work.

C. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure also includes the following:

    a. Deflection exceeding specified limits.
    b. Lateral Wind movement stresses transferring to building structure
    c. Thermal stresses transferring to building structure.
    d. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
    e. Glass breakage.
    f. Glazing to glazing contact.
    g. Noise or vibration created by wind and thermal and structural movements.
    h. Loosening or weakening of fasteners, attachments, and other components.
    i. Sealant Failure.

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j. Failure of operating units.

D. Structural Loads:

1. Dead Loads: Weights of materials and construction.
2. Wind Loads: Wind pressures are based on the provisions of the American Society of Civil Engineers, "Minimum Design Loads for Buildings and Other Structures", ASCE 7-16.
3. Wind pressures used in the Project design are shown on the Structural Drawings.
4. Other Design Loads: As indicated on Structural Drawings.

E. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
2. Deflection Parallel to Glazing Plane: Limited to [amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

F. Structural: Test according to ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

G. Water Penetration under Static Pressure: Test according to ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
2. Maximum Water Leakage: According to AAMA 501.1. No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

H. Energy Performance: Certified and labeled by manufacturer for energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor):
   a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
   b. Entrance Doors: U-factor of not more than 0.68 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
2. Air Leakage:
   a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested according to ASTM E283.
   b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

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3. Condensation Resistance Factor (CRF):

    a. Fixed Glazing and Framing Areas: CRF for the system of not less than 70 as determined according to AAMA 1503.
    b. Entrance Doors: CRF of not less than 68 as determined according to AAMA 1503.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

    a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 degrees F.
    b. Low Exterior Ambient-Air Temperature: 0 degrees F.
    c. Interior Ambient-Air Temperature: 75 degrees F.

J. Reference Standards: Comply with published recommendations of product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for terms not otherwise defined in this Section or in referenced standards.

1. Glass Association of North America (GANA) Publications: "Laminated Glazing Reference Manual", "Glazing Manual" and "Sealant Manual".
2. Consumer Product Safety Commission (CPSC): Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of CPSC 16 CFR Part 1201 for category II materials.

    a. Subject to compliance with requirements and California State Building Code, provide safety glass with a removable certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to local Building Department.

3. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
4. NAAMM "Metal Finishes Manual".

2.2 MANUFACTURERS

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

2.3 MATERIALS, GENERAL

A. Recycled Content of Products:

1. Provide products with an average recycled content of aluminum products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 12.5 percent.
2. Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

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2.4 STOREFRONT SYSTEMS

A. Basis of Design: Provide products by Oldcastle BuildingEnvelope (OBE); CRH Americas, or approved equal.

1. Comparable Products: Subject to compliance with requirements, provide products of one of the following:

    a. Building Envelope Systems.
    b. Crawford Tracey Corporation.
    c. Enclos Corp.
    d. Harmon, Inc.
    e. Kawneer Company, Inc.
    f. United Architectural Metals.
    g. U.S. Aluminum; a brand of C.R. Laurence.
    h. Wausau Window and Wall Systems; Apogee Wausau Group, Inc.

2. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
3. Framing Construction: Thermally broken.
4. Glazing System: Retained mechanically with gaskets on four sides.
5. Glazing Plane: Front.
6. Finish: Superior-performance organic finish.
7. Fabrication Method: Field-fabricated stick system.
8. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
9. Steel Reinforcement: As required by manufacturer.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.5 ALUMINUM ENTRANCE DOOR SYSTEMS

A. Basis of Design **(EDS-01)**: Provide products by Oldcastle BuildingEnvelope (OBE); CRH Americas, or approved equal.

1. Comparable Products: Subject to compliance with requirements, provide products of one of the following:

    a. Building Envelope Systems.
    b. Crawford Tracey Corporation.
    c. Enclos Corp.
    d. Harmon, Inc.
    e. Kawneer Company, Inc.
    f. United Architectural Metals.
    g. U.S. Aluminum; a brand of C.R. Laurence.
    h. Wausau Window and Wall Systems; Apogee Wausau Group, Inc.

B. Aluminum Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Basis of Design: “MS375TC” Entrance Doors; Oldcastle BuildingEnvelope (OBE); CRH Americas, or approved equal.

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2. Door Construction: 2-inch overall thickness, with minimum 0.188-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
3. Door Design: Medium stile as indicated.
4. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
5. Finish: Superior-performance organic finish; match adjacent storefront framing finish.

2.6 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Division 08 Section "Door Hardware."

B. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

C. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

2.7 GLAZING

A. Glazing: Comply with Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.8 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
3. Structural Profiles: ASTM B308/B308M.

B. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

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C. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.9 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration. Tighten torques as required to achieve maximum torque tension relationship required by fasteners.
2. Reinforce the interior surface with aluminum or non-magnetic type stainless steel to receive screw threw threads or provide manufacturer's standard non-corrosive pressed-in splined grommet nuts to receive fastener heads. Drill screwed connections.
3. Where exposed in finish surfaces, use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer. Use only stainless steel anchors outside the air barrier.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

C. Concealed Flashing: Dead-soft, 0.018-inch-thick stainless steel, complying with ASTM A240/A240M, of type recommended by manufacturer.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.10 FABRICATION

A. General: Factory fabricate aluminum framed entrances and storefronts to designs, sizes, and thicknesses indicated and to comply with indicated standards.

1. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from [exterior] [interior] [interior for vision glass and exterior for spandrel glazing or metal panels].

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7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Fabricate door framing in profiles indicated. Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. Provide compression weather stripping at fixed stops.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce frame units at hinge jamb with continuous minimum 1-1/4 x 1-1/4 x 3/16 inch steel angle full height of door for installing hardware. Cut, drill, and tap for factory-installed hardware before finishing components.

1. At exterior doors, provide compression weather stripping at fixed stops. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.11 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Finishes Application: Apply high performance organic coatings to exposed surfaces of exterior enclosure system components. Apply thermosetting acrylic enamel coatings to concealed interior surfaces of exterior enclosure system components.

1. During production, maintain large size color range samples for use in comparing against production material.
2. Adhesion and Compatibility Testing: Test samples of high performance coatings on aluminum shall be provided for compatibility and adhesion testing of joint sealants proposed for use on exterior enclosure system components prior to installations. Refer to Section Division 07 Section "Joint Sealants.'

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

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E. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish system consisting of corrosion inhibitive primer, fluoropolymer color coat and clear fluorocarbon topcoat, complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat, in not less than 1.6 mils dry film thickness. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss (**MTL-01**): PPG Duranar Sunstorm UC126244F, Gray Velvet".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION, GENERAL

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Install components plumb and true in alignment with established lines and grades.

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E. Install fiberglass insulation solid between storefront members and adjacent construction and in voids within the system and where shown on the Drawings. Compress fiberglass to 50 percent or less of original thickness.

F. Set continuous sill members and flashing in full sealant bed, as specified in Division 07 Section "Joint Sealants," to produce weathertight installation.

G. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.4 INSTALLATION OF GLAZING

A. Install glazing as specified in Division 08 Section "Glazing."

3.5 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. Entrance Doors: Install entrance doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.6 ERECTION TOLERANCES

A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Contractor's Responsibility: Furnish the Testing Agency with access to the Work, materials and facilities as required by the Agency.

1. Provide adequate notice of construction activities to allow timely inspections and observation of testing.

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2. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed aluminum framed entrances and storefront installation, including accessories.
3. Notify the Owner, the Architect, the Manufacturer's field Representative so that each entity may have adequate representation at the testing.

C. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive phases as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

D. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.

1. Water-Spray Test: Areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

E. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

G. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

H. Prepare test and inspection reports.

3.8 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

END OF SECTION 084113

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SECTION 084116 - ALUMINUM FRAMED FOLDING STOREFRONT

PART 1 - GENERAL

1.1 CONTROLLING DOCUMENTS

A. This specification is controlled by Division 08 Section “Exterior Enclosure System Requirements”. In addition to the requirements of this document, all requirements of Controlling Documents must also be met. The more onerous conditions of this document or the Controlling Document must be met.

1.2 SUMMARY

A. Provide thermally broken aluminum framed folding storefront in accordance with requirements of the Contract Documents.

B. This section includes, but is not limited to the following:

1. Sliding/folding aluminum and glass storefront, including aluminum framed panels, threshold, sliding/folding and locking hardware, weather stripping, thermal break, multipurpose frame insert, glass and glazing panel catch, and accessories; designed to provide an opening glass wall, with sizes and configurations as shown on drawings and specified herein.

C. Related Work Specified Elsewhere

1. Division 07 Section "Thermal Insulation".
2. Division 07 Section "Sheet Metal Flashing and Trim".
3. Division 07 Section "Joint Sealants".
4. Division 08 Section "Exterior Enclosure System Requirements" for exterior performance requirements.
5. Division 08 Section "Aluminum Framed Entrances and Storefront".
6. Division 08 Section "Door Hardware" for hardware
7. Division 08 Section "Glazing" for glass and glazing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Manufacturer’s literature including independently tested data listing performance criteria and Owner’s Manual with installation instructions, construction details, material descriptions, dimensions of individual components and profiles, and finishes for folding doors.

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B. LEED Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:

a. Leadership Extraction Practices

1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.

a) Include statement indicating costs for each product having recycled content.

b. Sourcing of Raw Materials: For products that are required to comply with requirements for regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.

1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

C. Shop Drawings: Indicate dimensioning, direction of swing, configuration, swing panels, stacking layout, typical head jamb, side jambs and sill details, type of glazing material and handle heights.

D. Samples for Verification: For each type of exposed finish.

1. Include Samples of hardware and accessories to verify color and finish selection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Informational LEED Submittals:

1. Building Product Disclosure and Optimization - Environmental Product Declarations

a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.

2. Building Product Disclosure and Optimization - Material Ingredients

a. Material Ingredient Optimization: Submit at least one of the following:

1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo, with gold or platinum certification.
3) International Alternative Compliance Path - REACH Optimization
4) Declare: Manufacturer's completed Product Declaration Form
5) Other programs approved by USGBC

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C. Product Test Reports: For each folding door, for tests performed by a qualified testing agency, evidencing compliance with performance requirements.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Submit Owner's Manual from manufacturer. Identify with project name, location and completion date, type and size of unit installed.

1.7 QUALITY ASSURANCE

A. Manufacturer: Provide complete, precision built, engineered, pre-fitted unit by a single source manufacturer with at least 25 year experience in providing folding/sliding storefront for large openings in the North American market.

1. The manufacturer shall have a quality management system registration to the ISO 9001: 2008 standard.

B. Installer Qualifications: Installer experienced in the installation of manufacturer's product or other similar products for large openings. Installer to provide reference list of at least 3 projects of similar scale and complexity successfully completed in the last 3 years.

1. Installer shall be trained and certified by manufacturer.

C. References: Except as modified by governing codes and local regulations comply with recommendations and requirements of the following reference standards:

1. American Architectural Manufacturers Association (AAMA):
    a. AAMA 520, Voluntary Specification for Rating the Severe Wind-Driven Rain Resistance of Windows, Doors, and Unit Skylights
    b. AAMA 1304, Voluntary Specifications for Forced Entry Resistance of Side-Hinged Door Systems.
    c. AAMA 2604, Voluntary Specifications, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
    d. AAMA 2605, Voluntary Specifications, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels. B. American Society for Testing and Materials (ASTM):
2. American National Safety Institute
    a. ANSI Z97.1, Safety Performance Specifications and Methods of Test for Safety Glazing Material Used In Buildings.
3. Consumer Product Safety Commission (CPSC):
    a. CPSC 16CFR-1201, Safety Standard for Architectural Glazing Materials. E. National Fenestration Rating Council (NFRC):
4. National Fenestration Research Council
    a. NFRC 100, Procedure for Determining Fenestration Product Thermal Materials.
    b. NFRC 200, Procedure for Determining Solar Heat Gain Coefficient.
    c. NFRC 400, Procedure for Determining Fenestration Product Air Leakage.
5. AAMA/WDMA/CSA 101/I.S.2/A440 Fenestration Standards

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1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's instructions and recommendations, Division 01 Section Product Requirements" and as follows:

1. Deliver materials to job site in sealed, unopened cartons or crates.
    a. Upon receipt, inspect the shipment to ensure it is complete, in good condition and meets project requirements.
2. Store material under cover in a clean and dry location, protecting units against weather and defacement or damage from construction activities, especially to the edges of panels.

1.9 FIELD CONDITIONS

A. Field Measurements: Contractor to field verify dimensions of rough openings and threshold depressions to receive sill. Mark field measurements on product drawing submittal.

1.10 WARRANTY

A. Provide manufacturer's standard warranty against defects in materials and workmanship. Warranty to be issued by the original manufacturer. No third party or other sub-supplier warranties will be accepted.

1. Warranty Period: Provide manufacturer's ten year warranty for doors and hardware.

B. Installer's Warranty: Provide two year warranty signed by the manufacturer's certified trained installer, from date of delivery by manufacturer agreeing to repair or replace aluminum framed folding storefront.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Recycled Content of Products:

1. Provide products with an average recycled content of aluminum products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 2.5 percent.
2. Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

2.2 PERFORMANCE CRITERIA

A. Provide aluminum framed storefront that has independently tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 Fenestration Standard, to include:

1. Structural Loads in accordance with ASTM E330:
    a. Dead Loads: Weights of materials and construction.

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b. Wind Loads: Wind pressures are based on the provisions of the American Society of Civil Engineers, "Minimum Design Loads for Buildings and Other Structures", ASCE 7-16.
c. Wind pressures used in the Project design are shown on the Structural Drawings.
d. Other Design Loads: As indicated on Structural Drawings.

2. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

a. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans.
b. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

3. Air infiltration in accordance with ASTM E283 and NFRC 400, as follows:

a. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

4. Condensation Resistance Factor (CRF):

a. Fixed Glazing and Framing Areas: CRF for the system of not less than 70 as determined according to AAMA 1503.
b. Entrance Doors: CRF of not less than 68 as determined according to AAMA 1503.

5. Water penetration in accordance with ASTM E547 and E331, as follows:

a. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
b. Maximum Water Leakage: According to AAMA 501.1. No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

B. Provide aluminum framed storefront that has independently tested typical units for water penetration under dynamic pressure in accordance with AAMA 520 and ASTM E2268 and operation/cycling performance on a swing panel as per AAMA 920.

C. Thermal Performance U-factor: Unit to be rated, certified, and labeled in accordance with NFRC 100, shown in manufacturer’s latest published data for the glazing, sill, and direction of opening specified.

1. Entrance Doors: U-factor of not more than 0.68 Btu/sq. ft. x h x deg F as determined according to NFRC 100.

D. Solar Heat Gain Coefficient: IGU Unit to be rated, certified, and labeled in accordance with NFRC 200, shown in manufacturer’s latest data published for the glazing, sill, and direction of opening specified.

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2.3 MANUFACTURER

A. Basis of Design (**EDS-02**): Generation 4 Comprehensive Product Line NW Aluminum 640 Outward Opening, Thermally Broken Low Profile Saddle Aluminum Framed Folding Storefront manufactured by NANA WALL SYSTEMS, INC., 100 Meadow Creek Drive, Corte Madera, CA 94925

1. Other suppliers equal to the specified product must submit substitution request two weeks before bid for prior approval. The following fabricators may provide aluminum framed folding storefront, subject to compliance with requirements:

    a. Panda Wall.
    b. La Cantina.

2.4 MATERIALS

A. Frame and Panels: Provide metal frames and panels fabricated from manufacturer's standard profiles for number and size of panels as shown. Provide head track, side jambs, and panels with dimensions shown on drawings.

1. Aluminum Extrusion: 2-5/8 inch thick, extrusions with nominal thickness of 0.078 inch. Alloy specified as AlMgSi0.5 with strength rated as 6063-T5.
2. Thermal Break: 1-15/16 inch wide specially designed glass fiber reinforced polyamide thermal break for panels.
3. Panels:

    a. Rail Depth: 2-5/8 inch.
    b. Top Rail Width: 2-5/8 inch.
    c. Bottom Rail Width: 10 inches
    d. Stiles: 1-3/4-inch on both stiles for a nominal frame stile width of 3-7/8 inch between folding panels.

4. Frame:

    a. Thermally broken top track and side jambs with multipurpose frame insert to hide anchoring frame connections and conceal cable routing to security system. Provide tight sealing adjustable feature at side jambs capable of +/- 3/16 inch adjustment at side jambs
    b. Side Jamb Depth: 2-5/8-inch.
    c. Head Track Widths: 2-13/16 inch.
    d. Side Jamb Width: 2 inches

5. Sill Type: Extruded aluminum low profile sill ADA compliant with high heel protector insert (thermally broken)

    a. Sill finish: Clear anodized.

6. Operation: Adjustable sliding and folding hardware with top and bottom tracks.
7. Mounting Type: Floor Track supported with upper guide track.
8. Swing Configuration: Outswing type.
9. Panel Type: Primary swing panel of paired swing panels
10. Aluminum Finish: Powder coating

B. Glass: Comply with safety glazing requirements of ANSI Z97.1 and CPSC 16CFR 1201. Provide manufacturer's standard glass with dry glazing with glass stops on the inside only:

1. Provide glass type **GL-02** indicated and specified in Section "Glazing".

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C. Locking Hardware and Handles: Provide manufacturer's standard two-point locking with flat handle on inside only set with lockable latch, multi-point locking with a dead bolt and rods at the top and bottom on primary panel.

1. Rods shall be concealed and not edge mounted.
2. After turn of key or thumb turn, depression of handles shall withdraw latch.
3. Lifting of handles shall engage rods and turn of key or thumb turn shall engage deadbolt and operate lock.
4. On the secondary swing panel, provide matching dummy lever handles on both sides and concealed flush bolts that operate the rods at the top and the bottom for the secondary swing panel.
5. Provide stainless steel lever handles for both swing panel and folding panel handle with a brushed satin finish
6. Provide handle height centered at 41-3/8 inch from bottom of panel.
7. Aluminum locking rods with standard fiber glass reinforced polyamide end caps at top and bottom. Rods to have a stroke of 15⁄16 inch.
8. If there are more than one unit, keyed alike.

D. Sliding/Folding Hardware: Provide manufacturer's standard combination sliding and folding hardware with top, bottom tracks and threshold. All running carriages to be with sealed, self-lubrication, ball bearing multi-rollers.

1. Clear anodized, surface mounted hinges and running carriages will not be allowed. Weight of panels to be borne by the bottom of the guide channel in the sill will not be allowed.
2. Provide upper guide carriage and lower running carriage with four vertical stainless steel wheels and two horizontal polyamide wheels. The vertical wheels to ride on top of guide track covers over the full length of the sill track and lie above the water run-off level. Carrying capacity of lower running carriage to be 440 lbs. Wheels riding below the water run-off level and/ or wheels riding on aluminum surfaces will not be allowed.
3. Threshold: Provide thermally broken with polyamide raised sill in the same finish as panel finish
4. For ADA compliance in commercial projects, provide gasket to cover the channel in the sill at swing doors.
5. Adjustment: Provide folding/sliding hardware capable of specified amount of compensation and adjustments without needing to remove panels from tracks, in width, 1⁄16 inch per hinge and in height, 1⁄16 inch up and down.

E. Other Components:

1. Weather stripping: Provide manufacturer's standard double layer EPDM, Q-lon gasket or brush seals with a two layer fiber glass reinforced polyamide fin at both the inner and outer edge of door panels or on frame for sealing between panels and between panel and frame. Single layer weather stripping will not be allowed.
2. Provide tapered pins or stainless steel screws for connecting frame components.

2.5 FABRICATION

A. Fabricate aluminum framed glass doors in profiles, and dimensions indicated.

B. Provide frames, corner connectors and hinges, sliding and folding hardware, locking hardware and handles, glass and glazing, weather stripping, fasteners and accessories required for a complete installation.

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C. Refer to drawings for selected custom dimensions, number of panels and configuration. Provide inward opening units.

D. Factory pre-assemble units and ship with all components and installation instructions. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

E. Factory-Glazed Fabrication: Glaze aluminum-framed glass doors in the factory. Comply with requirements in Section 088000 "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440

F. Weep Holes: Provide weep holes and internal drainage passages to conduct infiltrating water to the exterior.

2.6 ACCESSORIES

A. Provide other side lites, transoms, corner posts, or single or double doors as per drawings provided.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. High Performance Fluoropolymer (For Exterior): Two-coat thermo-cured fluoropolymer finish system consisting of corrosion inhibitive primer, fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight complying with AAMA 2605 and AA-C12C42R1x, in not less than 1.2 mils dry film thickness. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss (**MTL-01**): PPG Duranar Sunstorm UC126244F, Gray Velvet".

B. Powder-Coat Finish (For Interior): AAMA 2604 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss to match curtainwall color.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions with installer present for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify surfaces of openings and verify dimensions; verify rough openings are level, plumb, and square, with no unevenness, bowing, or bumps on the floor.

B. Proceed with installation only after unsatisfactory conditions have been corrected. Installation of units constitutes acceptance of existing conditions.

3.2 PREPARATION

A. For folding doors supported by or anchored to permanent construction, advise installers of specific requirements for placement of anchorage devices. Furnish installers of other work with templates and drawings indicating locations of anchorage devices and similar items.

1. Verify the structural integrity of the header. Deflection with live and dead loads is limited to the lesser of L/720 of the span and 1/4 inch. Structural support for lateral loads (both wind load and eccentric load when the panels are stacked open) must be provided.

3.3 INSTALLATION

A. Install frame and folding doors complying with manufacturer’s recommendations and written installation instructions and final approved shop drawings. Properly flash and waterproof around the perimeter of the opening.

B. Provide appropriate anchorage devices and to securely and rigidly fit frame in place, absolutely level, straight, plumb, and square. Install frame in proper elevation, plane, and location, and in proper alignment with other work.

C. Install track in one piece. Set sill members in bed of sealant or with gaskets as indicated to provide weathertight construction. If necessary, provide drain connections from lower track.

D. Install door panels, handles and lockset in accordance with manufacturer’s recommendations and installation instructions and to drain condensation, water penetrating joints and moisture migrating within doors to the exterior.

E. Install doors level, plumb, square, true to line, without distortion, without warp or rack of frames and panels, and without impending thermal movement, anchored securing to structural support, and improper relation to wall flashing, vapor retarders, air barriers, water/weather barriers and other adjacent construction.

F. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

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3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Field Quality-Control Testing: Perform the following test on aluminum-framed folding storefront.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

C. Aluminum-framed folding storefront will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust units to ensure smooth, quiet operation without warping or binding. Adjust hardware to function smoothly. Confirm that latches engage accurately and securely without forcing or binding.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain aluminum folding doors.

END OF SECTION

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SECTION 084126 - ALL-GLASS ENTRANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide the work of this section in accordance with requirements of the Contract Documents.

B. This Section includes, but is not limited to:

~~1. Exterior manual-swinging all-glass entrance doors.~~
~~2.~~1. Interior manual-swinging all-glass entrance doors.
~~3.~~2. All-glass sidelights.

C. Related Work Specified Elsewhere

1. Division 07 Section "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
2. 08 Section "Exterior Enclosure System Requirements" for exterior performance requirements pertinent to all glass entrances.
3. Division 08 Section "Aluminum Framed Entrances and Storefronts" for aluminum framed entrances.
4. Division 08 Section "Glazing" for glass glazing in conjunction with the work of this section.

~~1.3 PERFORMANCE REQUIREMENTS~~

~~A. General Performance: All-glass systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction.~~

~~B. Structural Performance: All-glass systems shall withstand the effects of gravity loads and interior air pressures.~~

~~1. Deflection Limits: Deflection normal to glazing plane is limited to 1/175 of clear span or 3/4 inch, whichever is smaller.~~

~~1.4~~1.3 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

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B. LEED Action Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:

a. Leadership Extraction Practices

1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.

2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.

a) Include statement indicating costs for each product having recycled content.

b. Sourcing of Raw Materials: For products that are required to comply with requirements for regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.

1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

2. Indoor Environmental Quality, Low Emitting Materials:

a. Laboratory Test Reports: For adhesives, sealants, paints, coatings wet applied on site, indicating testing and compliance with the California Department of Public-Health (CDPH) Standard Method V1.2-2017, using the applicable exposure scenario.

b. For paints, and coatings, wet applied, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure for Architectural Coatings or the South Coast Air Quality Management District (SCAQMD) Rule 113, effective February 5, 2016.

c. Adhesives and Sealants wet applied on site: Submit printed statement of showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168effective July 1, 2005, and rule amendment date of October 6, 2017.

d. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants

~~B.~~**C.** Shop Drawings: Show fabrication and installation details, including the following:

1. Plans, elevations, and sections.
2. Details of fittings and glazing, including isometric drawings of rail fittings.
3. Door hardware locations, mounting heights, and installation requirements.

~~C.~~**D.** Samples: For each type of exposed finish indicated.

~~D.~~**E.** Other Action Submittals:

1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

~~**1.5 SUSTAINABLE DESIGN SUBMITTALS**~~

~~A. Comply with requirements specified in Section 018113.~~

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~~1.6~~1.4 INFORMATIONAL SUBMITTALS

A. LEED Informational Submittals

1. Building Product Disclosure and Optimization - Environmental Product Declarations

a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.

2. Building Product Disclosure and Optimization - Material Ingredients

a. Material Ingredient Optimization: Submit manufacturer's Environmental Product Declaration (EPD) and at least one of the following:

1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo.
3) International Alternative Compliance Path - REACH Optimization
4) Declare: Manufacturer's completed Product Declaration Form
5) Other programs approved by USGBC

~~A.~~B. Warranty: Sample of special warranty.

~~1.7~~1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

~~1.8~~1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain all-glass systems from single source from single manufacturer.

C. Accessible All-Glass Entrance Doors: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

D. Preinstallation Conference: Conduct conference at Project site.

~~1.9~~1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of all-glass systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: All-glass systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Performance: All-glass systems shall withstand the effects of gravity loads and interior air pressures.

1. Deflection Limits: Deflection normal to glazing plane is limited to 1/175 of clear span or 3/4 inch, whichever is smaller.

~~2.1~~2.2 SUSTAINABLE DESIGN REQUIREMENTS

A. Comply with requirements specified in Section 018113.

~~2.2~~2.3 MANUFACTURERS

A. Swinging Doors: Ultra-narrow stile, fully assembled with insulating glazing; thermally broken stiles and rails.

1. Basis of Design:

a. "Entice Series 104"; C.R. Laurence Co.
b. "Entice Series 110"; C.R. Laurence Co.

2. Subject to compliance with requirements, comparable products by one of the following may be considered:

a. ACI Distribution; a division of Vitro America, Inc.
b. Oldcastle Glass, Inc.
c. Virginia Glass Products Corporation; a subsidiary of Virginia Mirror Company.
d. Or approved equal,

~~2.3~~2.4 MATERIALS

~~A. Insulating Glass: Provide products specified in Section 088000.~~

~~B.~~A. Monolithic Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), tested for surface and edge compression per ASTM C 1048 and for impact strength per 16 CFR 1201 for Category II materials.

1. Class 1: Clear monolithic.

a. Thickness: 1/2 inch (13 mm) minimum.
b. Locations: As indicated.

2. Exposed Edges: Machine ground and flat polished.
3. Butt Edges: Flat ground.
4. Corner Edges: Lap-joint corners with exposed edges polished.

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~~C.~~ **B.** Aluminum Extrusions: ASTM B 221, with strength and durability characteristics of not less than Alloy 6063-T5.

1. Stainless-Steel Cladding: ASTM A 666, Type 304.

~~2.4~~2.5 METAL COMPONENTS

A. Fitting Configuration: Continuous stiles and rail fittings as indicated.

B. Stiles: Ultra narrow, 1-1/8 inches (28.5 mm) profile.

1. Thickness: 2-1/2 inches (57.1 mm).

C. Rail Fittings:

1. Material: Stainless-steel-clad aluminum.
2. Height:
   a. Top Rail: 4 inches.
   b. Intermediate Rail: 2 inches.
   c. Bottom Rails:
      1) 4 inches where indicated.
      2) 10 inches where indicated.
3. Profile: As indicated.
4. End Caps: Manufacturer's standard precision-fit end caps for rail fittings.

D. Accessory Fittings: Match rail-fitting metal and finish.

E. Anchors and Fastenings: Concealed.

~~2.5~~2.6 DOOR HARDWARE

A. Provide products specified in Division 08 Section "Door Hardware."

~~2.6~~2.7 FABRICATION

A. Provide holes and cutouts in glass to receive hardware, fittings, and accessory fittings before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.

1. Fully temper glass using horizontal (roller-hearth) process, and fabricate so that when glass is installed, roll-wave distortion is parallel with bottom edge of door or lite.

B. Factory assemble components and factory install hardware and fittings to greatest extent possible.

~~2.7~~2.8 STAINLESS-STEEL FINISHES

A. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Directional Satin Finish: No. 4.
2. Run grain of directional finishes with long dimension of each piece.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install all-glass systems and associated components according to manufacturer's written instructions.

B. Set units level, plumb, and true to line, with uniform joints.

C. Maintain uniform clearances between adjacent components.

D. Lubricate hardware and other moving parts according to manufacturer's written instructions.

E. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.

F. Install joint sealants as specified in Division 07 Section "Joint Sealants."

G. Apply distraction markings at all glass doors and sidelights to comply with requirements for glass markings specified in Division 08 Section "Glazing".

3.3 ADJUSTING AND CLEANING

A. Adjust **interior** all-glass entrance doors and hardware to produce smooth operation and tight fit at contact points.

1. For all-glass entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch measured to the leading door edge.

B. Remove excess sealant and glazing compounds and dirt from surfaces.

END OF SECTION 084126

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SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 CONTROLLING DOCUMENTS

A. This specification is controlled by Division 08 Section “Exterior Enclosure System Requirements”. In addition to the requirements of this document, all requirements of Controlling Documents must also be met. The more onerous conditions of this document or the Controlling Document must be met.

1.3 SUMMARY

A. Provide the work of this Section in accordance with requirements of the Contract documents

B. This Section Includes, but is not limited to:

1. Conventionally glazed aluminum curtain wall systems including framing components, glazing, flashing, attachment devices, expansion devices and fasteners.
2. Glazing is physically and thermally isolated from framing members.
3. Related trim components such as sill extenders and metal closures at the interface with adjacent materials.
4. Spandrel panel facing materials including transparent glass panels, insulation and back pans.
5. Metal panels glazed in curtain walls.
6. Shop applied coating finishes on curtain wall.
7. Steel elements reinforcing the curtain wall and securing it to abutting construction and slab edges, including embedded plates, and auxiliary support framing.
8. Thermal insulation on inside face of curtain wall.
9. Integration of adjacent enclosure materials and components to create an air and water tight exterior enclosure system.
10. Fire safing insulation, including supporting clips, between curtain wall and edges of floor slab construction to maintain and continue the fire resistance rating of floor slabs.
11. Vents and weeps, weep tubes, bellows, closures, gutters, end dams, flashings, trim and cutouts as shown or as may be required in conjunction with the system or to join the system to adjacent construction.
12. Fasteners, anchors, shims, fasteners, inserts, expansion devices, accessories, support brackets, support struts and attachments
13. Construction of performance mock-up(s) of size as may be approved by the Architect, including all coordination of chamber construction.
14. Construction of Visual Mockups
15. Coordination of testing of mockup(s) with independent testing laboratory engaged by the Owner, including all coordination of testing and testing procedures.
16. On-site testing for water leakage.

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C. Related Requirements:

1. Division 07 Sections "Thermal Insulation" and "Fire Resistive Joint Assemblies", for fire safing insulation, including supporting clips, between curtain wall and edges of floor slab construction to maintain and continue the fire resistance rating of floor slabs.
2. Division 07 Section "Flashing" for field-formed flashings and other sheet metal work not part of curtain wall assemblies.
3. Division 07 Section "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
4. Division 08 Section "Aluminum-Framed Entrances and Storefronts."
5. Division 08 Section "Glazing" for glass and glazing in conjunction with the work of this Section.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.to comply with requirements of Division 01, "Project Management and Coordination". Review methods and procedures related to glazed curtain wall systems including but not limited to the following:

1. Inspect and discuss condition of substrate, and other preparatory work performed by other trades.
2. Review structural loading limitations.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review required inspecting, testing, and certifying procedures.
5. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. LEED Action Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:
    a. Leadership Extraction Practices
        1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
        2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
            a) Include statement indicating costs for each product having recycled content.
    b. Sourcing of Raw Materials: For products that are required to comply with requirements for regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.
        1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

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2. Indoor Environmental Quality, Low Emitting Materials:

    a. Laboratory Test Reports: For adhesives, sealants, paints, coatings wet applied on site, indicating testing and compliance with the California Department of Public-Health (CDPH) Standard Method V1.2-2017, using the applicable exposure scenario.
    b. For paints, and coatings, wet applied, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure for Architectural Coatings or the South Coast Air Quality Management District (SCAQMD) Rule 113, effective February 5, 2016.
    c. Adhesives and Sealants wet applied on site: Submit printed statement of showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168effective July 1, 2005, and rule amendment date of October 6, 2017.
    d. Alternative tests for VOC include ASTM D2369-10, ISO 11890, ASTM D6886-03; or ISO 11890-2.
    e. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants

C. Shop Drawings: For glazed aluminum curtain walls, stamped by a professional engineer licensed to practice in the State of New Jersey who is responsible for their preparation and who has performed the structural analysis to show compliance with performance requirements. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.

    a. Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
    b. Show details for coping attachment.

2. Include full-size isometric details of each type of vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:

    a. Metal panels.
    b. Copings.
    c. Joinery, including concealed welds.
    d. Anchorage.
    e. Expansion provisions.
    f. Glazing.
    g. Flashing and drainage.

3. Distinguish among factory-, shop-, and field-assembled work
4. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joining of typical curtain wall components at framing intersections and corners.
2. Joinery, including concealed welds.
3. Anchorage.

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4. Expansion provisions.
5. Glazing.
6. Flashing and drainage.

F. Fabrication Engineering and Design Submittal: For glazed aluminum curtain walls, coping and metal panel system submit comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for their preparation, indicating compliance with performance requirements specified. Submission shall include:

1. Analysis for applicable loads on framing members
2. Analysis for applicable loads on anchors and support system for the project.
3. Structural calculations and details of anchoring system, including type, size, and spacing of fasteners.

1.6 INFORMATIONAL SUBMITTALS

A. Preconstruction Laboratory Mockup Testing Submittals:

1. Provide laboratory testing data results (performed within 4 years prior to the date of submission) providing structural, air, and water penetrating testing data for each wall system specified.

B. LEED Informational Submittals

1. Building Product Disclosure and Optimization - Environmental Product Declarations
    a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.
2. Building Product Disclosure and Optimization - Material Ingredients
    a. Material Ingredient Optimization: Submit manufacturer's Environmental Product Declaration (EPD) and at least one of the following:
        1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
        2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo.
        3) International Alternative Compliance Path - REACH Optimization
        4) Declare: Manufacturer's completed Product Declaration Form
        5) Other programs approved by USGBC

C. Qualification Data:

1. For qualified Installer, laboratory mockup testing agency and field testing agency.
2. For professional engineer's experience with providing fabrication engineering and design services of the kind indicated, including documentation that engineer is licensed in the State of New Jersey.

D. Welding Certificates.

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E. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

F. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed aluminum curtain walls, for tests performed by a qualified testing agency, indicting compliance with performance requirements.

1. Provide lab testing data results (performed within 4 years prior to the date of submission) providing structural, air, and water penetrating testing data for each wall system specified.

H. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.

I. Source Quality Ccontrol Reports.

J. Field Quality-Control reports.

K. Sample Warranties: For special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

B. Warranties: Sample of special warranties.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with 10 years successful experience on projects of comparable size and scope, with in house engineering capability to design, engineer, and fabricate curtain wall systems specified for this project to meet or exceed energy performance requirements specified, and capable of documenting this performance by certification, labeling, and inclusion in lists, who have the in house capability to produce the necessary shop drawings, conduct thermal and energy modeling and provide a comprehensive engineering analysis.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project. Installers and supervisors shall be trained by the manufacturer.

C. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025 and acceptable to Owner and Architect.

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D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of New Jersey and who is experienced in providing comprehensive engineering services to show that glazed curtain walls designed for the project comply with performance requirements.

E. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, or in-service performance.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval, and only to the extent needed to comply with performance requirements. If changes are proposed, submit comprehensive explanatory data to Architect for review.

F. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

G. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.

H. Mockups: Prior to installing exterior wall systems, construct mockup of glazed curtain wall to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution.

1. Provide materials in this section to create the composite mockup indicated.
2. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
    1) Build mockup of typical wall area as shown on Drawings by full thickness, including supports, attachments, and accessories.
    b. Include four-way joint.
    c. Actual glass coatings and material finishes shall be provided in mockups for color selection and verification.
    d. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
    e. Demonstrate the proposed range of aesthetic effects and workmanship
    f. Obtain Architect's approval of mockups before start of Work
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

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1.9 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and show recorded measurements on Shop Drawings. Provide actual locations of structural supports for glazed curtain walls. Coordinate fabrication schedule with construction progress to avoid delaying the work.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver curtain wall components, and other manufactured items so as not to be damaged or deformed. Package wall panels for protection during transportation and handling.

B. Unload, store, and erect curtain wall and metal panel system in a manner to prevent bending, warping, twisting, and surface damage.

C. Store wall panels vertically, covered with suitable weathertight and ventilated covering. Store wall panels to ensure dryness, with positive slope for drainage of water. Do not store wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 degrees F.

D. Retain strippable protective covering for period of construction until final acceptance.

1.11 WARRANTY

A. Special Assembly Warranty: Manufacturer and Installer agree to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures including, but not limited to, excessive deflection.
    b. Noise or vibration created by wind and thermal and structural movements.
    c. Thermal stresses transferred to building structure.
    d. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
    e. Failure of system to meet performance requirements.
    f. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    g. Water penetration through fixed glazing and framing areas.
    h. Failure of operating components.
    i. Loosening or weakening of fasteners, attachments and other components.
    j. Glazing Breakage.
    k. Sealant failure.

2. Warranty Period: Ten years from date of Substantial Completion.

B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
    b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.

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c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fabrication Engineering and Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements," to provide fabrication engineering and design of glazed aluminum curtain walls, including metal panels, copings, supports, air/water barrier, insulation to comply with performance requirements specified. Provide a comprehensive engineering analysis by a qualified professional engineer licensed to practice in the State of New Jersey and responsible for preparation of fabrication engineering, using performance requirements and criteria specified.

B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls, metal panels and copings representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum curtain walls shall withstand movements of supporting structure, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Deflection exceeding specified limits.
b. Framing members transferring stresses, including those caused by thermal and structural movements to glazing and/or metal panels.
c. Thermal stresses transferring to building structure.
d. Glass breakage.
e. Glazing-to-glazing contact.
f. Noise or vibration created by wind and thermal and structural movements.
g. Loosening or weakening of fasteners, attachments, and other components.
h. Failure of operating units.

C. Structural Loads:

1. Dead Loads: Weights of materials and construction.
2. Wind Loads: Wind pressures are based on the provisions of the American Society of Civil Engineers, "Minimum Design Loads for Buildings and Other Structures", ASCE 7-16.
3. Wind pressures used in the Project design are shown on the Structural Drawings.
4. Other Design Loads: As indicated on Structural Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans of greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

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2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

    a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

    a. Perpendicular to Plane of Wall: Deflection of cantilevered framing members shall not exceed 2L/175 or 3/4-inch maximum, whichever is less.

E. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft..

G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft..
2. Maximum Water Leakage: In accordance with AAMA 501.1. No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters or water that is drained to exterior.

H. Interstory Drift: Accommodate design displacement of adjacent stories indicated.

1. Design Displacement: As indicated on Drawings.
2. Test Performance: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.4 at design displacement and 1.5 times the design displacement.

I. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

J. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

    a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.36 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.

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2. Solar Heat Gain Coefficient (SHGC):
    a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.25 as determined in accordance with NFRC 200.
3. Air Leakage:
    a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested in accordance with ASTM E283.
4. Condensation Resistance Factor (CRF):
    a. Fixed Glazing and Framing Areas: CRF for the system of not less than 55 as determined in accordance with AAMA 1503.

K. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows:

1. Outdoor-Indoor Transmission Class: TBD.
2. Sound Transmission Class: TBD.

L. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
    a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 degrees F.
    b. Low Exterior Ambient-Air Temperature: 0 degrees F.

M. Fire, Smoke and Draft Barrier: Provide a continuous fire/smoke/draft barrier as an integral component of the exterior wall systems to prevent the passage of air, flame and smoke from one floor to another, within the exterior wall work. Comply with the requirements of the local authorities having jurisdiction, including testing and certification requirements indicating compliance with requirements when tested in accordance with ASTM E2307

1. Design the barrier system to accept floor fire safing as an integral part of the system.

N. Unacceptable Conditions: Vibration harmonics, wind whistles, noise or vibration created by thermal movement, structural movement, or wind; thermal movement transferred to building structure; loosening, weakening or failure of fasteners, attachments or other components.

2.2 MANUFACTURERS

A. Basis-of-Design: “Reliance ~~HTC~~**TC**” Curtain Wall System; Oldcastle BuildingEnvelope (OBE); CRH Americas, or approved equal.

1. Comparable Products: Subject to compliance with requirements, comparable products of the following manufacturers may be considered:
    a. Building Envelope Systems.
    b. Crawford Tracey Corporation.
    c. Enclos Corp.
    d. Harmon, Inc.

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e. Kawneer Company, Inc.
f. United Architectural Metals.
g. U.S. Aluminum; a brand of C.R. Laurence.
h. Wausau Window and Wall Systems; Apogee Wausau Group, Inc.

B. Source Limitations: Obtain all components of curtain-wall system, including framing, spandrel panels, and accessories, from single manufacturer.

2.3 MATERIALS, GENERAL

A. Recycled Content of Products:

1. Provide products with an average recycled content of aluminum products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 12.5 percent.
2. Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

2.4 MATERIALS

A. Aluminum: Minimum aluminum yield strength shall be as required to comply with performance requirements, but not less than 25,000 psi. Snap on elements or other aluminum extrusions that are not structurally connected to act as a single composite member shall not be considered in determining the structural capacity of the mullion.

B. Aluminum Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.

1. Sheet and Plate: ASTM B209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
3. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
4. Structural Profiles: ASTM B308/B308M.
5. Welding Rods and Bare Electrodes: AWS A5.10.
6. Vertical and horizontal mullions: Alloy 6063-T6 or equivalent
7. Anchors: Alloy 6061-T6 or 6005A-T61 or equivalent.
8. Aluminum plate: Alloy 3003-H14 or equivalent.

C. Steel Reinforcement: Minimum steel yield strength shall be 36,000 psi for steel bars used to reinforce vertical mullions of the windows and curtain walls, if determined necessary by calculation. A dynamic enhancement factor of 1.2 may be applied to the yield stress for steel members, to account for strain rate effects.

1. Qualities:

a. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
b. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
c. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

2. The reinforcing steel bars and the aluminum mullions shall be structurally connected to sufficiently transfer the applied loads across the interface between the members.
3. Composite section properties of mullion components may only be used if calculations demonstrate strain compatibility across the interface.
4. Combined section properties of mullion components may be used if calculations demonstrate deformation compatibility between the aluminum and steel components

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D. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM and prepare surfaces in accordance with applicable SSPC standard.

2.5 FRAMING

A. Framing Members: Manufacturer's extruded aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally improved.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front, unless otherwise indicated.
4. Finish: Superior-performance organic finish.
5. Fabrication Method: Either factory- or field-fabricated system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

B. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.

1. Include snap-on aluminum trim that conceals fasteners.

C. Metal Closures and Trim: Fabricate from aluminum extrusions or formed from aluminum sheet; minimum 0.125-inch thickness.

1. Finish: Match framing system components.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.6 GLAZING

A. Glazing: Comply with Division 08 Section "Glazing."

B. Glazing Gaskets: ASTM C509 or ASTM C864. Comply with Division 08 Section "Glazing.".

1. Color: Black.

C. Glazing Sealants: As recommended by manufacturer. Comply with Division 08 Section "Glazing" and Division 07 Section "Joint Sealants."

1. Sealant shall have a VOC content of 250 g/L or less.

2.7 OPERABLE UNITS

A. Entrances: Comply with Division 08 Section "Aluminum-Framed Entrances and Storefronts."

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2.8 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners including their accessory items (washers, nuts, etc.), are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration. Tighten torques as required to achieve maximum torque tension relationship required by fasteners
2. Reinforce the interior surface with aluminum or non-magnetic stainless steel as required to receive fastener threads or provide manufacturer's standard non-corrosive pressed-in splined grommet nuts to receive fastener threads. Drill screwed connections.
3. Use exposed fasteners with countersunk Phillips screw heads, fabricated from 300 series stainless steel, where exposed fastening is unavoidable.
4. Finished exposed elements and portions to match framing system.

B. Anchors: Three-way stainless steel adjustable anchors with minimum adjustment of 2inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
2. Where anchors penetrate the air barrier, provide only stainless-steel inserts.

C. Anchors, Clips, and Accessories for Terrace Doors: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B456 or ASTM B633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated

D. Concealed Flashing: Dead-soft, 0.018-inch-thick stainless steel, ASTM A240/A240M of type recommended by manufacturer.

E. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.9 FABRICATION

A. General: Fabricate glazed aluminum curtain wall system according to final Shop Drawings and Mockup Testing recommendations.

B. Forming: Form, break form, or extrude aluminum shapes before finishing.

C. Welding: Weld components to comply with referenced standards and shop drawings unless otherwise indicated. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

D. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted and secured joints with ends coped or mitered.
3. Hairline joints free of burrs and distortion
4. Physical and thermal isolation of glazing from framing members.
5. Have accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

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6. Provisions for field replacement of glazing from exterior. Include accommodations for using temporary support device (Dutchman) to retain glazing in place while sealant cures.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

E. Fabricate components to resist water penetration as follows:

1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

F. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.

G. Unitized Curtain Wall Units:

1. Rigidly secure nonmovement joints.
2. Seal joints watertight unless otherwise indicated.
3. Install glazing to comply with requirements in Division 08 Section "Glazing."
4. Assemble components to drain water passing joints, condensation occurring in glazing channels and condensation occurring within framing members and moisture migrating within the system to the exterior.
5. Retain bracing or stiffening until erected to prevent racking of units during transportation and erection.

H. Metal Panels: Provide where shown, exposed aluminum panels fabricated and coordinated to install within the exterior wall construction in profiles, face dimensions and patterns as shown complete with matching reveals.

1. Fabricate panels of minimum 3/16 in. thick aluminum plate rigidized with welded concealed aluminum stiffeners as required to prevent oil-canning or other visible distress.
2. Nominal Panel Thickness: 1 inch.
3. Finish panels to match finish of exterior exposed aluminum mullions unless otherwise shown or specified.
4. Metal Panel Tolerances: Fabricate panels with panel stiffeners as required to comply with deflection limits. Weld and grind panel corners smooth. Fabricate panels to the following dimensional tolerances:
    a. Length and Width: Plus, or minus 0.032 inch up to 48 inches; 0.064 inch more than 48 inches.
    b. Diagonal: Plus, or minus 0.1875 inch.
    c. Panel Bow: Not more than 0.2 percent of panel width or length up to 0.1875 inch maximum.
    d. Thickness: Plus, or minus 0.008 inch.
    e. Squareness: 0.1875-inch difference between diagonal measurements.
    f. Camber: 0.032 inch.

I. Glass Spandrel Panels: Provide insulated glass panels at spandrels of type shown and specified in Section "Glazing". Provide mineral wool insulation specified in Section "Thermal insulation" in the cavity behind insulated spandrel panels. Provide concealed back panels fabricated from stretcher leveled 22 gage galvanized steel sheet. Seal back pans to aluminum framing.

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J. Brackets and Reinforcement: Provide manufacturer's standard high strength aluminum brackets and reinforcements. Provide nonstaining, nonferrous shims for aligning system components.

K. Accessories: Provide components required for a complete assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, stiffeners and similar items.

L. Fabricate and finish curtain wall components, metal panels, and accessories at the factory to the greatest extent possible, utilizing manufacturer's procedures and processes necessary to fulfill indicated performance requirements.

M. After fabrication, disassemble for shipping, clearly marking components to identify their locations in Project with joinery in accordance with final Shop Drawings.

2.10 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Finishes Application: Apply high performance organic coatings to exposed exterior surfaces of exterior enclosure system components. Apply thermosetting acrylic enamel coatings to exposed and concealed interior surfaces of exterior enclosure system components.

1. During production, maintain large size color range samples for use in comparing against production material.
2. Adhesion and Compatibility Testing: Test samples of high performance coatings on aluminum shall be provided for compatibility and adhesion testing of joint sealants proposed for use on exterior enclosure system components prior to installations. Refer to Section Division 07 Section "Joint Sealants.'

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

E. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish system consisting of corrosion inhibitive primer, fluoropolymer color coat and clear fluorocarbon topcoat, complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat, in not less than 1.6 mils dry film thickness. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss (**MTL-01**): PPG "Duranar Sunstorm UC126244F Gray Velvet".

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2.11 STEEL PRIMING

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying primer.

B. Surface Preparation: Perform manufacturer's standard cleaning operations to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.

