TMCA CENTRAL TOWER MAU

THE MEDICAL CENTER OF AURORA
1501 S POTOMAC ST
AURORA, COLORADO 80012

08.08.2023

PW PROJECT #222319.000

ISSUE FOR PERMIT

OWNER	FACILITY	ARCHITECT	STRUCTURAL	MEP	CITY OF AURORA
HCA HEALTHCARE ONE PARK PLAZA, BLDG II EAST 3RD FLOOR, NASHVILLE, TN 37203 CONTACT: DENNIS CLAIR	THE MEDICAL CENTER OF AURORA 1501 S POTOMAC ST, AURORA, CO 80012	PERKINS&WILL 475 LINCOLN ST. #100 DENVER, CO 80203 CONTACT: BRITTANY CAEL	SALAS O'BRIEN 9250 E COSTILLA AVE STE 220, GREENWOOD VILLAGE, CO 80112 CONTACT: RYAN NELSON	SALAS O'BRIEN 9250 E COSTILLA AVE STE 220, GREENWOOD VILLAGE, CO 80112 CONTACT: JON GRANT	CITY OF AURORA 15151 E. ALAMEDA PARKWAY AURORA, CO 80012 303.739.7000 (TEL)

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During construction, maintain required exits, existing structural elements, fire protection devices and sanitary safeguards . 2021 IBC 3302.1

Code violations that are found during inspection are required to be corrected. Permit issuance does not grant approval of a code violation. **2021 IBC 105.4**

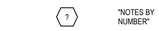
PROVIDE A FULL-SIZE SET OF LEGIBLE APPROVED CONSTRUCTION DOCUMENTS **PRINTED IN COLOR** FOR REVIEW BY INSPECTOR

SYMBOLS LEGEND

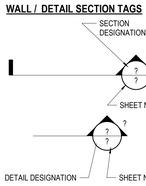
COLUMN GRID DESIGNATIONS



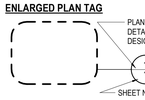
NOTE TAGS



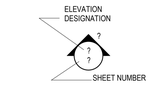
WALL / DETAIL SECTION TAGS



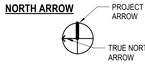
ENLARGED PLAN TAG



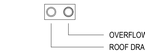
EXTERIOR ELEVATION TAG



NORTH ARROW



ROOF DRAIN AND OVERFLOW DRAIN



EXISTING PARTITION / ITEM TO REMAIN

NEW PARTITION / ITEM

EXISTING TO BE REMOVED

EXISTING TO REMAIN. REFERENCE ENTIRE DOCUMENTS FOR ADDITIONAL WORK IN THIS AREA

DOOR IDENTIFICATION TAG



DOOR DESIGNATOR ROOM NUMBER (THAT DOOR SWINGS INTO)

EQUIPMENT DESIGNATION

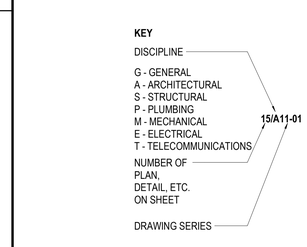
EQUIPMENT REFER TO RESPONSIBILITY MATRIX

ABBREVIATIONS LEGEND

NOTE 1: ABBREVIATIONS WHEN USED IN COMPOSITION MAY INCLUDE PERIODS FOR CLARIFICATION
NOTE 2: ABBREVIATIONS MAY BE DIFFERENT WHEN PART OF A LEGEND