C. Priming: Apply manufacturer's standard corrosion-resistant primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify dimensions, tolerances, and method of attachment with other related work.
2. Verify that curtain wall openings and adjoining air and vapor seal materials are ready to receive work of this section
3. Verify that anchorage devices have been properly installed and located.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that will contact curtain wall according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION, GENERAL

A. General: Install curtain wall system to comply with manufacturer's written instructions.

1. Do not install damaged components.
2. Rigidly secure nonmovement joints. Provide alignment attachments and shims to permanently fasten system to building.
3. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and irregularities.
4. Fit joints to produce hairline joints free of burrs and distortion.

B. Install components plumb, level and true in alignment with established lines and grades, free from warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

C. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within curtain wall to exterior.

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D. Provide thermal isolation where components penetrate or disrupt building insulation

E. Install sill flashings turning up ends and edges, sealing to adjacent work to form watertight dams.

F. Anchoring and Fastening: Install and anchor accessories and components with positive anchorage to building and weathertight mounting and provide for thermal expansion in accordance with final reviewed shop drawings.

1. Anchor components with concealed fasteners and anchors.
2. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

G. Field Welding: Comply with requirements for welding and for finishing welded connections in "Fabrication Article." Weld connections that are not to be left as exposed joint but cannot be shop welded because of shipping size limitations. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.

H. Seal joints watertight unless otherwise indicated.

I. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

J. Install insulation solid in voids between and within curtain members, behind solid panels, where curtain wall abuts adjacent construction, in shim spaces as required to maintain continuity of thermal barrier in accordance with requirements in Division 07 Section "Building Insulation". Compress insulation to 50 percent or less of original thickness.

3.4 INSTALLATION OF OPERABLE UNITS

A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

3.5 INSTALLATION OF GLAZING

A. Install glazing as specified in Division 08 Section "Glazing."

3.6 INSTALLATION OF INSULATION AND FIRE SAFING

A. Installation curtain wall insulation and fire safing complying with requirements specified in Section "Thermal Insulation" and the following:

1. Clean debris from behind exterior wall during erection and provide temporary closures to prevent accumulation of debris.
2. Install firestopping/safing and smoke seal to comply with local authorities having jurisdictions.

    a. Install firestopping/safing with securely anchored metal flanges or make equivalent provisions to prevent dislocation.

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b. Install fire rated silicone smoke seal system over safing insulation to provide a complete smoke seal. Comply with Division 07, Section “Fire Resistive Joints”, appropriate UL listing and local authorities having jurisdiction.

3. Install curtain wall insulation in accordance with manufacturer's written instruction utilizing materials and methods to comply with tested rated assembly if required.

   a. Retain insulation in place by metal clips and straps or integral pockets within window frames, spaced at intervals recommended by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width between insulation and glass of dimension indicated.
   b. Brace insulation where it contacts safing insulation to prevent insulation from bowing under pressure from safing insulation.

3.7 INSTALLATION OF METAL PANELS, COPINGS, FLASHINGS AND ACCESSORIES

A. Metal Panels: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Commence metal wall panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. Flash and seal metal wall panels at perimeter of all openings. Do not begin installation until fluid applied air barrier, insulation and flashings that will be concealed by panels are installed.
4. Install flashing and trim as metal wall panel work proceeds.
5. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
6. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
7. Attach metal wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.
8. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
9. Install wall panels to allow individual panels to be installed and removed without disturbing adjacent panels. Coordinate installation with installation of glazed aluminum curtainwalls and seal joints between systems so entire enclosure is water and weather proof.
10. Do not apply sealants to joints unless otherwise indicated.

B. Coping Installation: Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

1. Anchor copings to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and to comply with performance requirements.

   a. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at 24-inch centers, except where more stringent requirements are specified in manufacturer's installation directions.

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C. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, SMACNA's "Architectural Sheet Metal Manual", and Division 07 Section "Sheet Metal Flashing and Trim". Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inchdeep, filled with mastic sealant (concealed within joints).

D. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

3.8 ERECTION TOLERANCES

A. Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Contractor's Responsibility: Furnish the testing Agency with access to the Work, materials and facilities as required by the Agency.

1. Provide adequate notice of construction activities to allow timely inspections and observation of testing.
2. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed glazed curtain walls, metal panel and coping installation, including accessories.

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3. Notify the Owner, the Construction Manager, the Architect, the Manufacturer's field Representative so that each entity may have adequate representation at the testing.
4. Test and inspect representative areas of glazed curtain walls as the work proceeds to determine compliance of installed assemblies with specified requirements.
5. The testing and inspection activities do not relieve the Contractor of responsibilities under the Contract.

C. Manufacturer's Field Service: Engage a factory-authorized service representative for the Exterior Enclosure System to inspect completed installation of its specific Components, including accessories and connection to adjacent assemblies. Report results in writing.

D. Field Quality-Control Testing: Perform the following test on representative areas of glazed aluminum curtain walls.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.

   a. Perform a minimum of three tests in areas as directed by Architect.
   b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.

2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

   a. Perform a minimum of three tests in areas as directed by Architect.
   b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.

3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. and shall not evidence water penetration.

E. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections. Following repair or replacement of failed areas, retest according to the same protocols, until construction passes testing requirements. Fabrication and installation of new areas may not proceed until tested areas have passed tests.

F. Prepare test and inspection reports.

3.10 PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as assemblies are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of Exterior Enclosure System installation, clean finished surfaces as recommended by each assembly manufacturer. Maintain in a clean condition during construction.

1. Debris caused by, or incidental to, the erection of the assemblies shall be removed from the site and disposed of legally.

B. After curtain wall installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

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C. Replace components of the Exterior Enclosure System that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures before the date of Substantial Completion.

D. Institute protective measures required throughout the remainder of the construction period to ensure that the Exterior Enclosure System work will be without damage or deterioration, other than normal weathering, at time of acceptance.

E. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, which ensure glazed curtain wall system is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 084413

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SECTION 084426 – FIRE-RATED SILICONE GLAZED STEEL CURTAIN WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 CONTROLLING DOCUMENTS

A. This specification is controlled by Division 08 Section “Exterior Enclosure System Requirements”. In addition to the requirements of this document, all requirements of Controlling Documents must also be met. The more onerous conditions of this document or the Controlling Document must be met.

1.3 SUMMARY

A. Provide the work of this Section in accordance with requirements of the Contract Documents.

B. Section Includes:

1. Silicone glazed, fire-rated curtain wall systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of curtain wall framing.

C. Related Sections include the following:

1. Section 051200 “Structural Steel Framing:” Steel attachment members
2. Section 055000 “Metal Fabrications:” Steel attachment members inserts and anchors
3. Section 072500 “Weather Barriers:” Perimeter air, water and vapor seal between the work of this section and adjacent construction
4. Section 076200 “Sheet Metal Flashing and Trim” Flashing between this work and other work
5. Section 078400 – “Firestopping” for perimeter fire-containment systems (safing insulation) field installed with steel fire-rated glazed curtain-wall systems.
6. Section 079200 – “Joint Sealants” for installation of joint sealants installed with steel fire-rated glazed curtain-wall systems and for sealants to the extent not specified in this Section.
7. Section 081100 – “Metal Doors and Frames” for fire-rated doors.
8. Section 084313 – “Aluminum Entrance and Storefronts” for entrance and storefront systems installed with steel fire-rated glazed curtain-wall systems.
9. Section 087100 – “Door Hardware” for door hardware not provided by this Section.
10. Section 084123 – “Fire Rated Steel Framed Entrances – Heat Barrier Series” for fire-rated doors.
11. Section 084123 – “Fire Rated Glass and Framing Systems – Designer Series” for fire-rated doors.

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1.4 REFERENCES

A. American Architectural Manufacturers Association (AAMA)

1. AAMA 501.1-2005: Standard Test Method for Water Penetration of Windows, Curtain Walls, and Doors Using Dynamic Pressure
2. AAMA 501.2-2003: Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems
3. AAMA 501.4-2000 (Revised 2001): Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts
4. AAMA 501.5-2005: Test Method for Thermal Cycling of Exterior Walls
5. AAMA 506-2000 (Revised 2003): Voluntary Specifications for Hurricane Impact and Cycle Testing of Fenestration Products
6. AAMA 1503-1998: Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
7. AAMA 2603-2002 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
8. AAMA 2604-2005 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
9. AAMA 2605-2005 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. American Society for Testing and Materials (ASTM):

1. Fire safety related:
    a. ASTM E119: Methods for Fire Tests of Building Construction and Materials.
    b. ASTM E2074-00: Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
2. Material related
    a. ASTM A 1008/A 1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2007.
    b. ASTM A 1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2006b.
3. Exterior related
    a. ASTM E 283: Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen
    b. ASTM E 330: Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference Procedure A
    c. ASTM E 331: Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
    d. ASTM E 783: Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors
    e. ASTM E 1105: Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference

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4. Hurricane related
    a. ASTM E 1886-05: Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
    b. ASTM E 1996-05: Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
5. Sound related:
    a. ASTM E 90-04: Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
    b. ASTM E 413-04: Standard Classification for Rating Sound Insulation

C. American Welding Society (AWS)

1. AWS D1.3 - Structural Welding Code - Sheet Steel; 2007

D. Builders Hardware Manufacturers Association, Inc

1. BHMA A156 - American National Standards for door hardware; 2006 (ANSI/BHMA A156).

E. Canadian Standards

1. CAN/ULC-S101 Standard Test of Fire Endurance Tests of Building Construction and Materials
2. CAN/ULC-S104 Standard Method of Fire Tests of Door Assemblies
3. CAN/ULC-S106 Standard Method of Fire Tests of Window and Glass Block Assemblies

F. National Fire Protection Association (NFPA):

1. NFPA 80: Fire Doors and Windows
2. NFPA 251: Fire Tests of Building Construction & Materials
3. NFPA 252: Fire Tests of Door Assemblies
4. NFPA 257: Fire Test of Window Assemblies

G. Underwriters Laboratories, Inc. (UL):

1. UL 9: Fire Tests of Window Assemblies
2. UL 10 B: Fire Tests of Door Assemblies
3. UL 10 C: Positive Pressure Fire Tests of Window & Door Assemblies
4. UL 263: Fire Tests of Building Construction and Materials
5. UL-752: Ratings of Bullet-Resistant Materials

H. American National Standards Institute (ANSI):

1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings

I. Consumer Product Safety Commission (CPSC):

1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials

J. American Society of Civil Engineers (ASCE)

1. ASCE 7 – Minimum Design Loads for Buildings and Other Structures; 2005

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1.5 DEFINITIONS

A. Manufacturer: A firm that produces primary glass, fabricated glass or framing as defined in referenced glazing publications.

1.6 PRE-INSTALLATION MEETINGS

A. Conduct pre-installation meeting at least one week prior to start of the work of this Section, to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product. Submit latest edition of manufacturer's product data providing product descriptions, technical data, Underwriters Laboratories, Inc. listings and installation instructions.

1. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.

B. LEED Action Submittals

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:

a. Leadership Extraction Practices

1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
a) Include statement indicating costs for each product having recycled content.

b. Sourcing of Raw Materials: For products that are responsibly sourced within 100 miles of project site, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.

1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

2. Indoor Environmental Quality, Low Emitting Materials:

a. Laboratory Test Reports: For adhesives, sealants, paints, coatings wet applied on site, indicating testing and compliance with the California Department of Public-Health (CDPH) Standard Method V1.2-2017, using the applicable exposure scenario.
b. For paints, and coatings, wet applied, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure for Architectural Coatings or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016.
c. Adhesives and Sealants wet applied on site: Submit printed statement of showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005, and rule amendment date of October 6. 2017.

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~~d. Alternative tests for VOC include ASTM D2369-10, ISO 11890, ASTM D6886-03; or ISO 11890-2.~~

~~e.~~**d.** Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants.

C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of fire-rated glazing systems.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Include plans, elevations, sections, and details
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Detail attachments to other work, and between units, if any.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Glazing details.
9. Accessories.

D. Fabrication and Engineering Design:

1. Provide structural calculations sealed by a licensed professional engineer in the State in which the project is located; prepared in compliance with referenced documents and these specifications.

E. Samples: For following products:

1. Glass samples.
2. Sample of frame.
3. Verification of sample of selected finish

F. Fabrication Sample: Of each vertical-to-horizontal intersection of framed systems, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.

G. Glazing Schedule: Use same designations indicated on drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

H. Hardware Schedule: Coordinate with Division 08 Section "Door Hardware."

I. Warranties: Submit manufacturer’s warranty.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, and testing agency.

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B. LEED Informational Submittals

1. Building Product Disclosure and Optimization - Environmental Product Declarations

a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.

2. Building Product Disclosure and Optimization - Material Ingredients

a. Material Ingredient Optimization: Submit manufacturer's Environmental Product Declaration (EPD) and at least one of the following:

1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo.
3) International Alternative Compliance Path - REACH Optimization
4) Declare: Manufacturer's completed Product Declaration Form
5) Other programs approved by USGBC

C. Product Test Reports: For fire-rated silicon glazed steel curtain walls, for tests performed by a qualified testing agency.

D. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements.

1. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.

E. Field quality-control reports.

F. Sample Warranties: For special warranty.

G. Maintenance Data

1.9 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to

1. International Accreditation Service for a Type A Third-Party Inspection Body (Field Services ICC-ES Third-Party Inspections Standard Operating Procedures, 00-BL-S0400 and S0401)
2. International Accreditation Service for Testing Body-Building Materials and Systems

a. Fire Testing

1) ASTM Standards E 119
2) CPSC Standards 16 CFR 1201
3) NFPA Standards 251, 252, 257
4) UL Standards 9, 10B, 10C, 1784, UL Subject 63

B. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving application method.

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C. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

D. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

E. Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by UL, for fire ratings indicated, based on testing according to NFPA 252, ASTM E119. Assemblies must be factory-welded or come complete with factory-installed mechanical joints and must not require job site fabrication.

F. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are classified and labeled by UL, for fire ratings indicated, based on testing according to NFPA 252.

G. Certification: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. Door assemblies shall be tested to the acceptance criteria of ASTM E2074, NFPA 252, UL 9, UL 10-C Standard Methods of Fire Tests of Door Assemblies.
2. Wall assemblies shall be tested to the acceptance criteria of ASTM E119, NFPA 251, UL 263 Standard Test Methods for Fire Tests of Building Construction and Materials.
3. Underwriters Laboratories (UL) shall conduct fire test.

H. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

I. Reference Standards: Comply with published recommendations of product manufacturers and organizations below unless more stringent requirements are indicated. Refer to these publications for terms not otherwise defined in this Section or in referenced standards.

1. Glass Association of North America (GANA) Publications:
2. Consumer Product Safety Commission (CPSC): Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of CPSC 16 CFR Part 1201 for category II materials.

a. Subject to compliance with requirements and local authorities having jurisdiction, provide safety glass with a removable certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.

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3. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1, as follows:
    a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
    b. Door Closers: Comply with the following maximum opening-force requirements indicated:
        1) Accessible doors no more than 5 lbf push or pull force
        2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction
4. NFPA 101: Comply with the following for means of egress doors:
    a. Latches, Locks, and Exit Devices: Not more than 15 lbfto release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
    b. Door Closers: Not more than 30 lbfto set door in motion and not more than 15 lbfto open door to minimum required width.
5. NAAMM "Metal Finishes Manual".

J. Listings and Labels - Fire Rated Assemblies: Under current follow-up service by Underwriters Laboratories® maintaining a current listing or certification. Label assemblies accordance with limits of manufacturer's listing.

K. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code - Steel."
2. AWS D1.2, "Structural Welding Code - Aluminum."

L. Engineering Responsibility: Preparation of data for fire rated glazing systems including the following:

1. Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1.10 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1. If field measurements will not be available in a timely manner coordinate planned measurements with the work of other sections.
2. Note whether field or planned dimensions were used in the creation of the shop drawings.

B. Coordinate the work of this section with others effected including but not limited to: other interior and/or exterior envelope components and door hardware beyond that provided by this section

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle under provisions specified by manufacturer.

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B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass, and impair performance and appearance.

1.12 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of fire-rated glazed partition systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures, including excessive deflection.
c. Deterioration of metals, metal finishes, and other materials beyond normal wear.
d. Deterioration of fire rated laminated glazing.
e. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard

2. Warranty Period:

a. Finish: 20 years from date of Substantial Completion.
b. Glazing: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fabrication Engineering and Design: Engage a qualified New Jersey State licensed professional engineer, as defined in Division 01, Section "Quality Requirements", to engineer fire-rated silicone glazed steel curtain wall using structural performance requirements specified in the Division 08 Section "Exterior Enclosure System Requirements" and be responsible for engineering of fire-rated silicone glazed steel curtain wall components and materials, fabrication, and installation.

1. Deflection Limits: Design fire-rated silicone glazed steel curtain wall to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressures.
2. Uniform Wind Load: ASTM E 330; Static air design load of 40 PSF applied in positive and negative direction; no deflection in excess of L/175 of span of any framing member at design load.
3. At structural test load equal to 1.5 times specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

B. System Description:

1. Steel fire-rated glazed curtain wall system, silicone glazed toggles (manufacturer’s fastening system Patent No. 8,567,142) as needed for the conditions of the assembly. System is field assembled and glazed.

C. Air Infiltration: ASTM E 283; Air infiltration rate shall not exceed 0.06 cfm/ft^2 at a static air pressure differential of 6.24 psf.

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D. Water Resistance, (static): ASTM E 331; No leakage at a static air pressure differential of 15 psf as defined in AAMA 501.

E. Water Resistance, (dynamic): AAMA 501.1; No leakage at an air pressure differential of 15 psf as defined in AAMA 501.

F. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.

1. Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 deg F temperature-rise limitation; and the fire-resistance rating in minutes.

G. Thermal Movements: Provide fire-rated silicone glazed steel curtain wall systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS (ACCEPTABLE MANUFACTURERS/PRODUCTS)

A. Exterior Wall System **EWS-06**: One hour rated exterior storefront composed of aluminum clad steel members tested for a 1 hour fire rating, and meeting criteria for exterior envelope in Performance Requirements article above. System comprised of the following selected as basis of design:

1. Manufacturer Glazing Material: **TGP** “Pilkington Pyrostop®” fire-rated glazing as manufactured by the Pilkington Group and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065 phone (800.426.0279) e-mail tgp.sales@allegion.com, website http://www.fireglass.com, or approved equal.
2. Frame System: **TGP** “Fireframes SG Curtainwall® Series” fire-rated steel frame system with structural silicone glazing as supplied by Technical Glass Products 8107 Bracken Place SE, Snoqualmie, WA 98065 phone (800.426.0279) e-mail tgp.sales@allegion.com website http://www.fireglass.com, or approved equal.

2.3 MATERIALS - GLASS

A. Low-E Coated glass for use in insulated exterior units See Section 088000**, "Glazing".**

B. Fire Rated Glazing: Composed of multiple sheets of Pilkington Optiwhite™ - high visible light transmission glass laminated with an intumescent interlayer, or approved equal.

C. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).

D. Glass Type **GL-03**: ~~Available Glazing Material~~ **1-5/8-inch thick Insulating Glass Unit as follows**, or approved equal:

1. Outer Lite: 1/4-inch heat-strengthened, OptiWhite clear low-iron glass lite. High performance VRE-65 low e coating and bird friendly frit on #2 surface

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2. **Air Space: 1/2-inch argon filled airspace with black warm edge spaces**
~~1.~~**3. Interior Lite: 7/8-inch thick, TGP** Pilkington "Pyrostop® 60-101" **Optiwhite high visible light transmission laminated glass with intumescent interlayers fire rated for** 60 min. **At spandrel provide V954 Gray opaque spandrel frit on the #4 surface**

E. Logo: Each piece of fire-rated glazing shall be labeled with a permanent logo including name of product, manufacturer, testing laboratory (UL), fire rating period, safety glazing standards, and date of manufacture

F. Glazing Accessories: Manufacturer's standard compression gaskets, spacers, setting blocks and other accessories necessary for a complete installation.

G. Sound Transmission: provide fire rated structural sealant glazed curtain walls with fixed glazing and framing areas having the following sound-transmission characteristics, minimum requirement STC 40 when tested for laboratory sound transmission loss according to ASTM E90 and ASTM E1425, and based on 1" insulating glass.

1. Pilkington "Pyrostop 60-101"60 minutes, STC 44

2.4 MATERIALS –STEEL FRAMING

A. Steel Curtain Wall Framing System 60 min.

1. Frame Steel: profiled steel tubing permanently joined with steel bolts.
2. Insulation: Insulate framing system against effects of fire, smoke, and heat transfer from either side. Firmly pack perimeter of framing system to rough opening with mineral wool fire stop insulation or appropriately rated intumescent sealant
3. Fasteners: Type recommended by manufacturer
4. Glazing Gaskets, Compounds and tapes: Glaze Pilkington Pyrostop glass with approved EPDM glazing gaskets and, or pure silicone sealant.

B. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221.

C. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M Standard Specification for Carbon Structural Steel
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

D. Brackets and Reinforcements: Manufacturer's standard high-strength materials with nonstaining, nonferrous shims for aligning system components.

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E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.

F. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

G. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

2.5 ACCESSORIES

A. Exposed Fasteners: Use fasteners fabricated from Type 304 or Type 316 stainless steel.

B. Glazing Gaskets:

1. Glazing gaskets for interior or exterior applications: ASTM C 864 (extruded EPDM rubber that provides for silicone adhesion) or ASTM C1115 Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories (extruded silicone).

C. Intumescent Tape: As supplied by frame manufacturer.

D. Setting Blocks: ¼” Calcium silicate or Silicone.

E. Toggles: connectors between glazed unit and perimeter spacers, oriented parallel to glazing plane. Provide toggle assembly as tested by manufacturer for weight of glazed units and to conform with required fire rating.

F. Perimeter Anchors: primed Steel or Type 316 Stainless steel when exposed.

G. Flashings: As recommended by manufacturer;

H. Silicone Sealant: One-Part Low Modulus, neutral cure, High Movement-Capable Sealant: Type S; Grade NS; Class 25 with additional movement capability of 100 percent in extension and 50 percent in compression (total 150 percent); Use (Exposure) NT; Uses (Substrates) M, G, A, and O as applicable. (Use-O joint substrates include: Metal factory-coated with a high-performance coating; galvanized steel; ceramic tile.)

1. Available Products:

a. Dow Corning 790, 795- Dow Corning Corp.
b. Momentive
c. Tremco
d. Or approved equal.

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I. Intumescent Caulk: Single component, latex-based, intumescent caulk designed to stop passage of fire, smoke, and fumes through fire-rated separations; permanently flexible after cure; will not support mold growth; flame spread/smoke developed 10/10.

1. Available Products:

a. 3M CP-25 WP+, or approved equal.

2.6 SLAG-WOOL-FIBER/ROCK-WOOL-FIBER INSULATION

A. Available Manufacturers:

1. Fibrex Insulations Inc.
2. Owens Corning.
3. Thermafiber.
4. Rockwool.
5. Or approved equal.

B. Unfaced, Slag-Wool-Fiber/Rock-Wool-Fiber Board Insulation: ASTM C 612, maximum flame-spread and smoke-developed indexes of 15 and 0, respectively; passing ASTM E 136 for combustion characteristics; and of the following nominal density and thermal resistivity:

1. Nominal density of 4 lb/cu. ft., Types IA and IB, thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F.
2. Fiber Color: Regular color, unless otherwise indicated.

2.7 FABRICATION

A. General:

1. Fabricate components per manufacturer's installation instructions and with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
2. Accurately fit and secure joints and corners. Make joints flush and weatherproof.
3. Provide physical and thermal isolation of glazing from framing members.
4. Provide internal guttering to drain water from joints and condensation occurring within system.
5. Prepare components to receive anchor devices.
6. Fabricate anchors.
7. Arrange fasteners and attachments to be concealed from view.

B. Guttered System Components:

1. Fabricate components to resist water penetration as follows:

a. Internal guttering system or other means to drain water passing joints, occurring within framing members, and moisture migrating within glazed steel curtain walls.

b. Pressure-equalized system, double barrier, or two lines of air and water resistance design with primary air and water barrier at interior side of glazing pocket.

2.8 POWDER COAT FINISHES

A. Finish after fabrication.

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B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable. Noticeable variations in the same piece are not acceptable.

C. Interior or Exterior Steel Finishes (Note: this finish is suitable for exterior exposed portions of the wall systems, including extruded aluminum covers)

1. Powder-Coat Finish: Polyester Super Durable powder coating which meets AAMA 2604 for chalking and fading. Apply manufacturer's standard powder coating finish system applied to factory-assembled frames before shipping, complying with manufacturer's recommended instructions for surface preparation including pretreatment, application, and minimum dry film thickness.
2. Color and Gloss (**MTL-01**): to match PPG "Duranar Sunstorm UC126244F, Gray Velvet".
3. Acceptable Manufacturers:

a. Tiger Drylac
b. Or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer’s instructions. Verify openings are sized to receive curtain wall system and sill plate is level in accordance with manufacturer’s acceptable tolerances.

B. Notify Architect of any conditions which jeopardize the integrity of the proposed fire wall / door system.

C. Do not proceed until such conditions are corrected.

3.2 INSTALLATION

A. See Fireframes SG Curtainwall Installation Manual**, and install to comply with requirements specified in Division 08 Section "Structurally Glazed Curtainwalls".**

3.3 PROTECTION AND CLEANING

A. Protect glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface`. Remove nonpermanent labels, and clean surfaces.

1. Do not clean with astringent cleaners. Use a clean “grit free” cloth and a small amount of mild soap and water or mild detergent.
2. Do not use any of the following:

a. Steam jets
b. Abrasives
c. Strong acidic or alkaline detergents, or surface-reactive agents
d. Detergents not recommended in writing by the manufacturer
e. Do not use any detergent above 77 degrees F
f. Organic solvents including but not limited to those containing ester, ketones, alcohols, aromatic compounds, glycol ether, or halogenated hydrocarbons.

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g. Metal or hard parts of cleaning equipment must not touch the glass surface

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 084426

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SECTION 08 7100 - DOOR HARDWARE

PART 1- GENERAL

1.01 SUMMARY

A. Section Includes: Door hardware for wood doors, steel doors, aluminum framed entrance doors, all glass entrance doors, and miscellaneous hardware items.

B. Provide hardware not described herein but otherwise required for proper completion of the project, conforming to size, function, quality, and finish of other specified hardware.

1.02 RELATED SECTIONS

A. Division 6: Rough Carpentry.

B. Division 8: Aluminum Doors and Frames

C. Division 8: Hollow Metal Doors and Frames.

D. Division 8: Wood Doors.

E. Division 26 Electrical

F. Division 28: Electronic Security

1.03 REFERENCED STANDARDS

A. American National Standards Institute (ANSI):
1. ANSI A117.1 Accessible and Usable Buildings and Facilities.

B. Builders Hardware Manufacturers Association (BHMA):
1. ANSI/BHMA A156.1 Butts and Hinges.
2. ANSI/BHMA A156.2 Bored and Preassembled Locks and Latches.
3. ANSI/BHMA A156.3 Exit Devices.
4. ANSI/BHMA A156.4 Door Controls - Closers.
5. ANSI/BHMA A156.5 Auxiliary Locks and Associated Products.
6. ANSI/BHMA A156.6 Architectural Door Trim.
7. ANSI/BHMA A156.7 Template Hinge Dimensions.
8. ANSI/BHMA A156.8 Door Controls - Overhead Stops and Holders.
9. ANSI/BHMA A156.13 Mortise Locks and Latches.
10. ANSI/BHMA A156.15 Release Devices: Closer Holders, Electromagnetic and Electromechanical.
11. ANSI/BHMA A156.16 Auxiliary Hardware.
12. ANSI/BHMA A156.18 Materials & Finishes.
13. ANSI/BHMA A156.19 Power Assist & Low Energy Power Operated Doors.
14. ANSI/BHMA A156.21 Thresholds.
15. ANSI/BHMA A156.22 Door Gasketing and Edge Seal Systems.
16. ANSI/BHMA A156.23 Electromagnetic Locks.
17. ANSI/BHMA A156.25 Electrified Locking Devices.
18. ANSI/BHMA A156.26 Continuous Hinges.
19. ANSI/BHMA A156.28 Recommended Practices for Mechanical Keying Systems.
20. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors with Steel Frames.
21. ANSI/BHMA A156.115W Hardware Preparation in Wood Doors with Wood or Steel Frames.

C. Door and Hardware Institute (DHI):

1. ANSI/DHI A115.IG Installation Guide for Doors and Hardware
2. DHI Keying Systems and Nomenclature
3. DHI Sequence and Format for the Hardware Schedule

D. International Building Code (IBC)

E. NYCBC – New York City Building Code

F. National Fire Protection Association (NFPA):
1. NFPA 80 Fire Doors and Fire Windows
2. NFPA 252 Fire Tests of Door Assemblies

G. Underwriters Laboratories Inc. (UL):
1. UL 10C Positive Pressure Fire Tests Of Door Assemblies
2. UL 305 Panic Hardware
3. UL 437 Drill and Pick Resistant Key Cylinders
4. UL 1034 Burglary-Resistant Electric Locking Mechanisms

1.04 SUBMITTALS

A. Products other than those designated herein must be approved as substitutions prior to submittal of Door Hardware.

B. Door Hardware Schedule: Vertical format conforming to DHI “Sequence and Format for the Hardware Schedule.” Horizontal format schedules will be rejected without review. Format shall be 8-1/2 by 11 inch page size. Organize Schedule into headings, grouping doors to receive same hardware items, indicating quantity and complete designations of every item required for each door opening.

C. Schedule shall be submitted in searchable digital file format.

D. The schedule shall include:
1. Cover sheet indicating name and location of Project; name of Architect; name of Contractor; name, address and phone of hardware supplier, name of hardware consultant preparing the schedule; date of submittal or revised submittal.
2. A list of abbreviations used in schedule.
3. An index of door openings, listed in numerical order, with hardware heading identification cross-referenced to Architect’s set identification.
4. Hardware headings shall be listed in numerical order corresponding, as closely as possible, with numerical order of Architect's set numbers.
5. Each hardware heading shall have each door listed in numerical order according to door numbers in the Architect's door schedule, and denoting: location, configuration (single, pair, etc.), type (elevation, etc.), door and frame size(s), door and frame material(s), handing, fire rating, and key set identification.
6. Type, complete model number, style, function, size, hand, and finish of each door hardware item.
7. Manufacturer of each item.
8. Fastenings and other pertinent information.

E. Manufacturer's Technical Product Data / Catalog Cut Sheets: Clearly marked for each hardware item, including installation details, material descriptions, dimensions of individual components and profiles, and finishes. Format shall be 8-1/2 by 11 inch page size.

F. Wiring Diagrams: No later than 14 days after receipt of reviewed hardware schedule submittal, submit detailed wiring diagrams for power, signaling, monitoring, and control of

the access control system electrified hardware or other system electrified components such as sensors, switches, or indicator/ strobe lights; identified by door number(s), and detailed specifically for each type and function of electrified door opening. Format shall be 8-1/2 by 11 inch page size. Include the following:

1. System Description of Operation. Include description of component functions including, but not limited to, the following situations: normal secured/unsecured state of door; authorized access; authorized egress; unauthorized access; unauthorized egress; fire alarm and loss of power conditions, and interfaces with other building control systems.
2. Elevation single-line diagram, showing interface between electrified door hardware and fire alarm, power, access control, and security systems as applicable.
3. Point-to-point wiring diagram for field-installed wiring.

G. Keying Schedule: In accordance with Owner's final keying instructions for locks. Conform to DHI “Keying Systems and Nomenclature.” Format shall be 8-1/2 by 11 inch page size.

H. Operation and Maintenance Data: Provide complete operating and maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides.

I. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

J. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

B. Manufacturers, Hardware Supplier, and Installer shall have no less than five years’ experience in the provision of Door Hardware for projects similar in size, complexity and type to this Project.

C. Hardware Schedule and Keying Schedule submittals shall be prepared by a Hardware Consultant holding the credentials of Architectural Hardware Consultant (AHC) issued by the Door and Hardware Institute. Hardware Consultant shall have no less than five years’ experience in the scheduling of Door Hardware for projects similar in size, complexity and type to this Project; and shall be available, at no additional cost, during the course of the Work to consult with Contractor, Architect, and Owner regarding door hardware and keying.

1.06 REGULATORY REQUIREMENTS

A. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with all applicable regulations, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. At rated doors with panic exit devices, provide devices labeled as “Fire Exit Device.”

B. Comply with all applicable accessibility regulations as set forth in the 2010 ADA Standards.

C. Latching and locking doors that are hand-activated and that are in a path of travel shall be operable with a single effort by lever-type hardware, panic bars, push-pull activating bars, or other hardware designed to be easy to grasp with one hand, not requiring tight

grasping, tight pinching or twisting of the wrist; from egress side shall not require the use of a key, tool, or special knowledge for operation.

1. All hand-activated hardware shall be mounted between 34 inches and 48 inches above finished floor.

D. At sliding and pocket doors, when fully open, operating hardware shall be exposed and usable from both sides.

E. Door closing devices shall comply with the following maximum opening-force requirements:
1. Interior Hinged Doors: 5 lbf applied perpendicular to door at latch.
2. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
3. Fire Rated Doors: 5 lbf applied perpendicular to door at latch. To ensure latching, may be increased to the minimum force allowable by the appropriate administrative authority, not to exceed 15 lbf.

F. Thresholds shall be maximum 1/2 inch in height above floor and landing on both sides of openings. Bevel raised thresholds with a slope of not more than 1:2.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Each article of hardware shall be delivered individually packaged in the manufacturer's standard commercial carton or container, and shall be properly marked or labeled to be readily identifiable with the approved hardware schedule.

B. Manufacturer's printed installation instructions, fasteners, and special tools shall be included in each package.

C. Hardware shall be stored in a dry, secure locked area, complete with shelving for unpacking and sorting of the door hardware.

D. Deliver all master keys by restricted, receipted delivery directly from the manufacturer to the Owner.

1.08 COORDINATION

A. Provide hardware templates to the parties involved for doors, frames, and other work specified to be factory prepared for door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. When required by door or frame fabricator, furnish physical samples of each mortised and recessed hardware item required.

C. Coordinate layout and installation of recessed pivots and closers with floor construction.

D. Electrical System Rough-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, and security system as applicable.

E. Pre-Installation Conference: Arrange conference at job site to coordinate door, frame, hardware and electronic security hardware installation; to be attended by the Architect, Owner, Contractor and representative personnel of firms involved in the provision and installation of said items.

F. Keying Conference: Arrange conference with Owner, or designated representative, and Manufacturer's/ Hardware Supplier's Architectural Hardware Consultant to establish keying requirements. Incorporate keying conference decisions into Keying Schedule.

1.09 WARRANTY

A. In addition to, and not precluding, other warranty requirements in the Contract Documents, the following hardware items shall carry extended minimum warranties as indicated:
1. Hinges: Ten years from date of Substantial Completion.
2. Locks: Five years from date of Substantial Completion.
3. Exit Devices: Three years from date of Substantial Completion.
4. Door Closers: Ten years from date of Substantial Completion.

1.10 MAINTENANCE

A. Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2- PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements herein, provide products by one of the following manufacturers for each type of hardware:
1. Hinges: Bommer, Hager, McKinney, or equal.
2. Door Push Plates and Pulls: Burns, Rockwood, Trimco, or equal.
3. Flush Bolts and Surface Bolts: Burns, Rockwood, Trimco, or equal.
4. Patented Cylinders: Medeco x4 7 Pin, or equal.
5. Mortise Locks: Sargent 8200 , or equal.
6. Mortise Deadlock: Sargent 4870, or equal.
7. Push Rail Exit Devices: Von Duprin 98/99 Series , or equal.
8. Tube Steel Removable Mullion: Sargent L980S Series , or equal.
9. Door Closers: Exterior: LCN 4000 Series , or equal.; Interior; Corbin Russwin DC6200 Series , or equal.
10. An ADA-compliant power-operated door with either arm-height (42") and foot-plate-height (6") push plate type actuator switches or continuous vertical push plate shall be provided at no less than one entrance (preferably the main entrance) for all campus buildings. Locations shall be approved by the University. b. All ADA door operator push buttons shall be located within 10 feet of the door and shall be located so as to not encroach the door opening

2.02 MATERIALS AND FABRICATION

A. Requirements for grade, materials, size, and other distinctive qualities of each type of door hardware are indicated herein. Furnish items in types, sizes or weight, in accordance with manufacturer's standards, appropriate for the conditions of installation and service, unless otherwise indicated.

B. Products named or identified by make or model number, or other designation and described herein are base products. Base products establish the standards of type, in-service performance, physical properties, appearance, warranty, cost, and other characteristics required by the Project.

2.03 FASTENERS

A. Provide concealed fasteners for hardware items on exterior doors which are exposed when door is closed.

B. Combination machine screws and expansion shields shall be used for attaching hardware to concrete or masonry.

C. Fasteners exposed to the weather in the finished work shall be of brass, bronze, or stainless steel.

2.04 BUTT HINGES

A. Butt hinges shall meet the requirements of ANSI/BHMA A156.1.

B. Hinge dimensions shall meet the requirements of ANSI/BHMA A156.7.

C. Base Metal shall be steel plated for fire-rated doors; bronze or stainless steel for exterior out swinging doors; bronze or plated steel elsewhere as scheduled.

D. Provide hinges with antifriction bearings for doors with closers.

E. Unless otherwise indicated, provide hinges in heights and weights as follows:
1. Doors to 36 inches wide: 4-1/2 inches Standard Weight.
2. Doors over 36 inches to 48 inches wide: 5 inches Heavy Weight.
3. Doors over 48 inches wide: 6 inches Heavy Weight.
4. Doors to 36 inches wide with exit devices: 4-1/2 inches Heavy Weight.
5. Doors over 1-3/4 inch thick shall be per hinge manufacturers published listings or recommendations.

F. Provide in minimum width sufficient to clear trim when door swings 180 degrees, whether or not shown on Drawings to swing 180 degrees.

G. Number of hinges per leaf shall be as follows:
1. Doors to 60 inches in height: 2 hinges.
2. Doors over 60 to 90 inches in height: 3 hinges.
3. Doors over 90 to 120 inches in height: 4 hinges.
4. For doors over 120 inches in height: 4 hinges plus 1 hinge for every 30 inches, or fraction thereof, door height greater than 120 inches.

H. Screws: Flat head wood screws not less than 1-1/2 inches long for hinges for wood doors; flat head machine screws elsewhere.

I. Hinges reverse bevel doors with key locks shall have pins that are made non-removable [NRP] when the door is in the closed position by means of a set screw in the hinge pin barrel. Where passage or privacy sets, push/pulls openings are specified, non-removable pins are not required.

J. Electrified hinges:
1. Coordinate number and size of wires for electrified hardware served.
2. Provide junction box/ mortar shield for each electrified hinge.
3. All electric hinges to have quick connector-type connectors.

2.05 PIVOT HINGES

A. Pivot hinges shall meet ANSI/BHMA A156.4 Grade 1 requirements.

B. Pivots shall be constructed of steel, cast or forged bronze, or stainless steel as indicated by BHMA finish specified.

C. Where offset pivots are used, provide intermediate pivots as follows:
   1. Doors over 60 to 90 inches in height provide one intermediate pivot.
   2. For doors over 90 inches in height provide one additional intermediate pivot for every 30 inches, or fraction thereof.

D. Electrified pivots:
   1. Coordinate number and size of wires for electrified hardware served.
   2. Provide junction box/ mortar shield for each electrified pivot.

E. All electric pivots to have quick connector-type connectors.

2.06 CYLINDERS, KEYING AND KEY STORAGE

A. Lock cylinders shall meet ANSI/BHMA A156.5 requirements.

B. Keying system shall meet ANSI/BHMA A156.28 requirements.

C. All cylinders shall be interchangeable core type.

D. Provide mortise or rim type cylinders as required by device for all exit devices having key locking function.

E. Keying shall be provided per the Owner's requirements.

F. Cylinders shall be keyed according to approved Keying Schedule.

G. Provide a temporary keying system for interim use during construction.

H. Provide change keys in individual envelopes for each cylinder delivered. Envelopes shall be marked with respective door identification numbers.

I. Key set symbol, and inscription "Do Not Duplicate" shall be stamped on all keys.

J. Key set symbol shall be concealed stamped on all cylinders/ removable/ Interchangeable cores.

K. Keys shall be supplied as follows:
   1. Locks: 2 change keys each lock.
   2. Master keyed sets: 2 keys each set.
   3. Grand master keys: 5 total.
   4. Great Grand master keys: 5 total.
   5. Interchangeable Core control keys: 2 total.
   6. Construction keys: 10 total.
   7. Blank keys: 100 total.

2.07 LOCKSETS AND LATCHSETS

A. Mortise Locks and Latches shall meet ANSI/BHMA A156.13 Grade 1 requirements.

B. Auxiliary Locks shall meet ANSI/BHMA A156.5 requirements.

C. Electrified Locks shall also meet ANSI/BHMA A156.25 requirements.

D. Operating trim shall be lever type: Refer to hardware sets.

E. Lock functions which include thumb turn trim shall be provided with thumb turns compliant with accessibility code requirements.

F. Lock Throw: Comply with requirements for length of latch bolts to comply with labeled fire door requirements.

G. Lock backset shall be 2-3/4 inches unless otherwise indicated.

H. Extended spindle as required based on door thickness.

I. Electromechanical locksets utilized at fire rated openings shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction, and shall maintain door in positive latched position when power is off.

J. Narrow backset locksets to be used when standard width/ backset devices do not fit door stile.

K. Provide occupancy indicator at all cylindrical and mortise privacy sets. Architect to select if wording to be Unlocked/Locked or Vacant/Occupied. Indicator shall be at each side of door. Example, Sargent V11/V21.

L. All electric locks to have quick connector-type connectors.

2.08 EXIT DEVICES

A. Exit devices and exit device accessories shall meet ANSI/BHMA A156.3, Grade 1 requirements.

B. Electromechanical exit devices shall also meet ANSI/BHMA A156.25 requirements.

C. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

D. Fire Exit Devices: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

E. Outside Trim: Design, material and finish to match locksets, unless otherwise indicated.

F. Extended spindle as required based on door thickness.

G. Adjustable strikes shall be provided for rim type and vertical rod devices.

H. Fire Exit Removable Mullions: Where indicated, provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions shall be used only with exit devices for which they have been tested.

I. Electromechanical exit devices utilized at fire rated openings shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction, and shall maintain door(s) in positive latched position when power is off.

J. Narrow backset devices shall be provided to match specified device when standard width chassis/ devices do not fit door stile.

K. Provide flush end caps at exit devices.

L. Provide device for proper door width and thickness.

M. Weatherized exit device:
1. Areas where hardware is prone to corrosion provide powder coated metal finish.

N. At locations where exit devices are being used in a Pool/Aquatic area, provide 628 or powder coated metal finish.

O. All electric exit devices to have quick connector-type connectors.

2.09 ELECTROMAGNETIC LOCK ASSEMBLIES

A. Electromagnetic lock assemblies shall meet ANSI/BHMA A156.23 Grade 1 requirements and be labeled under UL 294

B. Locks shall be field-selectable for 12 or 24 VDC operation, and provide 1,500 lbf minimum holding force for direct pull applications and 2,000 lbf holding force for shear type applications.

C. Wiring connections shall be via on-board screw terminal connections. Lock shall have built-in circuit/ surge and voltage kickback suppression protection.

D. Where indicated, locks shall be equipped with concealed sensors to monitor magnetic bond status and door position status.

E. Locks used on fire rated doors shall be listed and labeled for such use by a testing agency acceptable to authorities having jurisdiction.

F. All electric magnetic locks to have quick connector-type connectors.

2.10 FLUSH BOLTS

A. Automatic flush bolts shall meet ANSI/BHMA A156.3

B. Manual flush bolts shall meet BHMA A156.16 requirements.
1. Bottom bolt shall have 12 inch long operating rod. Top bolt operating rod shall be determined by door height, assuring the operator is located less than 72 inches above the floor.
2. Manual Flush Bolts are not to be utilized except where a pair of non-rated doors serving a room not normally occupied is needed for the movement of equipment.

C. Provide dust proof strikes for bottom bolts. Dust proof strikes shall meet BHMA A156.16.

2.11 DOOR COORDINATORS

A. Door coordinators shall meet ANSI/BHMA A156.3 requirements.

B. Door coordinators shall be flat bar type; stop mounted with all necessary filler bars and mounting brackets to accommodate required hardware.

C. Provide carry bar at each pair of doors equipped with an overlapping astragal, except when automatic or self-latching bolts are used.

2.12 SURFACE DOOR CLOSERS

A. Door closing devices shall meet ANSI/BHMA A156.4, Grade 1 requirements.

B. Surface closers shall be fully adjustable with sweep speed, latch speed and back check position valves.

C. Provide closers size adjusted in accordance with ANSI/BHMA A156.4; sized as required to ensure closing and latching of doors.

D. Arm selection shall follow the requirements of the manufacturer's recommendations with brackets, drop plates and miscellaneous accessories provided as necessary.

E. Provide closers with arms designed to permit openings of doors as far as job conditions will permit; unless otherwise indicated closers with arms restricting opening of door will not be acceptable.

F. Provide spacer, blade stop, drop plate as required for door and frame.

2.13 FLOOR CLOSERS

A. Floor Closers shall meet ANSI/BHMA A156.4, Grade 1 requirements.

B. Closers shall be fully adjustable with sweep speed, latch speed and back check position valves.

C. Floor closers shall have cement boxes.

D. Pivots used on doors with floor closers shall be of the same manufacturer as the floor closers.

E. Provide flush floor cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.

F. Provide recessed floor plates/ pans to accommodate insert of floor finish material for floor closers, unless thresholds are indicated. Provide extended closer spindle to accommodate thickness of floor finish.

2.14 ELECTROMAGNETIC HOLDER / RELEASES

A. Electromagnetic holders shall meet ANSI/BHMA A156.15 requirements.

B. Size and configuration shall provide degree of swing and hold open position as indicated on the drawings.

C. Coordinate length for attachment based on lever and locking device trim to wall.

2.15 ARCHITECTURAL DOOR TRIM

A. Architectural door trim shall meet ANSI/BHMA A156.6 requirements.

B. Door Protection Plates: Kick, mop, and armor plates shall be 0.050 inch thick brass, bronze, or stainless steel depending on finish indicated. Plates shall have beveled edges, and shall be provided with countersunk mounting holes and No. 6 oval head screw fasteners. Width of kick and armor plates shall be 2 inches less than door width for single doors and 1 inch less for pairs of doors. Width of mop plates shall be 1 inch less than door width.
   1. Kick Plates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.

2. Mop Plates: Provide with four beveled edges ANSI J103, 4 inches high by width less 1 inch on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.
3. Armor Plates: Provide ANSI J101 with four beveled edges, 30 inches high by width less 1 inch on single or pairs of doors. Furnish oval-head countersunk screws to match finish.
4. At fire rated doors, provide UL labeled protection plates in sizes, types, fasteners and materials only in accordance with door manufacturer's listings for respective ratings.
5. Provide cutouts for hardware as listed in the hardware sets.

C. Door Edging and Astragals: Fabricated from 18 gauge cold-rolled steel or 304 stainless steel as indicated; factory prepared for all mortise hardware; countersunk screw mounting.
1. At fire rated doors, provide UL labeled edge protection in sizes, types, fasteners and materials only in accordance with door manufacturer's listings for respective ratings.

D. Push and pull plates shall be 0.050 inch thick brass, bronze, or stainless steel depending on finish indicated. Plates shall have beveled edges, and shall be furnished with countersunk mounting holes and No. 6 oval head screw fasteners. Pull plates shall also be furnished with flat-head through bolts for pull grip.

E. Push and pull bars and grip handles shall be brass, bronze, or stainless steel depending on BHMA finish indicated.

2.16 AUXILIARY HARDWARE

A. Auxiliary hardware shall meet ANSI/BHMA A156.16 requirements.

B. A door stop shall be bid/provided at every door location, regardless if one is itemized in the heading/group.

C. Door Stops: Provide floor stop or wall bumper. Where it is not possible to properly place a floor or wall type stop, provide heavy duty surface overhead type stop, or when door closer is indicated on the push side of the door, provide heavy-duty dead stop function in closer.
1. Stops shall be of heavy duty construction.
   a. Wall bumpers shall have no visible fasteners.
   b. Floor stops shall be of height required by floor conditions.
   c. At areas where ligature resistant is required, provide Kingsway Group KG182.
2. Overhead Stops
   a. Overhead holders and stops shall meet ANSI/BHMA A156.8 requirements.
   b. Overhead door holders and stops shall be adjustable from 90 to 110 degrees dead stop or hold open position, as applicable.
   c. Overhead door stops shall have shock absorbers providing 5 to 7 degrees compression before dead stop.
   d. Overhead stops shall not be provided with hold open function when used at fire rated doors.
   e. Overhead stop to work with closer.

D. Silencers: Rubber, non-marring configured for metal or wood frames as scheduled. Provide quantity based on door size.

2.17 ELECTRICAL POWER TRANSFERS

A. Electrical power transfers shall be capable of transferring sufficient electrical current to properly operate electrified hardware in door.

B. Electrical power transfers used on fire rated doors shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

C. Verify and provide at all doors with Pivots.

D. At frames that are 1.5” or less or doors with swing clear hinges, provide Securitron EPT or ABH PT1000SC power transfer.

E. Provide with quick connector. Coordinate with hardware item being provided.

2.18 POWER SUPPLIES FOR ELECTRIFIED HARDWARE

A. Power supplies shall be UL listed for applicable use; shall be housed in an approved enclosure; and provide both Class 1 and Class 2 outputs. Provide security relays as part of power supply.

B. Output shall be filtered and regulated. Relay, timer, and logic modules shall be provided as required for interface to related security components; and shall be assembled, connected, and fully contained within the power supply enclosure. A fire alarm emergency release input terminal shall be provided for connection to fire / life safety system at fire-rated openings.

C. Power supplies shall provide sufficient power capacity for the worst-case condition that could occur in the operating environment without any loss or degradation of operation.

D. Power supplies shall be provided at all doors where electric latch retraction is specified.

2.19 ELECTRIFIED ACCESSORIES

A. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
   1. Provide one each of the following tools as part of the base bid contract:
      a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
      b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.
   2. Manufacturers - Coordinate with hardware item being provided:
      a. Hager Companies (HA) - Quick Connect.
      b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – QC-C Series.
      c. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – PoE Series.
      d. Allegion CON.
      e. dormakaba

B. Request-to-Exit Motion Sensor: Request-to-Exit Sensors motion detectors specifically designed for detecting exiting through a door from the secure area to a non-secure area. Include built-in timers (up to 60 second adjustable timing), door monitor with sounder alert, internal vertical pointability coverage, 12VDC or 24VDC power and selectable relay trigger with fail safe/fail secure modes.

2.20 DOOR BOTTOMS

A. Door bottoms shall be of aluminum or extruded bronze of the type and finish indicated and shall provide proper clearance and an effective seal with specified thresholds.

B. Door bottom shall have a vinyl, neoprene, silicone rubber, polyurethane or brush seal as indicated.

C. The door bottom shall exclude light when the door is in the closed position and shall inhibit the flow of air through the unit.

D. Concealed automatic door bottoms must extend the full width of the door. If door requiring concealed door bottom has conflicting concealed hardware provide narrow mortised door bottoms similar to Pemko US-FHRD.

2.21 METAL THRESHOLDS

A. Thresholds shall meet ANSI/BHMA A156.21 requirements.

B. Thresholds shall be heavy-gauge aluminum or bronze of the configuration and finish indicated, and shall provide an effective seal with door bottom.

C. Where required, thresholds shall be prepared to accommodate floor closers, pivots, and projecting bolts of latching hardware.

D. Thresholds at floor closers shall have mitered returns and removable access portion for floor closer maintenance.

E. Provide thresholds at doors where indicated. Refer to Door Schedule and Drawing details for type and configuration required. Additionally, where combustible flooring passes under doors, provide fire door thresholds in accordance with applicable regulatory requirements.

2.22 METAL HOUSED TYPE WEATHERSTRIP

A. Metal Housed Type Weatherstrip shall meet ANSI/BHMA A156.22 requirements.

B. Metal Housed Type Weatherstrip shall be aluminum or bronze of the type and finish indicated, comprised of metal retainers with vinyl, neoprene, silicone rubber, polyurethane or brush inserts as indicated.

2.23 GASKETING

A. Gasketing shall meet ANSI/BHMA A156.22 requirements.

B. Shall be a compression type product for use with wood or steel doors; labeled for use on smoke-control and fire-rated doors where required.

2.24 FINISHES

A. Provide hardware in finishes as indicated in hardware set or as noted below:

B. Closers shall be Powder Coated.

C. Adhesive Gasketing shall be black.

D. Hardware at NMR room to be clear powder coated

E. Hardware finishes for interior hardware to be US26D/626 Satin Chrome.

F. Hardware finishes for exterior hardware to be corrosive resistant and clear powder coated in US26D/US32D.

~~D.~~

PART 3- EXECUTION

3.01 EXAMINATION

A. Examine doors and frames for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine rough-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Steel doors shall be factory prepared for hardware per ANSI/BHMA A156.115.

B. Wood doors shall be factory prepared for hardware per ANSI/BHMA A156.115W.

C. Installation shall be in accordance with DHI A115.IG.

D. Hardware for fire door assemblies shall be installed conforming with NFPA 80, and all other applicable building codes and regulations.

E. Hardware for smoke door assemblies shall be installed conforming with NFPA 105, and all other applicable building codes and regulations.

F. Install each door hardware item according to manufacturer's printed instructions, utilizing templates and proper fasteners provided by manufacturer.

G. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

H. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in other Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

I. Install each door hardware item to comply with manufacturer's written instructions. Install overhead surface closers for maximum degree of opening obtainable. Place on room

side of corridor doors, stair side of stair doors, secondary corridor side of doors between corridors. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be finished, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

J. All wall stops shall be installed with reinforced blocking in wallboard construction. Drywall anchors are not an acceptable means of reinforcement/blocking. Provide intermediate steel plates or channel reinforcement backing at wall stops mounted in wallboard construction.

K. Do not install permanent key cylinders in locks until the time of preliminary acceptance by the Owner. At the time of preliminary acceptance, and in the presence of the Owner's representative, permanent key all lock cylinders. Record and file all keys in the key control system specified, and turn system over to Owner for sole possession and control.

L. Thresholds shall be secured with a minimum of 3 fasteners per single door width and 6 fasteners per double door width with a maximum spacing of 12 inches; with a minimum of 1 inch thread engagement into the floor or anchoring device used. Thresholds over 6 inches in width shall be secured with a double row of fasteners.

M. Exterior thresholds shall be installed in a bed of sealant with combination expansion anchors and stainless steel machine screws, except that bronze or anodized bronze thresholds shall be installed with expansion anchors with brass screws.

3.03 DOOR CLOSING DEVICES

A. Surface closers on doors opening to or from halls and corridors shall be mounted on the room side of the door.

B. Surface closers on doors opening into stairs or stair vestibules shall be mounted on the stair or stair vestibule side of the door.

C. Surface closers on exterior doors shall be mounted on the interior side of building utilizing regular arm, or parallel arm mounting as required.

D. Door closing devices with adjustable spring power shall be adjusted for proper door operation, and compliance with all applicable codes and regulations.

E. Cutting of gasketing or weatherstripping to accommodate closer installation is not acceptable.

3.04 PUSH-PULL PLATES

A. Pull plate grip handles shall be through bolted through the door. When push plate is indicated on opposite door side, through bolts shall be countersunk with push plate mounted to conceal through bolts.

3.05 GASKETING/ WEATHERSTRIPPING

A. Prevent conflicts with other installed hardware mounted in the same location.

B. Coordinate door sweep and door bottom widths to prevent conflicts with other door hardware such as continuous hinges. Door bottoms shall be installed full width of door to create a full seal.

3.06 ASTRAGALS

A. Unless otherwise indicated install overlapping astragals as follows:
   1. At out-swing pairs of doors, mount astragal on active leaf.
   2. At in-swing pairs of doors, mount astragal on inactive leaf.

3.07 HARDWARE LOCATIONS

A. Unless otherwise indicated install hardware as follows or as local codes require:
   1. Bottom Hinge: 10 inches from door bottom to bottom of hinge.
   2. Top Hinge: 5 inches from door top to top of hinge.
   3. Center Hinge(s) or Pivot(s): Spaced equidistantly between top and bottom hinges/ pivots.
   4. Lockset / Latchset: 38 inches from finished floor to center of lever.
   5. Hospital Push-Pull Latchset/ Lockset: 42 inches from finished floor to center of latch.
   6. Exit Device: 38 inches from finished floor to device centerline.
   7. Deadlock: 42 inches from finished floor to center key cylinder / thumb turn.
   8. Push Plate/ Pull Plate: 42 inches from finished floor to center of pull.
   9. Wall Bumper: Centered at point on wall where lever, or other operating trim, first makes contact with wall.
   10. Floor Stop: Adjacent to wall; not to exceed 4 inches from face of wall; located 3 inches from latch edge of door; in any case never more than 50 percent of door width from latch edge of door.

3.08 ADJUSTING

A. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended.

B. Engage a factory-authorized service representative to adjust door closing devices, compensating for final operation of heating and ventilating equipment, and to comply with referenced accessibility requirements.

C. Follow-up Adjustment: Approximately 6 months after date of Substantial Completion, Installer shall perform the following:
   1. Examine and readjust each item of door hardware as necessary to ensure function of door hardware.
   2. Consult with and instruct Owner's personnel on recommended maintenance procedures.
   3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

D. Where door closers are provided, adjust sweep speed so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum.

3.09 COMPLETION

A. When complete all hardware shall be properly secured in place and all exposed surfaces shall be clean and free from scratches, paint, and other defects and damages.

B. Contractor shall demonstrate that all keys properly operate the locks as identified in the approved Keying Schedule.

3.10 DOOR HARDWARE SETS

A. The following is a general listing of hardware requirements. Provide hardware items required by established standards and practices to meet state and local codes, whether or not specifically indicated in the following sets.

B. Silencers and gasketing, where listed in Hardware Sets, may be omitted at openings where door frames are provided with integral seals if integral seals satisfy all applicable Codes and Regulations.

C. Refer to Door Schedule and/ or Drawings for door opening information, hardware set assignment, and related requirements.

D. Door contacts shall be prepped for where indicated on security drawings.

E. Access Control Reader where indicated on security drawings.

F. Provide spacer, blade stop, drop plate as required for door closers.

G. At aluminum openings, coordinate gasketing, and/or astragal with Aluminum Entrances and Storefronts Section.

H. Coordinate Hinges, Sound Seals, Door Bottoms, Thresholds and any other requirements for Acoustical Ratings as required.

Set: 1.0

Description: Paired Opening - Exterior, Main Entry, Access Controlled, ADO

2	Continuous Hinge	CFM_SLF-HD1-M x Length Required	Pemko
1	Glass Door Exit Device	PA300 x Full Height Pull x Key	CRL
1	Glass Door Exit Device	PA300 x Full Height Pull x No Key	CRL
	Electric Strike	ES3101-DBL	Folger Adams
	Overhead Concealed Operator	SW200i-OHC	Besam
2	Sweep	By Door Manufacturer	
1	Threshold	By Door Manufacturer	
2	Wall Switch	MS41	BEA
1	Note:	Gasket provided with Aluminum Door and Frame	
1	Bollard	SQ25	Wikk

Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Upon loss of power door to remain locked from keyed side.
* Coordinate Power with Electrical/LV Contractor
* Provide Door/Frame Harnesses

Set: 1.5

Description: Paired Opening - Exterior, Main Entry, Access Controlled, ADO

2 Continuous Hinge	CFM_SLF-HD1-M x Length Required	Pemko
1 Glass Door Exit Device	PA300 x Full Height Pull x Key	CRL
1 Glass Door Exit Device	PA300 x Full Height Pull x No Key	CRL
Electric Strike	ES3101-DBL	Folger Adams
2 Overhead Concealed Closers	By Door Manufacturer	
2 Overhead Stops	9-ADJ Series	Rixson
2 Sweep	By Door Manufacturer	
1 Threshold	By Door Manufacturer	
2 Wall Switch	MS41	BEA
1 Note:	Gasket provided with Aluminum Door and Frame	

Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Upon loss of power door to remain locked from keyed side.
* Coordinate Power with Electrical/LV Contractor
* Provide Door/Frame Harnesses

Set: 2.0

Description: Paired Opening - Exterior, Main Entry, Access Controlled

2	Continuous Hinge	CFM_SLF-HD1-M x Length Required	Pemko
1	Glass Door Exit Device	PA300 x 24-inch High Height Pull x Key	CRL
1	Glass Door Exit Device	PA300 x 24-inch High Height Pull x No Key	CRL
	Electric Strike	To Suit Exit Device	CRL
2	Overhead Concealed Closers	By Door Manufacturer	
2	Overhead Stops	9-ADJ Series	Rixson
2	Sweep	By Door Manufacturer	
1	Threshold	By Door Manufacturer	
1	Note:	Gasket provided with Aluminum Door and Frame	

Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Upon loss of power door to remain locked from keyed side.
* Coordinate Power with Electrical/LV Contractor
* Provide Door/Frame Harnesses

Set: 3.0

Description: Single Opening - Exterior, Access Controlled

1 Continuous Hinge	CFM_SLF-HD1-M x Length Required	Pemko
1 Glass Door Exit Device	PA300 x 24-inch High Height Pull x Key	CRL
1 Electric Strike	To Suit Exit Device	CRL
1 Overhead Concealed Closers	By Door Manufacturer	
1 Overhead Stops	9-ADJ Series	Rixson
1 Sweep	By Door Manufacturer	
1 Threshold	By Door Manufacturer	
1	Gasket provided with Aluminum Door and Frame	

Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Upon loss of power door to remain locked from keyed side.
* Coordinate Power with Electrical/LV Contractor
* Provide Door/Frame Harnesses

Set: 4.0

Description: Single Opening - Exterior, Access Controlled

1 Continuous Hinge	CFM_SLF-HD1-M x Length Required	Pemko
1 Glass Door Exit Device	PA300 x 24-inch High Height Pull x Key	CRL
1 Electric Strike	To Suit Exit Device	CRL
1 Overhead Concealed Closers	By Door Manufacturer	
1 Overhead Stops	9-ADJ Series	Rixson
1 Sweep	By Door Manufacturer	
1 Threshold	By Door Manufacturer	
1	Gasket provided with Aluminum Door and Frame	
1 Bollard	SQ25	Wikk

Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Upon loss of power door to remain locked from keyed side.
* Coordinate Power with Electrical/LV Contractor
* Provide Door/Frame Harnesses

Set: 5.0

Description: Single Opening – Exterior, Access Controlled, Loading Dock, Roof (Exterior)

1 Continuous Hinge	CFM_SLF-HD1-M SER12 x Length Required	Pemko
1 Electrified Mortise Lock	R01 NAC-82271 LNJ	Sargent
1 Surface Closer x Stop Arm	4040XP SCUSH	LCN
1 Kick Plate	K1050 10" high CSK BEV	Rockwood
1 Gasketing	S88BL (Head & Jambs)	Pemko
1 Gasketing (Head and Jambs)	700NA	NGP
1 Door Bottom	234AV	Pemko
1 Sweep	3452CNB x Length Required	Pemko
1 Threshold	273x224AFGT x Length Required x MSES25SS	Pemko
1 Threshold @ door 6CR01 & 6ST04.1	½" high x 7.75" thermally broken	
1 Door Harness		
1 Frame Harness		

Note: Key at interior side at roof door

Notes: Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Built in request to exit switch to shunt door contact where contacts are indicated on security drawings.
*Upon loss of power door to remain locked from key side.
*Coordinate power with electrical/LV contractor
* Provide door/frame harnesses

Set: 5.5

Description: Single Opening – Exterior, Access Controlled, Roof (Exterior) (Aluminum)

1 Continuous Hinge	CFM_SLF-HD1-M SER12 x Length Required	Pemko
1 Electrified Mortise Lock	R01 NAC-82271 LNJ (Stile to Suit Lock)	Sargent
1 Surface Closer x Stop Arm	4040XP SCUSH	LCN
1 Gasketing (Head and Jambs)	By Opening Manufacturer	
1 Door Bottom	By Opening Manufacturer	
1 Sweep	By Opening Manufacturer	
1 Threshold	½" high x 8" thermally broken	
1 Door Harness		
1 Frame Harness		

Note: Key at interior side

Notes: Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Built in request to exit switch to shunt door contact where contacts are indicated on security drawings.
*Upon loss of power door to remain locked from key side.
*Coordinate power with electrical/LV contractor
* Provide door/frame harnesses

Set: 6.0

Description: Paired Opening - Main Entry, Vestibule

2 Continuous Hinge	CFM_SLF-HD1-M x Length Required	Pemko
2 Glass Door Exit Device, Dummy	DH300 x Full Height Pull x Dummy Bar	CRL
1 Overhead Concealed Operator	SW200i-OHC	Besam
2 Sweep	By Door Manufacturer	
1 Threshold	By Door Manufacturer	
2 Wall Switch	MS41	BEA
1 Note:	Gasket provided with Aluminum Door and Frame	
1 Bollard	SQ25	Wikk

Set: 6.5

Description: Paired Opening - Main Entry, Vestibule

2 Continuous Hinge	CFM_SLF-HD1-M x Length Required	Pemko
2 Glass Door Exit Device, Dummy	DH300 x Full Height Pull x Dummy Bar	CRL
1 Overhead Concealed Operator	SW200i-OHC	Besam
2 Sweep	By Door Manufacturer	
1 Threshold	By Door Manufacturer	
2 Wall Switch	MS41	BEA
1 Note:	Gasket provided with Aluminum Door and Frame	

Set: 8.0

Description: Single Opening - Access Controlled

Hardware to be coordinated with Aluminum Framed Opening Specification Section

	Hinge (heavy weight)	TA2714	
1	Storeroom Lock	8204 LNJ – Wide Stile Required	Sargent
1	Electric Strike	1600	HES
1	Surface Closer	DC6200 x Spacer x Drop Plate	Corbin Russwin
1	Door Stop	Overhead Stop By Demountable Partition (or) 400 (Per Conditions)	
1	Frame Harness		
1		Gasket provided with Aluminum Door and Frame	

Notes: Provide overhead stop or wall stop per conditions

Set: 9.0

Description: Single Opening - Access Controlled, Event Space
Hardware to be coordinated with Aluminum Framed Opening Specification Section

1 Continuous Hinge	CFM_SLF-HD1-M x Length Required	Pemko
1 Glass Door Exit Device	PA300 x 24-inch High Height Pull x Key	CRL
1 Electric Strike	To Suit Exit Device	CRL
1 Overhead Concealed Closers	By Door Manufacturer	
1 Frame Harness		

Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Upon loss of power door to remain locked from keyed side.
* Coordinate Power with Electrical/LV Contractor
* Provide Door/Frame Harnesses

Set: 10.0

Description: Paired Opening – Access Controlled

	Hinge, Full Mortise	TA2714 [NRP]	McKinney
1	Dust Proof Strike	570	Rockwood
2	Flush Bolt	555 / 557 (As Required)	Rockwood
1	Electric Power Transfer	EL-CEPT	Securitron
1	Electrified Mortise Lock	NAC-82271 LNJ	Sargent
2	Conc Overhead Stop	6-ADJ Series	Rixson
2	Kick Plate	K1050 10" high CSK BEV	Rockwood
2	Silencer		
1	Protector Bar	R111LPB	Rockwood

Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Built in request to exit switch to shunt door contact where contacts are indicated on security drawings.
*Upon loss of power door to remain locked from key side.
*Coordinate power with electrical/LV contractor
* Provide door/frame harnesses

Notes: Provide two edge guards x 30" High

Set: 11.0

Description: Single Opening – Access Controlled, Custodial

	Hinge, Full Mortise	TA2714 [NRP]	McKinney
1	Electric Power Transfer	EL-CEPT	Securitron
1	Electrified Mortise Lock	NAC-82271 LNJ	Sargent
1	Surface Closer x Stop Arm Hold Open Arm	DC6200 Series	Corbin Russwin
1	Door Stop	6-ADJ Series (or) 400 (Per Conditions)	
1	Kick Plate	K1050 16" High x CSK x 4BE	Rockwood
	Silencer		
1	Door Harness		
1	Frame Harness		

Notes: Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Built in request to exit switch to shunt door contact where contacts are indicated on security drawings.
*Upon loss of power door to remain locked from key side.
*Coordinate power with electrical/LV contractor
* Provide door/frame harnesses

Set: 11.5

Description: Single Opening – Access Controlled, Custodial

	Hinge, Full Mortise	TA2714 [NRP]	McKinney
1	Electric Power Transfer	EL-CEPT	Securitron
1	Electrified Mortise Lock	NAC-82271 LNJ	Sargent
1	Surface Closer	DC6200 Series	Corbin Russwin
1	Door Stop	6-ADJ Series (or) 400 (Per Conditions)	
1	Kick Plate	K1050 16" High x CSK x 4BE	Rockwood
	Silencer		
1	Door Harness		
1	Frame Harness		

Notes: Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Built in request to exit switch to shunt door contact where contacts are indicated on security drawings.
*Upon loss of power door to remain locked from key side.
*Coordinate power with electrical/LV contractor
* Provide door/frame harnesses

Set: 12.0

Description: Single Opening - Access Controlled

	Hinge (heavy weight)	T4A3786 [NRP]	McKinney
1	Electric Power Transfer	EL-CEPT	Securitron
1	Mortise Exit Nightlatch, QEL, RX	.QEL .RX 9975L-NL x 996L[F]	Von Duprin
1	Surface Closer	DC6200 Series	Corbin Russwin
1	Kick Plate	K1050 10" high CSK BEV	Rockwood
1	Door Stop	400 (per conditions)	Rockwood
1	Gasketing	S88BL (Head & Jambs)	Pemko
1	Door Harness		
1	Frame Harness		

Notes: Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Built in request to exit switch to shunt door contact where contacts are indicated on security drawings.
*Upon loss of power door to remain locked from key side.
*Coordinate power with electrical/LV contractor
* Provide door/frame harnesses

Set: 13.0

Description: Paired Opening – Electrical, Generator

Hinge (heavy weight)	T4A3786 [NRP]	McKinney
1 Concealed Vert Rod Exit	9847.EO [F]	Von Duprin
1 Concealed Vert Rod Exit	9847.L .996L [F]	Von Duprin
2 Surface Closer	DC6200 Series	Corbin Russwin
2 Kick Plate	K1050 10" high CSK BEV	Rockwood
2 Door Stop	400	Rockwood
2 Astragal	303AS	Pemko
1 Gasketing	S88BL (Head & Jambs)	Pemko
1 Threshold (On Curb)	To Suit Sill Condition	

Set: 14.0

Description: Paired Opening - Equipment Storage

	Hinge, Full Mortise	TA2714 [NRP]	McKinney
1	Dust Proof Strike	570	Rockwood
2	Flush Bolt	555 / 557 (As Required)	Rockwood
1	Classroom Lock	8237 LNJ	Sargent
1	Surface Closer x Stop Arm Hold Open Arm	DC6200 Series	Corbin Russwin
2	Kick Plate	K1050 10" High x CSK x 4BE	Rockwood
1	Overhead Stop	6-ADJ Series	Rixson
2	Silencer		

Set: 15.0

Description: Single Opening – Classroom Lock

	Hinge, Full Mortise	TA2714 [NRP]	McKinney
1	Classroom Lock	8237 LNJ	Sargent
1	Surface Closer x Stop Arm Hold Open Arm	DC6200 Series	Corbin Russwin
1	Kick Plate	K1050 10” High x CSK x 4BE	Rockwood
	Silencer		

Set: 16.0

Description: Single Opening –Passage

	Hinge (heavy weight)	T4A3786 [NRP]	McKinney
1	Mortise Exit, Passage	9975.LBE.[F] .996L-BE	Von Duprin
1	Surface Closer	DC6200 Series	Corbin Russwin
1	Kick Plate	K1050 10” high CSK BEV	Rockwood
1	Door Stop	400	Rockwood
	Silencers		
1	Perimeter Gasket @ Rated Doors	S88BL Head and Jambs	Pemko

Set: 17.0

Description: Single Opening – Stairwell – Access Controlled

	Hinge (heavy weight)	T4A3786 [NRP]	McKinney
1	Electric Power Transfer	EL-CEPT	Securitron
1	Mortise Exit Device, QEL, RX	.QEL .RX 9875.L .M996L(Std) FS	Von Duprin
1	Surface Closer	DC6200 Series	Corbin Russwin
1	Kick Plate	K1050 10” high CSK BEV	Rockwood
1	Door Stop	400	Rockwood
1	Gasketing	S88BL (Head & Jambs)	Pemko
1	Sweep	3452CNB x Length Required	Pemko
1	Door Harness		
1	Frame Harness		

Notes: Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Built in request to exit switch to shunt door contact where contacts are indicated on security drawings.
*Upon loss of power door to remain locked from key side.
*Coordinate power with electrical/LV contractor
* Provide door/frame harnesses

Set: 18.0

Description: Single Opening – Access Controlled, Fire Rated Assembly Opening

Hardware provided by Fire Rated Assembly and Storefront Section

Hinges

Power Transfers

1 Rim Exit Device, LBR, Fail Safe Trimset, QEL, RX

1 Closer x Stop Arm

Perimeter Gasket

Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Built in request to exit switch to shunt door contact where contacts are indicated on security drawings.
*Upon loss of power door to remain locked from key side.
*Coordinate power with electrical/LV contractor
* Provide door/frame harnesses

Set: 19.0

Description: Paired Opening – Fire Rated Assembly Opening

Hardware provided by Fire Rated Assembly Section

Hinges

1 CVR Exit Device, LBR, Passage

1 CVR Exit Device, LBR, Exit Only

2 Closers x Regular Arm

Perimeter Gasket, Astragal

Hardware provided by 087100

2 Magnetic Hold Opens	996	Rixson

Set: 20.0

Description: Paired Opening – Electrical Closet, Access Controlled

Hinge, Full Mortise	TA2714 [NRP]	McKinney
1 Electric Power Transfer	EL-CEPT	Securitron
1 Auto Flush Bolt Set	2845	Rockwood
1 Dust Proof Strike	570	Rockwood
1 Coordinator	1700	Rockwood
1 Electrified Mortise Lock	NAC-82271 LNJ	Sargent
2 Surface Closer x Stop Arm	DC6200 Series	Corbin Russwin
2 Astragal	178SA	NGP
1 Gasketing	S88BL (Head & Jambs)	Pemko
1 Door Harness		
1 Frame Harness		

Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Built in request to exit switch to shunt door contact where contacts are indicated on security drawings.
*Upon loss of power door to remain locked from key side.
*Coordinate power with electrical/LV contractor
* Provide door/frame harnesses

Set: 21.0

Description: Single Opening – Single User Restroom

Hinge, Full Mortise	TA2714 [NRP]	McKinney
1 Privacy Lock	V21 8265 LNJ	Sargent
1 Surface Closer	DC6200 Series	Corbin Russwin
2 Kick Plate	K1050 10” high CSK BEV	Rockwood
1 Door Stop	400 (or) 441CU (As Required)	Rockwood
1 Gasketing	S88BL (Head & Jambs)	Pemko

Set: 22.0

Description: Single Opening – Lactation

Hinge, Full Mortise	TA2714 [NRP]	McKinney
1 Hotel Lock x Occupancy Indicator	V01 8250 LNJ	Sargent
1 Surface Closer	DC6200 Series	Corbin Russwin
1 Kick Plate	K1050 10” high CSK BEV	Rockwood
1 Door Stop	400 (or) 441CU (As Required)	Rockwood
1 Gasketing	S88BL (Head & Jambs)	Pemko
1 Door Bottom	234AV	Pemko
1 Aluminum Plate	18/1A	Pemko

Set: 23.0

Description: Single Opening – Multi-Stall Toilet

1 Continuous Hinge	A500	ABH
1 Push Pull	110x73C/73CL	Rockwood
1 Surface Closer	DC6200 Series	Corbin Russwin
2 Kick Plate	K1050 10” high CSK BEV	Rockwood
1 Door Stop	400 (or) 441CU (As Required)	Rockwood
Silencer		

Set: 24.0

Description: Single Opening – Access Controlled

	Hinge	TA2714 [NRP]	McKinney
1	Electric Power Transfer	EL-CEPT	Securitron
1	Electrified Mortise Lock	NAC-82271 LNJ	Sargent
1	Surface Closer	DC6200 Series	Corbin Russwin
1	Kick Plate	K1050 10” high CSK BEV	Rockwood
1	Door Stop	400 (or) 441CU (As Required)	Rockwood
1	Gasketing	S88BL (Head & Jambs)	Pemko
1	Door Harness		
1	Frame Harness		

Notes: Provide Stop arm at reverse bevel doors
Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Built in request to exit switch to shunt door contact where contacts are indicated on security drawings.
*Upon loss of power door to remain locked from key side.
*Coordinate power with electrical/LV contractor
* Provide door/frame harnesses

Set: 25.0

Description: Paired Opening - Electrical

Hinge (heavy weight)	T4A3786 [NRP]	McKinney
1 Concealed Vert Rod Exit	9847.EO [F]	Von Duprin
1 Concealed Vert Rod Exit	9847.L .996L-NL [F]	Von Duprin
2 Surface Closer x Stop Arm	DC6200 Series x Stop Arm	Corbin Russwin
2 Kick Plate	K1050 10” high CSK BEV	Rockwood
2 Astragal	303AS	Pemko
1 Gasketing	S88BL (Head & Jambs)	Pemko

Set: 26.0

Description: Paired Opening – Access Controlled

Hinge (heavy weight)	TA2714 [NRP]	McKinney
1 Electric Power Transfer	EL-CEPT	Securitron
1 Dust Proof Strike	570	Rockwood
2 Flush Bolt	555 / 557 (As Required)	Rockwood
1 Electrified Mortise Lock	NAC-82271 LNJ	Sargent
1 Surface Closer x Stop Arm	DC6200 Series	Corbin Russwin
2 Kick Plate	K1050 10” high CSK BEV	Rockwood
1 Door Stop	400 /9-ADJ Series per conditions	
1 Door Harness		
1 Frame Harness		

Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Built in request to exit switch to shunt door contact where contacts are indicated on security drawings.
*Upon loss of power door to remain locked from key side.
*Coordinate power with electrical/LV contractor
* Provide door/frame harnesses

Set: 27.0

Description: Paired Opening – Access Controlled

1 Continuous Hinge x Power Transfer	A500 EZ12 [FR]	ABH
1 Continuous Hinge	A500 [FR]	ABH
1 Dust Proof Strike	570	Rockwood
1 Flush Bolt	2845	Rockwood
1 Electrified Mortise Lock	NAC-82271 LNJ	Sargent
1 Coordinator	1700	Rockwood
2 Surface Closer	DC6200 Series	Corbin Russwin
2 Wall Stops	400	Rockwood
2 Armor Plate	K1050 30” high CSK BEV	Rockwood
1 Astragal	178SA	NGP
1 Gasketing	290 x 2891APK	Pemko
1 Threshold	172 a	Pemko
1 Door Harness		
1 Frame Harness		
1 Protector Bar	R111LPB	Rockwood

Notes:
Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Built in request to exit switch to shunt door contact where contacts are indicated on security drawings.
*Upon loss of power door to remain locked from key side.
*Coordinate power with electrical/LV contractor
* Provide door/frame harnesses

Set: 28.0

Description: Paired Opening – Access Controlled

1 Continuous Hinge	A500 [FR]	ABH
1 Continuous Hinge x Power Transfer	A500 EZ12 [FR]	ABH
1 Dust Proof Strike	570	Rockwood
2 Flush Bolt	555 / 557 (As Required)	Rockwood
1 Electrified Mortise Lock	NAC-82271 LNJ	Sargent
1 Conc Overhead Stop	6-ADJ Series	Rixson
1 Surface Closer x Stop Arm Hold Open Arm	DC6200 Series	Corbin Russwin
2 Armor Plate	K1050 30” High x CSK x 4BE	Rockwood
Silencers	608	Rockwood
1 Door Harness		
1 Frame Harness		

Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Built in request to exit switch to shunt door contact where contacts are indicated on security drawings.
*Upon loss of power door to remain locked from key side.
*Coordinate power with electrical/LV contractor
* Provide door/frame harnesses

Set: 29.0

Description: Paired Opening – Access Controlled

1 Continuous Hinge	A500 [FR]	ABH
1 Continuous Hinge x Power Transfer	A500 EZ12 [FR]	ABH
1 Dust Proof Strike	570	Rockwood
1 Flush Bolt	2845	Rockwood
1 Electrified Mortise Lock	NAC-82271 LNJ	Sargent
1 Coordinator	1700	Rockwood
2 Surface Closer x Stop Arm	DC6200 Series	Corbin Russwin
1 Door Harness		
1 Frame Harness		

Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Built in request to exit switch to shunt door contact where contacts are indicated on security drawings.
*Upon loss of power door to remain locked from key side.
*Coordinate power with electrical/LV contractor
* Provide door/frame harnesses

Set: 30.0

Description: Paired Opening – Access Controlled

1 Continuous Hinge x Power Transfer	A500 EZ12 [FR]	ABH
1 Continuous Hinge	A500 [FR]	ABH
1 Dust Proof Strike	570	Rockwood
1 Flush Bolt	2845	Rockwood
1 Electrified Mortise Lock	NAC-82271 LNJ	Sargent
1 Coordinator	1700	Rockwood
2 Surface Closer	DC6200 Series	Corbin Russwin
2 Wall Stops	400	Rockwood
2 Armor Plate	K1050 30” high CSK BEV	Rockwood
1 Astragal	178SA	NGP
1 Gasketing	S88BL (Head & Jambs)	Pemko
1 Door Harness		
1 Frame Harness		
1 Protector Bar	R111LPB	Rockwood

Notes:
Operation:
*Door normally closed and secured.
*Upon use of mechanical key or presentation of authorized credentials door to unlock allowing authorized entry.
*Built in request to exit switch to shunt door contact where contacts are indicated on security drawings.
*Upon loss of power door to remain locked from key side.
*Coordinate power with electrical/LV contractor
* Provide door/frame harnesses

Set: 31.0

Description: Single Opening – Research to Research

	Hinge, Full Mortise	TA2714 [NRP]	McKinney
1	Communicating Lock	8226 LNJ	Sargent
1	Surface Closer @ door 330.1	DC6200 x Stop Arm	Corbin Russwin
1	Kick Plate	K1050 30" High x CSK x 4BE	Rockwood
1	Overhead Stop	6-ADJ Series	Rixson
1	Perimeter Gasket	S88BL	Head and Jambs

Set: 32.0

Description: Single Opening – Teaching Lab, Exit Only

	Hinge, Full Mortise	TA2714 [NRP]	McKinney
1	Exit Lock	8206 LNJ	Sargent
1	Surface Closer x Stop Arm	DC6200 Series	Corbin Russwin
1	Armor Plate	K1050 10” High x CSK x 4BE	Rockwood
	Silencer		

Set: 33.0

Description: Single Opening - Focus Rooms

Hardware to be coordinated with Aluminum Framed Opening Specification Section

2	Back to Back Door Pulls	RM3301 x 24”	Rockwood
1	Sliding Door Track x Soft Close		

Notes: Hardware to be coordinated with sliding door assembly

Set: 34.0

Description: Paired Opening – General Waste Room

2 Continuous Hinge	A500	ABH
2 Push Pull	110x73C/73CL	Rockwood
2 Surface Closer x Stop/Hold Open Arm	DC6200 Series	Corbin Russwin
2 Armor Plate	K1050 30” high CSK BEV	Rockwood
Silencer		

Set: 35.0

Description: Paired Opening – Future Imaginarium

Hinge, Full Mortise	TA2714 [NRP]	McKinney
1 Dust Proof Strike	570	Rockwood
2 Flush Bolt	555 / 557 (As Required)	Rockwood
1 Classroom Lock	8237 LNJ	Sargent
2 Conc Overhead Stop	6-ADJ Series	Rixson
2 Kick Plate	K1050 10" high CSK BEV	Rockwood
2 Silencer		

Set: 36.0

Description: Single Opening – Future Imaginarium

Hinge, Full Mortise	TA2714 [NRP]	McKinney
1 Classroom Lock	8237 LNJ	Sargent
1 Conc Overhead Stop	6-ADJ Series	Rixson
1 Kick Plate	K1050 10" high CSK BEV	Rockwood
Silencer		

Set: 37.0

Description: Single Opening – Phone, Focus Room
Hardware to be coordinated with Aluminum Framed Opening Specification Section

Hinges	TA2714	McKinney
1 Passage Set	8215 LNJ	Sargnet
1 Overhead Stop	6-ADJ Series	Rixson

Set: 38.0

Description: Single Opening – EMR

Hinge, Full Mortise	TA2714 [NRP]	McKinney
1 Storeroom Lock	8204 LNJ	Sargent
1 Surface Closer x Stop Arm Hold Open Arm	DC6200 Series	Corbin Russwin
1 Kick Plate	K1050 10” High x CSK x 4BE	Rockwood
1 Gasketing	S88BL (Head & Jambs)	Pemko

Set: 39.0

Description: Paired Opening – Circulation Corridor

2 Continuous Hinge	A500	ABH
2 Push Pull	110x73C/73CL	Rockwood
2 Surface Closer x Stop Arm	DC6200 Series	Corbin Russwin
2 Kick Plate Silencer	K1050 10” high CSK BEV	Rockwood

END OF SECTION

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 CONTROLLING DOCUMENTS

A. This specification is controlled by Division 08 Section “Exterior Enclosure System Requirements”. In addition to the requirements of this document, all requirements of Controlling Documents must also be met. The more onerous conditions of this document or the Controlling Document must be met.

1.3 SUMMARY

A. Provide the work of this Section in accordance with requirements of the Contract Documents.

B. This Section includes, but is not limited to glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Doors and Sidelites.
2. Aluminum Framed Storefront and Entrances.
3. Curtain Wall Systems.
4. Glazing Sealants and Accessories.

C. Related Requirements:

1. Division 07 Section "Joint Sealants."
2. Division 08 Section "Aluminum-Framed Entrances and Storefronts."
3. Division 08 Section "All-Glass Entrances and Storefronts."
4. Division 08 Section "Glazed Aluminum Curtain Walls."
5. Division 08 Section "Structural-Sealant-Glazed Curtain Walls."
6. Division 08 Section "Fire-Rated Glazing."

1.4 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036. Nominal glass thicknesses will be called out in this document. The more onerous of maximum or minimum thicknesses as defined in ASTM C1036 shall be used in all calculations and dimensions

C. IBC: International Building Code.

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D. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

E. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

G. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.5 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of glass and glazing product.

B. Sustainable Design Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:
    a. Leadership Extraction Practices
        1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
        2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
            a) Include statement indicating costs for each product having recycled content.

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b. Sourcing of Raw Materials: For products that are required to comply with requirements for regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.

1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

2. Indoor Environmental Quality, Low Emitting Materials: Building Products must be tested and compliant with the California Department of Public-Health (CDPH) Standard Method V1.1-2010, using the applicable exposure scenario.

a. Adhesives and Sealants wet applied on site: Submit printed statement of showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168-2005.
b. Alternative tests for VOC include ASTM D2369-10, ISO 11890, ASTM D6886-03; or ISO 11890-2.
c. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants

C. Shop Drawings: Include elevations, sizes, dimensions, materials, edge details, anchorage, hardware, and attachments to other work. Show sections and profiles of panel units, arrangement and provision for jointing, anchoring and fastening, supports and other installation details. Indicate locations of panels on elevations. Show large scale details of edge conditions and typical conditions.

1. Include information on size, edge seal, toggle channels, stamp and location for glazing.

D. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

E. Glazing Accessory Samples: For sealants, in 12-inch lengths.

1. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

F. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturers of insulating-glass units with sputter-coated, low-E coatings, glass testing agency and sealant testing agency.

B. LEED Informational Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:

a. Raw Material Sources and Extraction Reporting: Submit Raw materials supplier corporate Sustainability Reports (CSRs); documenting responsible extraction; including extraction locations, long term ecologically responsible land use, commitment to reducing environmental harms from extraction and manufacturing processes, and a commitment to meeting applicable standards or programs that address responsible sourcing criteria

1) Submit manufacturers' self-declared reports

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2) Submit third party verified corporate sustainability reports (CSR) using one of the following frameworks"
   a) Global Reporting Initiative (GRI) Sustainability Report
   b) Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises
   c) UN Global Compact
   d) ISO 26000
   e) USGBC approved program.

2. Building Product Disclosure and Optimization - Material Ingredients

   a. Material Ingredient Optimization: Submit manufacturer's Environmental Product Declaration (EPD) and at least one of the following:

      1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
      2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo.
      3) International Alternative Compliance Path - REACH Optimization
      4) Declare: Manufacturer's completed Product Declaration Form
      5) Other programs approved by USGBC

   b. Product Manufacturer Supply Chain Optimization: Submit documentation from manufacturers for products that go beyond material ingredient optimization as follows:

      1) No GreenScreen Benchmark 1 materials
      2) Cradle to cradle gold or platinum certification
      3) REACH
      4) Other programs approved by USGBC

C. Fabrication Engineering Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer licensed to practice in the jurisdiction of the project and responsible for their preparation.

D. Product Certificates: For glass and glazing from manufacturer, evidencing compliance with testing requirements.

1. Certification: Provide certification from glass producer/fabricator that glass producer/fabricator has reviewed all glazing details and thicknesses and finds same suitable for the purpose intended in accordance with these specifications. This shall include a written wind load and thermal stress analysis showing a probability of failure of no greater than eight (8) lites per thousand for vertical panels and one (1) lite per thousand for horizontal panels at the performance and test loads and local climatic thermal conditions.
2. Certification, Tempered Glass Testing: Submit certification that tempered glass intended for use on the project has been heat soaked tested in accordance with EN14179-1 “Heat Soaked Thermally Toughened Soda Lime Silicate Safety Glass”.
3. Certification, Insulating Glass Testing: Submit certification that the insulating glass units have been granted the labelling in accordance with ASTM E2190 compliance for insulated glass units.
4. Certification, Insulating Glass: Provide certification that insulating glass primary and secondary seals are capable of withstanding project structural loading requirements.

E. Fabricator's quality control/quality assurance procedures.

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F. Product Test Reports: For tinted glass, coated glass, insulating glass and glazing sealants, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

G. Preconstruction adhesion and compatibility test report.

H. Sample Warranties: For special warranties.

1.9 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of glass and each applied coating to include in maintenance manuals.

1.10 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program or has demonstrated 5-year experience on projects of comparable size and scope and has foremen who can demonstrate that they have taken online classes given by the National Glass Association at myglassclass.com in the specialties they are engaged to provide.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

E. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of Insulating Glass Certification Council (IGCC).

G. Mockups: Before glazing, build mockups for each glass product indicated below, to verify selections made under sample submittals, to demonstrate aesthetic effects and to set quality standards for materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Install glazing in mockups specified in the following Sections to match glazing systems required for Project, including glazing methods.
    a. Division 08 Section "Glazed Aluminum Curtain Walls."
    b. Division 08 Section "Structural Silicone Glazed Curtain Walls"

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3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting fabrication.
    a. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.11 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

B. Comply with requirements specified in Division 08 Section "Structural Silicone Glazed Aluminum Curtain Walls" for field hose testing of glass panels installed in assemblies erected in the work of those sections.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.13 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 degrees.

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1.14 WARRANTY

A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Heat Soaked Tempered Glass: Manufacturer agrees to replace heat soaked tempered glass (FT) units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) with within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

D. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

E. Manufacturer’s Special Warranty on Sealant: Manufacturer's standard form in which sealant manufacturer agrees to repair or replace silicone sealant compounds which have failed within specified warranty period. Failure includes, but is not limited to, failure to provide airtight and watertight joints or which have failed in adhesion, cohesion, abrasion-resistance, migration-resistance, stain-resistance, general durability or other form of apparent deterioration (excluding inherent qualities and limitations clearly specified in the manufacturer's data which was submitted).

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

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B. Fabrication Engineering: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements", and the Building Code, to engineer glass and glazing, including comprehensive engineering analysis according to ASTM E1300.

1. Glass Thicknesses indicated are minimums and for detailing only. Confirm glass thicknesses and heat treatment by analyzing Project loads and in-service conditions.
2. Provide glass lites for various openings in nominal thickness indicated, but not less that the thickness and strength (including heat treatment) as required to comply with performance criteria specified.

C. Structural Performance: Glazing shall be engineered, fabricated and installed to withstand the following design loads within limits and under conditions indicated, determined according to the Building Code and ASTM E1300.

1. Design Wind Pressures: Determine design wind pressures based on the provisions of the American Society of Civil Engineers, "Minimum Design Loads for Buildings and Other Structures", ASCE 7-16.

    a. Wind pressures used in the Project design are shown on the Structural Drawings.

2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, engineer glass to resist wind pressure based on glass type factors for short-duration load.
3. Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, engineer glass to resist each of the following combinations of loads:
4. Outward wind pressure minus the weight of the glass. Base on glass type factors for short-duration load.
5. Inward wind pressure plus the weight of the glass plus half of the snow load. Base on glass type factors for short-duration load.
6. Half of the inward wind pressure plus the weight of the glass plus the snow load. Base on glass type factors for long-duration load.

    a. Load Durations: Engineer glass for load duration factors in accordance with ASTM E1300. For wind loading assume a duration factor of 1.0.

7. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm for monolithic glass lites.
8. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites.

    a. Load duration: 3 seconds.

9. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001 under wind and snow action.

    a. Load Duration: 30 days.

10. Maximum Deflection:

    a. Deflection perpendicular to the face of the wall for framing members with spans up to 13 feet 6 inches between anchors shall be limited to L/175.
    b. Deflection perpendicular to the face of the wall for framing members with spans greater than 13 feet 6 inches between anchors shall be limited to L/240 plus 1/4-inch.
    c. Deflection perpendicular to the face of the wall for framing members shall be limited to the lesser of L/175 or 3/4-inch across an individual lite of glass.
    d. Deflection of cantilevered or overhanging framing members shall be limited to 2L/175.
    e. Deflection parallel to the glazing plane of framing members, due to wind load, between anchors at corners shall be limited to 3/8-inch between anchors.

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f. Deflection parallel to the face of the wall due to dead load shall not exceed 1/8-inch.
g. Deflection at center of glass under design wind pressures shall be the lesser of

11. Differential Shading and Heat Build Up: Engineer glass to resist thermal stresses induced by differential shading within individual glass lites.
12. Insulated Glass Units: Design of insulated glass units shall account for the building altitude, temperature, atmospheric pressure, and specified loads.
13. Laminated Glass Units: Structural design of laminated glass units shall account for the stiffness of the interlayer material and in-service material design temperature, but not less than 70 degrees F.

D. Tempered Glass: Unless otherwise specified tempered glass intended for use on the project shall be heat soaked tested in accordance with EN 14179-1 “Heat Soaked Thermally Toughened Soda Lime Silicate Safety Glass” for a minimum of 2 hours at not less than 260 degrees C to minimize the occurrence of nickel sulfide crystals. This process shall be strictly controlled and carried out paying attention to temperature limits and duration of treatment for each phase.

1. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.
2. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

E. Structural Glazing: To limit the stresses on structural glazing sealant under full loads and maximum building deflections, to produce sealant stress not exceeding 20 psi with a minimum safety factor of 2.5:1 per ASTM C1249 and the sealant manufacturer's instructions.

F. Safety Glazing: For glass panels that are accessible to pedestrians (and not protected by an 18-inch high obstruction) and glass in doors and door sidelights, and where safety glazing is indicated or required by Building Code, provide glazing that complies with 16 CFR 1201, Category II.

1. Permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
2. European alternate for certification of safety glazing is acceptable. All laminated glass is safety glazing.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.

H. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F .
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 7 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

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2.2 MANUFACTURERS

A. Basis of Design: Manufactured items listed are the Basis of Design selected for the project and serve as the standard of quality required for the project. Equivalent products by other manufacturers/fabricators listed in this section will be considered, provided they match the aesthetic and performance of the items designated. Items that do not match aesthetic and performance characteristics will be rejected. The Architect has the final approval.

B. Manufacturers: Subject to compliance with requirements, provide products from one of the following, or approved equal:

1. Guardian Glass Industries.
2. Pilkington North America.
3. Viracon, Inc.
4. Vitro Architectural Glass (Formerly PPG).

C. Fabricators: Subject to compliance with requirements, provide products by one of the following, or approved equal:

1. Guardian Glass Industries.
2. JEBerkowitz.
3. Old Castle Building Envelope.
4. Viracon, Inc.
5. Vitro Architectural Glass (formerly PPG).

D. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

E. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.

F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. National Glass Association NGA: "Laminated Glazing Reference Manual and "GANA Glazing Manual" and "Sealant Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
5. Consumer Product Safety Commission (CPSC): Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of CPSC 16 CFR Part 1201 for category II materials.

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B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

1. Subject to compliance with requirements and local authorities having jurisdiction, provide safety glass with a removable certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum and is for detailing only Confirm glass thickness and heat treatment necessary for glass unit sizes required against performance requirements for exterior glazing and in-service conditions. Provide glass that complies with performance requirements and is not less than the thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 1/4 inch (6 mm).
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength:

1. Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article.
2. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article.
3. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Low Iron Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent and solar heat gain coefficient of not less than 0.87. Subject to compliance with requirements, provide one of the following, or approved equal:

1. AGC Glass Company North America, Inc.; Krystal Klear.
2. Guardian Glass Industries; UltraClear.
3. Pilkington North America; Optiwhite.
4. Vitro Architectural Glass Starphire or Ultra-Clear.
5. Saint-Gobain; SGG Diamant.

C. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.

D. Heat-Treated Float Glass: ASTM C1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Flatness Tolerances: Overall bow and warp shall not exceed 50 percent of values tabulated in ASTM C1048.
2. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

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3. Fully Tempered Glass: Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
    a. Tempered architectural safety glass shall conform to ANSI Z97.1 and CPSC 16 CFR 1201.
4. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated. Direction of roller wave shall be consistent throughout building. Measurements of roller wave shall be performed in accordance with ASTM C1651.
    a. Roller wave peak-to-valley deviation shall not exceed 0.003 inch “Peak to Valley” in the central area and 0.008 inch) within 10-1/2 inches of the leading and trailing edge.
5. ASTM C1048 for uncoated glass, comply with requirements for Condition A.
6. ASTM C1048 for coated vision glass, comply with requirements for Condition B for fully or partially ceramic coated glass, and Condition C (other coated glass).
7. Provide heat soak testing for all tempered glass, conforming to EN 14179-1: 2016 which includes a 2-hour dwell at 482°F ± 18°F (260°C ± 10°C).