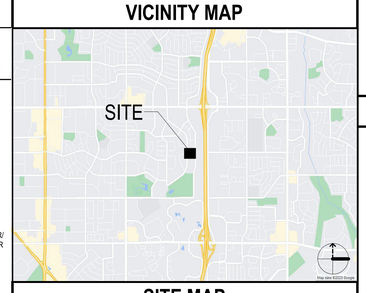
A/C	AIR CONDITION(ING)(ED)	F/F	FACE TO FACE	O/O	OUT TO OUT	UNEX	UNEXCAVATED
ACC	ACCESSIBLE	FARS	FIRE FIGHTER AIR REPLENISHMENT SYSTEM	OC	ON CENTER	UNFIN	UNFINISHED
ACST	ACOUSTIC(AL)	FCO	FLOOR CLEANOUT	OD	OUTSIDE DIAMETER	UNO	UNLESS NOTED OTHERWISE
AD	AREA DRAIN	FD	FLOOR DRAIN	OF/CI	OWNER FURNISHED, CONTRACTOR INSTALLED	UOI	UNLESS OTHERWISE INDICATED
ADA	AMERICANS WITH DISABILITIES	FDC	FIRE DEPARTMENT CONNECTION	OF/OI	OWNER FURNISHED, OWNER INSTALLED	UTIL	UTILITY
ADJ	ADJUSTABLE/ ADJACENT	FE	FIRE EXTINGUISHER	OFF	OFFICE	VB	VINYL BASE
AESS	ARCHITECTURAL EXPOSED STRUCTURAL STEEL	FEC	FIRE EXTINGUISHER CABINET	OH	OPPOSITE HAND	VCT	VINYL COMPOSITION TILE
AFC	ABOVE FINISHED COUNTER	FF	FINISH FACE	OPH	OPPOSITE HAND	VENT	VENTILATION
AFF	ABOVE FINISHED FLOOR	FH	FIRE HYDRANT	OPNG	OPENING	VERT	VERTICAL
AFG	ABOVE FINISHED GRADE	FHC	FIRE HOSE CABINET	OPP	OPPOSITE	VEST	VESTIBULE
AGGR	AGGREGATE	FIN	FINISH(ED)	ORD	OVERFLOW ROOF DRAIN	VIF	VERIFY IN FIELD
AHU	AIR HANDLING UNIT	FF EL	FINISHED FLOOR ELEVATION			VNR	VENEER
ALT	ALTERNATE	FLR	FLOOR	PA	PUBLIC ADDRESS	VOL	VOLUME
ALUM	ALUMINUM	FLUOR	FLUORESCENT	PAR	PARAPET, PARALLEL	VWC	VINYL WALL COVERING
ANOD	ANODIZE(D)	FO	FINISHED OPENING	PCC	PRE-CAST CONCRETE		
APC	ACOUSTICAL PANEL CEILING	FOC	FACE OF CURB	PERF	PERFORATED	W	WEST
APPROX	APPROXIMATE	FOF	FACE OF FINISH	PERP	PERPENDICULAR	W/	WITH
ARCH	ARCHITECT(URAL), ARCHITECT	FOM	FACE OF MASONRY	PLAM	PLASTIC LAMINATE	WO	WITHOUT
ASPH	ASPHALT	FOS	FACE OF SLAB/ FACE OF STUD	PLAS	PLASTER	WC	WATER CLOSET
ATC	ACOUSTICAL TILE CEILING	FP	FIRE PROTECTION/ FIREPROOF	PLBG	PLUMBING	WD	WOOD
AUTO	AUTOMATIC	FRTW	FIRE RETARDANT TREATED WOOD	PLYWD	PLYWOOD	WG	WALL GUARD
AWT	ACOUSTICAL WALL TREATMENT	FSAE	FIRE SERVICE ACCESS ELEVATOR	PNT	PAINT	WH	WATER HEATER
B/B	BACK TO BACK	FT	FOOT (FEET)/ FIRE TREATED	POL	POLISHED	WI	WROUGHT IRON
BC	BACK OF CURB	FTG	FOOTING	PR	PAIR	WSCT	WAINSCOT
BD	BOARD	FURG	FURRING	PREFAB	PREFABRICATE(D)	WT	WEIGHT
BITUM	BITUMINOUS	FURN	FURNISH, FURNITURE	PROJ	PROJECT	WWF	WELDED WIRE FABRIC
BLDG	BUILDING	FUT	FUTURE	PROP	PROPERTY	WWM	WELDED WIRE MESH
BM	BEAM/ BENCHMARK	FV	FIELD VERIFY	PSF	POUNDS PER SQUARE FOOT		
BOT/	BOTTOM OF			PSI	POUNDS PER SQUARE INCH	X	BY
BSMT	BASEMENT	GA	GAGE	PT	POINT/ PRESSURE TREATED		
BUR	BUILT-UP ROOFING	GALV	GALVANIZED	PTD	PAPER TOWEL DISPENSER	YD	YARD
CAB	CABINET	GEN	GENERAL	PTN	PARTITION	YR	YEAR
CB	CATCH BASIN	GFRC	GLASS FIBER REINFORCED CONCRETE	PVC	POLYVINYL CHLORIDE		
CCTV	CLOSED CIRCUIT TELEVISION	GFRG	GLASS FIBER REINFORCED GYPSUM	PVG	PAVING	ZN	ZINC
CEM	CEMENT			QT	QUARRY TILE		
CF/CI	CONTRACTOR FURNISHED, CONTRACTOR INSTALLED	GL	GLASS	QTY	QUANTITY		
CF/OI	CONTRACTOR FURNISHED, OWNER INSTALLED	GL BLK	GLASS BLOCK	R	THERMAL RESISTANCE, RADIUS, RISER		
CFM	CUBIC FEET PER MINUTE	GLU LAM	GLUED LAMINATED WOOD	RB	RUBBER BASE		
CFMF	COLD-FORMED METAL FRAMING	GR LN	GRADE LINE	RC	REINFORCED CONCRETE		