E. Low-Emissivity (Low 'E') Coated Glass: Provide low-emissivity factory applied coating complying with ASTM C1376 and resulting in a stable, uniform, nearly invisible coating which imparts average maintained insulating performance of at least U = 0.4. Comply with physical performance criteria as specified herein for each individual type of glass.

1. Provide accurate and straight edge deletions of coatings at areas of insulating glass assemblies where Low “E” coatings, metallic coating or other decorative coatings are applied to surfaces scheduled to be in contact with the primary seal of insulating glass units.

F. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3 and complying with NSA "Engineering Standards Manual" 66-9-20 Specification for Heat-Strengthened or Fully Tempered Ceramic Enameled Spandrel Glass for Use in Building Window/Curtain Walls and other Architectural Applications.

2.5 COATED FLOAT GLASS

A. General: Provide coated glass complying with requirements indicated in this Article

B. Sputter-Coated Float Glass: Float glass with the coating(s) specified in schedules at the end of Part 3, deposited by magnetron sputtered vacuum deposition process after manufacture and heat treatment (if any). Pyrolytic, and wet chemical deposition, glass coatings will not be permitted.

C. Coating Quality: The allowable range of defects in coatings applied to glass shall be as accepted through glass sample submissions. Installed coated glass products which are outside of the accepted sample range shall be subject to rejection by the Architect. To reduce the possibility of glass rejection, the supplier of coated glass products shall provide glass coating production runs for the entire project from a single coating facility. The allowable range of defects are defined as follows:

1. The vision glass area is defined as the field of glass which is greater than 3 inches from the glass unit edge.

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a. Pinholes: At an indoor viewing distance of 10 feet for low emissivity coatings, and 15 feet for reflective coatings:

1) Pinholes greater than 1/16 inch in dia. shall not be permitted;
2) Large clusters or close spacing of pinholes 1/16 inch and smaller shall not be permitted in the vision glass area; and
3) Large clusters or close spacing of pinholes 1/16 inch and smaller may be permitted outside of the vision glass area subject to Architect's acceptance.

b. Scratches: At an indoor viewing distance of 10 feet for low emissivity coatings, and 15 feet) for reflective coatings:

1) Scratches smaller than 3 inches long are allowed in any glass area;
2) Scratches from 3 inches to 4 inches long are allowed only within 3 inches of an edge; and
3) Scratches greater than 4 inches long shall not be permitted in the vision glass area.
4) Concentrated scratches, scuffs, rub marks, cup marks or abraded areas shall not be permitted in any glass area.

c. Reflectance and Transmission Inspection: When viewed outdoors against a bright uniform opaque background at a 10 ft. distance for low emissivity coatings (15 feet for reflective coatings), color, reflectance and transmission will be permitted to have a slight variance subject to Architect's acceptance.

1) Mottling and streaking of the coating shall not be permitted.

2.6 LAMINATED GLASS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:

1. AGC Glass Company North America, Inc.
2. Oldcastle Glass, Inc.
3. Vitro Architectural Glass
4. Viracon, Inc.
5. Agnora
6. Cristacurva.

B. Laminated Glass: ASTM C1172 and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Blemishes that may form or grow over time shall not exceed the limits defined in ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation. Misalignments between laminated lites may not exceed 1/32 inch.

C. Polyvinyl Butyral Interlayer: Polyvinyl butyral sheets of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation. At edges, where polyvinyl butyral (PVB) interlayers may contact silicone sealant, provide 3M glazing tape recommended for separation of silicone and PVB interlayer.

1. Laminate lites with polyvinyl butyral interlayer in autoclave with heat plus pressure.
2. Provide clear polyvinyl butyral sheets for laminating clear glass.
3. Provide ultraclear polyvinyl butyral sheets for laminating ultraclear (low-iron) glass.
4. Basis of Design: Subject to compliance with requirements, provide the following:

a. For laminating clear glass: Kuraray America, Inc.; Trosifol Clear.

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b. For laminated ultraclear (low-iron) glass: Kuraray America, Inc.; Trosifol UltraClear.

D. Ionomeric Polymer (Ionoplast) Interlayer (for Structural Glass Systems): Ionomeric polymer (ionoplast) interlayer sheets of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.

1. Laminate lites with ionoplast interlayer in autoclave with heat plus pressure.
2. Ionoplast Interlayer Properties:

a. Young's Modulus: 43 kpsi, when tested in accordance with ASTM D5026
b. Tensile Strength: 5.0 kpsi, when tested in accordance with ASTM D638.
c. Elongation: 400 percent, when tested in accordance with ASTM D638
d. Flex Modulus: 50 kpsi, when tested in accordance with D790.
e. Heat Deflection Temperature at 0.46 MPa: 110 deg F, when tested in accordance with D648.

3. Edge Stability: Laminate lites with ionoplast interlayer shall have zero defects for open-edge weather exposure and butt-joined silicone sealant contact when tested for 84 months.
4. Basis of Design: Subject to compliance with requirements, provide the following, or approved equal:

a. Kuraray America, Inc.; SentryGlas.

E. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.

1. Construction: Laminate glass with interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.
4. Where laminated glass is held using sealants, verify compatibility of interlayers and sealant with sealant manufacturer.

F. Laminated Safety Glass Units: Two sheets of glass of equal thickness, laminated together with not less than 1.52 mm thick clear interlayer, made specifically for laminating glass. At glazed doors and sidelights, provide glass complying with the requirements of 16 CFR 1201 Category II.

1. Prior to laminating, cut glass to required sizes and profiles as determined by accurate measurement of openings to be glazed, making allowance for required edge clearances. Cut and process edges in accordance with glass manufacturer's recommendations. Do not cut or treat edges in the field.

2.7 INSULATING GLASS

A. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated in the Glass Schedule at the end of this Section.

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B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190, and complying with other requirements specified.

1. Sealing System: Dual edge sealed insulating glass units, with polyisobutylene primary and silicone secondary sealants.
2. Fabricate units at factory with sheets of glass hermetically sealed at edges with a permanent elastomeric sealant. Dehydrate entrapped air. Glass lights with bent, welded or fused corners, splices or joints shall be separated by desiccant filled d spacer specified below, marked with the appropriate classification, listed manufacturer and approval marked on the spacer
3. Spacer: Viracon VTS Warm Edge Spacer, or approved equal.
    a. Color: Black.
4. Desiccant: Molecular sieve or silica gel, or a blend of both.
    a. Desiccant Temperature Rise Testing:
        1) Test Criteria: Comply with desiccant manufacturer's written recommendations.
        2) Test minimum of once every shift and after each drum change.
5. Insulating Glass Unit Requirements Testing:
    a. Test insulating glass units.
    b. Butterfly Unit Adhesion Pull Testing:
        1) Adhesion Criteria: Comply with pass/fail requirements of manufacturer's published minimum guidelines and manufacturer's certification audit requirements/recommendations. Minimum pull back to 30 degrees from horizontal with no significant adhesive failure.
        2) Test one unit each shift after each carton change.
        3) Minimum size 8 inch x 8 inch.
        4) Test units shall be fabricated at the same time and on the same production line as processing equipment with same spacers and sealant used in the production of the insulating glass units fabricated for the Project.
6. Bow/Warp and Air Space Measurement Concave/Convex: Submit manufacturer's quality assurance/quality control measures to comply with the intent of this section.
    a. Measure bow warp every hour on a vertical plane with aluminum or other type of straight edge.
7. Skips and voids in the primary or secondary seals are prohibited and maximum gap at primary/secondary seal interface is 1 inch in length and 3/32 inch in width.
8. Documentation:
    a. Document and record results
    b. Tag each insulating Glass Unit that falls outside the defined limits and certify that these non-conforming insulating glass units will not be supplied to the Project.
9. Quality Assurance: Provide method to assure spacer is square to the edge, polyisobutylene seal is within acceptable visual tolerances per mockup. In addition, provide quality assurance measures to control:
    a. Spacer Alignment, location, polyiso bleed.
    b. Argon gas initial fill and acceptable loss rate. Fill level for calculations.
    c. Altitude effects.
    d. Barometric Pressure variation effects.

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10. Low E Coating Edge Deletion in Insulating Glass Units: Provide accurate and straight edge deletions of coatings at areas of insulating glass assemblies where coatings, metallic coating or other decorative coatings are applied to surfaces scheduled to be in contact with the primary seal of insulating glass units or provide masking of edge to prevent low "E" coating from continuing to bonded edge.

    a. In IGUs, provide "Red line" installation, overlapping low e coating and primary seal no more than 50% of thickness of primary seal.

C. Provide insulating glass units with breather devices to compensate for atmospheric pressure differential between the site of unit fabrication and the site of installation, where an altitude differential of more than 2000 ft. (605m) exists.

D. Argon Fill: Minimum fill 90% in accordance with EN1279 and ASTM E2190, warrantable for loss of no more than 1 percent per year.

2.8 FIRE-RATED GLAZING

A. Comply with requirements specified in Division 08 Section "Fire-Rated Glazing."

2.9 SWITCHABLE PRIVACY GLASS

A. General: Switchable privacy glass shall consist of a laminated glass unit with an embedded sheet of liquid crystal particles. In the non-energized state, the privacy glass shall be opaque to provide privacy. When electric current is applied, the privacy glass shall become transparent to allow a view through the glass.

B. Light Transmittance:

1. Privacy State: In the non-energized privacy state, the privacy glass shall have a visible light transmittance of 5 percent, maximum. The haze factor shall be as recommended by the manufacturer to provide visual privacy.
2. Transparent State: In the energized transparent state, the privacy glass shall have a visible light transmittance of 70 percent, minimum. The haze factor shall be as recommended by the manufacturer to provide a transparent view through the glass.

C. Switching Speed:

1. Private to Transparent: Approximately 1 millisecond.
2. Transparent to Private: Approximately 1 millisecond.

D. Electrical Requirements:

1. Input Power: 120 VAC/60Hz.
2. Energy Consumption: 3 to 5 watts/meter squared/hour.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Power Module:

1. Electrical Box: Size as recommended by the manufacturer.
2. Relay: Mechanical relay with a life expectancy of 10 million cycles.
3. Electric Rating: 5 amps.
4. Electric Input: 120 VAC.
5. Electric Output: 12 VAC.

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6. Switch: Single pole switch. Power module shall also be capable of receiving a signal from a remote control device.

F. Basis-of-Design Product: McGrory Glass, Inc.; Electraview Switchable Privacy Glass.

2.10 GLAZING GASKETS

A. Dense Compression Gaskets: Continuous extruded silicone with cross sectional profile, physical properties and cross sectional fabrication tolerances as recommended by the glazing fabricator to comply with system performance requirements specified and in compliance with applicable provisions ASTM C1115.

B. Soft Compression Gaskets: Continuous extruded, closed-cell, integral-skinned silicone gaskets complying with ASTM C509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

C. Continuous Structural Gaskets/Spacers: Continuous extruded silicone or silicone compatible rubber, with cross sectional profile, physical properties, and tolerances as recommended by the window and curtain wall manufacturer, and as required, to comply with the system performance requirements specified and shown. Gaskets/Spacers shall be tested for compatibility with silicone sealants and shall be subject to the acceptance of the sealant manufacturer.

D. Corners: Sealed.

2.11 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Colors of Exposed Glazing Sealants: Match Architect's control Samples.

B. Sealant Types: As Specified in Division 07 Section "Joint Sealants."

C. Structural Glazing Seal: Neutral-curing structural silicone glazing sealant complying with ASTM C920 and ASTM C1184, Grade NS, Class 25 for Use NT.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. Dow Corning Corporation; DOWSIL 983 for field use and 995 or 121 for shop application.
b. GE Silicones; UltraGlaze SSG4600 for shop application and UltraGlaze SSG4000AC for field application.

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c. Sika; “Sikasil SG-500” for shop use and SG18 or SF500 for field use

2. Applications: For Structural Seals.

D. Glazing Sealant: Low modulus, neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following, or approved equal:

a. Dow Corning Corporation; DOWSIL 790, 791 or 795.
b. GE Silicones; SilPruf LM SCS2700 or SilPruf SCS2000.
c. Sika Corporation; Sikasil WS290 or Sikasil WS295.

2. Applications: Weather seal.

E. Glazing Sealant: Medium modulus, neutral-curing stain resisting, silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following, or approved equal:

a. Dow Corning Corporation; 756 SMS.
b. GE Silicones; SilPruf NB SCS9000.
c. Sika Corporation, Sikasil - WS295.

2. Applications: Stain resistant weather seal.

F. Sealant for IGU secondary seals: Compliant with ASTM C1369, and ASTM C1249 Guidelines.

G. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.12 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

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2.13 DECORATIVE FILMS

A. Decorative Film Overlay for Distraction Markings: Translucent, dimensionally stable, cast PVC film, 2-mil-minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.

1. Manufacturers: Subject to compliance with requirements provide products by one of the following:

a. 3M Fasara Decorative Films
b. Avery Dennison Graphics
c. FDC Graphics
d. Oracal

2. Use: Suitable for exterior and interior applications.
3. Patterns: As follows:

a. Translucent Film (GF-01): "Fasara, Dusted Crystal, 7725SE-314, Distraction Markings" (3M) with 1-1/2 inch square milky white squares on clear background , dimensionally stable, cast PVC film, 2-mil-minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.

~~2.13~~2.14 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Silicone material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Silicone blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Silicone material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material) and Type C (Closed Cell), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance, complying with requirements specified in Division 07, Section "Joint Sealants".

~~2.14~~2.15 FABRICATION OF GLAZING UNITS

A. Fabricate glass and glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with performance requirements.

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B. Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer. Provide thicknesses indicated or, if not otherwise indicated, as recommended by glass manufacturer for application indicated.

C. Cutting: Obtain sizes from shop drawings or field measurement. Cut lites to fit each opening with edge clearances and bite on glass as recommended by manufacturer. Do not nip glass edges.

1. Factory cut heavy float glass (1/2 inch and above). Edges may be wheel cut or sawed and seamed at manufacturer's option. For glass to be cut at site, provide glass larger than required to obtain, clean-cut edges without seaming or nipping.
2. Do not cut, seam, nip or abrade glass after heat-tempering. Before tempering glass, provide cutouts to receive hardware.

D. Edgework for Exposed Edges and Corners: Where edges of glass and corners are to be exposed in the finish work, provide polished edges and slightly eased arrises and eased corners. Where edges butt, provide flat polished and beveled edges.

E. Edges Concealed: Edges concealed in the finish work shall receive a flat ground finish, with edges free of blemishes, and square edges with slight chamfers at junctions of edges and faces.

F. Laminated Glass Edges: Zero tolerance and full alignment where exposed in the finish work. Comply with reference standards for laminated glass edges concealed in the finish work.

1. Ground smooth and polish edges of laminated glass to be butt glazed. Ground smooth and slightly chamfer edges at glass edges to be concealed in the finish work.

G. Decorative Film Overlay: Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges, in pattern indicated on Drawings to the back face of clean glass, according to manufacturer's written instructions, including surface preparation and application temperature limitations.

~~2.15~~2.16 SOURCE QUALITY CONTROL

A. Provide insulating glass fabricator's quality control/quality assurance procedures and methods to control quality of finished insulating units, before units are packaged to leave the fabricator's site. Do not package or ship insulating glass units that are defective in hermetic seal, are warped, biased, exhibit any of the deterioration that are defined in Part I under "Definitions Article", Part 2 under "Coatings Article", or do not comply with requirements for a fully warranted product.

1. Lites will be inspected by the Installer and Contractor upon arrival and rejected lites will be returned for full replacement at the fabricator's cost.

B. Provide manufacturer's quality control/quality assurance procedures and methods to control warp and bow (As an alternate to methodology in paragraphs B. through E. of this Article). Provide certification that all heat- treated glass processes are conducted in manufacturing facilities with in line equipment that provides testing and control of glass processes to provide uniform products without rollerwave distortions that are unacceptable to the design Architect. Items listed in paragraphs B. though E., of this section identify how this is controlled in the North and South American Continents.

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C. Distortion Tolerance Testing: Measure in line, each pane of monolithic uncoated and coated heat-treated glass and coated glass of 6 mm thickness or more used on the Project Including visual mockups.

D. Roll Wave Criteria (Horizontal): Maximum Average 0.003 Center and 0.008 edges (peak to valley) per ASTM C1651 Standard for Test Measurement of Roll Wave Optical Distortion in Heat Treated Glass.

E. Millidopter Criteria: (95% for pre-temperable coated and 90% for post-temperable coated surface) Maximum +/- 120A overall or highest overall measurement from the approved visual mock-up that is less than +/1 120 A overall, whichever is less.

F. Documentation:

1. Document and record results for each pane.
2. Tag each pane of glass that falls outside the maximum distortion limits and certify that these non-conforming glass panels will not be fabricated and supplied to the project.
3. Provide written documentation of the Roller Wave and Millidiopter measurements of the glass used in visual mock-ups before the mock-ups are reviewed by the Owner and Architect for approval.
4. Bow/Warp Tolerance:

    a. 1/2 of ASTM C1048
    b. Measure every hour on a vertical plane with a straight edge.
    c. Provide recorded written documentation upon request.
    d. Do not exceed maximum warpage in any direction.
    e. For uncoated glass comply with requirements for Condition A.
    f. For coated vision glass, comply with requirements for Condition C (other coated glass).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

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C. Inspect each piece of glass immediately before installation. Do not install any pieces which are improperly sized or have damaged edges, scratches or abrasion or other evidence of damage. Remove labels from glass immediately after installation.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Place blocks to allow water passage to weep holes. Set blocks in thin course of compatible sealant suitable for heel bead.

1. Glass Units Less Than 6 ft. - 0 inches: Locate setting blocks at sill one - quarter of the width in from each end of the glass unless otherwise recommended by the glass manufacturer.
2. Glass Units 6 ft. - 0 inches or Greater: Locate setting blocks at sill one - eighth of the width in from each end of the glass, but not less than 6 inches, unless otherwise recommended by the glass manufacturer.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

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I. Set glass lites in each series true in line with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Set glass in locations indicated on Drawings. Install glass with hardware and accessories according to hardware manufacturer's written instructions. Attach hardware securely to mounting surfaces and building structure.

L. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

M. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

N. The installation of each lite of exterior glass shall be watertight, airtight, and capable of withstanding temperature changes, wind loading, and impact from operation (doors) without failure of any kind including loss or breakage of glass, failure of seal, exudation of sealant and excessive deterioration of glazing materials.

O. Film Application:

1. **Clean glass surfaces thoroughly and install adhesive film in strict compliance with manufacturer's instructions.**
2. **Cut film edges neatly and square at a uniform distance of 1/8 inch to 1/16 inch of glass edges. Replace blade tips after 3 to 4 cuts, for a crisp straight edge.**
3. **Spray manufacturer recommended slip solution on glass and adhesive to facilitate proper positioning of film.**
4. **Apply film to glass and lightly spray film with slip solution.**
5. **Squeegee from top to bottom of each pane of glass receiving adhesive film. Spray slip solution to film and squeegee a second time.**
6. **Bump film edge with lint-free towel wrapped around edge of a manufacturer recommended 5-way tool.**
7. **Upon completion of film application, allow 30 days for curing film, allowing moisture from film installation to dry thoroughly, and allow film to dry flat without moisture dimples when viewed under normal viewing conditions.**

P. Entrance Glass/Visual Distraction Marks: Provide window and door distraction markings on glass surfaces, in colors, uniform patterns and spacing shown. Coordinate with Architect for custom graphics on interlayers to produce visual distraction markings complying with requirements.

1. **Where interlayers are not used, provide applied graphics to comply with referenced standards.**

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

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C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

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D. Structurally Glazed Insulating Glass Units: Set full length continuous structural gaskets/spacers to framing members of curtain wall systems. Set glass units with void between edge of units and framing members, but with units fully within framing member rebate so as to provide a minimum 1/2-inch bite. Align glass unit edges over framing members continuous structural gasket/spacers and secure with manufacturers recommended temporary cleats. Structurally seal glass unit to framing members with specified one-part structural silicone sealant to provide a minimum 1/4 by 1/4-inch bead of sealant. Tool structural silicone perpendicular to face of interior glass light; remove excess structural silicone from glass and metal substrates. After full cure of structural silicone sealant remove temporary cleats. Any holes left in the framing members which were caused by the temporary cleats shall be sealed immediately.

E. The installation of each light of exterior glass shall be watertight, airtight, and capable of withstanding temperature changes, wind loading, and impact from operation (doors) without failure of any kind including loss or breakage of glass, failure of seal, exudation of sealant and excessive deterioration of glazing materials.

F. Glazed Monolithic Glass Units (Butt Glazing): Glass to glass glazing shall be in accordance with the recommendations of sealant and glass manufacturers and shall include the following.

1. Mask both sides of each adjacent piece of glass to be glazed.
2. Provide wood dowel, with a diameter of at least 3 times of the joint width, wrapped in polyethylene and firmly taped to interior face of glass to act as a back-up during glazing operations.
3. Tool face of sealant slightly concave using extreme care not to chip or otherwise abrade corners of glass.
4. Allow sealant to fully cure before removing wood polyethylene wrapped dowel.

3.7 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
2. Remove and replace glass that cannot be cleaned without damage to coatings.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or otherwise damaged during construction period.

E. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

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3.8 GLASS SCHEDULE

A. Fabrication Engineering: Provide the following glass types at general locations indicated below and at locations shown on drawings. Glass thickness and heat treatment values below are minimum selected by Architect for detailing purposes. Provide thicker glass lites and heat treatments necessary for each condition of use to comply with ASTM E1300 and performance requirements indicated.

1. Thicker heat strengthened glass lites which comply with required performance may be proposed in lieu of thinner fully tempered glass at glass panels not in hazardous glazing locations and not adjacent to walking surfaces where fully tempered glass is specified.

B. Material Colors:

1. Glass dual seal at spacer bar: Black
2. Silicone gasket and silicone weather seal color: Black, except as otherwise indicated.
3. Ceramic frit flood coating color for spandrel glass: Match Architect's control Sample.

C. Glass Type **GL-01**: Exterior Vision Glass for **EWS-01**, **EWS-02**, and **EWS-03**.

1. Basis of Design: “1-Inch VZRE24-65 IGU”; Viracon, Inc.
2. Composition: 1-inch-thick insulated glass units (IGUs), consisting of:
    a. Outer Lite: 1/4-inch thick (6mm), heat-strengthened, OptiWhite clear low-iron glass lite. High performance VRE-65 Low-E coating and bird-friendly frit on the #2 surface.
    b. Air Space: 1/2-inch argon-filled airspace.
    c. Inner Lite: 1/4-inch thick (6mm), heat-strengthened, OptiWhite clear low-iron glass lite. High performance VZE-SC Low-E coating on the #3 surface.
3. Performance Requirements.
    a. Visible Light Transmittance: 55% minimum.
    b. Exterior Reflectance: 27% minimum.
    c. Winter Nighttime U-Factor: 0.24 maximum.
    d. Summer Daytime U-Factor: 0.20 maximum.
    e. Shading Coefficient: 0.38.
    f. Solar Heat Gain Coefficient: 0.33 maximum.

D. Glass Type **GL-01S**: Exterior Spandrel Glass for **EWS-01**, **EWS-02**, and **EWS-03**

1. Basis of Design: “1-Inch VZRE24-65 Spandrel IGU”; Viracon, Inc.
2. Composition: 1-inch-thick insulated glass units (IGUs), consisting of:
    a. Outer Lite: 1/4-inch thick (6mm), heat-strengthened, OptiWhite clear low-iron glass lite. High performance VRE-65 Low-E coating and bird-friendly frit on the #2 surface.
    b. Air Space: 1/2-inch argon-filled airspace.
    c. Inner Lite: 1/4-inch thick (6mm), heat-strengthened, OptiWhite clear low-iron glass lite. High performance VZE-SC Low-E coating on the #3 surface. V954 Gray opaque spandrel frit on the #4 surface.
3. Performance Requirements.
    a. Winter Nighttime U-Factor: 0.25 maximum.
    b. Summer Daytime U-Factor: 0.21 maximum.

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E. Glass Type **GL-01F**: Exterior Privacy Glass at Toilet Rooms on East Elevation.

1. Basis of Design: "1-Inch VZRE24-65 IGU with Privacy Frit"; Viracon, Inc.
2. Composition: 1-inch-thick insulated glass units (IGUs), consisting of:
    a. Outer Lite: 1/4-inch thick (6mm), heat-strengthened, OptiWhite clear low-iron glass lite. High performance VRE-65 Low-E coating and bird-friendly frit on the #2 surface.
    b. Air Space: 1/2-inch argon-filled airspace.
    c. Inner Lite: 1/4-inch thick (6mm), heat-strengthened, OptiWhite clear low-iron glass lite. High performance 100% V1093 simulated sandblast coating, and privacy frit on the #3 surface.
3. Performance Requirements.
    a. Visible Light Transmittance: 45% minimum.
    b. Exterior Reflectance: 40% minimum.
    c. Winter Nighttime U-Factor: 0.25 maximum.
    d. Summer Daytime U-Factor: 0.21 maximum.
    e. Shading Coefficient: 0.39.
    f. Solar Heat Gain Coefficient: 0.34 maximum.

F. Glass Type **GL-02**: Exterior Vision Glass (Ground Floor) for **EWS-04**.

1. Basis of Design: "1-Inch VE24-2M IGU"; Viracon, Inc.
2. Composition: 1-inch-thick insulated glass units (IGUs), consisting of:
    a. Outer Lite: 1/4-inch thick (6mm), heat-strengthened, OptiWhite clear low-iron glass lite. High performance VE-2M Low-E coating and bird-friendly frit on the #2 surface.
    b. Air Space: 1/2-inch argon-filled airspace.
    c. Inner Lite: 1/4-inch thick (6mm), heat-strengthened, OptiWhite clear low-iron glass lite.
3. Performance Requirements.
    a. Visible Light Transmittance: 74% minimum.
    b. Exterior Reflectance: 11% minimum.
    c. Winter Nighttime U-Factor: 0.25 maximum.
    d. Summer Daytime U-Factor: 0.21 maximum.
    e. Shading Coefficient: 0.47.
    f. Solar Heat Gain Coefficient: 0.41 maximum.

G. Glass Type **GL-02S**: Exterior Spandrel Glass (Ground Floor) for **EWS-04**.

1. Basis of Design: "1-Inch VE24-2M Spandrel IGU"; Viracon, Inc.
2. Composition: 1-inch-thick insulated glass units (IGUs), consisting of:
    a. Outer Lite: 1/4-inch thick (6mm), heat-strengthened, OptiWhite clear low-iron glass lite. High performance VE-2M Low-E coating and bird-friendly frit on the #2 surface.
    b. Air Space: 1/2-inch argon-filled airspace.
    c. Inner Lite: 1/4-inch thick (6mm), heat-strengthened, OptiWhite clear low-iron glass lite. V954 Gray opaque spandrel frit on the #4 surface.
3. Performance Requirements.
    a. Winter Nighttime U-Factor: 0.25 maximum.
    b. Summer Daytime U-Factor: 0.21 maximum.

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H. Glass Type **GL-03**: Fire-Rated Exterior Glass for **EWS-06**.

1. Composition: 1-inch-thick insulated glass units (IGUs) combined with fire-rated glass units, consisting of:

a. Outer Lite: **GL-01** or **GL-01S** as indicated on Drawings.
b. Air Space: As indicated on Drawings.
c. Inner Lite: “Pyrostop 60-101”; Pilkington North America. 1-hour fire-resistance rated, clear low-iron glass; 7/8-inch thickness.

I. Glass Type **GL-20**: Clear, low-iron, tempered float glass.

1. Thickness: ~~As indicated on Drawings~~**1/2 inch thick**

~~1.~~**J. Glass Type GL-21: Clear, low iron, tempered float glass, 1/4 inch thick**.

~~J.~~**K.** Glass Type **GL-50**: Clear, low-iron, fire-rated glass.

1. Basis of Design: “Vision Line 120”; McGrory Glass/AGC Pyrobel.

~~K.~~**L.** Glass Type **GL-70**: Switchable Glass.

1. Basis of Design: “Electraview - Zero”; McGrory Glass.

END OF SECTION 088000

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SECTION 088813 – FIRE-RATED GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide the work of this Section in accordance with requirements of the Contract documents.

B. Section Includes:

1. Fire-protection-rated glazing.
2. Fire-resistance-rated glazing.

1.3 DEFINITIONS

A. Fire-Protection-Rated Glazing: Glazing in rated doors and openings up to 45 minutes, limited in size, and not capable of blocking radiant heat.

B. Fire-Resistance-Rated Glazing: Glazing that prevents spread of fire and smoke and radiant heat; used in fire-resistance-rated wall and door applications 60 minutes and above without size limitations.

C. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

D. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations and details of product showing component dimensions; framed opening requirements, dimensions, tolerances, and attachment to structure

C. Samples:

1. Glass Samples: For each type of glass product; 12 inches square.
2. Sample of frame

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3. **Verification of sample of selected finish**

~~B.~~**D.** Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 SUSTAINABLE DESIGN SUBMITTALS

A. Comply with requirements specified in Section 018113.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and glass testing agency.

B. Product Certificates: For each type of glass and glazing product.

C. Sample Warranties: For special warranties.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the NGA's Certified Glass Installer Program**, and who has completed glazing similar in material, design and extent to that indicated for this Project, with a record of successful in-service performance, who employs glass installers for this project who are certified under the National Glass Association Glazier Certification Program ans Leve 3 Master Glaziers**.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by ITS, for fire ratings indicated, based on testing according to NFPA 252, ASTM E119. Assemblies must be factory-welded or come complete with factory-installed mechanical joints and must not require job site fabrication.

C. Fire-Rated Wall Assemblies: Assemblies complying with ASTM E119 that are classified and labeled by ITS, for fire ratings indicated, based on testing in accordance with UL 263, ASTM E119.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing **and other** materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install glazing products until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during remainder of construction period.

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1.11 WARRANTY

A. Manufacturer's Special Warranty for **Fire Rated** Laminated Glass: Manufacturer agrees to replace **fire-rated** laminated-glass units that deteriorate within specified warranty period. Deterioration of **fire rated** laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning **fire rated** laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: Five years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Tempered Glazing Units with Clear Intumescent Interlayer: Manufacturer agrees to replace units that deteriorate within specified warranty period. Deterioration of tempered glazing units with clear intumescent interlayer is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning glass contrary to manufacturer's written instructions. Evidence of failure is air bubbles within units, or obstruction of vision by contamination or deterioration of intumescent interlayer.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SUSTAINABLE DESIGN REQUIREMENTS

A. Comply with requirements specified in Section 018113.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

B. Fire Rating Requirements

1. Duration -- Doors: Capable of providing a fire rating for 90 minutes.
2. Duration -- Walls: Capable of providing a fire rating for 120 minutes.

2.3 MANUFACTURERS

A. Manufacturer Glazing Material: "AGC Pyrobel® by McGrory Glass®" fire-rated glazing as fabricated and distributed by McGrory Glass, 1400 Grandview Avenue, Paulsboro, NJ 08066 phone (800.220.3749) e-mail fire@mcgrory.com, website https://www.mcgroryfire.com.

B. Frame System: "forster fuego® light by McGrory Glass" fire-rated steel frame system as manufactured and supplied by McGrory Glass, 1400 Grandview Avenue, Paulsboro, NJ 08066 phone (800.220.3749) e-mail fire@mcgrory.com website https://www.mcgroryfire.com.

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~~A.~~**C.** Source Limitations for Glass: For each glass type, obtain from single source from single manufacturer.

~~B.~~**D.** Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

E. Design Requirements

1. Dimensions – Door and Framing:

a. Door framing face dimension: 2-3/8-inch.
b. Depth of door framing: 2-9/16-inch.
c. Door style face dimension: 3-9/16-inch.
d. Door cross rail (if applicable) face: 3-9/16-inch.
e. Depth of stile, header, sill and cross rail: 2 9/16-inch

2. Dimensions -- Window Assembly:

a. Perimeter framing face dimension: 2-3/4-inch at head, sill and jamb.
b. Horizontal and/or vertical mullions: 3-9/16-inch on the face.
c. Depth of perimeter and mullion: depth varies based on rating and profile

3. Construction: 120 minute narrow-profile, roll-formed steel architectural grade specialty fire framing, roll formed tubing, permanently joined with steel bolts.

a. Provide single leaf doors with manufacturer's rated hardware for 90 minute rating. Provide fully welded frames. Knock down frames are not permitted.

4. Insulation: Insulate framing against effects of fire, smoke, heat transfer form either side. Insulate profiled steel tubing using a shell construction that incorporates Promatect-H intermediate interlayer. Firmly pack perimeter of framing system to rough opening with mineral wool fire stop insulation or appropriately rated intumescent sealant.

2.4 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.5 GLASS PRODUCTS

A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Ultraclear Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear), with visible light transmission not less than 91 percent.

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C. Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.
2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.6 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing in accordance with NFPA 257 or UL 9, including hose-stream test, and shall comply with NFPA 80.

1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from hose-stream test.

B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether glazing has passed hose-stream test; whether glazing meets 450 degrees F temperature-rise limitation; and fire-resistance rating in minutes.

C. Fire-Protection-Rated Monolithic Glass for Doors Only: 19-mm thickness; clear, fire-protection glass; complying with 16 CFR 1201, Category II. UL listed and tested in accordance with NFPA 252 for fire-rated doors with hose-stream testing.

1. **GL-50:** Basis of Design: Subject to compliance with requirements, provide the following product, or approved equal:

   a. ~~SAFTI FIRST Fire Rated Glazing Solutions; SuperLite X-45/60/90~~**McGrory Glass AGC Probel, Vision Line 120-54, 2-1/8 inch thick for use in panels, doors, ransoms and sidelites with Forster Fuego Light steel framing system**~~.~~

2. Comparable products: Subject to compliance with requirements, comparable products of the following manufacturers may be considered:

   a. SAFTI FIRST
   ~~a.~~**b.** Schott North America, Inc.
   ~~b.~~**c.** Technical Glass Products.

D. Fire-Protection-Rated Laminated Ceramic Glazing: Laminated glass made from two plies of clear, ceramic glass; 8-mm total thickness; complying with 16 CFR 1201, Category II.

1. Products: Subject to compliance with requirements, provide one of the following, or approved equal:

   a. SAFTI FIRST Fire Rated Glazing Solutions; Pyran Platinum L.
   b. Schott North America, Inc.; Pyran Platinum L.
   c. Technical Glass Products; FireLite Plus, Premium Grade.

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2.7 FIRE-RESISTANCE-RATED GLAZING

A. Fire-Resistance-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-resistance ratings indicated, based on testing in accordance with ASTM E119 or UL 263.

B. Fire-Resistance-Rated Glazing Labeling: Permanently mark fire-resistance-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, that glazing is approved for use in walls, and fire-resistance rating in minutes.

C. Fire-Resistance-Rated Framing and Doors: Fire-resistance-rated glazing with 60-, 90-, and 120-minute ratings requires framing and doors from glass supplier, tested as an assembly complying with ASTM E119 or UL 263.

D. Fire-Resistance-Rated Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, ultraclear float glass; with intumescent interlayers; complying with 16 CFR 1201, Category II.

1. Basis of Design: Subject to compliance with requirements, provide the following product:
    a. SAFTI FIRST Fire Rated Glazing Solutions; SuperLite II-XL 60, or approved equal.
2. Comparable products: Subject to compliance with requirements, comparable products of the following manufacturers may be considered:
    a. Pilkington North America.
    b. Technical Glass Products.
    c. Vetrotech Saint-Gobain.

2.8 GLAZING ACCESSORIES

A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

1. Products: Subject to compliance with requirements, provide one of the following, or approved equal:
    a. GE Construction Sealants; Momentive Performance Materials Inc.; SilGlaze II SCS2800.
    b. The Dow Chemical Company; Dow Corning® 795 Silicone Building Sealant.
    c. Tremco Incorporated; Spectrem 2.
2. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Colors of Exposed Glazing Sealants: Match Architect's samples.

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C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

C. Perimeter Insulation for Fire-Resistance-Rated Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 FRAMING

A. Provide openings plumb, square and within allowable tolerances.

1. The manufacturer recommends 3/8 inch shim space at all walls

B. Notify Architect of any conditions which jeopardize the integrity of the proposed fire wall / door system.

C. Do not proceed until such conditions are corrected.

D. Install frames in accordance with the Forster Fuego Light Installation Manual by McGrory Glass.

~~3.3~~3.4 GLAZING, GENERAL

A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

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2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

I. Set glass lites with proper orientation so that coatings face fire side or protected side as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

~~3.4~~3.5 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

~~3.5~~3.6 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.

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C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

D. Install gaskets so they protrude past face of glazing stops.

~~3.6~~3.7 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial washaway from glass.

~~3.7~~3.8 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

~~3.8 FIRE-PROTECTION-RATED GLAZING SCHEDULE~~

~~A. Glass Type GL-XX: 45-minute fire-protection-rated glazing with 450 degrees F temperature-rise limitation in rated doors only, with a maximum vision area of 100 sq. in.; fire-protection-rated monolithic glass or fire-protection-rated laminated ceramic glazing.~~

~~3.9 FIRE-RESISTANCE-RATED GLAZING SCHEDULE~~

~~A. Glass Type GL-22: 60-minute fire-resistance-rated glazing complying with ASTM E119 or UL 263 in a tested assembly of glass and framing with 450 degrees F temperature-rise limitation; fire-resistance-rated laminated glass with intumescent interlayers.~~

END OF SECTION 088813

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SECTION 099611 – HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

~~1.2 CONTROLLING DOCUMENTS~~

~~A. This specification is controlled by Division 08 Section "Exterior Enclosure System Requirements". In addition to the requirements of this document, all requirements of Controlling Documents must also be met. The more onerous conditions of this document or the Controlling Document must be met.~~

~~1.3~~1.2 SUMMARY

A. Provide the work of this Section in accordance with requirements of the Contract Documents.

B. Section includes surface preparation and application of high-performance coating systems on the following exterior **and interior** substrates:

1. Steel.
2. Galvanized steel.

C. Related Requirements:

1. Division 05 Section "Structural Steel Framing" for shop priming of structural steel with primers specified in this Section.
2. Division 05 Section " Tube Railings" for shop priming pipe and tube railings with coatings specified in this Section.
3. Division 09 Sections "Interior Painting" and "Exterior Painting" for general field painting.

~~1.4~~1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Indicate VOC content.

B. Sustainable Design Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:

a. Leadership Extraction Practices

1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.

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2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.

a) Include statement indicating costs for each product having recycled content.

b. Sourcing of Raw Materials: For products that are responsibly sourced within 100 miles of project site, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.

1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

2. Indoor Environmental Quality, Low Emitting Materials:

a. Laboratory Test Reports: For adhesives, sealants, paints, coatings wet applied on site, indicating testing and compliance with the California Department of Public-Health (CDPH) Standard Method V1.2-2017, using the applicable exposure scenario.

b. Paints, and Coatings: For wet applied on-site products, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016.

c. Adhesives and Sealants: For wet applied on-site products, submit printed statement showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005, and rule amendment date of October 6, 2017.

d. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants.

~~B.~~C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.

1. Submit Samples on actual substrate material to be coated, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

~~C.~~D. Product List: Use same designations indicated on Drawings and in Exterior High-Performance Coating Schedule and Interior High performance Coating Schedule. Include color designations and product runs (batch numbers).

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Applicator.

B. Informational LEED Submittals:

1. Building Product Disclosure and Optimization - Environmental Product Declarations

a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.

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2. **Building Product Disclosure and Optimization - Material Ingredients**

   a. **Material Ingredient Optimization: Submit at least one of the following:**

      1) **GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.**
      2) **Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo, with gold or platinum certification.**
      3) **International Alternative Compliance Path - REACH Optimization**
      4) **Declare: Manufacturer's completed Product Declaration Form**
      5) **Other programs approved by USGBC**

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, (batch number) that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying high performance coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

   1. Architect will select typical steel framing elements and surfaces to represent substrates and conditions for application of each coating system.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F.

   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

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1.8 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 degrees F.

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carboline Company; a subsidiary of RPM International.
2. International Protective Coatings; AkzoNobel.
3. Sherwin-Williams Company (The).
4. Tnemec Company, Inc.

B. Basis of Design: Provide products indicated and manufactured by Tenemc Company, Inc.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. Material Compatibility:

1. Materials for use within each coating system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a coating system, products shall be recommended in writing by topcoat manufacturers for use in coating system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

B. VOC Content: Verify coatings comply with VOC content limits of authorities having jurisdiction and the following requirements:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
~~1.~~**3.** Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: 250 g/L or less.
~~2.~~**4.** Industrial Maintenance Coatings: 100 g/L or less.
~~3.~~**5.** Primers, Sealers, and Undercoaters: 100 g/L or less.
~~4.~~**6.** Rust Preventive Coatings: 100 g/L or less.
~~5.~~**7.** Zinc-Rich Primers: 100 g/L or less.
8. Pretreatment Wash Primers: 420 g/L.
9. Floor Coatings: 50 g/L.
10. Shellacs, Clear: 730 g/L.
11. Shellacs, Pigmented: 550 g/L.

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C. Low-Emitting Materials: For field applications that are inside the weatherproofing system, verify 90 percent of paints and coatings comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

~~C.~~**D.** Colors and Gloss: Match Architect's control Samples.

2.3 METAL PRIMERS

A. Zinc-Rich Inorganic Primer: Corrosion-resistant, inorganic-based, zinc-rich primer; formulated for use on prepared steel that will be exposed to severe industrial or marine environments.

B. Epoxy Zinc-Rich Primer: Solvent-based, multi-component, epoxy-type anti-corrosive primer; formulated for use on cleaned ferrous metal surfaces that will be exposed to moderate industrial or marine environments.

C. Water-Based, Rust-Inhibitive Primer: Corrosion-resistant, water-based-emulsion primer; formulated for resistance to flash rusting when applied to cleaned, ferrous metals that will be exposed to mildly corrosive environments.

D. Epoxy, Anti-Corrosive Primer: Solvent-based, two-component, epoxy, anti-corrosive primer; formulated for use on ferrous and galvanized metal surfaces.

~~2.3~~2.4 HIGH PERFORMANCE COATINGS

A. Aromatic Polyurethane, Zinc-Rich Primer: Single-component, moisture-cured, zinc-rich primer formulated for use on ferrous metal and galvanized steel surfaces.

~~1. Basis of Design: "Tnemec-Zinc 90G-1K97"; Tnemec Company, Inc., or approved equal.~~
~~2. Comparable products of the following manufacturers may be considered:~~

~~a. Carboline Company; a subsidiary of RPM International.~~
~~b. International Protective Coatings; AkzoNobel.~~
~~c. Sherwin-Williams Company (The).~~

B. Epoxy Coating: Polyamidoamine epoxy, anti-corrosive coating; formulated for use on ferrous metal and galvanized steel surfaces.

~~1. Basis of Design: "Hi-Build Epoxoline II Series N69"; Tnemec Company, Inc., or approved equal.~~
~~2. Comparable products of the following manufacturers may be considered:~~

~~a. Carboline Company; a subsidiary of RPM International.~~
~~b. International Protective Coatings; AkzoNobel.~~
~~c. Sherwin-Williams Company (The).~~

C. Aliphatic Acrylic Polyurethane Coating: Aliphatic acrylic polyurethane coating; formulated for use over cleaned metal surfaces, zinc rich primers and epoxy coatings as intermediate and topcoat coatings.

~~1. Basis of Design: "Endura-Shield Series 1095"; Tnemec Company, Inc.. or approved equal.~~
~~2. Comparable products of the following manufacturers may be considered:~~

~~a. Carboline Company; a subsidiary of RPM International.~~

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~~b. International Protective Coatings; AkzoNobel.~~
~~c. Sherwin-Williams Company (The).~~

2.5 SOURCE QUALITY CONTROL

A. Testing of Coating Materials:

1. Subcontractor shall engage services of a qualified testing agency to sample coating materials. Samples shall be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Subcontractor may be directed to stop applying coatings if test results show materials being used do not comply with product requirements. Subcontractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Subcontractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, both coatings are incompatible.

~~2.4~~2.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Finish Systems for Exposed Steel (HPC-01 through HPC-07):

1. Finish System:
   a. "Weld Through" Zinc rich primer in a crosslinked epoxy or organic resin, certified by manufacturer to provide ASTM A490 Class "A" Slip Coefficient and Creep Resistance for friction type connections, shop applied.
   b. Epoxy Intermediate Coat: Compatible with, and of the same manufacturer as, the primer Provide the respective dry film thickness specified; satin gloss finish coat, shop applied.
   c. Aliphatic Polyurethane Topcoat: Compatible with, and of the same manufacturer as, the intermediate coat; Shop applied or field applied on the exterior. Provide the respective dry film thickness specified; satin gloss finish coat.

2. Manufacturers and Products:
   a. Carboline:
      1) Primer: "859 VOC" (Carboline Co.); 2.5 to 4 mils min. d.f.t.
      2) Intermediate Coat: "Carboguard 893" (Carboline Co.). 4 to 6 mils d.f.t.
      3) Topcoat: "Carbothane 134 VOC" (or Carbothane 133 MC if applied onsite in enclosed space)" (Carboline Co.). 3 to 5 mils d.f.t.
   b. PPG
      1) Primer: Amercoat 68HS VOC" (PPG), 3 mils min. d.f.t.
      2) Intermediate Coat: "Amerlock 400" (PPG). 5 to 8 mils d.f.t.
      3) Topcoat: "Amershield" (or Amershield VOC if applied onsite in enclosed spaces)" (PPG). 4 to 5 mils d.f.t.
   c. Sherwin Williams
      1) Primer: “Zinc Clad III HS 100” 3to 5 mils d.f.t.
      2) Intermediate Coat: “SW Macropoxy 646” 3 to 8 mils d.f.t.
      3) Topcoat: “Acrolon 218 HS” (or Acrolon 100 HS if applied onsite in enclosed spaces) 3 to 6 mils d.f.t.

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3. Color of Finish Coat: Custom color as selected by Architect as follows:
   a. HPC-01: Custom Color as selected by Architect.
4. Gloss: Semi-gloss.

~~A. Steel Substrates:~~

~~1. Pigmented Aliphatic Acrylic Polyurethane over Polyamidoamine Epoxy and Aromatic Polyurethane, Zinc-Rich Primer System:~~

~~a. Prime Coat: Aromatic polyurethane, zinc-rich primer.~~

~~1) Spreading Rate: 3.0 – 3.5 mils (75 - 90 microns) DFT.~~

~~b. Intermediate Coat: Polyamidoamine epoxy coating.~~

~~1) Spreading Rate: 6.0 – 10.0 mils (150 - 250 microns) DFT.~~

~~c. Topcoat: Aliphatic acrylic polyurethane coating.~~

~~1) Spreading Rate: 5.0 mils (125 microns) DFT.~~

~~B. Galvanized-Steel Substrates:~~

~~1. Pigmented Aliphatic Acrylic Polyurethane over Polyamidoamine Epoxy System:~~

~~a. Prime Coat: Polyamidations epoxy coating.~~

~~1) Spreading Rate: 6.0 – 10.0 mils (150 - 250 microns) DFT.~~

~~b. Intermediate coat: Aliphatic acrylic polyurethane coating.~~

~~1) Spreading Rate: 5.0 mils (125 microns) DFT.~~

~~c. Topcoat: Aliphatic acrylic polyurethane coating.~~

~~1) Spreading Rate: 5.0 mils (125 microns) DFT.~~

2.7 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Finish Systems for Exposed Steel (HPC-20):

1. Finish System:
   a. Zinc rich primer in a crosslinked epoxy or organic resin certified by manufacturer to provide ASTM A490 Class "A" Slip Coefficient and Creep Resistance for friction type connections; maximum 100 VOC.
   b. Aliphatic Polyurethane Topcoats: Compatible with, and of the same manufacturer as, the primer; maximum 100 VOC. Provide the respective dry film thickness specified, satin finish coat.
2. Manufacturer and Product:
   a. Carboline:
      1) Primer: "859 VOC"; 2.5 to 4 mils min. d.f.t.
      2) Two Coats: "Carbothane 133MC" 3 to 5 mils d.f.t.
   b. PPG
      1) Primer: "Amercoat 68HS VOC" 3 mils min. d.f.t.
      2) Two Coats: "Amershield VOC" (4 to 5 mils d.f.t.

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c. Sherwin Williams

1) Primer: "Zinc Clad III HS 100" 3- to 5 mils d.f.t.
2) Two Coats: "Acrolon 100 HS" 3 to 6 mils d.f.t.

3. Color of Finish Coat: Custom color as selected by Architect.
4. Gloss: Semi-gloss.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Maximum Moisture Content of Substrates: Comply with manufacturer's requirements.
2. Verify suitability of substrates, including surface conditions and compatibility with primers.

B. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be coated.

1. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
2. After completing coating operations, use workers skilled in the trades involved to reinstall items that were removed.
3. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible coatings and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any.

1. Clean using methods recommended in writing by coating manufacturer but not less than the following:

a. SSPC-SP 6/NACE No. 3.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop coating is abraded. Coat exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

1. Shop primer: Coordinate work to ensure shop application of specified primer for high performance coating system.

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F. Galvanized-Steel Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

1. All galvanized steel elements shall receive shop primer and intermediate coat before delivery to site.

2. Clean using methods recommended in writing by manufacturer but not less than the following:

a. SSPC-SP 7/NACE No. 4.

G. Previously Coated Substrates: Remove all surface contamination such as oil, grease, loose paint, loose coatings, films, mill scale, dirt, foreign matter, rust, mold, mildew, mortar, efflorescence, sealers and other substances to assure sound bonding to the tightly adhering old paint and coatings. Glossy surfaces of old paint films must be clean and dull before recoating. Wash with an abrasive cleanser to clean and dull in one operation, or, wash thoroughly and dull by sanding. Spot prime bare areas with specified primers. Contractor acknowledges that any surface preparation short of total removal of previous coatings may compromise the service life of the specified coating system. Check for compatibility by applying a test patch of the specified coating system, covering at least 4 square feet. Allow to dry one week before testing adhesion per ASTM D3359. If testing indicates coating system incompatibility, remove previous coating completely.

1. Comply with coating manufacturer's recommendations for complete removal of existing coatings, including the following methods:
   a. SSPC-SP 6/NACE No. 3.
   b. SSPC-SP 16.

3.3 APPLICATION

A. Apply high-performance coatings in accordance with manufacturer's written instructions.

1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
3. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
4. Shop apply primers. Field touch up and restore damaged or defaced shop-applied coatings.
   a. Exception for galvanized steel substrates: Primers may be field-applied.
5. Field-apply intermediate and top coats.

B. Minimum Coating Thickness: Apply coating materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness. Provide total dry film thickness of entire coating system as recommended by coating manufacturer.

C. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

D. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

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E. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of subsequent coat does not cause undercoat to lift or lose adhesion.

F. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections.

3.4 FIELD QUALITY CONTROL

A. Testing of Coating Materials: Owner may engage the services of a qualified testing agency to sample coating materials.

1. Contractor will be notified in advance and may be present when samples are taken. Samples of coating materials delivered to Project site may be taken, identified, sealed, and certified by testing agency in the presence of the Contractor.
2. Testing agency will perform tests for compliance with product requirements including coatings testing for dry film thickness.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements or dry film thickness of applied coatings do not comply with manufacturer's written instructions. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with nonconforming or rejected materials. Contractor will be required to remove nonconforming or rejected materials from previously coated surfaces if, on recoating with complying materials, both coatings are incompatible.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

END OF SECTION 099611

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SECTION 101100 – VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide the work of this Section in accordance with requirements of the Contract Documents.

B. Section Includes:

1. Markerboards.
2. Tackboards.

C. Related Sections:

1. Division 08 Section "Glass Paneling" for marker boards in staff lounges, exam, conference and team rooms.
2. Division 10 Section "Directories" for bulletin boards within built-in directories.

1.3 DEFINITIONS

A. Tackboard: Framed or unframed, tackable, visual display board assembly.

B. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes chalkboards, markerboards, and tackboards.

C. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of chalkboards, markerboards, tackboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

1.4 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:
    a. Leadership Extraction Practices
        1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
        2) Wood Products: Certified by Forest Stewardship Council or USGBC approved equivalent.

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3) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
   a) Include statement indicating costs for each product having recycled content.

b. Sourcing of Raw Materials: For products that are required to comply with requirements for regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.

1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.

2. Indoor Environmental Quality, Low Emitting Materials: Building Products must be tested and compliant with the California Department of Public-Health (CDPH) Standard Method V1.1-2010, using the applicable exposure scenario.

a. Paints, and Coatings: For wet applied on site products, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3,-2011.
b. Adhesives and Sealants: For wet applied on site products, submit printed statement showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005 and rule amendment date of January 7, 2005.
c. Alternative tests for VOC above include ASTM D2369-10; ISO 11890 part 1; ASTM D6886-03; or ISO 11890-2.
d. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants
e. Composite Wood: Submit documentation showing that wood used in the project has low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low emitting formaldehyde (ULEF) resins or no added formaldehyde resins.

C. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of panel joints.
2. Include sections of typical trim members.

D. Samples: For each exposed product and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Informational LEED Submittals:

1. Building Product Disclosure and Optimization - Environmental Product Declarations

a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.

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2. Building Product Disclosure and Optimization - Sourcing of Raw Materials:
    a. Raw Material Sources and Extraction Reporting: Submit Raw materials supplier corporate Sustainability Reports (CSRs); documenting responsible extraction; including extraction locations, long term ecologically responsible land use, commitment to reducing environmental harms from extraction and manufacturing processes, and a commitment to meeting applicable standards or programs that address responsible sourcing criteria
        1) Submit manufacturers' self-declared reports
        2) Submit third party verified corporate sustainability reports (CSR) using one of the following frameworks"
            a) Global Reporting Initiative (GRI) Sustainability Report
            b) Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises
            c) UN Global Compact
            d) ISO 26000
            e) USGBC approved program.

3. Building Product Disclosure and Optimization - Material Ingredients
    a. Material Ingredient Optimization: Submit at least one of the following:
        1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
        2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle to Cradle logo, with gold or platinum certification.
        3) International Alternative Compliance Path - REACH Optimization
        4) Declare: Manufacturer's completed Product Declaration Form
        5) Other programs approved by USGBC
    b. Product Manufacturer Supply Chain Optimization: Submit documentation from manufacturers for products that go beyond material ingredient optimization as follows:
        1) Are sourced from product manufacturers who engage in validated and robust safety, health, hazard, and risk programs which at a minimum document at least 99% (by weight) of the ingredients used to make the building product or building material, and
        2) Are sourced from product manufacturers with independent third party verification of their supply chain that at a minimum verifies:
            a) Processes are in place to communicate and transparently prioritize chemical ingredients along the supply chain according to available hazard, exposure and use information to identify those that require more detailed evaluation
            b) Processes are in place to identify, document, and communicate information on health, safety and environmental characteristics of chemical ingredients
            c) Processes are in place to implement measures to manage the health, safety and environmental hazard and risk of chemical ingredients
            d) Processes are in place to optimize health, safety and environmental impacts when designing and improving chemical ingredients
            e) Processes are in place to communicate, receive and evaluate chemical ingredient safety and stewardship information along the supply chain
            f) Safety and stewardship information about the chemical ingredients is publicly available from all points along the supply chain.

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C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.

D. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

1.7 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Surfaces lose original writing and erasing qualities.
   b. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Recycled Content: Provide products with an average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following percent by weight:

1. Steel: 30%
2. Aluminum: 25%
3. Woodwork: 50%

B. Regional Materials: Provide a minimum of 20 percent of building materials (by cost) that are regionally extracted, processed and manufactured materials within a radius of 100 miles.

C. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated.

D. Natural Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.

E. Extruded Aluminum: ASTM B 221, Alloy 6063.

F. Particleboard: ANSI A208.1, Grade M-1, made with binder containing no urea formaldehyde.

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G. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific tack wall panels and substrate application, as recommended in writing by visual display surface manufacturer, and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Division 09 Section "Interior Painting" and recommended in writing by visual display surface manufacturer for intended substrate.

2.2 TACKBOARD ASSEMBLIES

A. Basis of Design (**VDS-04)**: Claridge Products and Equipment, Inc. "Cork, tackable surface" with TW1F edge wrapped cork on Duracore, metal framed with bulletin board finish. Equivalent products by one of the following will be considered subject to compliance with requirements:

1. Egan Visual Inc.
2. Ghent Manufacturing, Inc.
3. PolyVision Corporation; a Steelcase company.
4. Tri-Best Visual Display Products.

B. Natural-Cork Tackboard: 1/4-inch thick, natural cork sheet factory laminated to 1/4-inch thick hardboard backing.

2.3 VISUAL DISPLAY TYPES

A. Magnetic Markerboard:

B. Provide magnetic markerboard with Brilliant White color back painted float glass, gloss with magnetic finish, from basis of design or comparable manufacturers listed below:

1. Basis of Design: Clarus, Magnetic Dry Erase Glass Markerboard, or approved equal from one of the following:

   a. Skyline Vitracolor Magnetic Markerglass
   b. Ghent, Aria Glassboards

C. Frame: Clear anodized aluminum frame.

D. Accessories: Provide each markerboard with curve tray (1), Square Magnets (set of 1) and Gray Magnet Eraser (1).

E. Types: Provide the following types and sizes at locations indicated:

1. **VDS-01**: 1/4" Thick, horizontal panels.

   a. **VDS-~~01.1~~01.4:** 48" x 48".
   b. **VDS-~~01.2~~01.6:** 48" x 72".
   c. **VDS-~~01.3~~01.8:** 48" x 96 ".

2. **VDS-02**: Size 96 x 48, 1/4" Thick; vertical panels, with spline joinery in instances when multiple panels are joined together, and full length marker tray.
3. **VDS-03**: Magnetic glass marker board sliding panel on aluminum rail, 48 inch high x varying lengths as shown on drawings.
4. **VDS-05**: Magnetic glass marker board sliding panel on aluminum rail, 60 inch high by varying lengths as shown on drawings.

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2.4 MARKERBOARD AND TACKBOARD ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; of size and shape indicated on Drawings.

1. Field-Applied Trim: Manufacturer's standard, snap-on trim with no visible screws or exposed joints.

B. Field-Applied Wood Trim: Comply with requirements specified in Division 06 Section "Interior Architectural Woodwork."

2.5 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Visual Display Boards: Factory assemble visual display boards unless otherwise indicated.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.

1. Provide manufacturer's standard vertical-joint spline system between abutting sections of markerboards.
2. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

D. Modular Visual Display Boards: Fabricated with integral panel clips attached to core material.

E. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motor-operated, sliding visual display units.

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C. Examine walls and partitions for proper preparation and backing for visual display surfaces.

D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.

1. Prime wall surfaces indicated to receive direct-applied, visual display tack wall panels, visual display wall coverings, and as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
2. Prepare substrates indicated to receive visual display wall covering as required by manufacturer's written instructions to achieve a smooth, dry, clean, structurally sound surface that is uniform in color.
    a. Moisture Content: Maximum of 4 percent when tested with an electronic moisture meter.
    b. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
    c. Metals: If not factory primed, clean and apply metal as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
    d. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
    e. Painted Surfaces: Treat areas susceptible to pigment bleeding.

D. Prepare recesses for sliding visual display units as required by type and size of unit.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Field-Assembled Visual Display Units: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
2. Provide manufacturer's standard vertical-joint spline system between abutting sections of markerboards.

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C. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.

1. Field-Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 24 inches o.c.
2. Field-Applied Wood Trim: Install trim according to requirements in Division 06 Section "Interior Architectural Woodwork."

3.4 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train the LGP's maintenance personnel to adjust, operate, and maintain motor-operated, sliding visual display units.

END OF SECTION 101100

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SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide the work of this section in accordance with requirements of the Contract Documents.

B. This Section includes portable fire extinguishers and mounting brackets for fire extinguishers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 SUSTAINABLE DESIGN SUBMITTALS

A. Comply with requirements specified in Section 018113.

1.5 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.7 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

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1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Failure of hydrostatic test according to NFPA 10.
   b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SUSTAINABLE DESIGN REQUIREMENTS

A. Comply with requirements specified in Section 018113.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers for **FEC-01** and **FEC-02** Fire Extinguisher Cabinets: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.

1. Basis of Design (~~**FE-02**~~**FE-01**): Potter Roemer LLC, "3010", ABC Dry Chemical has been selected as the basis of design for the project. Subject to compliance with requirements, provide products by one of the following:
   a. J. L. Industries, Inc.; a division of Activar Construction Products Group.
   b. Larsen's Manufacturing Company.
   c. Potter Roemer LLC.
   d. Or approved equal.

2. Valves: Nickel-plated, polished brass body.
3. Handles and Levers: Stainless steel.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
5. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, 10-lb. nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

B. Fire Extinguishers for **FEC-03** Fire Extinguisher Cabinets in NMR Magnetic field: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.

1. Basis of Design (**FE-02**): Potter Roemer LLC, "3272", 2.5 Gallon Pressurized Water Mist Extinguisher" has been selected as the basis of design for the project. Subject to compliance with requirements, provide products by one of the following:
   a. J. L. Industries, Inc.; a division of Activar Construction Products Group.
   b. Larsen's Manufacturing Company.
   c. Potter Roemer LLC.
   d. Or approved equal.

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2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
3. Pressurized Water Mist Fire Extinguisher: 2.5 gallon, nominal capacity, UL 2A:C rating, stainless steel shell with pressure gage and wall bracket.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. J. L. Industries, Inc.; a division of Activar Construction Products Group.
b. Larsen's Manufacturing Company.
c. Potter Roemer LLC.

2. Provide mounting brackets for fire extinguishers that are not located in fire extinguisher cabinets.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

2. Provide identification lettering for fire extinguishers that are not located in fire extinguisher cabinets.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

C. Mounting Brackets: Where fire extinguishers are not located in fire extinguisher cabinets, install mounting brackets located 48 inches above finished floor to top of fire extinguisher, unless otherwise indicated on the Drawings.

1. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

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D. Identification Lettering: Where fire extinguishers are not located in fire extinguisher cabinets, apply identification lettering to wall surfaces as indicated.

END OF SECTION 104416

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SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings - domestic water.
2. Ductile-iron pipe and fittings - domestic water.
3. Galvanized-steel pipe and fittings - domestic water.
4. Stainless steel piping and fittings - domestic water.
5. Polypropylene (PP-R and PP-RCT) pipe and fittings - domestic water.
6. Piping joining materials - domestic water.
7. Encasement for piping.
8. Transition fittings - domestic water.
9. Dielectric fittings - domestic water.

B. Related Requirements:

1. Section 331415 "Site Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

This project is designed to achieve LEED v4 BD+C: Certification at the silver level. The following requirements apply to domestic water piping materials and installation practices:

1. Low-Emitting Materials
   All adhesives, sealants, and coatings used in domestic water piping systems shall comply with LEED EQ Credit: Low-Emitting Materials.
   VOC content shall not exceed limits established by SCAQMD Rule 1168 and Green Seal standards.
   Submittals shall include manufacturer documentation and third-party certifications.
2. Recycled Content
   Where feasible, piping components, fittings, and accessories shall contain post-consumer and/or pre-consumer recycled content.
   Provide documentation verifying recycled content percentages.
3. VOC Compliance
   All site-applied materials shall meet VOC limits as defined by LEED and applicable environmental standards.
   Submit VOC data sheets and certifications for all applicable products.
4. Submittals
   Include Sustainable Design Submittals as part of the Action Submittals for this section.
   Provide LEED-compliant documentation for all applicable products, including EPDs, HPDs, and VOC certifications.
5. General Compliance

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All domestic water piping work shall support the overall LEED certification effort and contribute to applicable credits under Materials & Resources (MR) and Indoor Environmental Quality (EQ).
Coordinate with Division 01 Section “Sustainable Design Requirements” for additional LEED documentation procedures.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. System purging and disinfecting activities report.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installers of pressure-sealed joints are to be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

1.5 WARRANTY

A. Polypropylene (PP-R and PP-RCT) Pipe and Fittings Manufacturer's Warranty: Manufacturer agrees to repair or replace PP-R and PP-RCT pipe and fittings that fail in materials or workmanship within 10 years from date of Substantial Completion.

1. Warranty is to cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of piping system due to defects in materials or manufacturing.
2. Warranty is to be in effect only upon submission by Contractor to manufacturer of valid pressure/leak documentation indicating that the system was tested and passed manufacturer's pressure/leak test.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Domestic water piping, tubing, fittings, joints, and appurtenances intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act, with requirements of authorities having jurisdiction, and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PIPING MATERIALS

A. Potable-water piping and components are to comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

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2.3 COPPER TUBE AND FITTINGS - DOMESTIC WATER

A. Hard Copper Tube: ASTM B 88, Type Lwater tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type Kand ASTM B 88, Type Lwater tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Elkhart Products Corporation.
    b. NIBCO Inc.
    c. Viega.
    d. Or approved equal.

2. Fittings for NPS 2and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
3. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2.4 DUCTILE-IRON PIPE AND FITTINGS - DOMESTIC WATER

A. Mechanical-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.

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2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Push-on-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51.
2. Push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

E. Standard-Pattern, Push-on-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Gaskets: AWWA C111/A21.11, rubber.

F. Compact-Pattern, Push-on-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Gaskets: AWWA C111/A21.11, rubber.

G. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

2.5 GALVANIZED-STEEL PIPE AND FITTINGS - DOMESTIC WATER

A. Mechanical-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Push-on-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51.
2. Push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

E. Standard-Pattern, Push-on-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Gaskets: AWWA C111/A21.11, rubber.

F. Compact-Pattern, Push-on-Joint Fittings:

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1. AWWA C153/A21.53, ductile iron.
2. Gaskets: AWWA C111/A21.11, rubber.

G. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

2.6 STAINLESS STEEL PIPING AND FITTINGS - DOMESTIC WATER

A. Potable-water piping and components are to comply with NSF 61 and NSF 372.

B. Stainless Steel Pipe: ASTM A312/A312M, seamless, stainless steel of types and schedules as indicated in "Piping Applications" Article.

C. Stainless Steel Pipe Fittings: ASTM A815/A815M.

D. Appurtenances for Grooved-End, Stainless Steel Pipe - Domestic Water:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. NIBCO Inc.
   b. Viega.
   c. Or approved equal.
2. Source Limitations: Obtain appurtenance for grooved-end, stainless steel pipe from single manufacturer.
3. Fittings for Grooved-End, Stainless Steel Pipe: Stainless steel casting with dimensions matching stainless steel pipe.
4. Mechanical Couplings for Grooved-End, Stainless Steel Pipe:

   a. AWWA C606 for stainless steel pipe dimensions.
   b. Stainless steel housing sections.
   c. Stainless steel bolts and nuts.
   d. EPDM-rubber gaskets suitable for hot and cold water.
   e. Minimum Pressure Rating:

      1) NPS 8 (DN 200) and Smaller: 600 psig.

E. Stainless Steel Piping, Pressure-Seal-Joint Fittings - Domestic Water:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. NIBCO Inc.
   b. Viega.
   c. Or approved equal.
2. Source Limitations: Obtain stainless steel piping, pressure-seal-joint fittings from single manufacturer.
3. Material: Type 316 stainless steel, ASTM A312/A312M, Schedule 10.
4. Fittings: Type 316 stainless steel with EPDM O-ring seal in each end, and approved for potable-water applications.
5. Listing: ICC-ES LC1002 or UL classified in accordance with NSF 61 and NSF 372.
6. Minimum 200 psig working-pressure rating at 250 deg F.

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2.7 POLYPROPYLENE PIPE AND FITTINGS - DOMESTIC WATER

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. GF PROGE (PP-H)
    b. Orion
    c. Uponor
    d. Or approved equal.

B. Source Limitations: Obtain polypropylene (PP-R and PP-RCT) pipe and fittings from single manufacturer.

C. Polypropylene (PP-R and PP-RCT) Pipe and Fittings: ASTM F2389, pipe pressure rating to comply with temperature and pressure ratings of code requirements for applicable service.

1. Polypropylene Fittings: ASTM F2389, socket fusion, butt fusion, electrofusion, or fusion outlet fittings to be used for fusion-welded joints between pipe and fittings.
2. Mechanical fittings and transition fittings to be used where transitions are made to other piping materials or to valves and appurtenances.
3. Polypropylene pipe is to be unthreaded. Threaded transition fittings per ASTM F2389 to be used where a threaded connection is required.

D. Smoke and Fire Ratings:

1. Where indicated on Drawings that a plenum-rated piping system is required, pipe is to be wrapped and/or insulated with fiberglass or mineral-wool pipe insulation, and field installed.
2. System is to have a flame-spread index of less than 25 and smoke-developed index of less than 50.
3. Pipe, wrap, or insulate as a system to comply with requirements of CAN/ULC-S102.2-03, ASTM E84, or UL 2846.
4. For insulation required for thermal and condensation reasons, see Section 220719 "Plumbing Piping Insulation."

E. Integration of PP-R and PP-RCT Piping Systems with Other Systems:

1. When integrating PP-R and PP-RCT piping systems with other systems or with components not made of PP-R or PP-RCT (for example, valves, pumps, other piping, check valves, or strainers), ensure that operating parameters for PP-R and PP-RCT will not damage other materials in the system or vice versa.
2. Verify that all parts of the system are compatible with the medium being carried before installation. PP-R and PP-RCT pipe do not require treatment to protect them from corrosion. Metals (ferrous and non-ferrous) in the system may be susceptible to corrosion. Provide water treatment to protect system metals.
3. Do not mix PP-R and PP-RCT pipe with other piping systems in conditions that will cause the other system or components to fail.
4. For Domestic Hot Water Recirculation (DHWR) Systems:

    a. When using copper piping in conjunction with PP-R and PP-RCT in a DHWR system, ensure that operating conditions will not cause degradation or erosion/corrosion of copper.
    b. Follow CDA guidelines (CDA's "Copper Tube Handbook") for sizing, temperature, and flow velocity in the copper tubing.

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c. Sustained high levels of copper in DHWR piping can damage components within the system, even PP-R and PP-RCT.
d. Ensure that maximum hot-water temperature within any part of the system/loop does not exceed 140 deg F. Some regulations and codes further restrict temperature at any fixture to maximum of 120 deg F. Do not exceed temperature rating of pipe for the operating pressure.
e. Maximum temperature used must not exceed rating of pipe for the operating pressure.
f. Flow rates in a DHWR system should not exceed 1.5 ft./sec anywhere in the system, except in some special cases where velocities up to 3 ft./sec are needed to achieve proper flow temperature.
g. When adding PP-R or PP-RCT to an existing copper system in a DHWR application, the level of copper in the water must be tested. Do not install PP-R or PP-RCT where dissolved copper levels exceed 0.1 mg/L (ppm).

F. PP-R and PP-RCT Socket Fittings: ASTM F2389.

2.8 PIPING JOINING MATERIALS - DOMESTIC WATER

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B32, lead-free alloys.

D. Flux: ASTM B813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.9 ENCASEMENT FOR PIPING

A. Standard: ASTM A674 or AWWA C105/A21.5.

B. Form: Sheet or tube.

C. Color: Black or natural.

2.10 TRANSITION FITTINGS - DOMESTIC WATER

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

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C. Plastic-to-Metal Transition Fittings - Domestic Water:

1. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Charlotte Pipe and Foundry Company.
   b. Harvel Plastics, Inc.
   c. Spears Manufacturing Company.
   d. Or approved equal.

2. Description:

   ~~a. CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.~~
   ~~b.~~**a.** One end with threaded brass insert and one solvent-cement-socket or threaded end.

D. Plastic-to-Metal Transition Unions - Domestic Water:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Colonial Engineering, Inc.
   b. NIBCO Inc.
   c. Spears Manufacturing Company.
   d. Or approved equal.

2. Source Limitations: Obtain plastic-to-metal transition unions from single manufacturer.
3. Description:

   ~~a. CPVC four-part union.~~
   ~~b.~~**a.** Brass or stainless steel threaded end.
   ~~c.~~**b.** Solvent-cement-joint or threaded plastic end.
   ~~d.~~**c.** Rubber O-ring.
   ~~e.~~**d.** Union nut.

2.11 DIELECTRIC FITTINGS - DOMESTIC WATER

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions - Domestic Water:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
   b. Central Plastics Company.
   c. Watts; a division of Watts Water Technologies, Inc.
   d. Wilkins; a Zurn company.
   e. Or approved equal.

2. Source Limitations: Obtain dielectric unions from single manufacturer.
3. Standard: ASSE 1079.

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4. Pressure Rating: 125 psig minimum at 180 deg F.
5. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges - Domestic Water:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
    b. Central Plastics Company.
    c. Watts; a division of Watts Water Technologies, Inc.
    d. Wilkins; a Zurn company.
    e. Or approved equal.

2. Source Limitations: Obtain dielectric flanges from single manufacturer.
3. Standard: ASSE 1079.
4. Factory-fabricated, bolted, companion-flange assembly.
5. Pressure Rating: 125 psig minimum at 180 deg F.
6. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits - Domestic Water:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Advance Products & Systems, Inc.
    b. Central Plastics Company.
    c. Pipeline Seal and Insulator, Inc.
    d. Or approved equal.

2. Source Limitations: Obtain dielectric-flange insulating kits from single manufacturer.
3. Nonconducting materials for field assembly of companion flanges.
4. Pressure Rating: 150 psig.
5. Gasket: Phenolic.
6. Bolt Sleeves: Phenolic or polyethylene.
7. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples - Domestic Water:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Elster Perfection Corporation.
    b. Grinnell Mechanical Products; Tyco Fire Products LP.
    c. Precision Plumbing Products, Inc.
    d. Victaulic Company.
    e. Or approved equal.

2. Source Limitations: Obtain dielectric nipples from single manufacturer.
3. Standard: IAPMO PS 66.

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4. Electroplated steel nipple complying with ASTM F1545.
5. Pressure Rating and Temperature: 300 psig at 225 deg F.
6. End Connections: Male threaded or grooved.
7. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance.

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water-pressure-reducing valves downstream from shutoff valves.

G. Install domestic water piping level without pitch and plumb.

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

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O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

P. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump.

Q. Install thermostats in hot-water circulation piping.

R. Install thermometers on outlet piping from each water heater.

S. Install sleeves for piping penetrations of walls, ceilings, and floors.

T. Install sleeve seals for piping penetrations of concrete walls and slabs.

U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

I. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

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3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2and Smaller: Plastic-to-metal transition fittings or unions.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.

D. Dielectric Fittings for NPS 5and Larger: Use dielectric flange kits.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feetand Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

3. Multiple, Straight, Horizontal Piping Runs 100 Feetor Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4and Smaller: 60 incheswith 3/8-inchrod.
2. NPS 1 and NPS 1-1/4: 72 incheswith 3/8-inchrod.
3. NPS 1-1/2 and NPS 2: 96 incheswith 3/8-inchrod.
4. NPS 2-1/2: 108 incheswith 1/2-inchrod.
5. NPS 3 to NPS 5: 10 feetwith 1/2-inchrod.

E. Install supports for vertical copper tubing every 10 feet.

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F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4and Smaller: 84 incheswith 3/8-inchrod.
2. NPS 1-1/2: 108 inches with 3/8-inchrod.
3. NPS 2: 10 feetwith 3/8-inch rod.
4. NPS 2-1/2: 11 feetwith 1/2-inchrod.
5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inchrod.
6. NPS 4 and NPS 5: 12 feetwith 5/8-inchrod.

G. Install supports for vertical steel piping every 15 feet.

H. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2and larger.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.

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2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psigabove operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

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3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppmof chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppmof chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Repeat procedures if biological examination shows contamination.
    e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building-service piping, NPS 3and smaller, shall be one of the following:

1. Soft copper tube, ASTM B 88, Type K ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed, copper pressure-seal fittings; and pressure-sealed joints.

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D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be one of the following:

1. Soft copper tube, ASTM B 88, Type K ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. Mechanical-joint, ductile-iron pipe; standard-pattern, mechanical-joint fittings; and mechanical joints.
3. Push-on-joint, ductile-iron pipe; standard-pattern, push-on-joint fittings; and gasketed joints.
4. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

E. Under-building-slab, domestic water piping, NPS 2and smaller, shall be one of the following:

1. Hard or soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed, copper pressure-seal-joint fittings; and pressure-sealed joints.

F. Aboveground domestic water piping, NPS 2and smaller, shall be one of the following:

1. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
2. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed, soldered joints.
3. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed, soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 3and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 4and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated, Memory-stop balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

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SECTION 221414 - STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.
3. Specialty pipe fittings.

B. Related Requirements:

1. Section 221429 "Sump Pumps" for storm drainage pumps.
2. Section 334200 "Stormwater Conveyance" for storm drainage piping outside the building.

1.2 ACTION SUBMITTALS

A. Product data.

~~B. Sustainable Design Submittals:~~

~~1. <Double click to insert sustainable design text for adhesives.>~~

~~C.~~**B.** Shop Drawings: For controlled-flow roof drainage system. Include calculations, plans, sections, elevations, and details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and elevations, or Building Information Model (BIM) drawn to scale, showing items described in this Section and coordinated with all building trades.

B. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.

C. Field Quality-Control Reports: Inspection reports signed by authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Provide materials bearing label, stamp, or other markings of specified testing agency.

1.5 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation are to be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.
2. Storm Drainage, Force-Main Piping: 50 psig.

B. Seismic Performance: Storm drainage piping and support and installation to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7. See Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully functional after the seismic event."
2. Component Importance Factor: 1.0.
3. **Component Amplification Factor (ap) and Component Response Modification Factor (Rp) shall be as defined in ASCE/SEI 7 Table 13.5-1 for piping systems**

2.2 PIPING MATERIALS

A. Piping materials to bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings:

1. Marked with CISPI collective trademark and NSF certification mark.
2. Standard: ASTM A74.
3. Class: Service weight cast iron.

B. Gaskets: ASTM C564, rubber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings:

1. Marked with CISPI collective trademark and NSF certification mark.
2. Standards: ASTM A888 and CISPI 301.

B. Standard, Hubless-Piping Couplings:

1. Marked with CISPI collective trademark and NSF certification mark.
2. Standards: ASTM C1277 and CISPI 310.

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3. Description: Stainless steel corrugated shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Standard: ASTM C1277 or ASTM C1540.
2. Description: Stainless steel shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Hubless-Piping Couplings:

1. Standard: ASTM A1056.
2. Description: Two-piece ASTM A48/A48M, cast-iron housing; stainless steel bolts and nuts; and ASTM C564, rubber sleeve with integral, center pipe stop.

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections of same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
3. Unshielded, Nonpressure Transition Couplings:

    a. Standard: ASTM C1173.
    b. Description: Elastomeric sleeve, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    c. Sleeve Materials:

        1) For Cast-Iron Soil Pipes: ASTM C564 rubber.
        2) For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
        3) For Dissimilar Pipes: ASTM D5926 PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

    a. Standard: ASTM C1460.
    b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
    c. End Connections: Same size as and compatible with pipes to be joined.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

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3.2 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

B. Install piping as indicated unless deviations from layout are approved on coordination drawings.

C. Install piping in concealed locations.

1. Piping installed in equipment rooms, service areas, and where indicated may be exposed.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

L. Make changes in direction for piping using appropriate branches, bends, and long-sweep bends.

1. Do not change direction of flow more than 90 degrees.
2. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

a. Reducing size of drainage piping in direction of flow is prohibited.

M. Lay buried building piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

N. Install piping at the following minimum slopes unless otherwise indicated.

1. Building Storm Drain: 1/4 inch per foot downward in direction of flow for piping NPS 3 and smaller; 1/8 inch per foot downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Storm Drainage Piping: 1/4 inch per foot downward in direction of flow.

O. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Ch IV, "Installation of Cast Iron Soil Pipe and Fittings."

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P. Install underground PVC piping in accordance with ASTM D2321.

Q. Install engineered controlled-flow drain specialties and storm drainage piping in locations indicated.

R. Plumbing Specialties:

1. Install backwater valves in storm drainage gravity-flow piping.

a. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

2. Install cleanouts in storm drainage gravity-flow piping in accessible locations.

a. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.
b. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."

3. Install drains in storm drainage gravity-flow piping.

a. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

S. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

T. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."

U. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

3.3 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hubless, Cast-Iron Soil Piping Coupled Joints: Join in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1.

1. Cut threads full and clean using sharp dies.

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2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
    c. Do not use pipe sections that have cracked or open welds.

D. Grooved Joints: Cut groove ends of pipe in accordance with AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

E. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

F. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join in accordance with ASTM D2235 and ASTM D2661 appendices.
3. PVC Piping: Join in accordance with ASTM D2855 and ASTM D2665 appendices.

G. Joint Restraints and Sway Bracing:

1. Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:

    a. Provide axial restraint for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.
    b. Provide rigid sway bracing for pipe and fittings 4 inches and larger, upstream and downstream of all changes in direction 45 degrees and greater.
    c. Provide rigid sway bracing for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction and branch openings.

3.4 INSTALLATION OF SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Drainage Piping: Shielded, nonpressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges flange kits.
4. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

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3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for hangers, supports, and anchor devices specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless steel fiberglass pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install hangers for cast-iron piping with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install hangers for piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

F. Support vertical cast-iron piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent, but as a minimum at base and at each floor.

G. Support vertical piping with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
2. Install horizontal backwater valves with cleanout cover flush with floor.

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3. Comply with requirements for backwater valves cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties."

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections in accordance with the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed storm drainage piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Test Procedure:

    a. Test storm drainage piping, except outside leaders, on completion of roughing-in.

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b. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
c. From 15 minutes before inspection starts until completion of inspection, water level must not drop.
d. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

3.10 PROTECTION

A. Protect piping and drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day and when work stops.

C. Repair damage to adjacent materials caused by storm drainage piping installation.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground storm drainage piping NPS 6 and smaller is to be the following:

1. Service weight, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI, hubless-piping couplings; and coupled joints.
3. [Retain " any of" option in first paragraph below to allow Contractor to select piping materials from those retained.

C. Aboveground, storm drainage piping NPS 8 and larger is to be the following:

1. Service weight, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI, hubless-piping couplings; and coupled joints.

D. drainage piping NPS 6 and smaller is to be the following:

1. Service weight, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI, cast-iron, hubless-piping couplings; and coupled joints.

E. Underground, storm drainage piping NPS 8 and larger is to be the following:

1. Service weight, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

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2. Hubless, cast-iron soil pipe and fittings; CISPI, cast-iron, hubless-piping couplings; and coupled joints.

END OF SECTION 221414

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SECTION 221513 - GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Piping and related specialties for general-service compressed-air systems, as follows:

1. Pipes, tubes, and fittings.
2. Joining materials.
3. Valves.
4. Dielectric fittings.
5. Flexible pipe connectors.
6. Specialties.
7. Quick couplings.
8. Hose assemblies.

B. Related Requirements:

1. Section 221519 "General-Service Packaged Air Compressors and Receivers" for general-service air compressors and accessories.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Plastic pipes, fittings, and valves.
2. Dielectric fittings.
3. Flexible pipe connectors.
4. Safety valves.
5. Pressure regulators. Include rated capacities and operating characteristics.
6. Automatic drain valves.
7. Filters. Include rated capacities and operating characteristics.
8. Quick couplings.
9. Hose assemblies.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Brazing certificates.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Joining Procedures for Aluminum Piping Systems: Qualify installers according to training provided by respective manufacturer.

B. Brazing: Qualify processes and operators in accordance with ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or with AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

1.6 PROJECT CONDITIONS

~~A. Interruption of Existing Compressed-Air Service: Do not interrupt compressed-air service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary compressed-air service according to requirements indicated:~~

~~1. Notify Architect Construction Manager Owner no fewer than two days in advance of proposed interruption of compressed-air service.~~
~~2. Do not proceed with interruption of compressed-air service without Architect's Construction Manager's Owner's written permission.~~

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Compressed-air piping system to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7. See Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

1. The term "withstand" means "the piping system will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
2. Component Importance Factor~~:~~: ~~[**1.5**]~~ ~~[~~1.0~~]~~.
3. ~~**<Insert requirements for Component Amplification Factor and Component Response Modification Factor>**~~.

B. ASME Compliance:

1. Comply with ASME B31.3, "Process Piping," for low-pressure, compressed-air piping.
2. Comply with ASME B31.9, "Building Services Piping," for low-pressure, compressed-air piping.

2.2 PIPES, TUBES, AND FITTINGS

A. Copper Tube: ~~[~~ASTM B88, Type K or L~~]~~ seamless, drawn-temper, water tube.

1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
2. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
3. Copper Unions: ASME B16.22 or MSS SP-123.

B. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux in accordance with ASTM B813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

2.4 VALVES

A. Metal Ball, Butterfly, Check, and Gate Valves: Comply with requirements in Section 220523 "General-Duty Valves for Plumbing Piping."

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: ~~[~~125 psig minimum at 180 deg F~~]~~ ~~[150 psig]~~ ~~[250 psig]~~.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.6 FLEXIBLE PIPE CONNECTORS

A. Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating~~:~~: ~~[200 psig]~~ ~~[~~250 psig~~]~~ minimum.
2. End Connections, NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.

B. Stainless Steel-Hose Flexible Pipe Connectors: Corrugated, stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating~~:~~: ~~[200 psig]~~ ~~[~~250 psig~~]~~ minimum.

2. End Connections, NPS 2 and Smaller: Threaded steel pipe nipple.

2.7 SPECIALTIES

A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.

1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.

B. Air-Main Pressure Regulators: Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for ~~[~~250 psig~~] <Insert pressure>~~ inlet pressure, unless otherwise indicated.

1. Type: Pilot operated.

C. Air-Line Pressure Regulators, Bronze Body: ~~[~~Diaphragm~~] [or] [pilot]~~ operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for ~~[~~200 psig~~] <Insert pressure>~~ minimum inlet pressure, unless otherwise indicated.

D. Air-Line Pressure Regulators, Aluminum Alloy or Plastic Body: Diaphragm operated, aluminum alloy or plastic body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for ~~[~~200 psig~~] <Insert pressure>~~ minimum inlet pressure, unless otherwise indicated.

E. Automatic Drain Valves: Stainless steel body and internal parts, rated for ~~[~~200 psig~~] <Insert pressure>~~ minimum working pressure, capable of automatic discharge of collected condensate.~~[~~ Include mounting bracket if wall mounting is indicated.~~]~~

F. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded.~~[~~ Include mounting bracket if wall mounting is indicated.~~]~~

G. Mechanical Filters: Two-stage, mechanical-separation, air-line filters. Equip with deflector plates, resin-impregnated-ribbon filters with edge filtration, and drain cock.~~[~~ Include mounting bracket if wall mounting is indicated.~~]~~

2.8 QUICK COUPLINGS

A. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.

B. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless steel or nickel-plated-steel operating parts.

1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
2. Plug End: ~~[~~Flow-sensor-bleeder, check-valve~~] [Straight-through]~~ type with barbed outlet for attaching hose.

C. Valveless Quick Couplings: Straight-through brass body with stainless steel or nickel-plated-steel operating parts.

1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
2. Plug End: With barbed outlet for attaching hose.

2.9 HOSE ASSEMBLIES

A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for ~~[~~300 psig~~]~~ ~~**<Insert pressure>**~~ minimum working pressure, unless otherwise indicated.

1. Hose: Reinforced ~~[single-]~~ ~~**[or]**~~ ~~[~~double~~]~~-wire-braid, CR-covered hose for compressed-air service.
2. Hose Clamps: Stainless steel clamps or bands.
3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
4. Hose Splicers: One-piece, straight-through brass or stainless steel fitting with barbed ends for connecting two sections of hose.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Compressed-Air Piping between Air Compressors and Receivers: Use~~[**one of**]~~ the following piping materials for each size range:

~~1. NPS 2 (DN 50) and Smaller, Threaded: Schedule 40, [**black**] [**galvanized**] steel pipe; threaded, malleable-iron fittings; and threaded joints.~~

~~2.~~**1.** NPS 2 (DN 50) and Smaller, Brazed: Type K or L, copper tube; wrought-copper fittings; and brazed joints.

~~3.~~**2.** 63 mm Outside Tube Diameter and Smaller: Aluminum pipe; solid-brass nickel-plated fittings; and push-connect bite ring couplings.

B. Low-Pressure Compressed-Air Distribution Piping: Use~~[**one of**]~~ the following piping materials for each size range:

~~1. NPS 2 (DN 50) and Smaller, Threaded: Schedule 40, [**black**] [**galvanized**] steel pipe; threaded, malleable-iron fittings; and threaded joints.~~

~~2.~~**1.** NPS 2 (DN 50) and Smaller, Brazed or Soldered: Type K or L, copper tube; wrought-copper fittings; and brazed~~[~~ or soldered~~]~~ joints.

C. Drain Piping: Use~~[**one of**]~~ the following piping materials:

1. NPS 2 (DN 50) and Smaller: Type M copper tube; wrought-copper fittings; and brazed or soldered joints.
2. 63 mm and Smaller: Aluminum pipe; solid-brass nickel-plated fittings; and push-connect bit ring couplings.

3.2 VALVE APPLICATIONS

A. Metal General-Duty Valves: Comply with requirements and use valve types specified in "Valve Applications" Article in Section 220523 "General-Duty Valves for Plumbing Piping," according to the following:

1. Low-Pressure Compressed Air: Valve types specified for low-pressure compressed air.
2. Equipment Isolation NPS 2 (DN 50) and Smaller: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

B. General-Duty Valves for Aluminum Piping System: Provide valves, made by piping system manufacturer, that are compatible with piping.

1. Ball Valves, 63 mm and Smaller: NPT ends, or push-connect bite ring ends.

3.3 INSTALLATION OF PIPING, GENERAL

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are app

B. roved on Coordination Drawings.

C. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless otherwise indicated.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.

F. Where installing piping adjacent to equipment and machines, allow space for service and maintenance.

G. Install air and drain piping with 1 percent slope downward in direction of flow.

H. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating unless otherwise indicated.

I. Equipment and Specialty Flanged Connections:

1. Use steel companion flange with gasket for connection to steel pipe.
2. Use cast-copper-alloy companion flange with gasket and brazed~~{~~ or soldered~~}~~ joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.

J. Extended-tee outlets with brazed branch connection may be used for copper tubing, within extruded-tee connection diameter to run tube diameter ratio for tube type, in accordance with Extruded Tee Connections Sizes and Wall Thickness for Copper Tube (Inches) Table in ASTM F2014.

K. Install eccentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

L. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

M. Install pressure gauge on discharge piping from each air compressor and on each receiver. Comply with requirements in Section 220500 "Common Work Results for Plumbing."

N. Install piping to permit valve servicing.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install seismic restraints on piping. Seismic-restraint devices are specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

3.4 INSTALLATION OF ALUMINUM PIPING SYSTEMS

A. Install aluminum piping systems in accordance with manufacturer's written instructions, using manufacturer's recommended tools, accessories, and methods.

B. Install branch connections ~~[~~NPS 2~~]~~ ~~[~~63 mm~~]~~ and smaller, to compressed-air mains using aluminum piping system reducing outlet tee with water trapping capabilities. Provide drain leg and drain trap at end of each main and branch and at low points.

C. Support aluminum pipe using manufacturer's hangers and supports, designed for use with the system.

D. Allow for expansion and contraction of aluminum piping system.

E. Do not use plastic components or plastic fittings of any kind within pressurized aluminum piping system. This limitation applies to main headers, branches, and drops.

3.5 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Brazed Joints for Copper Tubing: Join in accordance with AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

E. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Join in accordance with ASTM B828 or CDA's "Copper Tube Handbook."

F. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts in accordance with ASME B31.9 for bolting procedure.

G. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

3.6 INSTALLATION OF VALVES

A. General-Duty Valves: Comply with requirements in Section 220523 "General-Duty Valves for Plumbing Piping."

3.7 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. NPS 2 (DN 50) and Smaller: Use dielectric unions.

3.8 INSTALLATION OF FLEXIBLE PIPE CONNECTORS

A. Install flexible pipe connectors in discharge piping~~[~~ and in inlet air piping from remote air-inlet filter~~]~~ of each air compressor.

B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.

C. Install stainless steel-hose flexible pipe connectors in steel compressed-air piping.

3.9 INSTALLATION OF SPECIALTIES

A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.

B. Install air-main pressure regulators in compressed-air piping at or near air compressors.

C. Install air-line pressure regulators in branch piping to equipment~~[~~ and tools~~]~~.

D. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters.~~[~~ Mount on wall at locations indicated.~~]~~

E. Install quick couplings at piping terminals for hose connections.

F. Install hose assemblies at hose connections.

G. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.

3.10 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for hangers, supports, and anchor devices.

C. Install hangers for ~~[~~copper tubing~~]~~ ~~[~~and~~]~~ ~~[~~steel piping~~]~~, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install hangers for aluminum piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support horizontal piping within ~~[~~12 inches~~] <Insert dimension>~~ of each fitting and coupling.

F. Support vertical runs of ~~[~~copper tubing~~]~~ ~~[~~and~~]~~ ~~[~~steel piping~~]~~ to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

G. Support vertical runs of aluminum piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

H. Individual, Straight, Horizontal Piping Runs:

1. 100 Ft. (30 m) or Less: MSS Type 1, adjustable, steel clevis hangers.
2. Longer Than 100 Ft. (30 m): MSS Type 43, adjustable roller hangers.

I. Multiple, Straight, Horizontal Piping Runs 100 Ft. (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

J. Base of Vertical Piping: MSS Type 52, spring hangers.

3.11 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment."

3.12 FIELD QUALITY CONTROL

A. Perform field tests and inspections.

B. Tests and Inspections:

1. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than ~~[~~150 psig~~] <Insert pressure>~~. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
2. Piping Leak Tests for Aluminum Compressed-Air Piping: Test new piping system and modified parts of existing piping system. Cap and fill general-service compressed-air piping system to pressure of 15 psig, hold pressure for 10 minutes. Repeat until reaching required operating pressure, not to exceed 220 psig. Once desired operating pressure is met, let stand for one hour.
3. Repair leaks and retest until no leaks exist.
4. Inspect ~~[~~filters~~]~~ ~~[~~and~~]~~ ~~[~~pressure regulators~~]~~ for proper operation.

C. Prepare test and inspection reports.

END OF SECTION 221513

SECTION 226113 - COMPRESSED-AIR PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Shape-memory-metal couplings.
3. Copper pressure-seal fittings.
4. Flexible pipe connectors.
~~5. Zone valve box assemblies.~~
~~6.~~**5.** Ball valves.
~~7.~~**6.** Check valves.
~~8.~~**7.** Compressed-air safety valves.
~~9.~~**8.** Medical compressed-air service connections.

B. Related Requirements:

1. Section 115313 "Laboratory Fume Hoods" for compressed-air outlets in laboratory fume hoods.
2. Section 123553.13 "Metal Laboratory Casework" for compressed-air outlets in laboratory casework.
3. Section 123553.16 "Plastic-Laminate-Clad Laboratory Casework" for compressed-air outlets in laboratory casework.
~~4. Section 123553.19 "Wood Laboratory Casework" for compressed-air outlets in laboratory casework.~~
~~5. Section 123570 "Healthcare Casework" for compressed-air outlets in healthcare casework.~~
~~6.~~**4.** Section 221513 "General-Service Compressed-Air Piping" for general-service compressed-air piping and specialties.
~~7.~~**5.** Section 226119 "Compressed-Air Equipment for Laboratory and Healthcare Facilities" for air compressors and specialties.
~~8.~~**6.** Section 220963 "Medical Gas Alarms" for combined medical air, vacuum, and gas alarms.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For compressed-air manifolds, accessories, and components, from manufacturer.

B. Material Certificates: Signed by Installer, certifying that medical compressed-air piping materials comply with requirements in NFPA 99 for positive-pressure medical gas systems.

C. Brazing certificates.

D. Field Quality-Control Reports: Brazing certificates.

E. Source Quality Control Reports:

1. Certificates of Shop Inspection and Data Report for Bulk Gas Storage Tanks: As required by ASME Boiler and Pressure Vessel Code, Section VIII.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Medical Air Piping Systems for Healthcare Facilities: In accordance with ASSE Standard #6010 and ~~[**NFPA 99**]~~ for medical-gas-system installers.
2. Shape-Memory-Metal Coupling Joints: An authorized representative who is trained and approved by manufacturer in accordance with ASSE Standard #6040 ~~[**and**] [**NFPA 99**]~~.

B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the vacuum piping testing indicated, that is~~[**a member of the Medical Gas Professional Healthcare Organization or is**]~~ an NRTL, and that is acceptable to authorities having jurisdiction.

1. Qualify testing personnel in accordance with ASSE Standard #6020 ~~[**and**] [**NFPA 99**]~~ for medical-gas-system inspectors and ASSE Standard #6030 ~~[**and**] [**NFPA 99**]~~ for medical-gas-system verifiers.

C. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications," or AWS B2.2/B2.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

~~A. Medical air operating at [50 to 55 psig (345 to 380 kPa)] **<Insert values>**.~~

~~B. Instrument air operating at **[175 psig (1200 kPa)] <Insert value>**.~~

~~C.~~**A.** Laboratory air operating at ~~**[50 psig (345 kPa)]**~~ **[100 psig**~~100 psig (690 kPa)] [**125 psig (860 kPa)] <Insert value>~~.

~~D.~~**B.** All positive-pressure compressed-air products including piping, tubing, fittings, valves, zone valve boxes, manifolds, and service connections~~[for systems serving patients in healthcare~~

~~facilities]~~ are required to be manufacturer cleaned, purged, and sealed as for oxygen service, in accordance with CGA G-4.1.

1. All are to be delivered plugged or capped by the manufacturer and are to be kept sealed until prepared for installation.

~~E.~~**C.** Seismic Performance: Compressed-air manifolds shall withstand the effects of earthquake motions determined according to ~~[~~ASCE/SEI 7~~] <Insert requirement>~~. See Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

1. The term "withstand" means "the manifold will remain in place without separation of any parts when subjected to the seismic forces specified~~[~~ and the manifold will be fully operational after the seismic event~~]~~."
2. Component Importance Factor is ~~[1.5]~~ ~~[~~1.0~~]~~.

~~F.~~**D.** Comply with NFPA 99.

2.2 PIPES, TUBES, AND FITTINGS

A. Comply with ASME B31.1 for laboratory air piping operating at more than **150 psig**~~150 psig (1035 kPa)~~.

B. Comply with ASME B31.9 for laboratory air piping operating at **150 psig**~~150 psig (1035 kPa)~~ or less.

C. Copper Medical Gas Tube: ASTM B819, ~~[Type K] [and]~~ ~~[~~Type L~~]~~, seamless, drawn temper. Include standard color marking "MED" or "OXY/MED" in green for Type K tube and in blue for Type L tube.

D. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type.

E. Copper Unions: ASME B16.22 or MSS SP-123, wrought-copper or cast-copper alloy.

F. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150.

1. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos free, **1/8-inch**~~1/8-inch (3-mm)~~ maximum thickness, full-face type.
2. Flange Bolts and Nuts: ASME B18.2.1 carbon steel.

G. Shape-Memory-Metal Couplings:

1. Description: Cryogenic compression fitting made of nickel-titanium, shape-memory alloy.

H. Copper Pressure-Seal Fittings:

1. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
2. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless steel grip ring and EPDM O-ring seal in each end.

I. Flexible Pipe Connectors:

1. Description: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

    a. Working-Pressure Rating~~:~~ **:** ~~[~~**~~200 psig (1380 kPa)~~**~~]~~ [**250 psig**~~250 psig (1725 kPa)~~] minimum.
    b. End Connections: Plain-end copper tube.

2.3 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys.

B. Threaded-Joint Tape: PTFE.

2.4 VALVES

A. General Requirements for Valves: Manufacturer cleaned, purged, and bagged in accordance with CGA G-4.1 for oxygen service.

~~B. Zone-Valve Box Assemblies: Box with medical gas valves, tube extensions, and gauges.~~

~~1. Steel Zone-Valve Box with Aluminum Cover:~~
~~a. Description: Formed-steel box with cover, anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gauges and in sizes required to permit manual operation of valves.[**Medical air tubing, valves, and gauges may be incorporated in zone valve boxes for medical gases.**]~~
~~b. Interior Finish: Factory-applied white enamel.~~
~~c. Cover Plate: Aluminum with frangible or removable windows.~~
~~d. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, in accordance with NFPA 99.~~

~~2. Steel Zone-Valve Box with Stainless Steel Cover:~~
~~a. Description: Formed-steel box with cover, anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gauges and in sizes required to permit manual operation of valves.[**Medical air and medical vacuum tubing, valves, and gauges may be incorporated in zone valve boxes for medical gases.**]~~
~~b. Interior Finish: Factory-applied white enamel.~~
~~c. Cover Plate: Stainless steel with frangible or removable windows.~~
~~d. Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, in accordance with NFPA 99.~~

~~C.~~**B.** Ball Valves:

1. Standard: MSS SP-110.
2. Description: Three-piece body, brass or bronze.
3. Pressure Rating: **300 psig**~~300 psig (2070 kPa)~~ minimum.
4. Ball: Full-port, chrome-plated brass.
5. Seats: PTFE or TFE.
6. Handle: Lever~~[~~ type with locking device~~]~~.
7. Stem: Blowout proof with PTFE or TFE seal.

8. Ends: ~~[~~Manufacturer-installed ASTM B819, copper-tube extensions~~]~~ ~~[and]~~ ~~[manufacturer-installed ASTM B819, copper-tube extensions with pressure gage on one copper-tube extension].~~

~~D.~~**C.** Check Valves:

1. Description: In-line pattern, bronze.
2. Pressure Rating: **300 psig**~~300 psig (2070 kPa)~~ minimum.
3. Operation: Spring loaded.
4. Ends: Manufacturer-installed, ASTM B819, copper-tube extensions.

~~E.~~**D.** Compressed-Air Safety Valves:

1. Bronze body.
2. ASME-construction, poppet, pressure-relief type.
3. Settings to match system requirements.

~~F.~~**E.** Pressure Regulators:

1. Bronze body and trim.
2. Spring-loaded, diaphragm-operated, relieving type.
3. Manual pressure-setting adjustment.
4. Rated for [**250-psig**~~250-psig (1725-kPa)~~] ~~<Insert value>~~ minimum inlet pressure.
5. Capable of controlling delivered air pressure within **0.5 psig for each 10-psig**~~0.5 psig for each 10-psig (5.0 kPa for each 100-kPa)~~ inlet pressure.

2.5 MEDICAL COMPRESSED-AIR SERVICE CONNECTIONS

A. General Requirements for Medical Compressed-Air Service Connections:

1. Suitable for specific medical air pressure and service listed.
2. Include roughing-in assemblies, finishing assemblies, and cover plates.
3. Recessed-type units made for concealed piping unless otherwise indicated.

B. Roughing-in Assembly:

1. Steel outlet box for recessed mounting and concealed piping.
2. Brass-body outlet block with secondary check valve that will prevent gas flow when primary valve is removed.
3. Double seals that will prevent air leakage.
4. ASTM B819, **NPS 3/8**~~NPS 3/8 (DN 10)~~ copper outlet tube brazed to valve with service marking and tube-end dust cap.

C. Finishing Assembly:

1. Brass housing with primary check valve.
2. Double seals that will prevent air leakage.
3. Cover plate with gas-service label.

D. Quick-Coupler Pressure Service Connections:

1. Outlets for ~~[medical air] [and]~~ ~~[~~instrument air~~]~~ with noninterchangeable keyed indexing to prevent interchange between services.
2. Constructed to permit one-handed connection and removal of equipment.
3. With positive-locking ring that retains equipment stem in valve during use.

E. D.I.S.S. Pressure Service Connections: Outlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.

1. Medical Air: D.I.S.S. No. 1160.
2. Instrument Air: D.I.S.S. No. 1160.

F. Cover Plates:

1. One piece.
2. ~~[~~Aluminum~~]~~ ~~[~~or~~]~~ ~~[~~stainless steel~~]~~.
3. Permanent, color-coded, identifying label matching corresponding service.

PART 3 - EXECUTION

3.1 PREPARATION

~~A.~~ A. Cleaning of Medical Air Tubing: If manufacturer-cleaned and -capped fittings or tubing is not available or if precleaned fittings or tubing must be recleaned because of exposure, have supplier or separate agency acceptable to authorities having jurisdiction perform the following procedures:

1. Clean medical air tube and fittings, valves, gauges, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service in accordance with CGA G-4.1.
2. Wash medical air tubing and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of **1 lb**~~1 lb (0.453 kg)~~ of chemical to **3 gal.**~~3 gal. (11.3 L)~~ of water.

a. Scrub to ensure complete cleaning.
b. Rinse with clean, hot water to remove cleaning solution.

3.2 INSTALLATION OF PIPING

A. General Location and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated

B. unless deviations to layout are approved on coordination drawings.

C. Install seismic restraints on compressed-air piping. Seismic-restraint devices are specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

D. Comply with NFPA 99 for installation of compressed-air piping.

E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

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F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

H. Install piping adjacent to equipment and specialties to allow service and maintenance.

I. Install piping with 1 percent slope downward in direction of flow.

J. Install nipples, unions, special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications specified in "Piping Schedule" Article unless otherwise indicated.

K. Install eccentric reducers, if available, where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

L. Install branch connections to mains from top of main. Provide drain leg at end of each main and branch at low points.

M. Install piping to permit valve servicing.

N. Install piping free of sags and bends.

O. Install fittings for changes in direction and for branch connections.

P. Install medical air piping to medical air service connections specified in this Section, to medical air service connections in equipment specified in Section 226313 "Gas Piping for Laboratory and Healthcare Facilities," and to equipment specified in other Sections requiring medical air service.

Q. Piping Restraint Installation: Install seismic restraints on compressed-air piping. Seismic-restraint devices are specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

R. Install service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.

S. Connect piping to air compressors and to compressed-air outlets and equipment requiring compressed-air service.

T. Install unions in copper tubing adjacent to each valve and at final connection to each machine, specialty, and piece of equipment.

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

3.3 INSTALLATION OF VALVES

A. Install shutoff valve at each connection to and from compressed-air equipment and specialties.

B. Install check valves to maintain correct direction of compressed-air flow from compressed-air equipment.

C. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.

D. Install zone valves and gages in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.

E. Install pressure regulators on compressed-air piping where reduced pressure is required.

F. Install flexible pipe connectors in discharge piping~~[~~ and in inlet air piping from remote air-inlet filter~~]~~ of each air compressor.

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of cleaned tubing and fittings before assembly.

C. Threaded Joints: Apply appropriate tape to external pipe threads.

D. Brazed Joints: Join copper tube and fittings in accordance with CDA's "Copper Tube Handbook," Ch. "Brazed Joints." Do not use flux. Continuously purge joint with oil-free dry nitrogen during brazing.

E. Soldered Joints: Apply ASTM B813, water-flushable flux to tube end. Join copper tube and fittings in accordance with ASTM B828.

F. Extruded-Tee Outlets: Form branches in copper tube in accordance with ASTM F2014, with tools recommended by tube manufacturer.

G. Flanged Joints:

1. Copper Tubing: Install flange on copper tubes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts in accordance with ASME B31.9 for bolting procedure.

H. Shape-Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of shape-memory-metal coupling joints.

3.5 INSTALLATION OF COMPRESSED-AIR SERVICE COMPONENTS

A. Install compressed-air pressure-control panel in walls. Attach to substrate.

B. Install compressed-air manifolds~~[on concrete base]~~ anchored to substrate.

C. Install compressed-air cylinders and connect to manifold piping.

D. Install compressed-air manifolds with seismic restraints as indicated.

~~E. Install compressed-air-cylinder wall storage racks attached to substrate.~~

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for hangers, supports, and anchor devices specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

C. Vertical Piping: MSS Type 8 or Type 42 clamps.

D. Individual, Straight, Horizontal Piping Runs:

1. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel, clevis hangers.
2. Longer Than 100 Feet (30 m): MSS Type 43, adjustable, roller hangers.

E. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44 pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for trapeze hangers.

F. Base of Vertical Piping: MSS Type 52 spring hangers.

G. Install hangers for copper tubing with maximum horizontal spacing and minimum rod diameters to comply with MSS SP-58, NFPA 99, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

H. Support horizontal piping within ~~[~~**12 inches**~~12 inches (300 mm)]~~ ~~**<Insert dimension>**~~ of each fitting and coupling.

I. Support vertical runs of copper tubing to comply with MSS SP-58, NFPA 99, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 IDENTIFICATION

A. Install identifying labels and devices for laboratory compressed-air piping, valves, and specialties. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Install identifying labels and devices for medical compressed-air piping systems in accordance with NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:

1. Medical Air: Black letters on yellow background.
2. Instrument Air: White letters on red background.
3. Laboratory Air: Black letters on yellow-and-white checkerboard background.

3.8 FIELD QUALITY CONTROL FOR MEDICAL COMPRESSED-AIR PIPING IN HEALTHCARE FACILITIES

A. Testing Agency:

1. Owner will engage a qualified testing agency to perform tests and inspections.
2. Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections~~[~~ with the assistance of a factory-authorized service representative~~]~~.

C. Tests and Inspections:

1. Medical Compressed-Air Testing Coordination: Perform tests, inspections, verifications, and certification of medical compressed-air piping systems concurrently with tests, inspections, and certification of ~~[medical gas piping] [and] [medical vacuum piping]~~ systems.
2. Preparation: Perform the following Installer tests in accordance with requirements in NFPA 99 and ASSE Standard #6010:

    a. Initial blowdown.
    b. Initial pressure test.
    c. Cross-connection test.
    d. Piping purge test.
    e. Standing pressure test for positive-pressure medical compressed-air piping.
    f. Repair leaks and retest until no leaks exist.

3. System Verification: Perform the following tests and inspections in accordance with NFPA 99, ASSE Standard #6020, and ASSE Standard #6030:

    a. Standing pressure test.
    b. ~~[~~Individual-pressurization~~] [or] [pressure-differential]~~ cross-connection test.
    c. Valve test.
    d. Master and area alarm tests.
    e. Piping purge test.
    f. Piping particulate test.
    g. Piping purity test.
    h. Final tie-in test.
    i. Operational pressure test.
    j. Medical air-purity test.
    k. Verify correct labeling of equipment and components.

4. Testing Certification: Certify that specified tests, inspections, and procedures have been performed, and certify report results. Include the following:

    a. Inspections performed.
    b. Procedures, materials, and gases used.
    c. Test methods used.
    d. Results of tests.

D. Piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

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3.9 FIELD QUALITY CONTROL FOR COMPRESSED-AIR PIPING IN LABORATORY FACILITIES

A. Testing Agency~~:~~: ~~[Owner will engage]~~ ~~[~~Engage~~]~~ qualified testing agency to perform tests and inspections of compressed-air piping in laboratory facilities and to prepare test and inspection reports.

B. Perform tests and inspections~~[with the assistance of a factory-authorized service representative]~~.

C. Tests and Inspections:

1. Piping Leak Tests for Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill compressed-air piping with oil-free dry nitrogen to pressure of 50 psig~~50 psig (345 kPa)~~ above system operating pressure, but not less than ~~[~~150 psig~~150 psig (1035 kPa)] <Insert value>~~. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
2. Repair leaks and retest until no leaks exist.

D. Piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 PROTECTION

A. Protect tubing from damage.

B. Retain sealing plugs in tubing, fittings, and specialties until installation.

C. Clean tubing not properly sealed, and where sealing is damaged, in accordance with "Preparation" Article.

3.11 PIPING SCHEDULE

A. Connect new tubing to existing tubing with memory-metal couplings.

B. Flanges may be used where connection to flanged equipment is required.

C. Type L Copper Tubing for Medical Air Piping Instrument Air Piping and Dental Air Piping, NPS 3 (DN 80) and Smaller, Operating between 15 psig (103 kPa) and 50 psig (345 kPa): Type L copper tubing, wrought copper fittings, and brazed joints.

~~D. Type K Copper Tubing for Medical Air Piping Instrument Air Piping and Dental Air Piping, NPS 3 (DN 80) and Smaller, Operating between 15 psig (103 kPa) and 50 psig (345 kPa): Type K copper tubing, wrought copper fittings, and brazed joints.~~

~~E.~~D. Type L Copper Tubing for Laboratory Air Piping, NPS 3 (DN 80) and Smaller, Operating between 15 psig (103 kPa) and 50 psig (345 kPa): Type L copper tubing, wrought copper fittings, and brazed joints.

3.12 VALVE SCHEDULE

A. Shutoff Valves: Ball valve with manufacturer-installed ASTM B819, copper-tube extensions.

B. Zone Valves: Ball valve with manufacturer-installed ASTM B819, copper-tube extensions with pressure gauge on one copper-tube extension.

END OF SECTION 226113

SECTION 230925 - LABORATORY INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1. Section 2305xx - Basic materials, methods and requirements specification sections
2. Section 232113 - Hydronic Piping
3. Section 230923 – Building Automation System specification sections

4. Specified elsewhere:

    a. Variable Speed Control
    b. Motors
    c. HVAC Pumps
    d. Fans
    e. Air Conditioning Units
    f. Plumbing Systems
    g. Testing, Adjusting and Balancing
    h. Basic Elec. Materials Methods
    i. Electrical Wiring

1.2 SUMMARY

A. The system is based upon the Phoenix Controls Critical Spaces Control Platform.

B. The work of this section shall include the furnishing and installing of a complete Laboratory Control System (LCS) fully and seamlessly integrated to the BAS.

C. All Lab controls shall be High Speed, meaning all Air Valves shall utilize high speed actuation stroking each valve from 0-90% flow within 1 second.

D. The use of hybrid BAS/Lab Control Systems is not acceptable. All laboratory controls, airflw control valves, actuators, sensors, etc. shall be of a single manufacturer

1. Basis of Design is Phoenix Controls Critical Spaces Control Platform.
2. Alternate manufacturers are Simens Apogee Lab Control System and Triatek Air SmartLab Systems.
3. The Lab Control System shall be pressure independent based on mechanical design and shall respond and maintain specific airflow within one second of change in duct static pressure irrespective of the magnitude of pressure and/or flow change (within product specifications) or quantity of airflow controllers on a manifolded system.

E. The Lab control system shall be fully and seamlessly integrated to the BAS. Provide a BACnet MS/TP interface per floor.

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1.3 SCOPE OF WORK

A. Furnish and install a Laboratory Airflow Control System (LACS) in conjunction with the central Building Automation System (BAS) to maintain laboratory room supply and exhaust airflows, room ventilation rates, room static pressurization, room ambient temperatures & humidity's and the laboratory exhaust system functionality as specified herein.

1. The LACS shall also ensure that all VAV fume hood average face velocities and minimum exhaust airflows are maintained as required and as indicated in the project plan schedules.
2. The LACS shall also ensure that all biological safety cabinets and other required exhaust airflows listed in the project plan schedules are maintained.
3. The LACS shall also provide the laboratory emergency control modes as detailed in this specification.
4. The LACS shall comply with the functional requirements of U.S. OSHA 29 CFR, (Canada Public Works MD 1580), NFPA 45, AIHA Z9.5, and all applicable Local and State codes. The LACS shall serve all laboratories and shall include all:
    1. Laboratory room supply and exhaust Air Valves
    2. Reheat coils
    3. Reheat coil valves - Fail Normally Closed, characterized ball valves.
    4. High Speed Actuators for all spaces that feature fume hoods. Standard Speed actuators are only acceptable in spaces without fume hoods or without high-speed requirements as defined by the Air Valve schedule High speed actuators are defined as actuators that stroke the full range of the valve within 3 seconds.
    5. Temperature, Pressure, Humidity Sensors
    6. Associated instrumentation and the control units and associated interconnecting wiring. Any and all associated components required to implement a fully functioning and integrated system as specified herein shall also be provided. System verification and other documentation as specified under the commissioning requirements and commissioning plan section shall also be included.

C. All LACS data shall be capable of being accessed by authorized persons via the facility BAS network.

1.4 DEFINITIONS

A. AI - Analog Input

B. ACM Actuator Control Module

C. ALN - Automation Level Network

D. ANSI- American National Standards Institute

E. AO - Analog Output

F. ASC - Application Specific Controller

G. ASCII- American Standard Code for Information Interchange

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H.	AWG-	American Wire Gauge
I.	BAS -	Building Automation System
J.	CSCP	Critical Spaces Control Platform
K.	CVV	Constant Volume Venturi Valve
L.	DDC -	Direct Digital Control
M.	DI -	Digital Input
N.	DO -	Digital Output
O.	EEPROM-	Electronically Erasable Programmable Read Only Memory
P.	EMI -	Electromagnetic Interference
Q.	FAS -	Fire Alarm Detection and Annunciation System
R.	FLN -	Field Level Network
S.	HOA -	Hand-Off-Auto
T.	IEEE -	Institute of Electrical and Electronics Engineers
U.	I/O -	Input/Output
V.	LAN -	Local Area Network
W.	LCD -	Liquid Crystal Display
X.	LACS -	Laboratory Airflow Control System
Y.	LED -	Light Emitting Diode
Z.	MCC -	Motor Control Center
AA.	NC -	Normally Closed
BB.	NVLAP	National Voluntary Lab Accreditation Program
CC.	NO -	Normally Open
DD.	OAT -	Outdoor Air Temperature
EE.	OPC -	Object Linking and Embedding (OLE) for Process Control
FF.	OWS -	Operator Workstation

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GG.	PBC	Programmable BACnet Controller
HH.	PC -	Personal Computer
II	PCI	Phoenix Controls Integrator
JJ.	PCP -	Primary Control Panel
KK.	RAM -	Random Access Memory
LL.	RFI -	Radio Frequency Interference
MM.	RH -	Relative Humidity
NN.	ROM -	Read Only Memory
OO.	RTD -	Resistance Temperature Detector
PP.	TCP/IP-	Transmission Control Protocol/Internet Protocol
QQ.	UPS -	Uninterruptible Power Supply
RR.	VAC -	Volts, Alternating Current
SS.	VAV -	Variable Air Volume
TT.	VFD	Variable Frequency Drive
UU.	VDC	Volts, Direct Current
VV.	WAN	Wide Area Network
WW.	ZPS	Zone Presence Sensor

1.5 TECHNICAL PROPOSAL

A. Submit a detailed technical proposal for pre-qualification. At the owner's discretion pre-qualified vendors will be invited to bid. Unsolicited bids will be not considered.

B. Submit the following documentation as part of the proposal:

1. Laboratory Control System Architecture.
2. Air Valve Specification Sheets. High speed actuator specification and performance sheets. Reheat coil and transition cut sheets. BACnet/IP interface per floor. Points list.
3. Technical specification sheets for all BAS controllers, hardware, software and field devices, including certificates of agency listings (MEA, UL, BACnet BTL, ISO, etc.)
4. Line by line specification conformance statement with clear indication of deviations.
5. Qualification of the bidder including experience, description and size of the organization, organizational chart, project team, comparable reference projects in size and complexity and any other supporting information.

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1.6 SUBMITTALS

A. General

1. Indicate at the beginning of each submittal, all substitutions and deviations from requirements of Contract Documents.

B. Product Data

1. Technical bulletins and catalog data for all equipment and system components. Clearly identify, by use of symbol or tag number, the service of each item. All irrelevant information shall be marked out leaving only pertinent data.
2. LACS. Provide manufacturer's product data sheets including technical specifications of all LACS components including air terminals, sensors, actuators, reheat valves, control units, local monitors, etc. Where applicable the specifications shall include minimum and maximum flow rates, sound ratings, measurement device accuracies, operational ranges, etc. Moreover, provide:

    a. A tabulation of all air terminals including types, sizes, air capacities, sound ratings, reheat coil ratings, etc.
    b. A comprehensive list of all LACS input/output point functions including all alarm and monitoring points.
    c. Detailed descriptions of all LACS operational sequences.
    d. Shop drawings showing LACS control unit configuration and wiring connection diagrams
    covering all LACS input/output interconnections and termination details
    e. Details of LACS monitoring system, system security, system archiving database software.

C. Shop Drawings

1. Shop drawing submittals shall comply with Division 01 and other specified requirements and shall include sufficient data to indicate complete compliance with Contract Documents. Submission shall be in the form of drawings, brochures, bulletins, catalog data and/or narrative descriptions.
2. Submission shall include, but not be limited to:

    a. Symbol and abbreviation lists.
    b. System block diagram showing quantity and location of personal operator workstation(s), Primary Control Panels, Secondary Control Panels, and locations of power feeds to BAS and other major system components.
    c. Control diagrams for all systems controlled. Controls shall be shown on system flow diagrams.
    d. Power wiring diagrams and electrical requirements.
    e. Interfaces (software and hardware) with other equipment provided in other sections of specifications including but not limited to chiller control system.
    f. Narrative description of operation for each system, enumerating and describing the function of each component. Include alarm and emergency sequences, and equipment interlocks.
    g. Description of manual override operation for every input and output point.
    h. Complete input/output point schedule. Identify point function, type and location.
    i. Spare capacity provisions.

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j. Detailed bill of materials.
k. Valve and damper schedule: Provide identification numbers, location, system, dimensions and performance data. Include damper leakage rates.
l. Device mounting details. Include as a minimum:

1) Sensing elements in ducts and casings.

2) Sensing elements in piping.

a) Ladder wiring diagrams.
b) Other information as requested herein.
c) Complete full size drawings, 11" x 17" minimum.

3. LCS submittals shall also include:

a. A tabulation of all air terminals including types, sizes, air capacities, sound ratings, reheat coil ratings, etc.
b. A comprehensive list of all LCS input/output point functions including all alarm and monitoring points.
c. Detailed descriptions of all LCS operational sequences.
.Shop drawings showing LCS control unit configuration and wiring connection diagrams covering all LCS input/output interconnections and termination details

D. Programming
1. Point identification code.
2. System advisory messages, printouts, logging formats.
3. Drawings of system graphics showing monitored points. (Include only if graphics are specified elsewhere in this specification).
4. Software flow-charts for applications and DDC programs.
5. Person machine interface program, including commands, alarm annunciation, logs and programming capabilities.
6. Description of system operation under failure conditions.

E. Samples

1. All wall, pipe and duct sensors.
.All other devices mounted on finished surfaces.
2. Valve, damper, panel and sensor tags.

F. Quality Control Submittals

1. UL, FM, CSA listing compliance certificates.
2. Final calibration, commissioning and testing reports.

G. Time Requirements

1. Within thirty (30) days of award of contract manufacturer shall provide schedule of all submittals employing format as provided hereinafter and enumerating all drawings, samples and miscellaneous submittals by name, quantity, etc.

1.7 QUALITY ASSURANCE

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A. All LACS materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

B. All portions of the system must be of the same manufacturer and must be designed, furnished, installed, commissioned and serviced by manufacturer-approved, factory trained employees.

C. Single source responsibility of the manufacturer shall be the complete installation and proper operation of the LACS control system and shall include debugging and proper calibration of each component in the entire system.

D. Supplier shall have an in place support facility within 30 miles of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.

E. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, Governing Radio Frequency Electromagnetic Interference and be so labeled. F. All system components shall be fault-tolerant. System shall include:

1. Satisfactory operation without damage at 110% and 85% of rated voltage and at plus 3 Hertz variation in line frequency.
2. Static, transient and short-circuit protection on all inputs and outputs.
3. Protection for communication lines against incorrect wiring, static transients and induced magnetic interference.
4. Network-connected devices to be AC coupled or equivalent so that any single device failure will not disrupt or halt network communication.
5. All real time clocks and data file RAM to be battery-backed for a minimum 72 hours and include local and remote system low battery indication.

G. The LACS contractor shall be regularly engaged in the installation and maintenance of LACS systems and shall meet the following qualifications.

1. A minimum of fifteen (15) years of demonstrated technical expertise and experience in the installation and maintenance of LCS systems similar in size and complexity to this project.
2. A minimum of fifteen (15) years experience installing the lab control system of the manufacturer that is to be proposed.
3. Shall be a certified-to-install, direct representative of a control system manufacturer that has a minimum of ten (10) years experience producing control systems similar to that which is to be proposed.
4. The Bidder shall not be considered qualified to bid this project unless they can provide a list of 10 projects, similar in size and scope to this project, completed within the last four (4) years.

H. The system installer shall provide an experienced project manager for this work from beginning of control installation until final completion. The project manager responsible for direct supervision of the design, installation, start-up and commissioning of the LACS as well as attending of project meetings whenever directed by the owner, construction manager, and/or mechanical contractor. It shall not be acceptable to change the project manager after the project has begun and before final completion. If the LACS contractor wishes to change the project manager, the construction manager and/or owner’s representative must be notified immediately and both the new project manager and the previous project manager shall spend 5 consecutive business days together on-site performing a project management switch-over.

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I. Comply with all current governing codes, ordinances, and regulations including UL, NFPA, the local Building Code, NEC, etc.

J. The system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability for any existing control system component including but not limited to Primary Control Panels, Secondary Control Panels, personal operator workstations, and portable operator's terminals, to be connected and directly communicate with any new BAS system equipment without bridges, routers or protocol converters.

K. LACS components shall be the standard catalogued products of the LACS supplier and shall be the most recent product design that complies with the specified requirements.

L. The LACS supplier shall provide a one full year warranty on the entire LACS including any service/replacement labor during the warranty period shall start on the date of owner acceptance. Any LACS component or system performance problem during the warranty period shall be corrected by
the LACS supplier at no cost to the owner.

M. The complete installation of the LACS shall be the responsibility of the LACS supplier and the checkout, startup and verification of specified performance of the LACS shall be by factory trained local branch office employees of the LACS supplier.

1.8 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Division 25 Section "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.

C. Coordinate supply of conditioned electrical circuits for control units and operator workstation.

D. Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.

E. Coordinate equipment with Division 26 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

F. Coordinate Laboratory air terminal size, location, with mechanical and sheet metal contractor.

1.9 SPECIFICATION COMPLIANCE REVIEW

A. Provide at time of bid opening, a paragraph by paragraph specification compliance report. This report shall indicate for each numbered paragraph whether the Contractor meets the criteria of the paragraph.
The following format must be utilized in completing the compliance report:

1. Comply - without exception.

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2. Exception - Meet the functional intent. For each paragraph, the contractor shall identify all differences in specific functions stated in the given paragraph and provide a description of what is excluded or how he intends to meet the function specified.
3. Does not Comply - Cannot meet specified function and will not provide

1.10 RECORD DOCUMENTS

A. Owner's Manual General

1. Submit two (2) draft copies of owner's manuals for review. After review by authorized representative, the contractor shall incorporate review comments and shall submit four (4) interim final copies. Upon completion of project, acceptance of project by the owner, submit six (6) copies of final "as built" manuals.

B. Provide an operating manual to serve as training and reference manual for all aspects of day-to-day operation of the system. Include as a minimum:

1. Control flow diagrams for all lab airflow control systems.
2. Sequence of operation for automatic and manual operating modes for all building systems. The sequences shall cross-reference the system point names.
3. Description of manual override operation of all control points in system.
4. BAS system manufacturers complete operating manuals.

C. Provide a maintenance manual to serve as training and reference manual for all aspects of day-to-day maintenance and major system repairs. Include as a minimum:

1. Complete as-built installation drawings for each building system.
2. Overall system electrical power supply scheme indicating source of electrical power for each system component. Indicate all battery backup provisions.
3. Overall system shielding and grounding scheme indicating all major components and ground paths.
4. Drawings showing installation details and locations of equipment.
5. Charts showing normal operating conditions at significant points such as electrical test points.
6. Routine preventive maintenance procedures, corrective diagnostics troubleshooting procedures, and calibration procedures.
7. Parts lists with manufacturer's catalog numbers and ordering information.
8. Lists of ordinary and special tools, operating materials supplies and test equipment recommended for operation and servicing.
9. Manufacturer's operating, set up, maintenance and catalog literature for each piece of equipment.
10. Maintenance and repair instructions.
11. Recommended spare parts.
12. Field test reports.

1.11 WARRANTY

A. The Contractor shall warranty the LACS to be free from defects in workmanship and material for a period of one (1) year from the date of acceptance by the Owner. During the warranty period, the Contractor shall furnish all labor to repair or replace all items or components that fail due to defects in workmanship or material. This contractor shall also provide all system software upgrades during the warranty period.

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B. The Contractor shall provide an on-line troubleshooting service during the warranty period. The online system shall allow the contractor or owner's agent the ability to interrogate, troubleshoot and correct warranty defects remotely. This system shall be operational 24 hours a day, 365 days a year. If the local manufacturer's staff cannot resolve the problem, the corporate home office staff shall remotely connect to the system and troubleshoot the warranty defect (if owner provides suitable remote connection capability).

C. The Contractor shall submit a written report within 3 days of all warranty defects, the action taken, and corrections made for each warranty call.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. The Laboratory control system shall be a completely digital system, with electric actuation, manufactured and provided by a single manufacturer.

B. Airflow control valves shall be capable of 20:1 turndown

C. All control valves shall include metered airflow feedback via a fully characterized airflow metering venturi, creating a closed loop control scenario as defined in ASHRAE. Feedback shall be directly from metered airflow.

D. Manufacturers: Given all performance requirements of this specification, sequence of operations, point list, and control diagrams are met, provide products from one of the following:

1. Phoenix Controls Critical Spaces Control Platform (CSCP)
2. Siemens Building Technologies APOGEE Laboratory Airflow Control System (Model LGS/LGE Air Valve System)
3. Triatek Air SmartLab Laboratory Control System
4. Or Equal

2.2 SYSTEM ARCHITECTURE

A. A minimum of one Ethernet Based Router/Controller shall be located on each floor to interface lab room control data to the BAS at each floor. Router/Controller shall not allow BAS users to interface with the Lab system unless operator privilege has been established by the administrator at the BAS or
Lab System Server

B. All Lab Control System data shall be viewable, alarmed, displayed on graphics, etc. through the connection to the BAS.

2.3 OPERATOR INTERFACE

A. The LACS operator interface shall be through the BAS. All data will dynamically update on graphics at the BAS.

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B. Provide a dedicated graphic per lab. Provide all points listed in point list on dynamic graphics.

C. Operator shall be able to command temperature setpoint.

D. Operator shall be able to view system alarms.

2.4 PRIMARY CONTROL PANEL (PCP)

A. In order to ensure network speed meets specification, an Ethernet level primary panel shall be provided per floor for integration to the BAS. The primary panel shall retain system trend data as an intermediate device between each lab room controller / Fume hood controller and the BAS server.

Primary panel shall monitor communication status of each lab room controller and fume hood controller and alarm at the BAS server if any controller fails to communicate to the primary panel and the BAS

2.5 SECONDARY FIELD LEVEL NETWORK

A. General

1. Provide for control of each piece of equipment, including, but not limited to, the following:

    a. Laboratory Room Controller
    b. VAV and CAV Fume Hood Controller (1 controller per hood)
    c. Point Exhaust (1 controller per point exhaust)

2. Rooms with a supply valve and a general exhaust valve, or a fume hood exhaust valve, or both a general exhaust valve and a fume hood exhaust valve shall utilize a laboratory room controller to coordinate the supply and exhaust flow rates to meet room ventilation rate, pressurization, and temperature setpoints. Individual controllers per valve are not acceptable.
3. All laboratory control valves shall include metered airflow feedback trending and alarms at the BAS.
4. Supply and exhaust airflow control valves shall include capability for field recalibration to confirm Venturi valves operate per factory calibration for the life of the valve. Provide controller capable of monitoring airflow via feedback to allow field recalibration..

B. ASC Hardware

.Each ASC shall operate as a stand-alone controller capable of performing its user selectable control routines independently of any other controller in the system. Each secondary control panel shall be a microprocessor-based, multi-tasking, real-time digital control processor.

1. Each Secondary Control Panel shall, at a minimum, be provided with:

    a. Appropriate NEMA rated enclosure.
    b. A stand-alone real-time digital control microprocessor module.
    c. Secondary network communications ability.
    d. Power supplies as required for all associated modules, sensors, actuators, etc.
    e. Input/output points as required.

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f. Software as required for all sequences of operation, logic sequences and energy management routines. Relay logic is not acceptable.
g. Auxiliary enclosure for analog output transducers, isolation relays, etc. Auxiliary enclosure shall be part of primary enclosure or mounted adjacent primary enclosure.
h. Each controller measuring air volume shall include a differential pressure transducer.
i. SCR control of electric heaters.
j. Fan speed controller for fan powered VAV boxes
k. Fan relay for fan powered VAV boxes and fan coil units

3. Each ASC shall continuously perform self-diagnostics on all hardware and secondary network communications. The ASC shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failure to establish communication to the system.
4. Provide each ASC with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in nonvolatile EEPROM, EPROM and PROM, or a minimum of 72-hour battery backup shall be provided. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration. Provide uninterruptible power supplies
(UPSs) of sufficient capacities for all ASCs that do not meet this protection requirement. Operating programs shall be field-selectable for specific applications. Controllers that require factory changes of all applications are not acceptable.
5. The ASC shall be powered from a 24 VAC source provided by the BAS contractor and shall function normally under an operating range of +/- 10%, allowing for power source fluctuations and voltage drops. The controllers shall also function normally under ambient conditions of 32 to 122 F (0 to 50 C) and 10% to 90% RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the intelligence board assembly.

C. ASC Software

1. Provide all necessary software for a complete operating system as required. All software shall reside in each ASC.
2. Each ASC shall perform its primary control function independent of primary controller LAN communication, or if LAN communication is interrupted. Reversion to a fail-safe mode of operation during LAN interruption is not acceptable. The controller shall receive its real-time data from the primary control panel time clock to ensure LAN continuity. Each controller shall include algorithms incorporating proportional, integral and derivative (PID) control for all applications. All PID parameters shall be field-adjustable by the user via a portable operator's terminal.
3. All Laboratory Air Valve control applications shall be field-selectable such that a single controller may be used in conjunction with any of the above types of terminal units to perform the specified sequences of control. This requirement must be met in order to allow for future design and application changes and to facilitate system expansions. Controllers that require factory application changes are not acceptable.

D. Laboratory Room and Critical Environment Controllers

1. VAV Laboratory Room Controllers

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a. Furnish and install Laboratory room controllers to provide closed loop pressure independent control of all Laboratory room ventilation and ambient requirements. The Laboratory room controller shall continuously monitor the exhaust airflow values from each VAV fume hood in the room. In addition, the Laboratory room controller shall continuously measure the room general exhaust airflow rate and room miscellaneous exhausts as applicable to individual Laboratory rooms and as indicated in the Laboratory room control schedule in the project plans.
b. All Laboratory room controllers shall include all inputs and control outputs necessary to perform the specified control sequences. Each Laboratory room controller shall operate as a stand alone unit, performing its specified control responsibilities independently. All input point and control output point databases as well as the control programs shall be stored in non-volatile EEPROM, EPROM and PROM memory, or a minimum of 72-hour battery backup shall be provided.
c. Momentary or extended losses of power shall not change or affect any Laboratory room controller setpoints or stored data. Upon resumption of power the controller shall resume full normal operation exactly as before without any need for manual intervention. Upon a power failure or operational failure within the controller, the air terminal shall automatically be positioned to the predetermined fully open or fully closed (failsafe) position as indicated on the air terminal schedules in the project plans.
d. All Laboratory room controllers shall include the ability to accept and incorporate a dry contact closure input from an auxiliary source into the room control sequence for such purposes as occupied/unoccupied ventilation changeover, emergency mode sequences, etc.
e. All Laboratory room controllers shall provide a general alarm output that may be used for auxiliary signaling or notification.
f. Ventilation rate control:

    1) The Laboratory room controller shall continuously monitor the flow feedback of the other room exhaust provisions including the room general exhaust and all miscellaneous exhausts such as bench snorkels, etc.
    2) The laboratory room controller shall continuously totalize all room exhaust airflows as the total room exhaust airflow. The laboratory room controller shall continuously calculate the difference between the total room exhaust airflow and the room exhaust airflow required to maintain the room air ventilation rate (air change per hour) as listed in the laboratory room schedule in the plans. Whenever the total room exhaust airflow is less than the room exhaust airflow required to maintain the room minimum ventilation rate, the laboratory room controller shall increase the room general exhaust airflow until the total room exhaust airflow equals the required room exhaust airflow.
    3) Whenever total room exhaust airflow is greater than the required room exhaust airflow, the laboratory room controller shall decrease the room general exhaust airflow until the total room exhaust airflow equals the required room exhaust airflow or the general exhaust airflow is reduced to its minimum value. The room minimum general exhaust minimum value shall be at least 12% of the maximum room general exhaust airflow rate to ensure that accurate general exhaust airflow measurement and control is continuously maintained.
    4) The Laboratory room controller shall control the room general exhaust airflow by a proportional, integral and derivative (PID) closed loop control algorithm. Each Laboratory room controller shall be specifically designed

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for application to Laboratory room ventilation and room ambient condition control. Each controller shall be a microprocessor-based, multi-tasking, real-time digital control processor. Control sequences shall be included as part of the factory supplied software. These sequences shall be able to be customized on site by adjusting parameters such as control loop algorithm gains, temperature set-point, alarm limits, airflow differential set-point, and pressurization mode.

g. Room Pressurization Control:

1) The Laboratory room controller shall modulate the air terminal dampers to maintain the required airflow set points as indicated in the Laboratory room schedule on the plans. The supply airflow set point shall be a fixed amount less than the total room exhaust airflow by the airflow tracking differential in order to maintain negative room pressurization.

a) Changes to Laboratory room controller operational variables such as the supply airflow set point and other functional parameters shall be accessible to authorized personnel through a plug-in, portable operator's terminal and through interface with the BAS.

h. Room Temperature Control:

1) The temperature in the room shall be continuously measured by means of the return temperature sensor. The room temperature shall be maintained at its (adjustable) set point by modulating a normally closed, equal percentage, reheat valve. The room temperature control action shall utilize a proportional, integral and derivative (PID) closed loop control algorithm. The Laboratory room temperature set point shall be established by authorized personnel through the plug-in, portable operator's terminal.
2) To minimize a potential room temperature swing away from the room temperature setpoint the laboratory room controller shall also incorporate a BTU compensation temperature control. Btu compensation shall be based upon continuously calculating the room's heating or cooling load in BTU's per hour based upon the difference between the return temperature and the supply air discharge temperature and room supply airflow. Whenever a significant change in the room supply airflow suddenly occurs, the laboratory room controller shall utilize BTU compensation control action to quickly raise or lower the room supply air discharge temperature to maintain the room's previous BTU's per hour cooling effect.
3) BTU compensation control action shall consist of immediately positioning the reheat valve to attain a new room supply air discharge temperature, which in combination with the new room supply airflow, shall maintain the room's previous BTU per hour cooling effect. The room ambient temperature control with BTU compensation control action shall utilize a proportional, integral and derivative (PID) closed loop control algorithm.

i. Room Control Priority

1) A. A control priority structure shall apply to all room ventilation and fume hood control functions to ensure that safety requirements are addressed in proper order to prevent a conflict in control operations or an inability of the ventilation system to fulfill its requirements. The room ventilation and fume hood control priority structure shall be as listed with the lowest numbered item (#1) having the first or highest operational priority and proceeding

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sequentially through the list with the highest numbered item having the lowest operational priority.

2) Fume Hood Face Velocity Control

   a) Unless an emergency mode of control is in effect, all VAV fume hood controllers in the room shall be allowed to maintain their respective fume hood face velocity setpoints independent of the action of the laboratory room controller.

3) Room Ventilation Rate (Air Changes per Hour)

   a) Unless an emergency mode of control is in effect, laboratory rooms having a general exhaust shall maintain sufficient general exhaust airflow so that the total room exhaust airflow (fume hood exhausts plus miscellaneous room exhausts plus the room general exhaust) will provide the required minimum room ventilation rate (air changes per hour).

4) Room Pressurization

   a) Unless a fire emergency mode is in effect, the laboratory room controller shall maintain required room pressurization

5) Room Occupied/Unoccupied Ventilation Changeover

   a) Unless an emergency mode is in effect, the laboratory room controller shall maintain the room's minimum ventilation rate and ambient conditions in accord with whether the room is in the occupied or unoccupied mode.

6) Room Ambient Conditions

   a) Room ambient temperature and humidity shall always be maintained in accord with the room's occupied or unoccupied mode

j. Typical Lab Room Controller Points integrated to and displayed at the BAS:

1) Supply Air Flow (Metered CFM)
2) General Exhaust Air Flow (Metered CFM)
3) Fume Hood Exhaust Flow (Metered CFM)
4) Total Exhaust Flow
5) Total Supply Flow
6) Differential Flow
7) Differential Flow Setpoint
8) Ventilation Rate Alarm
9) Differential Pressure Alarm
10) Supply Air Valve Position
11) Exhaust Air Valve Position
12) Reheat Valve Command
13) Discharge Air Temperature
14) Room Temperature
15) Room Temperature Setpoint

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16) Occupancy Status

k. VAV Fume Hood Controller

1) VAV Fume Hood Controllers shall be supplied in conjunction with a VAV Fume Hood Exhaust Terminal Unit for control of each VAV Fume Hood as indicated on the contract drawings.
2) Furnish and install a UL 916 listed individual VAV fume hood controller for each VAV fume hood which shall maintain the required average face velocity at the setpoint independently of the sash position. Documentation verifying the UL 916 Listing for the fume hood controller shall be included in any proposal as well as the submittal. Also, furnish and install sash sensors on each fume hood to indicate the position of all fume hood sashes to the respective fume hood controller. Sash sensors shall provide an input signal to the fume hood controller that is linearly proportional to within one half inch of the actual sash position. All sash sensors shall be highly corrosion resistant and allow easy removal of a fume hood's sashes for cleaning. Sash sensor operational life shall allow a minimum of 1 million full sash travel cycles.
3) The fume hood face velocity control process shall maintain the average fume hood face velocity at the desired set-point using a proportional, integral and derivative (PID) closed loop control algorithm. The fume hood face velocity control process shall be as follows:
4) The fume hood controller shall continually determine the fume hood's total open area by monitoring the fume hood sash position(s) by the sash sensor(s) as well as taking account of any fume hood fixed open areas and the bypass opening(s).
5) The fume hood controller shall calculate the required fume hood exhaust airflow necessary to maintain the average face velocity set-point over the total open area. The controller shall ensure detection of and a maximum of 1 second response to any change in sash position.
6) The fume hood controller shall control the fume hood exhaust airflow at the rate necessary to maintain the average face velocity set-point. The fume hood controller shall ensure that the required fume hood exhaust to maintain the average face velocity set-point is always maintained independently of any variations in exhaust system static pressure or any laboratory room conditions such as the ventilation airflow or room static pressure that could otherwise affect the fume hood exhaust airflow.
7) The fume hood face velocity control process shall accommodate the required fume hood maximum to minimum exhaust airflow rate. The fume hood controller shall always maintain the required minimum fume hood exhaust airflow recommended by laboratory safety standards whenever the total fume hood open area requires less than the calculated fume hood exhaust airflow necessary to maintain the average face velocity set point. The fume hood controller shall also be capable of limiting the maximum fume hood exhaust airflow regardless of the extent of the sash opening.
8) The fume hood controller shall also interface to a Fume Hood Display (FHD) at the designated measurement location on the front of the fume hood as shown on the project plans. The FHD shall provide a continuous digital display of average fume hood face velocity whenever the fume hood sash open area requires more than the minimum fume hood exhaust airflow. The

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fume hood face velocity display shall be the true average face velocity as calculated by the fume hood controller based upon actual measured fume hood exhaust airflow and the total fume hood total open area.

9) The FHD shall also include separate colored pilot lights that shall illuminate to indicate fume hood operational status as:

   a) Green for proper face velocity
   b) Yellow for marginal face velocity
   c) Red for face velocity alarm conditions
   d) The ODP shall also sound an audible alarm device in response to face velocity alarm conditions and the ODP digital display shall change to "LOW FACE VELOCITY" or "HIGH FACE VELOCITY" appropriate to the alarm condition. A SILENCE pushbutton on the FHD shall allow the user to silence the audible alarm which shall then remain silent until a subsequent face velocity alarm occurs.

10) The FHD shall also provide an EMERGENCY EXHAUST OVERRIDE pushbutton which shall enable a user to increase fume hood exhaust airflow to the maximum amount for a designated period of time as required by laboratory safety standards. After the designated time has expired the fume hood exhaust shall automatically reset to a lower level to prevent excessive demand on the exhaust system. The emergency purge mode of operation shall also be able to be cancelled at any time by depressing the emergency purge button a second time. The FHD shall sound its audible alarm device whenever the emergency purge mode of operation is activated. The silence pushbutton on the FHD shall also allow the user to silence the audible alarm which shall then remain silent until either the emergency purge operational mode is again activated or a face velocity alarm occurs.

11) The FHD shall also provide an audible sash open alert feature that can be implemented to caution users whenever the fume hood sash opening exceeds a predetermined amount. In addition, failure of a fume hood sash sensor shall also be indicated as an alarm condition on the FHD.

12) All fume hood control and FHD display and operational parameters shall be established and be changeable only by authorized personnel using a portable operator's terminal. These operational parameters shall include:

   a) Fume hood average face velocity set-point.
   b) Fume hood minimum & maximum exhaust airflow.
   c) Face velocity high and low alarm limits and associated alarm time delay to avoid transient alarms.
   d) Face velocity high and low warning limits.
   e) Emergency purge time periods and exhaust levels.
   f) Allowable maximum sash opening associated with the sash alert feature.

13) The portable operator's terminal shall plug into the FHD as well as into the laboratory room controller. In addition, all laboratory fume hood and laboratory room control parameters along with all other facility control and monitoring functions shall be accessible to authorized personnel from designated terminals on the BAS control and monitoring network.

14) Momentary or extended losses of power shall not change or affect any VAV fume hood control set-points, operational parameters or stored data. Upon

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resumption of power after a power failure, fume hood controllers shall resume full normal operation exactly as before the power failure and without any need for manual intervention. Upon a power failure or operational failure within the fume hood controller, the fume hood exhaust air terminal shall be automatically positioned to the fully open (failsafe) position as required by laboratory safety standards.

15) Typical Points integrated to and displayed at the BAS:

a) Airflow (Measured CFM)
b) Face Velocity
c) Sash Position
d) Low Face Velocity Alarm
e) Air Valve Position
f) Purge Alarm

2. Differential Pressure Monitors (Optional – see schedule for details)

a. Each room shall be provided with a differential pressure monitor (Room Pressure Indicator - RPI). The RPI shall be integrated into the LCS/BAS system via the building's RS-485, Level 2, LAN network.
b. The Differential Pressure Monitor shall include:

1)Digital Display of pressure (inches of water or Pascals)

a) Occupied
b) Unoccupied

3) Display indicators for normal and alarm status

c. DPM Display: The DPM shall include a liquid crystal display which has indication of the following features:

1) Pressure monitoring mode
2) High pressure alarm
3) Low pressure alarm
4) General failure
5) Status of door switch (if specified – see schedule for details)

2.6 INPUT DEVICES

A. General

1. All devices and equipment shall be approved for installation.
2. Provide the following field devices as required by the monitoring, control and optimization functions listed elsewhere in this specification.

B. Analog Inputs

1. Temperature Sensors (Not Including Space Temperature Sensors)

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a. All temperature sensors shall use RTD (Resistance Temperature Detector) elements. All control signals shall be via a 4-20 ma loop.
b. Calibration adjustments: Zero & Span.
c. Any point, physical or calculated may be designated for trending.
d. Range:

1) Liquid Immersion Temperature +20/+120 F, +70/+220 F
2) Duct (Single Point) Temperature +20/+120 F, +70/+220 F
3) Duct (Averaging) Temperature +20/+120 F
4) Outside Air Temperature -50/+122 F

2. Space Temperature Sensors

a. RTD or thermistor type
b. Accuracy: +0.5 F
c. Operating Range: 80 Degree Range Maximum
d. Setpoint Adjustment Range: 55 to 95 F
e. Shall include a terminal jack integral to the sensor assembly to allow the operator to query and modify operating parameters of the local room terminal unit from the portable operator's terminal.
f. Concealed setpoint adjustment switch with software limits.
g. Push-button override switch. The override switch may be locked out, overridden, or limited as to time through software by an authorized operator.
h. Room sensors shall not be located on outside walls.
i. The length of wiring from the space temperature sensor to the controller shall not exceed 100 ft.

3. Humidity Sensors

a. All control signals shall be via a 4-20 ma loop.
b. Sensor Range: 0 to 100%
c. Accuracy: +2% RH
d. Sensing element: Capacitive sensor
e. Operating Temperature:15F to 170F
f. Supply Voltage: 12 – 36 VDC

2.7 OUTPUT DEVICES

A. General

1. All devices and equipment shall be approved for installation.
2. Provide the following field devices as required by the monitoring, control and optimization functions listed elsewhere in this specification.

B. Actuation

1. All actuation shall be electric.

2.8 CONTROL VALVES

A. General

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1. All automatic control valves controlled by the BAS shall be furnished by the controls contractor unless noted otherwise in these documents.
2. All automatic control valves shall be installed by the mechanical trade.
3. The controls contractor shall provide wiring as follows:

    a. All line voltage power for electric valve actuators shall be wired by the controls contractor from the nearest available power panel. Coordinate with electrical trade.
    b. All wiring between the central control system (ATC/BAS) and the valve actuator shall be wired by the controls contractor.
    c. All wiring between the valve actuator and their associated thermostats, pressure switches, control devices, etc. shall be wired by the controls contractor.
    d. All wiring shall comply with code requirements. Segregate high and low voltage wiring & circuits and segregate the FAS and controls (BAS) terminals.

B. Hot Water Reheat Control Valves

1. Single-seated.
2. Pressure independent control valves by FCI.
3. Body pressure rating and connection type construction shall conform to fitting and valve schedules. The ANSI rating of the valve shall match the ANSI rating of the piping in which the valve is installed. Minimum ANSI rating shall be ANSI 125.
4. Stainless steel stems and trim.
5. Provide 50:1 turndown.
6. Spring loaded Teflon packing with replaceable discs.
7. Quiet in operation.
8. Fail-safe in either normally open or normally closed position in the event of power failure.
9. Capable of operating in sequence with other valves and/or dampers when required by the sequence of operation.
10. Capable of operating at varying rates of speed to correspond to the exact dictates of the controller and variable load requirements.
11. Sized by the control manufacturer and guaranteed to meet the heating and cooling loads as scheduled.
12. Shall be suitable for the pressure conditions and shall be sized to close against 125% of the design pump head.
13. Where pressure and flow combinations exceed ratings for commercial valves and operators, industrial class valves and operators shall be provided.
14. Lab reheat valves shall fail normally open

2.9 LABORATORY AIR TERMINAL EQUIPMENT

A. VAV VENTURI AIR VALVES

1. The airflow control device shall be a Phoenix Controls mechanically pressure independent venturi valve.
2. The venturi valve manufacturer’s Quality Management System shall be registered to ISO 9001:2015.
3. Venturi valve shall be OSHPD tested and certified per 2013 CBC, 2012, IBC, ASCE 7-10, and ICC-ES-AC-156.

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4. Venturi valve shall be HCAI (formerly OSHPD) Certified to Preapproval per 2013 CBC, 2012 IBC, ASCE 7-10, and IEC-ES-AC-156. HCAI Special Certification number OSP-0290.
5. All components of the venturi valves, their controllers, and wiring shall be RoHS compliant.
6. The venturi valve shall be mechanically pressure independent over its specified differential static pressure operating range. An integral pressure independent assembly shall respond and maintain specific airflow within one second of a change in duct static pressure irrespective of the magnitude of pressure and/or flow change (within product specifications) or quantity of airflow controllers on a manifolded system.
7. The airflow control device shall maintain accuracy within ±5% of signal to set point over an airflow range of no less than:
    a. 06” Valve Flow Range
        - Standard (non-shutoff) valve body at 0.6 in wc 30-350 CFM (51-595 m^3/hr), 11:7:1 turndown
    b. 08” Valve Flow Range
        - Standard (non-shutoff) valve body at 0.6 in wc 35-700 CFM (60-1189 m^3/hr), 20:1 turndown
        - Standard (non-shutoff) valve body at 0.3 in wc 35-500 CFM (60-850 m^3/hr), 14.3:1 turndown
        - Shutoff valve body at 0.6 in wc 35-600 CFM (60-1019 m^3/hr), 17.1:1 turndown
        - Shutoff valve body at 0.3 in wc 35-400 CFM (60-680 m^3/hr), 11.4:1 turndown
    c. 10” Valve Flow Range
        - Standard (non-shutoff) valve body at 0.6 in wc 50-1000 CFM (85-1700 m^3/hr), 20:1 turndown
        - Standard (non-shutoff) valve body at 0.3 in wc 50-550 CFM (85-935 m^3/hr), 11:1 turndown
        - Shutoff valve body at 0.6 in wc 50-850 CFM (85-1444 m^3/hr) 17:1 turndown
        - Shutoff valve body at 0.3 in wc 50-450 CFM (85-765 m^3/hr) 9:1 turndown
    d. Dual 10” Valve Flow Range
        - Standard (non-shutoff) valve body at 0.6 in wc 100-2000 CFM (170-3398 m^3/hr) 20:1 turndown
        - Standard (non-shutoff) valve body at 0.3 in wc 100-1100 CFM (170-1869 m^3/hr), 11:1 turndown
        - Shutoff valve body at 0.6 in wc 100-1700 CFM (170-2888 m^3/hr), 17:1 turndown
        - Shutoff valve body at 0.3 in wc 100-900 CFM (170-1529 m^3/hr), 9:1 turndown
    e. 12” Valve Flow Range:
        - Standard (non-shutoff) valve body at 0.6 in wc 90-1500 CFM (153-2549 m^3/hr), 16.7:1 turndown
        - Standard (non-shutoff) valve body at 0.3 in wc 90-1050 CFM (153-1784 m^3/hr), 11.7:1 turndown
        - Shutoff valve body at 0.6 in wc 90-1300 CFM (153-2209 m^3/hr), 14.4:1 turndown
        - Shutoff valve body at 0.3 in wc 90-900 CFM (153-1529 m^3/hr), 10:1 turndown
    f. Dual 12” Valve Flow Range:

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- Standard (non-shutoff) valve body at 0.6 in wc 180-3000 CFM (306-5097 m^3/hr), 16.67:1 turndown
- Standard (non-shutoff) valve body at 0.3 in wc 180-2100 CFM (306-3568 m^3/hr), 11.7:1 turndown
- Shutoff valve body at 0.6 in wc 180-2600 CFM (306-4417 m^3/hr), 14.4:1 turndown
- Shutoff valve body at 0.3 in wc 180-1800 CFM (306-3058 m^3/hr), 10:1 turndown

g. 14" Valve Flow Range
- Standard (non-shutoff) valve body at 0.6 in wc 200-2500 CFM (340-4248 m^3/hr), 12.5:1 turndown
- Standard (non-shutoff) valve body at 0.3 in wc 200-1400 CFM (340-2379 m^3/hr), 7:1 turndown
- Shutoff valve body at 0.6 in wc 200-1600 CFM (340-2718 m^3/hr), 8:1 turndown
- Shutoff valve body at 0.3 in wc 200-1000 CFM (340-1699 m^3/hr), 5:1 turndown

h. Dual 14" Valve Flow Range
- Standard (non-shutoff) valve body at 0.6 in wc 400-5000 CFM (680-8495 m^3/hr), 12.5:1 turndown
- Standard (non-shutoff) valve body at 0.3 in wc 400-2800 CFM (680-4757 m^3/hr), 7:1 turndown
- Shutoff valve body at 0.6 in wc 400-3200 CFM (680-5437 m^3/hr), 8:1 turndown
- Shutoff valve body at 0.3 in wc 400-2000 CFM (680-3398 m^3/hr), 5:1 turndown

8. No minimum entrance or exit duct diameters shall be required to ensure accuracy and/or pressure independence.
9. No rotational/axial orientation requirements shall be required to ensure accuracy and/or pressure independence.
10. The venturi valve shall maintain pressure independence regardless of loss of power. "Electronically pressure independent" devices will not be acceptable.
11. Airflow control devices utilizing ASHRAE 130 minimum operating pressure as a rating for minimum design pressure at required flow will not be acceptable on basis on minimum operating pressure alone. Valve manufacturer will provide minimum required differential pressure in writing for each size valve they offer.
12. Airflow control device shall be able to achieve its maximum turndown ratio at its stated minimum operating differential pressure; i.e., if minimum operating pressure is 0.6" wc dp, a 10" air valve must be able to achieve its minimum of 50 CFM and its maximum of 1000 CFM at stated 0.6" wc dp. Devices that require duct static pressure to be increased to achieve maximum flow shall not be acceptable.
13. The airflow control device shall be a venturi valve and shall be constructed of one of the following types:
    a. Class A—The airflow control device for non-corrosive airstreams, such as supply and general exhaust, shall be constructed of 16-gauge aluminum. The device's shaft and internal "S" link shall be made of 316 stainless steel. The shaft support brackets shall be made of galvaneal (non-shutoff valves) or 316 stainless steel

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(shutoff valves). The pivot arm shall be made of aluminum (for non-shutoff valves) and 303/304 stainless (for shutoff valves). The pressure independent springs shall be a spring-grade stainless steel. All shaft bearing surfaces shall be made of a PP (polypropylene) or PPS (polyphenylene sulfide) composite. 6" valves will have cone made of industrial grade material (PPS) with bearings integrated into cone. Sound attenuating devices used in conjunction with general exhaust or supply airflow control devices shall be constructed using 24 gauge galvanized steel or other suitable material used in standard duct construction. No sound absorptive materials of any kind shall be used. 6" valves will have cone made of industrial grade composite material (PPS) with bearings integrated into cone.

b. Class B—The airflow control device for corrosive airstreams, such as fume hoods and biosafety cabinets, shall have a baked-on, corrosion-resistant phenolic coating. The device's shaft shall be made of 316 stainless steel with a Teflon coating. The shaft support brackets shall be made of 316 stainless steel. The pivot arm and internal "S" link shall be made of 316 or 303 stainless steel. The pressure independent springs shall be a spring-grade stainless steel. The internal nuts, bolts and rivets shall be stainless steel. All shaft bearing surfaces shall be made of PP (polypropylene) or PPS (polyphenylene sulfide) composite. 6" valves will have cone made of industrial grade composite material (PPS) with bearings integrated into cone.

B. High Speed Laboratory Electric Actuators

1. High-speed electronic actuators shall be provided for all terminal units associated with areas classified as laboratories. The actuator shall be specifically designed for critical environment applications. The Laboratory Airflow Control System shall utilize high-speed electronic actuation for supply terminal boxes, exhaust terminal boxes, and fume hood airflow control.
2. The flow response time from 0 to 90% flow shall be no greater than 1 second under normal conditions or with any change in duct static pressure.
3. Actuator shall provide full stroke in less than 3 seconds from shutoff to full open, or from full open to shutoff.
4. The minimum torque at a 45-degree rotation shall be 179 in-lbs, at 60-degree rotation shall be 137 in-lbs, and at 90-degree rotation 97 in-lbs.
5. The power consumption shall be no greater than 96VA at startup.
6. The actuator shall be capable of analog (0-10Vdc, 4-20mA) control, as needed by the Laboratory application.
7. The actuators shall be provided with a manual override feature allowing the end user to stroke the damper to either the full open or full closed position.
8. The actuators shall be compatible with DDC controllers and terminal equipment controllers.
9. The lab control contractor shall utilize high speed actuation on all lab control air valves.
10. Actuator failsafe or fail in place shall be field resettable at the actuator.

PART 3 - EXECUTION

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3.1 DESIGN CRITERIA

A. Supply air valves shall fail closed. Fume Hood and General Exhaust air valves shall fail open.

3.2 INSTALLATION CRITERIA

A. Space mounted devices are to be identical in appearance. All devices shall be mounted under the same style cover.

B. Room sensors and thermostats shall not be located on outside walls.

C. Provide all relays, switches, sources of electricity and all other auxiliaries, accessories and connections necessary to make a complete operable system in accordance with the sequences specified.

D. Install controls so that adjustments and calibrations can be readily made. Controls are to be implemented by the Lab Airflow Control System equipment manufacturer.

E. Mount surface-mounted control devices, tubing and raceways on brackets to clear the final finished surface on insulation.

F. Conceal control conduit and wiring in all spaces except in the Mechanical Equipment Rooms and in unfinished spaces. Install in parallel banks with all changes in directions made at 90 degree angles.

G. Install control valves horizontally with the power unit up. Installation of control valves will be by the mechanical contractor.

H. Unless otherwise noted, install wall-mounted sensors, thermostats and humidistats to meet ADA requirements. Submit device samples, locations, mounting heights and details for approval for all devices.

I. All relays, electrical wiring, panels, outputs, etc. to make a complete operational system, shall be provided and installed by this section. See sequences of operation for details.

J. Component Tags

1. All automatic and manual valves provided by this contractor, shall be identified with 2" diameter brass tags and brass chains. Lettering shall be ½" high, stamped and painted black.
   Automatic valve tags shall be stamped with the letters "AV" and sequentially numbered. Provide valve schedule and sample tags for approval.
2. All sensors shall be identified with 1"x 3" black labels with white lettering. Lettering shall be 1/4" high. Provide sensor number, HVAC Unit number, part number and sensor range on tag. Submit tag schedule and sample for approval.
3. All panels, auxiliary component panels, transformer panels, etc. provided by this contractor, shall be identified with 2"x 5" black lamacoid labels with engraved white lettering. Lettering shall be ½" high. Provide panel number, HVAC unit number and service on tag. Submit tag schedule and sample for approval.

3.3 ELECTRICAL WIRING

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A. The BAS Contractor shall be responsible for all electrical control work associated with the BAS, Lab Airflow Control System, HVAC and plumbing systems which are not specified as work of others.

1. Perform all wiring in accordance with all local and national codes including the NEC.
2. Install all line voltage wiring, concealed or exposed, in conduit in accordance with the Division 26 specifications, NEC and local building code.
3. All Primary Network wiring throughout the building shall be run in conduit.
4. Low voltage electrical control wiring, terminal equipment sensors and the secondary network wiring may be run in plenum rated cable above accessible hung ceilings. Plenum cable shall be run parallel to building lines and supported from the building structure (not from duct, pipe or associated hangers) with bridle rings.
5. Provide extension of 120 volt, 20 amp circuits and circuit breakers from UPS power panels for entire system as required.
6. Surge transient protection shall be incorporated in the design of system to protect electrical components in all DDC control panels and operator workstations.
7. Provide all miscellaneous field device mounting and interconnecting control wiring for all mechanical systems including but not limited to the fuel oil system, emergency generators, chillers, water treatment, AC units, condensing units, cooling towers, expansion tanks, VFDs, unit heaters, filtration systems (air and water), terminal units, fan coil units, electric heaters, house tanks, fans, H&V, cabinet heaters, hot water heater, ejectors, sump pits, domestic water system and plumbing systems.
8. All systems requiring interconnecting control wiring as specified herein, shall have hardwired interlocks and shall not rely on the BAS to operate. Interconnecting wiring shall be run in conduits separate from the BAS associated wiring.
9. All wiring for network communication, sensor signals and interlock wiring shall be permanently labeled at a minimum of 10-foot intervals. Label shall indicate BAS manufacturer's name and cable usage. Labels shall be securely fastened and not be damaged during installation. Cable jackets shall also be color coded to indicate application.
10. Cables shall be tagged or labeled at each termination point and in each intermediate junction box, pull box or cabinet through which they pass.
11. All control and power wiring associated with the control of all automatic, fire/smoke or smoke dampers shall be installed in conduit, regardless of voltage. All control and power wiring for relays associated with the control of any automatic, fire/smoke or smoke damper shall be installed in conduit, regardless of voltage.
12. Provide all line and low voltage wiring for the control of all HVAC, plumbing and fire protection motors (whether individual or as part of packaged equipment) and dampers, including wiring for relays, control panels, unit heater and cabinet heater control, etc.
13. Provide wiring, for smoke and fire control of dampers which are to be automatically and/or manually controlled. Wiring will include connections to an adequate 120 volt emergency source, and to interface relays provided as part of the automatic temperature control work within 10 feet of each such damper which is also to be controlled as part of the automatic temperature control work.
14. The BAS contractor shall provide wiring:

    1) Between thermostats, aquastats and unit heater motors.
    2) All control and alarm wiring for all control and alarm devices for all Sections of Specifications.
    3) 120 volt, single phase, 60 hertz UPS power to every BAS panel, VAV box controller, BAS console, valve transmission power supplies, printers and to other devices as required. It is the intent that the entire building

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management system and all peripheral devices, alarms, etc., shall be operative under UPS power conditions in the building. The power supplies are to be extended in conduit and wire from UPS circuit breakers.

4) Provide power supply and control wiring (as required) to all motorized dampers.
5) Provide status function conduit and wiring for equipment covered under this section.
6) Provide conduit and wiring between the BAS panels and the temperature, humidity, or pressure sensing elements, including low voltage control wiring.
7) Provide conduit and control wiring for devices specified in this Section.
8) Provide conduit and signal wiring between motor starters in motor control centers and high and/or low temperature relay contacts and remote relays in BAS panels located in the vicinity of motor control centers.
9) Provide conduit and wiring between the PC workstation, electrical panels, metering instrumentation, indicating devices, miscellaneous alarm points, remotely operated contractors, and BAS panels, as shown on the drawings or as specified.
10) Provide electrical wall box and conduit sleeve for all wall mounted devices.
11) Firestopping shall be provided for all penetrations of conduit, etc. through fire rated walls and floors and other fire rated separations.
12) Where conduit is required, it shall be steel metallic tubing, except that it shall be galvanized intermediate steel conduit where located within 8'-0" of the floor in mechanical spaces (or is otherwise exposed to mechanical damage), or is intended for embodiment in concrete.

15. Wires and cables shall have characteristics - in compliance with Articles 725 and/or 800 (as applicable) of the National Electrical Code - as described elsewhere in the specifications or drawings for this project, and shall be UL listed in accordance therewith.
16. Where wires and cables are permitted to be run without conduit, they shall be independently supported from the building structure or ceiling suspension systems at intervals not exceeding four feet on center, utilizing cable supports specifically approved for the purpose. Wires and cables shall not rest on or depend on support from suspended ceiling media (tiles, lath, plaster, as well as splines, runners or bars in the plane of the ceiling), nor shall they be supported from pipes, ducts or conduits. Where cables are bundled together, separate bundles shall be provided separately for each type of cabling and separately for each independent system. Bundling and/or supporting ties shall be of a type suitable for use in a ceiling air handling plenum regardless of whether or not installed in a plenum.
17. Utilize #14 AWG THWN conductors minimum throughout for power wiring (120 VAC or greater) except in conjunction with a manual starter. For a manual starter, utilize conductors equal in size to those in the power circuit.
18. Motor control circuit wires may be run in the same conduit as the wires of motor power circuits; however, abide by the following:

    1) Exclude motor control wires from enclosures (other than motor starter enclosures) which contain power circuit overcurrent protection and switching devices;
    2) Exclude motor control wires from pull boxes and junction boxes containing the wires of main and submain feeders.
    3) Utilize auxiliary pull boxes to separate motor control wires from motor power circuit wires at a point before the power circuit wires enter the items from which motor control wires are excluded.

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4) Exclude motor control wires from the same conduits as motor power circuit wires larger than 250 MCM.

19. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

    1) Wires and Cables:

        a) American Insulated Wire Corporation, Leviton Manufacturing Co.
        b) Brand-Rex Cable Systems, Brintec Corp.
        c) Carol Cable Company, Inc.
        d) Senator Wire & Cable Co.
        e) Southwire Co.
        f) Belden Division, Cooper Industries
        g) Cable & Wire Division, A.T.& T.
        h) American Insulation Wire Company.

    2) Connectors for Wires and Cables:

        a) AFC, Monogram Co.
        b) AMP, Inc.
        c) Anderson, Square D Co.
        d) Electrical Products Division, 3M Co.
        e) O-Z/Gedney Unit, General Signal.

    3) Connectors and Splices

        a) UL-listed factory-fabricated wiring connectors of size, ampacity rating, material, and type and class for application and for service indicated.

20. Examine raceways and building finishes to receive wires and cables for compliance with installation tolerances and other conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.
21. Utilize copper conductors with THWN, THHN or XHHW insulation. Type THHW and THHW-2 shall not be utilized where excluded by conduit sizing. Type THWN shall not be utilized for connection to 100% rated overcurrent devices.
22. Pull conductors into raceway simultaneously where more than one is being installed in same raceway.
23. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.
24. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
25. Tighten electrical connectors and terminals according to manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in
    UL 486A and UL 486B.
26. Properly ground all field equipment panels and terminal unit equipment.

3.4 COORDINATION

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A. Coordination with Other Trades

1. Piping and duct installation requirements are specified in other Division 23 Sections. Coordinate installation of all devices furnished under this section to be installed by other trades with the appropriate trade.
2. It is the responsibility of this contractor to coordinate with all trades the location of installed equipment and routing of all electrical and pneumatic control conduits and lines.
3. Install control system components to allow for proper service and maintenance of equipment.
4. Air Valve sizing, placement on drawings, etc shall be coordinated by a project manager delegated by the lab airflow control system manufacturer.

B. Work Performance Schedule

1. A time-phased schedule for delivery, installation, and acceptance of components for the complete system shall be prepared. Submit this schedule to the Owner within five (5) days after award of contract. Submit updates and changes to this schedule promptly to the Owner.

3.5 COMMISSIONING, TESTING AND ACCEPTANCE

A. Perform a three-phase commissioning procedure consisting of field I/O calibration and commissioning, system commissioning and integrated system program commissioning. Document all commissioning information on commissioning data sheets which shall be submitted prior to acceptance testing. Commissioning work which requires shutdown of system or deviation from normal function shall be performed when the operation of the system is not required. The commissioning must be coordinated with the owner and construction manager to ensure systems are available when needed. Notify the operating personal in writing of the testing schedule so that authorized personnel from the owner and construction manager are present throughout the commissioning procedure.

B. In order to ensure preparedness for field commissioning and to avoid downtime caused by troubleshooting during the commissioning phase the DDC programs shall be pre-tested by the contractor and demonstrated to the owner’s commissioning authority for proper functionality prior to field installation. The pre-test shall model the full system control functionality with actual programming, point database, graphics either hard-wired end devices or software simulation. The user shall be able to test the system in all modes of operation, including changing control setpoints and environmental variables and to observe system performance, point trends and alarms. The system control performance shall be documented on trend reports and commissioning checkout sheets.

C. Field I/O Calibration and Commissioning

1. Prior to system program commissioning, verify that each control panel has been installed according to plans, specifications and approved shop drawings. Test, calibrate and bring on line each control sensor and device. Commissioning to include, but not be limited to:

    a. Sensor accuracy at 10, 50 and 90% of range.
    b. Sensor range.
    c. Verify analog limit and binary alarm reporting.
    d. Point value reporting.

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e. Binary alarm and switch settings.
f. Actuator and positioner spring ranges.
g. Fail safe operation on loss of control signal, electric power, network communications, etc.

2. Record calibration and test data on commissioning data sheets. Sufficient space should be provided near each point name for sign off.
3. Verify that the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC control loops and optimum start/stop routines. Provide documented evidence of tuned DDC control loops (e.g., graphical logs or trend reports).

D. System Program Commissioning

1. After control devices have been commissioned (i.e. calibrated, tested and signed off), each DDC program shall be put on line and commissioned. The contractor shall, in the presence of the owner and construction manager, demonstrate each programmed sequence of operation and compare the results in writing. In addition, each control loop shall be tested to verify proper response and stable control, within specified accuracy's. System program test results shall be recorded on commissioning data sheets and submitted for record. Any discrepancies between
the specification and the actual performance will be immediately rectified and retested.

E. Integrated System Commissioning

1. After all DDC programs have been commissioned, the contractor shall verify the overall system performance as specified. Tests shall include, but not be limited to:

a. Data communication, both normal and failure modes.
b. Fully loaded system response time.
c. Impact of component failures on system performance and system operation.
d. Time/Date changes.
e. End of month/ end of year operation.
f. Season changeover.
g. Global application programs and point sharing.
h. System backup and reloading.
i. System status displays.
j. Diagnostic functions.
k. Power failure routines.
.Battery backup.
l. Smoke Control, stair pressurization, stair, etc. vents, in concert with Fire Alarm System testing.
m. Testing of all electrical and HVAC systems with other division of work.
n. Acceptance Testing

1) Submit for approval, a detailed acceptance test procedure designed to demonstrate compliance with contractual requirements. This Acceptance test procedure will take place after the commissioning procedure but before final acceptance, to verify that sensors and control devices maintain specified accuracy's and the system performance does not degrade over time.

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2) Using the commissioning test data sheets, the contractor shall demonstrate a minimum of 15 percent of each point type, as randomly selected by the owner. The contractor shall also demonstrate 15 percent of the system functions, as randomly selected by the owner. Based on the above samples, the owner may accept the entire system or require the contractor to demonstrate all points and system functions until all devices and functions meet specification.
3) The contractor shall supply all instruments for testing and turn over same to the owner after acceptance testing.
4) All test instruments shall be submitted for approval. 5) Test Instrument Accuracy:

a) Temperature: 1/4F or 1/2% full scale, whichever is less
b) Pressure:High Pressure (psi): ½ psi or 1/2% full scale, whichever is less.
c) Low Pressure: 1/2% of full scale (in w.c.)
d) Humidity:2% RH
e) Electrical:1/4% full scale

p. After the above tests are complete and the system is demonstrated to be functioning as specified, a thirty day performance test period shall begin. If the system performs as specified throughout the test period, requiring only routine maintenance, the system shall
be accepted. If the system fails during the test, and cannot be fully corrected within eight hours, the owner may request that performance tests be repeated.
q. Move In Checkout

1) Each floor shall be re-tested 24 hours prior to move in. The test shall ensure all corrective work is complete and all systems are 100% operational.

3.6 TRAINING

A. The Contractor shall provide competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed rather than a general training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. All training shall be held during normal work hours of 8:00 a.m. to 4:30 p.m. weekdays.

B. Provide Sixteen (16) hours of training for Owner's operating and maintenance personnel. Training shall include:

1. Explanation of drawings, operator’s and maintenance manuals.
2. Walk-through of the job to locate all control components.
3. Peripherals.
4. DDC Controller and ASC operation/function.
5. Explanation of adjustment, calibration and replacement procedures.

END OF SECTION 230925

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SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Chilled-water piping.
2. Hot-water piping.
3. Makeup-water piping.
4. Blowdown-drain piping.
5. Chemical treatment piping.
6. Refrigerant relief vent piping.
7. Condensate drain piping.

B. See Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

C. See Division 23 Section “Piping Materials Installation” for detailed requirements of hydronic system installation.

D. Related Sections include the following:

1. Division 01 Section “Construction Waste Management”

2. Division 01 Section "Sustainable Design Requirements - LEEDv4 BD+C" for additional LEED requirement

1.2 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:

1. Chilled-Water Piping (Water): 300 psig at 200 deg F.
2. Hot-Water Piping: 250 psig @ 200 deg F.
3. Makeup-Water Piping: 80 psig at 150 deg F.
4. Blowdown-Drain Piping: 125 psig at 150 deg F.
5. Chemical treatment piping: 125 psig at 150 deg F.
6. Refrigerant relief vent piping: 125 psig at 150 deg F.
7. Condensate drain piping: 125 psig at 150 deg F.

1.3 SUBMITTALS

A. Product Data: For each type of the following:

1. Plastic pipe and fittings with solvent cement.
2. Pressure-seal fittings.

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3. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
4. Air control devices.
5. Chemical treatment.
6. Hydronic specialties.
~~6.~~7. **Grooved Joint Systems**

B. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Field quality-control test reports.

D. Operation and maintenance data.

E. LEED Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:
    a. Leadership Extraction Practices
        1) **(RC)** Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
            a) Include statement indicating costs for each product having recycled content.

2. Indoor Environmental Quality, Low Emitting Materials:
    a. Laboratory Test Reports: For adhesives, sealants, paints, coatings wet applied on site, indicating testing and compliance with the California Department of Public-Health (CDPH) Standard Method V1.2-2017, using the applicable exposure scenario.
    b. Paints, and Coatings: For wet applied on site products, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016.
    c. Adhesives and Sealants: For wet applied on site products, submit printed statement showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005, and rule amendment date of October 6, 2017.
    d. Methylene Chloride and perchloroethylene may not be added to paints, coatings, adhesive or sealants
    e. Flooring: Submit documentation to show that 100% of flooring emissions comply with California Department of Public Health (CDPH) Standard Method V1.2-2017, using applicable exposure scenario, or FloorScore certification.

1.4 INFORMATIONAL SUBMITTALS

A. Informational LEED Submittals:

1. **(EPD)** Building Product Disclosure and Optimization - Environmental Product Declarations

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a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.
b. EPD Optimization: For materials, indicating embodied carbon/LCA optimization report or action plan.
c. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.
d. EPD Optimization: For materials, indicating embodied carbon/LCA optimization report or action plan.

1.5 RELATED SECTIONS INCLUDE THE FOLLOWING:

A. Division 01 Section ”Construction Waste Management.”

B. Division 01 Section “LEED Requirements” for additional LEED requirements.

1.6 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code Section IX.
1. Comply with provisions in ASME B31 Series, “Code for Pressure Piping”
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Wrought-Copper Fittings: ASME B16.22.

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Anvil International, Inc.
b. S. P. Fittings; a division of Star Pipe Products.
c. Or approved equivalent.

C. Wrought-Copper Unions: ASME B16.22.

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2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.

~~D.~~**E. Installation-Ready™ fittings for Schedule 10 through Schedule 80 plain end carbon steel piping in sizes NPS ½" thru 2" (DN15 thru DN50), rated for working pressure of 300 psi (2065 kPa). Fittings shall consist of a ductile iron housing with Installation-Ready™ ends, gasket liner, zinc-electroplated steel bolts and nuts, and 300 series stainless steel retainer. Basis of Design: Victaulic QuickVic™ SD.**

~~E.~~**F.** Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.

~~F.~~**G.** Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

H. Grooved Mechanical-Joint Fittings and Couplings:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Victaulic Company.
b. Anvil International, Inc.
c. Or approved equivalent.

2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 53/A 53M, Type F, E, or S, Grade B factory-fabricated steel; or ASTM A 234, Grade WPB steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

a. 2" through 12" (DN50 through DN300); ASTM A536 Grade 65-45-12 ductile iron with Victaulic Original Grooved System (OGS) grooved ends, stiffening ribs, and alignment indicators, orange coated or hot dipped galvanized as per ASTM A123, working pressure 400-psi (2758-kPa). Victaulic QuickVic™ V10 (90-deg), V11 (45-deg), and V20 (tee).

3. Couplings: Two ductile iron housings and synthetic rubber gasket of central cavity pressure-responsive design; with ASTM A449 compliant bolts and nuts to secure grooved pipe and fittings.

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a. **Rigid Type through NPS 12: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.9.**

a) **NPS 2 to NPS 12: Installation-Ready couplings, designed for direct stab installation without field disassembly and no loose parts. Housings cast with torque-absorber and shift-limiting slant bolt pad design to provide piping system rigidity and support and hanging in accordance with ANSI B31.1 and B31.9, and to prevent mis-assembly due to overshift. Housings cast with alignment indicator notch for visual proper alignment to adjoining fitting. Grade EHP center-leg gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth, rated to +250 deg F. Victaulic Style 107V-Quick-Vic or approved equal.**

b. **Rigid Type NPS 14 and Larger: Housing key shall fill the wedge shaped groove (Victaulic AGS or approved equal); two ductile iron housings cast with a wide key profile and flat bolt pads, with wide width Grade "E" EPDM FlushSeal gasket. Victaulic Style W07 or approved equal.**

c. **Three Victaulic flexible type couplings may be used in lieu of a flexible connector for vibration attenuation at equipment connections on applicable piping systems. The couplings shall be placed in close proximity to the source of the vibration.**

4. **Flange Adapters NPS 2 and above: ASTM A-536, ductile iron casting, flat face, for direct connection to ANSI Class 125 or 150 flanged components. Victaulic Style 741 (or approved equal) or Style W741 (NPS 14 to NPS 24)(or approved equal).**

~~2.3~~2.2 PLASTIC PIPE AND FITTINGS

A. PVC Plastic Pipe: ASTM D 1785, Schedule 80, plain ends as indicated in Part 3 "Piping Applications" Article.

B. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2467 for Schedule 80 pipe.

~~2.4~~2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

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D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

F. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

G. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

H. Grooved Joint Lubricants: Lubricate gaskets in accordance with manufacturer's recommendations with lubricant supplied by the coupling manufacturer that is suitable for the gasket elastomer and system media. Provide Victaulic 'Vic-Lube' or approved equal.

~~2.5~~2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Charlotte Pipe and Foundry Company.
b. IPEX Inc.
c. KBi.
d. Or approved equivalent.

2. PVC one-piece fitting with one threaded brass or copper insert and one Schedule 80 solvent-cement-joint end.

B. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Charlotte Pipe and Foundry Company.
b. IPEX Inc.
c. KBi.
d. NIBCO INC.
e. Or approved equivalent.

2. MSS SP-107, PVC union. Include brass or copper end, Schedule 80 solvent-cement-joint end, rubber gasket, and threaded union.

~~2.6~~2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Hart Industries International, Inc.
    d. Jomar International Ltd.
    e. Matco-Norca, Inc.
    f. McDonald, A. Y. Mfg. Co.
    g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    h. Wilkins; a Zurn company.
    i. Or approved equivalent.

2. Description:

    a. Standard: ASSE 1079.
    b. Pressure Rating: 250 psig minimum at 180 deg F.
    c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. **Dielectric Waterway: Copper silicon casting conforming to UNS C87850 with grooved and/or threaded ends. UL classified in accordance with ANSI / NSF 61 for potable water service. Basis of Design: Victaulic Style 647.**

~~2.7~~2.6 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."

C. Diaphragm-Operated, Pressure-Reducing Valves:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump; a division of ITT Industries.
    d. Conbraco Industries, Inc.
    e. Spence Engineering Company, Inc.
    f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    g. Or approved equivalent.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.
8. Inlet Strainer: stainless-steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.

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10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

D. Diaphragm-Operated Safety Valves:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump; a division of ITT Industries.
   d. Conbraco Industries, Inc.
   e. Spence Engineering Company, Inc.
   f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   g. Or approved equivalent.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: stainless-steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

E. Automatic Flow-Control Valves:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Flow Design Inc.
   b. Griswold Controls.
   ~~b.~~**c. Victaulic Company**
   ~~c.~~**d.** Or approved equivalent.

2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Stainless steel or Corrosion resistant, tamper proof, self cleaning, and removable.
4. Combination Assemblies: Include bonze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 300 psig.
9. Maximum Operating Temperature: 250 deg F.

~~2.8~~2.7 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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1. Bell & Gossett Domestic Pump; a division of ITT Industries.
2. Amtrol, Inc.
3. Armstrong Pumps, Inc.
4. Spirotherm.
5. Taco.
6. Wessels.
7. Or approved equivalent.

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 300 psig.
7. Maximum Operating Temperature: 225 deg F.

C. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 300 psig.
7. Maximum Operating Temperature: 240 deg F.

D. Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested with taps fabricated and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig working pressure and 250 deg F maximum operating temperature.
3. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
4. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch- diameter gage glass, and slotted-metal glass guard.

E. Bladder-Type Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

F. Tangential-Type Air Separators:

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1. Tank: Welded steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature.
2. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
3. Tangential Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.
4. Blowdown Connection: Threaded.
5. Size: Match system flow capacity.

G. Coalescing Type, Straight-through, Air Elimination and Dirt Separators:

1. Tank: Welded steel; ASME constructed and labeled for 150-psig minimum working pressure and 270 deg F maximum operating temperature.
2. Air / Dirt Elements, Coalescing Medium: Copper core tube with continuous wound copper wire medium permanently attached and followed by a separate continuous wound copper wire permanently affixed. Stainless steel medium is acceptable. Each unit shall have separate venting chamber with integral full port float actuated brass venting mechanism. External vent for field installation is also acceptable. Unit shall include a valved side tap for flushing/skimming.
3. Dirt Separator Efficiency: 80% minimum of all particles 30 micron and larger with 100 passes.
4. Straight-through Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.
5. Blowdown Connection: Threaded.
6. Size: Match system flow capacity. Velocity shall be limited to less than 10 feet per second.

~~2.9~~2.8 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body:
   a. ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
   ~~a.~~b. **ASTM A 536, Grade 65-45-12, ductile iron with coupled cover.**
2. End Connections: Threaded ends for NPS 2 and smaller; flanged **or grooved** ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent **total** free area.
4. CWP Rating: **300** ~~250~~ psig.
~~4.~~5. **Basis of Design: Victaulic Style 732 and AGS W732 or approved equal.**

B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 250 psig.

C. T-Pattern Strainers:

1. Body: Ductile ~~or malleable~~ iron with removable access coupling and end cap **or factory-manufactured steel body with T-bolt hinged closure** for strainer maintenance.

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2. End Connections: Grooved ends.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with **2:1 total**~~57 percent~~ free area.
4. CWP Rating: **300**~~750~~ psig.
~~4.~~**5. Basis of Design: Victaulic Style 730 and AGS W730 or approved equal.**

D. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 250 psig.
5. Maximum Operating Temperature: 250 deg F.
6. **Three Victaulic flexible type couplings may be used in lieu of a flexible connector for vibration attenuation at equipment connections on applicable piping systems. The couplings shall be placed in close proximity to the source of the vibration.**

E. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 250 psig.
5. Maximum Operating Temperature: 250 deg F.

F. Expansion fittings are specified in Division 23 Section “Expansion Fittings and Loops for HVAC Piping."

G. Vibration Isolation Pump Drops:

1. **Manufactured grooved end vibration pump discharge drop for pipe sizes 3” through 12” (DN80 though DN300). Orange enamel coated assembly, consisting of a Class 150 flange for pump connection, [base elbow for horizontal pump connection] [straight line with concentric reducer for vertical pump connections], tri-service valve assembly consisting of a spring-actuated check [Venturi-Check] valve and butterfly valve with offset stem for 360-degree circumferential seating, and pipe spool with thermometer and pressure ports. Assembly is installation-ready, with flexible couplings to accommodate vibration attenuation and stress relief. Assembly rated for working pressure to 300-psig (2068-kPa). Standard of Acceptance: Victaulic Series 380 or approved equal.**

2. **Manufactured grooved end vibration pump suction drop for pipe sizes 3” through 12” (DN80 though DN300). Orange enamel coated assembly, consisting of a suction diffuser with stainless steel basket and diffuser and Class 150 flange for pump connection, butterfly valve with offset stem for 360-degree circumferential seating, and pipe spool with thermometer and/or pressure ports. Assembly is installation-ready, with flexible couplings to accommodate vibration attenuation and stress relief. Assembly rated for working pressure to 300-psig (2068-kPa). Standard of Acceptance: Victaulic Series 381 or approved equal.**

3. **Manufactured grooved end vibration pump suction drop for pipe sizes 3” through 12” (DN80 though DN300). Orange enamel coated assembly, consisting of a 90-degree base elbow with Class 150 flange for pump connection, Wye pattern strainer**

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with stainless steel perforated metal basket, butterfly valve with offset stem for 360-degree circumferential seating, and pipe spool(s) with thermometer and/or pressure ports. Assembly is installation-ready, with flexible couplings to accommodate vibration attenuation and stress relief. Assembly rated for working pressure to 300-psig (2068-kPa). Standard of Acceptance: Victaulic Series 382 or approved equal.

4. Manufactured grooved end vibration pump discharge drop for pipe sizes 3" through 12" (DN80 though DN300). Orange enamel coated assembly, consisting of a Class 150 flange for pump connection, [base elbow for horizontal pump connection] [straight line with concentric reducer for vertical pump connections], spring-actuated check [Venturi-Check] valve and Series 789 circuit balancing valve, and pipe spool with thermometer and pressure ports. Assembly is installation-ready, with flexible couplings to accommodate vibration attenuation and stress relief. Assembly rated for working pressure to 300-psig (2068-kPa). Standard of Acceptance: Victaulic Series 383 or approved equal.

H. Air Handling Unit Drops:

1. Manufactured grooved end vibration isolation drop for air handling unit coil supply and return connections in sizes 2" through 6" (DN50 though DN150) to accommodate isolation, straining, balancing, and drainage. Orange enamel coated drop, consisting of ASTM A53 carbon steel pipe spool(s), Victaulic #20 (straight) and #25 (reducing) tees or Style 920/920N Mechanical-T fittings, with base end cap with drain outlet and DZR brass drain valve. Supply connections include a Vic-300 MasterSeal butterfly valve and Style 732 Y-pattern strainer with PT ports, and the return connection includes a Series 787 or 789 circuit balancing valve. Installation-ready, with flexible couplings to accommodate vibration attenuation and stress relief, rated for working pressure to 300-psig (2068-kPa). Basis of Design: Victaulic Series 385 or approved equal.

I. Outlet Fittings

~~6.~~1. Manufactured grooved end outlet fitting all-in-one assembly for fluid distribution. Outlet fitting shall consist of an ASTM A53, Grade B, standard weight pipe spool with required outlet connections. Grooved ends roll grooved to Victaulic OGS/AGS dimensions, with enamel coating or galvanized to project requirements. Basis of Design: Victaulic No. 26 and W26 or approved equal.

~~2.10~~2.9 CHEMICAL TREATMENT

A. Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

~~2.11~~2.10 HYDRONIC PIPING SPECIALTIES

A. Suction Diffuser:

1. Body: ASTM A536, Grade 65-45-12, ductile iron or ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Grooved and/or flanged ends for NPS 2-1/2 and larger.

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3. Strainer Screen: **20-mesh stainless steel or 16-**~~16~~-mesh bronze start-up strainer (disposable)
4. Stainless Steel inlet vanes and Diffuser-Strainer-Orifice Cylinder with **5/32" or** 3/16" diameter openings for pump protection. Orifice cylinder shall be equipped with a disposable fine mesh strainer which can be removed after system start-up.
5. ~~Orifice cylinder shall be designed to withstand pressure differential equal to pump shut-off head and shall have free area equal to five times cross section area of pump suction opening.~~ Vane length shall be no less than 2-1/2 times the pump connection diameter.
6. Provide adjustable support as required to carry weight of suction piping.
7. CWP Rating: **300**~~250~~ psig.
8. Operating Temperature: **230**~~250~~ deg F.

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT (LEED)

A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor's "Waste Management Plan" as required by Division 01 Section "Construction Waste Management."

3.2 PIPING APPLICATIONS

A. Chilled-water piping (Water), aboveground, NPS 2 and smaller**,** shall be any of the following:
1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

B. Chilled-water piping (Water), aboveground, NPS 2-1/2 and larger**,** shall be any of the following:

1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

C. Hot-water piping, aboveground, NPS 2 and smaller**,** shall be any of the following:
1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

D. Hot-water piping, aboveground, NPS 2-1/2 and larger**,** shall be any of the following:

1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

E. Makeup-water piping installed aboveground shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

F. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

G. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

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H. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

I. Chemical treatment piping installed aboveground shall be the following:

1. PVC Plastic Pipe: ASTM D 1785, Schedule 80, plain ends with PVC plastic pipe socket-type pipe fittings, ASTM D 2467 for Schedule 80 pipe with solvent cement and primer.

J. Condensate drain piping, aboveground, NPS 2 and smaller**,** shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

3.3 VALVE APPLICATIONS

A. Install shut-off duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install throttling-duty valves as shown on drawings.

C. Install check valves at each pump discharge and elsewhere as required to control flow direction.

D. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.4 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Refer to Division 23 “Piping Materials Installation” for additional requirements and guidelines.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

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K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap or as shown on drawings, at low points in piping system mains and elsewhere as required for system drainage.

M. Install vents, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap or as shown on drawings, at high points in piping system mains and elsewhere as required for venting of air from system.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install dielectric unions in piping where dissimilar materials are required to be joined in the piping system.

S. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated. **Unions or flanges for servicing and disconnect are not required in installations utilizing grooved joint couplings.**

T. Install strainers on inlet side of each control valve, pressure-reducing valve, pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

U. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeve seals specified in Division 23 Section "Common Work Results for HVAC" and per details on construction plans.

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Common Work Results for HVAC" and per details on construction plans.

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Install the following pipe attachments:

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1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.

E. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.6 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

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2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
3. PVC Nonpressure Piping: Join according to ASTM D 2855.

H. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

3.7 AIR DEVICES AND HYDRONIC SPECIALTIES INSTALLATION

A. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

B. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.

C. Install tangential air separator in pump suction. Install blow down piping with gate or full-port ball valve; extend full size to nearest floor drain.

D. Ceiling Mounted Expansion Tanks: Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank. Follow manufacturer’s instructions and recommendations for setup.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

E. Floor Mounted Expansion Tanks: Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements. Follow manufacturer’s instructions and recommendations for setup.

F. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

G. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above the floor. Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

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3.8 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 section 230519 Meters and Gauges.

3.9 CHEMICAL TREATMENT

A. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

B. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

3.10 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, un-insulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. System shall be flushed as described in Division 23 “Piping Materials Installation.”
4. Chemical treatment shall be completed per procedures outlined in Division 23 “HVAC Water Treatment.”
5. Do not allow raw water to remain in piping system for over 24 hours. Provide chemical treatment within 24 hours of initial fill of system.
6. Refer to Division 23 “Piping Materials Installation” for further requirements.
7. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests per Division 23 “Pressure Testing of Piping Assemblies” and “Piping Materials Installation” for further requirements.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Inspect “end of loop” bypass piping to ensure that all flush/fill valves are closed and isolation valves for bypass are closed and locked in closed position.
6. Set temperature controls so all coils are calling for full flow.
7. Inspect and set operating temperatures of hydronic equipment, such as chillers, cooling towers, to specified values.

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8. Verify lubrication of motors and bearings.

END OF SECTION

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SECTION 238214 - CHILLED BEAMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Active chilled beams.

1.2 ACTION SUBMITTALS

A. Product Data: For chilled beams.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chilled beams.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories for chilled beams.
   3. Submit sufficient information needed for direct comparison to each entry scheduled on Drawings.
   4. Submit manufacturer's velocity and temperature profiles beneath passive chilled beams under conditions obtained in accordance with BS EN 14518 test procedures to show compliance.

B. Shop Drawings: For chilled beams.

   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

   1. Chilled-Beam Finishes: 24”x24”

E. Product Schedule: As indicated on plans

F. Delegated Design Submittals: For chilled beams.

   1. Include design calculations for selecting mounting and seismic restraints.

G. LEED Submittals:

   1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:
      a. Leadership Extraction Practices

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1) **(RC)** Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
   a) Include statement indicating costs for each product having recycled content.

2. Indoor Environmental Quality, Low Emitting Materials:
   a. Laboratory Test Reports: For adhesives, sealants, paints, coatings wet applied on site, indicating testing and compliance with the California Department of Public-Health (CDPH) Standard Method V1.2-2017, using the applicable exposure scenario.
   b. Paints, and Coatings: For wet applied on site products, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016.
   c. Adhesives and Sealants: For wet applied on site products, submit printed statement showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005, and rule amendment date of October 6, 2017.
   d. Methylene Chloride and perchloroethylene may not be added to paints, coatings, adhesive or sealants
   e. Flooring: Submit documentation to show that 100% of flooring emissions comply with California Department of Public Health (CDPH) Standard Method V1.2-2017, using applicable exposure scenario, or FloorScore certification.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, sections, and other details, or BIM model, drawn to scale, showing the items described in this Section and coordinated with all building trades.

B. Seismic Qualification Data: Certificates, for chilled beams, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

D. Sample Warranty: For manufacturer's warranty.

E. Informational LEED Submittals:

1. **(EPD)** Building Product Disclosure and Optimization - Environmental Product Declarations

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a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.
b. EPD Optimization: For materials, indicating embodied carbon/LCA optimization report or action plan.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Shipped chilled-beam products with similar requirements to those indicated for a continuous period of [5] five years within time of bid.
2. Chilled-beam products that have been successfully tested and in use on at least [5] five completed projects.
3. Having complete published catalog literature, installation, and operation and maintenance manuals for all products intended for use.
4. Having full-time in-house employees for the following:

    a. Product research and development.
    b. Product and application engineering.
    c. Product manufacturing, testing, and quality control.
    d. Technical support for system installation training, startup, commissioning, and troubleshooting.
    e. Owner training.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build mockups to show a finished installation for each of the following applications:

    a. For each different chilled beam type indicated on Drawings.

2. Mockups shall be fully operational.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: Subject to compliance with requirements, provide the product indicated on Drawings, or approved equal.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

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B. Capacities and Characteristics: See Drawings.

C. Chilled beam components shall provide ingredient disclosure through HPD, Declare, or equivalent programs to support LEED v4.1 Material Ingredients credit.

2.3 ACTIVE CHILLED BEAMS

A. Active chilled beam units shall be as indicated on the Mechanical and Architectural Drawings and shall meet the capacity and acoustical performance requirements specified and indicated on the schedule and Contract Documents. Active chilled beam cooling and heating performance data shall be based on the specified room temperature and not an assumed temperature at the ceiling or the coil, unless specified on the schedules. Active chilled beam performance data shall be established by testing in accordance to ASHRAE standard 200.

B. Source Limitations: Obtain chilled beams from single manufacturer.

C. Description: Sheet metal casing with primary-air, secondary-air, and mixed-air plenums; air nozzles; air inlet grille; supply-air discharge slot(s); cooling and heating hydronic coil assembly; and mounting brackets**;** and accessories suitable for location and mounting arrangement indicated on Drawings.

1. Maximum Overall Height (Exposed Units): See Drawings and Schedules
2. Maximum Overall Height (Recessed Units): See Drawings and Schedules

D. Components:

1. Casing:

a. Materials, Exposed Units: Minimum 20 GA G-60, galvanized-steel sheet.
b. Materials, Recessed Units: Minimum 20 GA G-60, galvanized-steel sheet.
c. Mounting Brackets: Factory installed along long side of units, with not less than four supports located near corners of units; field adjustable.
d. Commissioning Ports: Equip chilled beams with commissioning ports for field measurement of static pressure differential between primary-air plenum and room. Include an airflow calibration chart attached to each chilled beam.
e. Casing Leakage: Factory seal casing joints, seams, and penetrations of casing positive-pressure plenums to be airtight. Leakage in primary-air plenum shall not exceed [5] five percent of airflow rate indicated on Drawings.
f. Primary-Air Plenum Duct Connections: Round or oval collar of sufficient length to accommodate a slip-on field-installed duct. Size as indicated on Drawings
g. Insulation: Exterior or interior portions of casing capable of forming surface condensation shall be insulated with mineral-fiber insulation to prevent condensation. Thermal insulation to be manufactured in accordance with ASTM C1071-05, UL-181, and ASTM E84 25/50 flame spread and smoke density standards.
h. Blank (Filler) Sections: Where indicated on Drawings, chilled-beam manufacturer shall furnish blank (filler) sections to match external appearance of adjoining active portions.
i. Multiple Section Mating and Alignment: Where multiple sections are required to join end to end to make a longer contiguous unit, manufacturer to provide means to join multiple sections, so they appear as a single unit with no obvious obstructions or visual cues of multiple sections.

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2. Constant Airflow Regulators (CAR's): Quantity, size, and arrangement selected by chilled-beam manufacturer for performance indicated on Drawings. Primary air supplied through nozzles shall induce room (secondary) air across hydronic coil, and two air steams shall mix to supply conditioned air to room. CAR's to be UL2043 Listed.

    a. Material: ABS plastic, complying with NFPA 90A and UL 94 V-0.
    b. Airtight assembly consisting of UL 94V-0 ABS plastic body house din round sleeve for duct mounting. Preset and factory calibrated to airflows indicated on equipment schedules.

3. Inlet Air Grille: Mounted on face of chilled beam and arranged for room (secondary) air to enter grille and hydronic coil before mixing with primary air.

    a. See Drawings for face type
    b. Hinged on two sides to open from room side.
    c. Removable from room side.

4. Supply-Air Discharge Slot(s): Size and arrangement selected by chilled-beam manufacturer for performance indicated on Drawings.

    a. Material: Extruded aluminum or formed steel.
    b. Field-Adjustable Discharge-Air Pattern: Include field-adjustable air pattern control to adjust the direction of the discharge air.

5. Hydronic Coil: Copper tube mechanically bonded to aluminum fins and mounted in a galvanized-steel coil casing; rated for minimum working pressure of 300 psig.

    a. Tube Thickness: Minimum 0.016-inch thick.
    b. Fluid Tube Velocity (at Chilled-Water Design Flow Rate):

        1) Maximum: 4 fps.
        2) Minimum: 1 fps.

    c. Fin Thickness: Minimum 0.006-inch thick.
    d. Fin Spacing: No closer than 10 fins per inch.
    e. Field Piping Connections: Threaded or soldered ends with terminations oriented for field connection, as indicated on Drawings.
    f. Piping Arrangement: **Two or** Four pipe **as indicated on plans.**
    g. Include coil with manual air vent and drain fitting with valve.
    ~~h. Include coil face with removable lint screen that is easily accessible for inspection and cleaning from room side.~~
    ~~i. Include vertical-oriented coil(s) with drain pan constructed of galvanized steel and sloped at least 1 percent toward a NPS 1/2 capped drain connection.~~

6. Factory Piping: Seamless ASTM B88, Type L copper tube with ASME B16.22 wrought-copper fittings. 0.016 in wall thickness

E. Finish: Powder coat

1. Color: Manufacturer's standard paint color, as selected by Architect.
2. Appearance of Finished Work: Variations in same piece are unacceptable.

F. Accessories:

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1. Hoses: NPS 1/2; 36 inches long; PTFE-lined flexible hose wrapped in a stainless steel braided jacket and fitted with NPT threaded swivel ends; rated for 300 psig.
2. Primary Airflow Automated Dampers: Modulating inlet damper with low-voltage electric actuator for connection to external controls.
3. Primary Airflow Manual Dampers: Integral damper assembly with locking handle for field adjustment.
4. Primary Airflow Regulators: Factory set to airflow rate indicated on Drawings; capable of maintaining constant airflow rate within 10 percent of set point.

G. Source Quality Control: Comply with ASHRAE 200, AHRI 1240, and AHRI 1241.

1. Rate capacity of coils in accordance with AHRI 410, with capacities established in accordance with ASHRAE 200.

2.4 GENERAL PROTECTION REQUIREMENTS

A. Protect finishes on exposed surfaces from damage by applying a removable, temporary protective covering at the factory before shipping.

B. Protect coil and piping openings with removable end caps before shipping.

C. Protect duct connection openings with removable end caps before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive chilled beams for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for duct**,** piping and wiring to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CHILLED BEAMS

A. Install chilled beams level and plumb.

B. Coordinate layout and installation of chilled beams and suspension-system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, communications system, security system, and partition assemblies.

C. Seismic Restraints: Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

D. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

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E. Install continuous-thread hanger rods of size required to support chilled-beam weight. Laterally brace chilled beams to prevent movement.

3.3 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements for general-duty valves specified in Section 230523 "General-Duty Valves for HVAC Piping."

C. Make piping connections to chilled-beam units at locations indicated on Drawings.

D. Where installing piping adjacent to chilled beams, allow space for service and maintenance.

3.4 DUCT CONNECTIONS

A. Comply with requirements for ductwork specified in Section 233113 "Metal Ducts." and Section 233346 "Flexible Ducts**"** Drawings indicate general arrangement of ductwork.

B. Make ductwork connections to chilled-beam units at locations indicated on Drawings.

C. Where installing ductwork adjacent to chilled beams, allow space for service and maintenance.

3.5 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Comply with NECA 1.

D. Wiring Method: Install concealed cables in raceways and cable trays. Do not install cable within consoles, cabinets, desks, and counters. Conceal conductors and cables in accessible ceilings, walls, and floors. Do not conceal raceways and cables in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for cable trays specified in Section 260536 "Cable Trays for Electrical Systems.
3. Comply with requirements for raceways and boxes specified in Section 260533.13 "Conduits for Electrical Systems" and Section 260533.16 "Boxes and Covers for Electrical Systems."

E. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

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3.6 CONTROLS

A. Comply with requirements for controls specified in Section 230923 "Direct Digital Control (DDC) System for HVAC and Section 230993.11 "Sequence of Operations for HVAC DDC."

3.7 IDENTIFICATION

A. Identify electrical system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Identify hydronic piping and valves. Comply with requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.8 CLEANING AND PROTECTION

A. Protect exposed surfaces of chilled beams from damage with factory-installed protective covering. Maintain covering in place until start of unit testing and balancing.

B. Protect chilled beam water connections with factory-installed protective covers, and keep them covered until making final field piping connections.

C. Protect chilled-beam air connections with factory-installed protective covers and keep them covered until making final field duct connections.

D. Clean chilled beams inside and out to a factory-new condition.

E. Reject damaged chilled beams and replace with new units.

F. Only if acceptable to the Owner, minor damage to finishes may be repaired as required to restore beams to factory-new appearance. Any variation in visual appearance between factory and repaired finish shall be rejected.

3.9 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. Tests and Inspections:

1. Leak Test: After installation, fill system with water under [**design**] pressure and test for leaks. Repair leaks and retest until no leaks exist.

D. Chilled beam will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

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3.10 ADJUSTING

A. Occupancy Adjustments: When requested within (12) twelve months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to (2) two visits to Project during other-than-normal occupancy hours for this purpose.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chilled beams.

END OF SECTION

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SECTION 28 05 13 – CONDUCTORS~~26 – GROUNDING~~ AND CABLES~~BONDING~~ FOR ELECTRONIC SAFETY AND SECURITY

PART 1 – GENERAL

1.1 SUMMARY

A. **1.1 SUMMARY**

A. Section Includes:

1. **Low-voltage copper conductors**~~This section includes requirements for grounding~~ and **cables used for** ~~bonding of~~ electronic safety and security systems**.**
2. **Plenum**~~ to ensure reliable operation, protect equipment,~~ and **riser rated communication cables.**~~comply with electrical codes.~~
   ~~B. Applies to systems including, but not limited to:~~
~~1.~~**3.** Access control **system cabling.**~~systems~~
~~2.~~**4. CCTV and video** ~~Video~~ surveillance **cabling.**~~systems~~
~~3.~~**5.** Intrusion detection **system cabling.**~~systems~~
6. **Cable terminations and labeling.**

B. Systems Covered:

1. **Electronic Access Control**
2. **Video Surveillance Systems**
3. **Intrusion Detection Systems**
4. Intercom and **Communication Systems**~~emergency communication systems~~
5. **Security Network Infrastructure**

C. Related Sections:

~~5.~~ **Section**~~Central equipment racks and cabinets~~

~~**1.2 RELATED SECTIONS**~~

- ~~A.~~ 26 05 **19 – Low Voltage**~~26 – Grounding and Bonding for~~ Electrical **Power Conductors**
- **Section 27 10**~~Systems~~
  ~~B. 28 05~~ 00 – **Structured Cabling System**
- **Section 28 10 00 –**~~Common Work Results for~~ Electronic **Access Control**
- **Section**~~Safety and Security~~
  ~~C.~~ 28 13 00 – ~~Access Control~~
  ~~D. 28 23 00 –~~ Video Surveillance
  ~~E. 27 05 26 – Grounding and Bonding for Communications Systems~~

1.2~~3~~ REFERENCES

Comply with the latest versions of the following standards:

- **National Fire Protection Association**

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- NFPA 70
- Telecommunications Industry Association
  - ANSI/TIA-568
- Underwriters Laboratories
  - UL 444
  - UL 13
- National Electrical Manufacturers Association

~~A. **NFPA 70** – National Electrical Code (NEC)~~
~~B. **TIA-607** – Commercial Building Grounding and Bonding Requirements for Telecommunications~~
~~C. **UL 467** – Grounding and Bonding Equipment~~
~~D. **IEEE 1100** – Powering and Grounding Electronic Equipment~~
~~E. **ANSI J-STD-607-A** – Commercial Building Grounding and Bonding Requirements~~

1.34 SUBMITTALS

A. Product Data~~:~~

Submit manufacturer specification sheets for:

- **Copper cable**
- **Category cabling**
- **Coaxial cable**
- **Composite CCTV cable**

B. Shop Drawings

Provide:

1. **Cable routing diagrams**
2. **Riser diagrams**
3. **Security device wiring diagrams**

C. Certifications

~~1.~~ **Provide** ~~Ground bars, conductors, lugs, bonding straps~~

~~2. UL listings or compliance~~ documentation **showing compliance with**
~~B. Shop Drawings~~:

- **NEC**
- **UL listings**
- **TIA cabling standards**

~~3. Grounding riser diagram~~
~~4. Bonding connection details~~
~~C. Test Reports:~~
~~5. Continuity testing~~
~~6. Resistance-to-ground measurements~~

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1.4~~5~~ QUALITY ASSURANCE

A. All cabling shall be UL listed and NEC compliant.

B. Installers shall be certified for structured cabling installation.

C. All network cabling shall comply with ANSI/TIA-568 standards.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver cables in factory-sealed containers.

B. Protect cable from:

- **Moisture**
- **Sunlight**
- **Physical damage.**

~~A. Grounding work shall be performed by qualified personnel familiar with low-voltage and signal grounding best practices.~~
~~B. All bonding and grounding components shall be UL listed for their intended use.~~
~~C. Installer shall coordinate with Division 26 and 27 to ensure a single, unified grounding system.~~

PART 2 – PRODUCTS

2.1 MANUFACTURERS~~GROUNDING CONDUCTORS~~

Acceptable manufacturers include:

- **CommScope - SYSTIMAX**
- **Belden**
- **West Penn Wire**
- **General Cable**

Substitutions must be approved prior to bid.

2.2 GENERAL CABLE REQUIREMENTS

A. **Cables shall be** ~~Stranded~~ **copper conductors unless otherwise specified.**

B. Minimum conductor size for security devices shall be 22 AWG.

C. Cable~~, green~~ insulation **shall be PVC** or **plenum-rated fluoropolymer where required.**~~bare~~
~~B. Minimum sizes:~~

D. All cable jackets shall be clearly marked with:

- **Manufacturer**
- **Cable type**

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- UL listing
- Sequential footage markings.

2.3 CATEGORY CABLE

Used for:

- IP cameras
- Networked access control panels
- Security workstations

A. Cable type:

- Category 6 UTP
- 4-pair twisted copper cable
- 23 AWG solid conductors.

B. Performance:

- 250 MHz minimum bandwidth.

C. Rating:

- CMP (plenum) where required
- CMR (riser) where applicable.

2.4 ACCESS CONTROL CABLE

Card Readers
- 22/6 shielded cable

Door Position Switch
- 22/2 stranded cable

Request to Exit
- 22/4 stranded cable

Electric Lock Power
- 18/2 stranded cable

2.5 CCTV CABLE

CCTV cameras shall be wired using one of the following:

IP Cameras

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- Category 6 UTP cable.

Analog Cameras (if applicable)

- RG59 coaxial cable with 18/2 power.

Cable shall be 95% braided shield coax.

2.6 COMPOSITE SECURITY CABLE

Composite cables may combine:

- Video
- Power
- Data

Used for:

- CCTV camera installations
- PTZ cameras.

2.7 FIBER OPTIC CABLE

Where fiber is required for security networks:

A. Type:

- Single-mode fiber (OS2)

B. Construction:

- Loose tube or tight buffered

C. Connector types:

- LC

- ~~#6 AWG for bonding equipment racks, panels, and metallic raceways~~
- ~~#4 AWG minimum for central ground bar to building ground electrode system~~
  ~~C. All ground conductors shall be continuous or irreversibly bonded (exothermic weld or compression crimp)~~

~~**2.2 GROUND BARS**~~

~~A. Solid copper grounding bars (minimum 1/4" thick x 2" wide)~~
~~B. Pre-drilled with threaded holes for compression lugs~~
~~C. UL listed for telecommunications or security system use~~
~~D. Wall- or rack-mounted as appropriate~~
~~E. Isolated and non-isolated bars where required~~

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~~**2.3 GROUND LUGS AND CONNECTORS**~~

~~A. Mechanical or compression-type, UL-listed~~
~~B. One-piece, corrosion-resistant copper or tinned copper~~
~~C. Compatible with conductor and mounting surface~~
~~D. Use irreversible compression lugs for permanent terminations~~

~~**2.4 BONDING HARDWARE**~~

~~A. Braided bonding straps or ground jumpers for equipment racks, cabinets, and doors~~
~~B. Anti-oxidant compound for all aluminum connections~~
~~C. Thread-forming screws with toothed washers for equipment bonding~~

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install cabling in accordance with:

- **NFPA 70**
- **ANSI/TIA-568**

B. Separate security cabling from power wiring in accordance with NEC requirements.

C. Maintain proper bend radius and pulling tension.

~~A. Ground all system cabinets, panels, control enclosures, equipment racks, metal conduit, and device enclosures.~~
~~B. Ground all metallic raceways that carry security or signal cabling.~~
~~C. Provide an isolated ground bar for each equipment rack, bonded to main telecom or security ground.~~
~~D. Ensure direct, low-impedance path between each subsystem ground and the building's main ground electrode system.~~

3.2 IDENTIFICATION~~BONDING~~

A. All cables shall be labeled at both ends.

B. ~~A. Bond metallic components within security systems to the common ground reference point.~~
~~B. Use bonding jumpers across equipment hinges or isolated mounting structures.~~
~~C. Do not rely on conduit or raceway for bonding.~~

~~**3.3 LABELING**~~

~~A. Identify all ground conductors and terminations with permanent labels.~~
~~B.~~ Labels **shall correspond to** ~~to include "GROUND – DO NOT REMOVE" and match~~ system documentation **and drawings**.

C. Provide machine-printed labels.

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3.34 TESTING

A. Category cable shall be tested to TIA standards.

B. Fiber optic cable shall be tested using:

- **OTDR testing**
- **Power meter testing.**

C. Provide test reports to Owner.

~~A. Measure resistance between each ground point and building ground:~~

- ~~Shall not exceed 1 ohm unless approved by the authority having jurisdiction (AHJ).~~
  ~~B. Submit documentation of all readings.~~
  ~~C. Verify continuity of all bonding connections.~~

3.45 PROTECTION ~~AND CLEANUP~~

~~A.~~ Protect **cables**~~grounding conductors and hardware~~ from ~~mechanical~~ damage during **construction**~~and after installation.~~
~~B. Restore finishes and clean equipment surfaces after grounding installation is complete~~.

Replace damaged cable at no cost to Owner.

END OF SECTION 28 05 13~~26~~

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SECTION 28 10~~13~~ 00 – ELECTRONIC ACCESS CONTROL

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. **Electronic** ~~This section covers electronic~~ access control **system (ACS).**~~systems including:~~

~~1. Card readers~~

2. Access control panels **and controllers.**
3. ~~Door~~ Card readers **and credentials.**
4. **Electric locking** hardware interface**.**
~~3.~~**5. Request-to-Exit** devices**.**
6. **Door position switches.**
~~4.~~**7.** Power supplies **and battery backup.**
8. **Integration with video surveillance and alarm systems.**

B. Related Sections:

~~5. Section~~**Section**~~Management software~~
~~6. Network and system integration~~

~~B. Access control system shall provide centralized monitoring, control, and auditing of secured openings.~~

~~**1.2 RELATED SECTIONS**~~

1. ~~A.~~ 08 71 00 – Door Hardware**.**
2. **Section**
   ~~B.~~ 26 05 **19 – Low Voltage**~~00 – Common Work Results for~~ Electrical **Power Conductors.**
3. **Section**
   ~~C.~~ 27 10 00 – Structured Cabling**.**
4. **Section**
   ~~D.~~ 28 **13**~~05 00 – Common Work Results for Electronic Safety and Security~~
   ~~E. 28 23~~ 00 – Video Surveillance **Systems.**
5. **Section**~~(for integrated systems)~~
   ~~F.~~ 28 31 00 – **Fire**~~Intrusion~~ Detection **and Alarm.**

1.2 REFERENCES

Comply with the latest editions of:

- **National Fire Protection Association**
  - **NFPA 70**
  - **NFPA 72**
  - **NFPA 101**
- **Security Industry Association**

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- UL Solutions
  - UL 294
  - UL 603
- Electronic Security Association

1.3 SYSTEM DESCRIPTION

A. Provide a network~~System shall support the following features:~~

~~1. Credential~~-based electronic access control system capable of~~(cards, fobs, mobile credentials)~~

~~2.~~ ~~Real-time~~ monitoring and controlling doors, gates, and other secured openings.

B. System shall include:

1. Door controllers capable of supporting minimum two readers per door (entry and exit).
2. Central management software.
3. Credential management.
~~3.~~4. Event logging and reporting.
5. Integration with video management systems (VMS).

C. System architecture shall support:

~~4.~~• IP~~Time~~-based communication~~access schedules~~
- Cloud or on-premise servers
~~5.~~• Remote~~Local and remote~~ administration
- Encryption of credential and communication data.

~~6. Fail-secure/fail-safe operation modes~~

1.4 SUBMITTALS

A. Product Data
B. Shop Drawings
C. Wiring Diagrams
D. Sequence of Operations
E. Test and Inspection Reports
F. Training Plan
G. As-Built Documentation
H. Warranty Documentation

1.5 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of 5 years of experience in access control systems.
B. Installer shall be certified by the system manufacturer.

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C. Equipment shall be listed and labeled by UL 294 or equivalent.
D. System shall comply with the following standards:

1. NFPA 70, 72
2. UL 294
3. TIA/EIA 568 and 606
4. ADA, IBC, and applicable local codes

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. **Basis of Design**: LenelS2, Genetec, or Johnson Controls
B. Acceptable Manufacturers:

1. LenelS2
2. Genetec
3. Software House
4. Johnson Controls
5. Or approved equal

2.2 ACCESS CONTROL PANELS

A. Shall support door input/output, reader connections, and interface to host system
B. Include onboard storage for transaction buffering
C. UL 294 listed

2.3 CARD READERS

A. Proximity, smart card, or mobile credential readers
B. Compatible with ISO 14443, 15693, or OSDP protocol
C. Mount as required (mullion, wall, single-gang box)
D. Tamper-resistant housing

2.4 DOOR HARDWARE INTERFACE

A. Electrified strikes or locks
B. Door position switches
C. Request-to-exit (REX) devices
D. Interface relays as required

2.5 POWER SUPPLIES

A. Provide UL-listed, regulated power supplies with battery backup
B. Altronix or equal
C. Load shall not exceed 80% of rated capacity
D. Monitor and report power and battery status to system

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2.6 ACCESS CONTROL SOFTWARE

A. Client-server or cloud-hosted access management
B. Features:

1. System configuration and control
2. Credential enrollment
3. Event log storage
4. Alarm reporting
5. Video integration (optional)
   C. Provide 3 administrator licenses and 5 operator licenses
   D. Must support HTTPS and role-based access

2.7 CABLING

A. Comply with TIA/EIA standards
B. Plenum-rated Category 6 for networked components
C. 18/2 and 22/6 stranded shielded cable for door components

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install components per manufacturer recommendations and NEC
B. Securely mount all devices
C. Maintain separation of signal and power wiring
D. Terminate all cabling per TIA/EIA standards

3.2 IDENTIFICATION

A. Label all panels, terminations, and cabling
B. Coordinate with Section 27 05 00 for labeling standards

3.3 FIELD QUALITY CONTROL

A. Test each opening for:

1. Reader operation
2. Lock actuation
3. Door position sensing
4. REX function
5. Alarm generation

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B. Submit written test results

3.4 TRAINING

A. Provide 4 hours of on-site training for Owner's staff
B. Include credential management, door control, and alarm handling

3.5 WARRANTY

A. Provide 1-year warranty on labor and materials
B. Manufacturer's extended warranty if available

END OF SECTION 28 10~~13~~ 00

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SECTION 28 13 43 – ELECTRONIC MONITORING AND SURVEILLANCE

PART 1 – GENERAL

1.1 SUMMARY

A. This section covers electronic monitoring and surveillance systems used for security monitoring and incident response, including:

1. Surveillance system integration with access control
2. Monitoring stations and consoles
3. Alarm annunciation devices
4. System software interfaces
5. Status indicator panels
6. Event logging and time synchronization

B. Work includes furnishing, installing, programming, and testing all components.

1.2 RELATED SECTIONS

A. 28 05 00 – Common Work Results for Electronic Safety and Security
B. 28 13 00 – Access Control
C. 28 23 00 – Video Surveillance
D. 28 31 00 – Intrusion Detection
E. 27 10 00 – Structured Cabling
F. 26 05 00 – Electrical Power

1.3 DEFINITIONS

A. **Monitoring System**: Equipment used for visual or data-based observation of events (e.g., alarms, entry/exit, motion, or video analytics)
B. **Workstation**: A configured PC or appliance used for system monitoring and control
C. **Event Logging**: Timestamped system-generated reports or alerts

1.4 SUBMITTALS

A. Product Data for all system components
B. Shop Drawings including:

1. Block diagrams
2. System risers
3. Device locations
4. Console layouts
   C. O&M Manuals
   D. Manufacturer certifications and warranties
   E. Field testing reports

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

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1. 5+ years experience in surveillance and monitoring systems
2. Certified by system manufacturer
   B. All components shall be UL 294, FCC, and CE listed where applicable
   C. System shall comply with:
3. NFPA 70
4. IBC and IFC
5. ADA accessibility guidelines

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. **Basis of Design**: EXISTING
B. Approved manufacturers must offer complete, compatible systems

2.2 MONITORING SOFTWARE

A. Integrated with access control and video management
B. Features:

1. Alarm annunciation with event-based display
2. Video pop-up on alarm
3. Customizable user interface
4. Time-stamped event logging
5. Operator login with access level control
6. Web client access and remote monitoring capability
   C. System shall support multiple concurrent operator sessions
   D. Provide three (3) operator workstations and two (2) supervisory licenses

2.3 MONITORING WORKSTATIONS

A. Commercial-grade PC or appliance
B. Dual monitor capable with minimum 1080p resolution
C. Minimum requirements:

- Intel i7 processor
- 16GB RAM
- 500GB SSD
- Windows 10 or manufacturer-supported OS
  D. Preconfigured and imaged by system provider

2.4 ALARM DISPLAY / ANNUNCIATION PANELS

A. Visual and audible indication of system alarms
B. Configurable to indicate zone or device
C. Interface with access control, intrusion, and surveillance platforms

2.5 SYSTEM CLOCK / TIME SYNCHRONIZATION

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A. Use NTP-based system time synchronization
B. All events, logs, and video timestamps shall reference the central clock
C. Local server or cloud-based synchronization acceptable

2.6 ENCLOSURES, CABLING, AND ACCESSORIES

A. Use plenum-rated cabling, Category 6 or better
B. All wiring concealed in finished areas
C. Provide 24/7-rated UPS power to all monitoring equipment

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install all monitoring and alarm devices per manufacturer recommendations
B. Ensure systems are physically and logically secure
C. Integrate alarm annunciation with access control and video systems

3.2 SYSTEM CONFIGURATION

A. Configure all alarm types, logging thresholds, and user permissions
B. Coordinate event priorities with Owner
C. Configure event triggers for the following:

1. Door forced open
2. Unauthorized access attempts
3. Motion detection after hours
4. Loss of video feed
5. Power failure or tamper alarm

3.3 IDENTIFICATION

A. Label all devices, terminations, and cables per TIA/EIA-606
B. Label workstations with system name and location ID

3.4 FIELD QUALITY CONTROL

A. Perform full system test simulating various alarm conditions
B. Confirm video linkage, alarm annunciation, and event logging
C. Document test results and submit for review

3.5 TRAINING

A. Provide 4 hours of on-site operator training
B. Provide manuals, quick-reference guides, and escalation procedures

3.6 WARRANTY

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A. Provide minimum 1-year manufacturer and installer warranty
B. Provide optional 24/7 service contract pricing

END OF SECTION 28 13 43

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SECTION 28 23 00 – VIDEO SURVEILLANCE

PART 1 – GENERAL

1.1 SUMMARY

A. This section includes requirements for a complete video surveillance system, including:

1. Cameras (fixed, PTZ, panoramic, fisheye)
2. Video management system (VMS)
3. Network video recorders (NVRs)
4. Video storage and playback
5. Monitoring stations and software
6. Cabling, infrastructure, and accessories

B. The system shall provide real-time video monitoring, recording, and playback for safety, security, and operational oversight.

1.2 RELATED SECTIONS

A. 28 05 00 – Common Work Results for Electronic Safety and Security
B. 28 05 13 – Conductors and Cables for Electronic Safety and Security
C. 28 05 26 – Grounding and Bonding
D. 28 05 28 – Pathways
E. 28 05 53 – Identification
F. 27 15 00 – Communications Horizontal Cabling
G. 27 20 00 – Data Communications Network Equipment

1.3 REFERENCES

A. **NFPA 70** – National Electrical Code
B. **TIA/EIA Standards** – Structured cabling and network systems
C. **ONVIF Profile S/G/T** – Interoperability standards for IP video
D. **UL 60950 / UL 62368** – Safety for IT and communication equipment
E. **FCC 47 CFR Part 15** – Radio frequency devices compliance

1.4 SUBMITTALS

A. Product Data:

- Manufacturer’s catalog sheets, specifications, and certifications
  B. Shop Drawings:
- System riser diagram
- Camera layout plans with field of view
- Device mounting details
  C. Test Reports:
- Network bandwidth test
- Video quality and recording retention compliance
  D. Operations & Maintenance (O&M) Manuals
  E. Final As-Built Documentation

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1.5 SYSTEM DESCRIPTION

A. The system shall include IP-based cameras connected to a centralized or distributed video management system accessible by authorized personnel.
B. Features shall include:

- High-definition video
- Motion-based and continuous recording
- Remote access
- Integration with access control and intrusion systems

1.6 QUALITY ASSURANCE

A. Equipment shall be manufactured by established companies with 5+ years' experience.
B. All work shall comply with applicable codes and standards.
C. Installer must be factory-certified in the selected VMS platform.
D. All software and firmware shall be the latest stable release.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. **Basis of Design** (or Approved Equal):

- Cameras: Avigilon
- VMS: Existing
- NVRs: Existing
- Mounts & Accessories: specified by camera manufacturer

2.2 CAMERAS

A. Types (as required by the design):

- Fixed IP Cameras (indoor/outdoor)
- Pan-Tilt-Zoom (PTZ) Cameras
- 360° Panoramic / Fisheye Cameras
- Low-light / IR Cameras

B. Features:

- Minimum 1080p resolution (2MP or higher preferred)
- H.264/H.265 compression
- PoE (802.3af/at compliant)
- ONVIF Profile S/G/T compliance
- Adjustable field of view and focus (manual or remote)
- Environmental rating IP66 or NEMA 4X for outdoor units

2.3 NETWORK VIDEO RECORDING (NVR)

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A. Storage capacity for minimum 30 days of continuous recording at full frame rate
B. RAID 5 or RAID 6 storage configuration
C. Redundant power supply (where applicable)
D. Recording performance: support for minimum 100 Mbps sustained write throughput
E. Support dual-stream recording for bandwidth optimization

2.4 VIDEO MANAGEMENT SYSTEM (VMS)

A. Windows-based or Linux-based server
B. Features:

- User authentication (AD integration preferred)
- Role-based access control
- Live view, playback, digital zoom, and export
- Event-based recording and alarm management
- Multi-site/multi-server scalability
- Web client and mobile application support

2.5 MONITORING STATIONS

A. High-resolution monitors (min. 1080p)
B. Ergonomic workstation furniture and chairs (if specified)
C. Video wall (if required)

2.6 CABLING & INFRASTRUCTURE

A. Category 6A (minimum) UTP cable for camera connectivity
B. Fiber optic backbone (where distances exceed 100m or for high-throughput applications)
C. Rack-mounted PoE+ network switches
D. Surge protection on all exterior cable entries

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install cameras as shown on drawings and per manufacturer instructions.
B. Adjust field of view and focus for each camera during commissioning.
C. Mount all equipment securely and in locations free of interference or obstruction.
D. Label all devices, cables, and ports per Section 28 05 53.
E. Connect cameras to PoE network switch and verify link and power status.

3.2 CONFIGURATION

A. Configure camera parameters: resolution, frame rate, motion zones, IP addressing
B. Add all devices to the VMS with logical names and site mapping
C. Configure recording profiles (continuous, motion, schedule-based)
D. Assign user roles and permissions
E. Set up system alerts and health monitoring

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3.3 TESTING & COMMISSIONING

A. Verify each camera is live, properly focused, and recording as per specifications
B. Demonstrate search, playback, and export functions
C. Perform failover and recovery testing (if redundant systems are used)
D. Provide final report with camera coverage confirmation and storage analysis

3.4 TRAINING

A. Provide on-site user training for system operators and administrators
B. Include instruction on:

- Monitoring
- Playback and export
- System administration and troubleshooting
- Remote access setup (if applicable)

3.5 WARRANTY

A. Minimum 1-year warranty on all equipment and labor
B. Include manufacturer's standard warranty extensions if applicable
C. Provide optional service agreement quote for maintenance and support

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END OF SECTION 28 23 00

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SECTION 312316 – TRENCH EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Excavating trenches for the installation of utilities.

B. Provision of all temporary excavation support necessary to facilitate trench excavation, utility installation, and backfilling in accordance with this Specification, and in coordination with Work required by Section 315000 - Temporary Excavation Support and Protection.

C. Removal and disposal of material deemed by Geotechnical Engineer to be geotechnically unsuitable for reuse as on-site fill.

D. Segregation and stockpiling of excavated soils.

E. Dewatering as necessary to facilitate excavation, construction of utilities, construction and proper curing of concrete foundations and foundation elements, and compacted fill placement in the dry, and in coordination with Section 312319 – Dewatering.

F. Backfilling trench with bedding material as specified and finish filling trenches with suitable material to proposed subgrade.

G. Compacting subgrade, bedding, and backfill materials in an acceptable manner.

H. Requirements of the construction contract.

1.2 RELATED SECTIONS AND DOCUMENTS

A. Section 310000 – Earthwork

B. Section 315000 – Temporary Excavation Support and Protection

C. Section 331000 – Water Distribution System

D. Section 333000 – Sanitary Sewer System

E. Section 334000 – Storm Sewer System

F. Section 335100 – Other Utilities

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) Latest Edition

1. D422 Method for Particle Size Analysis

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2. D1557 Test for Moisture-Density Relations of Soils Using 10-lb. (4.5 Kg) Hammer and 18-inch (457 mm) Drop (Modified Proctor)

3. D2216 Laboratory Determination of Moisture Content of Soil

4. D2487 Classification of Soils for Engineering Purposes

5. D2922 Tests for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

6. D3017 Test for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition

1. T88 Mechanical Analysis of Soils

1.4 QUALITY ASSURANCE

A. Provide at least one supervisory person who shall be present at all times during execution of the Work and who is thoroughly familiar with the type of Work being performed and its best methods for completion. This person shall have the authority to act on behalf of Contractor.

B. Comply with any provisions of all applicable Federal, State, and Local requirements, codes, regulations and standards.

C. Geotechnical Engineer will perform construction observation and testing of backfilling operations as specified in Section 310000 – Earthwork of these Technical Specifications and as stated herein. Geotechnical Engineer will perform density testing and visual observation. This observation shall not relieve from responsibility to complete the Work in accordance with the plans and specifications. Geotechnical Engineer will be solely responsible for determining what is geotechnically unsuitable material.

D. All costs related to re-testing due to failures shall be paid for at no additional expense to Owner. Provide free access to the Site for Geotechnical Engineer's activities.

1.5 SUBMITTALS

A. Contact all utility companies and identify any requirements that may impact Work of this Section. Submit written confirmation of the status of all utility construction to Owner no later than two weeks prior to mobilization of equipment and material to the Site.

B. At least two weeks prior to mobilization of equipment and material to the Site, submit to Owner and Geotechnical Engineer a schedule detailing the sequence and time of completion of all phases of Work under this section.

C. At least two weeks prior to mobilization of equipment and material to the Site, submit to Owner and Owner's Geotechnical Engineer its proposed excavation means and methods, and equipment to be utilized for such Work. Include proposed method of temporary excavation support to be utilized to facilitate proposed utility excavation and installation, and backfilling at the Site in accordance with the Contract Documents and Technical Specifications.

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D. At least two (2) weeks in advance of imported fill delivery to the site for proposed use, submit either the following laboratory test data or a 50-pound soil sample to Geotechnical Engineer for each type of imported soil/gravel material to be used as compacted fill.

E. Moisture and Density Relationship: ASTM D1557

F. Mechanical Analysis: AASHTO T-88

G. Together with the above test data, submit a 25-pound sample of each type of proposed off-site fill material in an air tight container for the review and approval by Geotechnical Engineer. Submit the name and details of the source for the proposed material, and any necessary environmental certificates. Any change in source or soil type throughout the job requires approval of Geotechnical Engineer. Certification of environmental compliance for each type of proposed off-site fill material shall be submitted in accordance with the requirements of Section 310000 – Earthwork.

H. At least two weeks prior to mobilization of equipment and materials to the Site, submit proposed dewatering means and methods and equipment to be utilized for such Work for review by Geotechnical Engineer.

I. At least two weeks prior to mobilization of equipment and materials to the Site, submit to Owner and Geotechnical Engineer evidence substantiating its qualifications as required herein.

1.6 EXISTING CONDITIONS

A. The existing site conditions, including topographic survey and utilities information, are based on the topographic and boundary survey on record for the project.

B. Borings have been performed by Owner at the Site. The logs of these borings, soil samples, and rock cores taken from the borings are available from Owner for review.

1. No guarantee is expressed or implied for the information given in the above documents. No information derived from such above documents will, in any way, relieve from the responsibility of making one's own evaluations, inspections, and determinations with respect to the conditions and requirements at the Site. Make own assumptions of subsurface soil, rock, and groundwater conditions which may affect methods of construction of the Work.

2. Prior to commencement of any Work, consult the records for existing structures and utilities (both above and below grade), and note all conditions and limitations that might affect the Work required under this Section. The locations of existing structures and utilities shall be verified in the field prior to work.

3. By submitting its bid, it is warranted that the site has been visited, has made own examinations, and additional investigations (if necessary) with Owner's permission, of the surface and subsurface conditions, and he fully accepts these as working conditions. No extra payment will be made for lost time or other problems caused by the surface and subsurface conditions.

C. Investigate the conditions of public thoroughfares and roads as to availability, clearances, loads, limits, restrictions, and other limitations affecting transportation to, ingress and egress of the Site of the Work. Conform to all Local, State, and Federal requirements and regulations in regard to

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the transportation of materials to and from and at the job site and shall secure in advance such permits as may be required.

D. Inform as to any restrictions to grading or disturbance identified on the Contract Documents.

1.7 QUALIFICATIONS

A. Work of this Section shall specialize in performing trench excavation and backfill for utilities of the size and depth as required for this project with a minimum of five (5) years satisfactory experience.

1.8 ENVIRONMENTAL CONSIDERATIONS

A. Maintain erosion control measures installed as specified on the Contract Documents to protect adjacent properties and water resources from erosion and sediment damage.

B. All excavation, handling, hauling, on-site storage, and disposal of soil and other materials, and dewatering performed at the Site shall be in accordance with any environmental requirements established for the Site and in accordance with Section 312319 – Dewatering and as required by the Contract Drawings and Technical Specifications.

C. Perform all Work of this Section in accordance with the most recently adopted and applicable general industry (29 CFR 1910) and construction (29 CFR 1926) standards of the Federal Occupational Safety and Health Administration (OSHA), U.S. Department of Labor, as well as any other Federal, State, or Local applicable statutes or regulations.

1.9 PROTECTION OF ADJACENT STRUCTURES AND PROPERTY

A. Prior to commencement of any Work, consult the records for existing structures and utilities and note all conditions and limitations which might affect the Work required under this Section. Notify utility locator service for area where project is located prior to excavation and earthwork. Any damage to utilities, permanent or temporary structures, and trees, slopes, and vegetated areas designated to remain undisturbed, as a result of procedures/operation shall be sole responsibility, and shall be immediately reported to Owner and respective utility Owner(s).

B. All benchmarks and monuments shall be protected during construction. If disturbed or destroyed, they shall be replaced in original position by a Professional Land Surveyor licensed in the State of New Jersey at no cost to the owner.

C. The responsibility and cost for repair for any damage to buildings, structures, utilities, sidewalks, pavement, and other facilities in the vicinity resulting from operations shall be entirely its, and it shall take whatever measures are necessary to prevent the same. Any damage resulting from work shall be repaired to the satisfaction of the respective Owners.

D. Provide and install temporary excavation support, shoring, bracing, and fencing and such other protection as required to insure against any damage to existing streets, pavement, other structures, and utilities when excavation work occurs adjacent to or below same. Shoring and bracing shall be installed in accordance with Section 315000 - Temporary Excavation Support and Protection and in accordance with Federal OSHA requirements as well as the requirements of all State and Local authorities having jurisdiction.

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E. Provide barricades, warning lights, and barriers to prevent accidents, to avoid all necessary hazards and protect the public, the Work, and the property at all times, including Saturdays, Sundays and Holidays. Minimize interference of vehicular and pedestrian traffic with adjoining roads, streets, walks, and other adjacent occupied or used facilities during all operations. Protect fences, structures, sidewalks, paving, curbs, etc. to remain from equipment and vehicular traffic.

F. Dust and Dirt Control:

1. Use all means necessary to control dust on or near Work.

2. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors and performance of other Work on the Site.

3. Provide vehicle wheel cleaning to prevent tracking of soil, dirt, etc., onto public streets.

G. Be solely responsible for safety at the Site as it relates to trench excavation and utility installation operations.

1.10 PROJECT RECORD DOCUMENTS

A. Accurately record and promptly inform Owner and Geotechnical Engineer of actual locations of all subsurface utilities, structures and obstructions encountered.

B. Accurately record any as-built variation from the construction plans and specifications. Contractor shall provide as-built drawings within 30 days of project completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bedding Material:

1. Clean washed 3/4-inch crushed stone.

2. AASHTO No. 67 processed sand and gravel free from debris, clay lumps, organic, or other deleterious material, and complying with the following gradation requirements:

U. S. Sieve Size	Percent Passing (by weight)
1 Inch	100
3/4 Inch	90-100
3/8 Inch	20-55
No. 4	0-10
No. 8	0-5

Alternate bedding material shall be subject to review and approval by Geotechnical Engineer.

B. On-site fill for backfilling of utility excavations shall meet the requirements for on-site fill as identified in Section 310000 – Earthwork of these Technical Specifications.

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C. Off-site imported fill for backfilling of utility excavations shall meet the requirements for off-site imported fill as identified in Section 310000 – Earthwork of these Technical Specifications.

D. Topsoil shall be used as fill only in landscaping areas if adequately mixed with other material and approved by Geotechnical Engineer.

E. Dense Graded Aggregate (DGA) meeting gradation requirements of the State of New Jersey Department of Transportation Standard Specifications for Roads and Bridges Construction (Section 901.08).

F. Clean, washed 3/4-inch crushed stone.

G. Filter/drainage fabric: Mirafi 100X (or equivalent as approved by Geotechnical Engineer)

2.2 EQUIPMENT

A. Compactor – Minimum 5-ton static drum weight vibratory smooth drum roller compactor as approved by Geotechnical Engineer.

B. Compactor – Wacker 82-SC (or equivalent, as approved by Geotechnical Engineer) double drum walk behind roller for areas where access or maneuverability is limited.

C. Compactor – Wacker BS500 (or equivalent, as approved by Geotechnical Engineer) jumping jack compactor for backfilling of very narrow trenches.

D. Small vibratory plate compactors are not acceptable for compacting footing subgrades or compacting soil fill. Plate tampers may be utilized to compacted crushed stone.

E. All equipment and tools required to perform the work. All equipment and tools shall be in perfect operating conditions.

PART 3 - EXECUTION

3.1 GENERAL

A. Set all lines, elevations, and grades for utility and drainage system work and maintain for the duration of Work. Provide careful maintenance of benchmarks, property corners, monuments, or other reference points.

B. Protect and maintain in operating condition existing utilities encountered during utility installation. Repair any damage to surface or subsurface improvements shown on Contract Documents.

C. Verify location, size, elevation, and other pertinent data required to make connections between existing utilities and drainage systems, and proposed construction indicated on Contract Documents. Coordinate all building utility connection locations and elevations with site-civil, structural, and architectural plans. Contractor shall comply with all Local codes and regulations.

D. Perform dewatering in accordance with requirements of Section 312319 – Dewatering to facilitate utility construction and placement and compaction of bedding and backfill materials.

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E. Over-excavate and properly prepare areas of subgrade that are not capable of supporting the proposed systems. These areas shall be stabilized by using acceptable backfill materials and/or additional bedding material placed and compacted as specified to the satisfaction of Geotechnical Engineer.

3.2 EXCAVATION

A. Contact Local utility companies before excavation begins. Dig trenches at proper width and depth for laying pipe, conduit, or cable and in accordance with utility company requirements. Cut trench banks for safety and remove stones as necessary to avoid point-bearing.

B. All trench excavation side walls shall be sloped, shored, sheeted, braced or otherwise supported by means of sufficient strength to protect the workmen within them in accordance with the applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by Local ordinances. Temporary excavation support shall be provided in accordance with the requirements of Section 315000 – Temporary Excavation Support and Protection.

C. Trench width requirements below the top of the pipe shall not be less than 12 inches nor more than 2 feet wider than outside surface of any pipe or conduit that is to be installed. All other trench width requirements for pipe, conduit, or cable shall be the minimum practical width that will allow for proper compaction of trench backfill and satisfy safety and utility company regulations.

D. Accurately grade trench bottom to an elevation 6 inches below the pipe, per bedding details in Contract Documents. Provide uniform bearing and support for each section of pipe on bedding material at every point along the entire length, except where necessary to excavate for bell holes, pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make the joint connection properly.

E. During excavation, stockpile excavated material suitable for backfilling in an orderly manner far enough from the trench to avoid overloading, slides, or cave-ins.

F. Stockpile excavated materials deemed by Geotechnical Engineer and Owner's Engineer to be geotechnically unsuitable for backfill, as indicated in Section 310000 – Earthwork of these Technical Specifications.

G. Any abandoned structures, utilities or debris discovered during excavation shall be removed and disposed of, abandoned in place by complete filling with grout or sand, or capped subject to review and approval by Geotechnical Engineer on a case-by-case basis.

H. Utility alignments have been designed to avoid expected obstructions wherever possible. If unanticipated significant obstructions are encountered during utility installation Work immediately notify Owner and Engineer.

I. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches or other excavations by pumping or other acceptable methods. Dewatering shall be performed in accordance with the requirements of Section 312319 – Dewatering. Coordinate dewatering with any established dewatering effluent limitations.

J. Utility installation shall meet the following minimum pipe installation depths, or applicable codes and ordinances, measured from finished grade or the paved surface.

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1. Water Mains: 48 inches to top of pipe barrel or 6" below the frost line (established by the Local building official or Local utility company), whichever is deeper.

2. Sanitary Sewer: Elevations and grades as indicated on Contract Documents.

3. Storm Sewer: Elevations and grades as shown on Contract Documents.

4. Gas Mains and Service: 30 inches minimum to top of pipe, or as required by the Local utility company, whichever is deeper.

3.3 LATERALS

A. All utilities intended to connect to services within the proposed building shall be extended to within 5 feet of the exterior face of the building in the direction and elevation to connect at those geometrical locations indicated or inferred on the drawings. All utility ends will be plugged and marked by a 2" x 4" piece of wood extending from the utility invert to 4 feet above final grade.

3.4 PIPE BEDDING

A. Accurately cut trenches for pipe or conduit to designated line and grade 6 inches below the bottom of the pipe or as otherwise indicated on the Contract Drawings, to width as specified previously. Compact trench bottoms to a minimum of 95% of the material's maximum dry density as determined by ASTM D1557, Modified Proctor Test.

B. Over excavate unstable soil from trench bottom to provide a suitable base for continuous and uniform bedding. The maximum depth of over-excavation shall be 2 ft below proposed utility subgrade elevation, or as otherwise approved by Geotechnical Engineer.

C. Place bedding material and compact in 8-inch loose lifts to obtain at least 95% of the material's Modified Proctor maximum dry density. Accurately shape bedding material to conform to lower portion of pipe barrel. After pipe installation, place and compact bedding material around the pipe as specified above in maximum 8 inch loose lifts to the springline of the pipe.

3.5 BACKFILLING

A. After pipe or conduit has been installed, bedded and tested as necessary, backfill trench to finish grade in maximum 12 inch thick loose lifts using fill soils approved by Geotechnical Engineer, compacting each lift as specified above and in accordance with requirements of Section 310000 – Earthwork of these Technical Specifications. Dewatering shall be performed as necessary to facilitate placement and compaction of fill.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces. Should these conditions exist, the areas shall be removed, replaced and re-compacted in accordance with the requirements of Section 310000 – Earthwork of the Technical Specifications.

C. For cases where groundwater is encountered within a utility excavation, and only with prior approval by Geotechnical Engineer, backfilling shall be done using 3/4-inch clean crushed stone to a level 6 inches above the encountered groundwater level and then using approved compacted fill.

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D. Gas Pipe Backfill

1. Key Sand Backfill Specifications

a. Material Characteristics: Clean, course sand. It should be non-cohesive and free of debris, rocks, organic matter, and clay balls.

b. Typical Gradation:

1) 1/2" Sieve: 100% Passing
2) No. 4 Sieve: 75-100% Passing
3) No. 200 Sieve: 0-15% Passing

c. pH Value: Value of pH must be between 4.5 and 9

2. Installation Guidelines

a. Bedding: Bottom of trench must be smooth and level as practical and free of rocks or other abrasives. A minimum of 6 inches of sand should be placed below the conduit before installation.

b. Initial Backfill (Embedment): Sand should be placed around and up to 12 inches above the pipe/conduit.

c. Compaction: Machine tamping is allowed, but care must be taken to avoid damaging pipes/joints.

d. Marking: Install metallic, detactable tracer warning tape directly above the sand layer during backfilling.

e. Always check with local, state, and utility company specifications as they may have specific requirements for sand type.

3.6 COMPACTION

A. All off-site materials used for backfill shall be tested in accordance with Section 310000 – Earthwork of these Technical Specifications.

B. Exercise proper caution when compacting immediately over top of pipes or conduits.

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Compaction of backfill shall be performed in accordance with the requirements of Section 310000 – Earthwork.

END OF SECTION 312316

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