CG	CORNER GUARD	GRFL	GROUND FLOOR	RCP	REFLECTED CEILING PLAN		
CI	CAST IRON, CURB INLET	GSB	GYPSUM SHEATHING BOARD	RCPTN	RECEPTION		
CIP	CAST-IN-PLACE	GT	GREASE TRAP	RD	ROOF DRAIN		
CJ	CONTROL JOINT	GYP BD	GYPSUM BOARD	REC	RECESSED		
CL	CENTER LINE	GYP PLAS	GYPSUM PLASTER	REF	REFERENCE, REFRIGERATOR		
CLG	CEILING	H	HIGH	REINF	REINFORCE, REINFORCING		
CLO	CLOSET	HB	HOSE BIBB	REQ(D)	REQUIRE, REQUIRED		
CLR	CLEAR	HC	HOLLOW CORE	RESIL	RESILIENT		
cm	CENTIMETER	HDW	HARDWARE	REV	REVISION		
CMU	CONCRETE MASONRY UNIT	HDWD	HARDWOOD	RF	RESILIENT FLOORING		
CO	CLEANOUT	HM	HOLLOW METAL	RH	RIGHT HAND		
COL	COLUMN	HORIZ	HORIZONTAL	RM	ROOM		
CONC	CONCRETE	HPT	HIGH POINT	RO	ROUGH OPENING		
CONF	CONFERENCE	HSKPG	HOUSEKEEPING	ROW	RIGHT OF WAY		
COORD	COORDINATE	HT	HEIGHT	RTF	RUBBER TILE FLOOR		
CORR	CORRIDOR	HVAC	HEATING, VENTILATION, AIR CONDITIONING	RVL	REVEAL		
CP	CARPET	HW	HOT WATER	S	SOUTH		
CPT	CARPET TILES	ID	INSIDE DIAMETER	SAN	SANITARY		
CT	CERAMIC TILE	INCAND	INCANDESCENT	SC	SOLID CORE		
CTR	CENTER/CONTOUR	INSUL	INSULATION	SCHED	SCHEDULE		
CU	CUBIC	INT	INTERIOR	SECT	SECTION		
CW	COLD WATER PIPING/ CHEMICAL WASTELINE	INV	INVERT	SF	SQUARE FOOT(FEET)		
		JAN CLO	JANITOR'S CLOSET	SGL	SINGLE		
D	DEEP, DEPTH, PENNY (NAIL)			SHR	SHOWER		
DBL	DOUBLE	KIT	KITCHEN	SHT	SHEET		
DEG	DEGREE			SIM	SIMILAR		
DEMO	DEMOLISH, DEMOLITION	L	LONG, LENGTH	SJ	SLIP JOINT, SCORED JOINT		
DEPT	DEPARTMENT	LAM	LAMINATE(D)	SPEC	SPECIFICATION		
DF	DRINKING FOUNTAIN	LAU	LAUNDRY	SPKR	SPEAKER		
DIA	DIAMETER (EXTERIOR)	LAV	LAVATORY	SQ	SQUARE		
DIAG	DIAGONAL	LB	POUND(S)	SST	STAINLESS STEEL		
DIFF	DIFFUSER/ DIFFERENCE	LF	LINEAR FOOT, (FEET)	STA	STATION		
DIM	DIMENSION	LH	LEFT HAND	STC	SOUND TRANSMISSION CLASS		
DISP	DISPENSER	LIB	LIBRARY	STD	STANDARD		
DIV	DIVISION	LKR	LOCKER	STL	STEEL		
DL	DEAD LOAD	LL	LIVE LOAD	STOR	STORAGE		
DR	DOOR/ DRAIN	LONG	LONGITUDINAL	STRUCT	STRUCTURAL		
DS	DOWNSPOUT	LOC	LOCATION	SUSP	SUSPENDED		
DW	DISHWASHER	LPT	LOW POINT	SV	SHEET VINYL		
DWG	DRAWING	LT	LIGHT	SYMM	SYMMETRICAL		
E	EAST	LVR	LOUVER	T	TREAD		
EA	EACH	m	METER	TA	TOILET ACCESSORY		
EIFS	EXTERIOR INSULATION AND FINISH SYSTEM	MACH	MACHINE	T&B	TOP & BOTTOM		
EJ	EXPANSION JOINT	MAINT	MAINTENANCE	T&G	TONGUE & GROOVE		
EL	ELEVATION	MATL	MATERIAL	TEL	TELEPHONE		
ELAST	ELASTOMERIC	MAX	MAXIMUM	TEMP	TEMPORARY		
ELEC	ELECTRIC(AL)	MECH	MECHANICAL	TER	TERRAZZO		
ELEV	ELEVATOR	MEMB	MEMBRANE	THK	THICK		
EMER	EMERGENCY	MEP	MECHANICAL, ELECTRICAL, PLUMBING @ FIRE PROTECTION	TI	TENANT IMPROVEMENT		
EMER SHR	EMERGENCY SHOWER			TLT	TOILET		
ENGR	ENGINEER	MEZZ	MEZZANINE	TO_	TOP OF ___		
ENTR	ENTRANCE	MFR	MANUFACTURER	TOC	TOP OF CONCRETE		
EO	ELECTRIC OUTLET	MH	MANHOLE	TOF	TOP OF FOOTING		
EOS	EDGE OF SLAB	MHO	MAGNETIC HOLD OPEN	TOM	TOP OF MASONRY		
EP	ELECTRICAL PANEL	MIN	MINIMUM	TOP	TOP OF PARAPET		
EQ	EQUAL	MISC	MISCELLANEOUS	TOS	TOP OF SLAB		
EQUIP	EQUIPMENT	MKR BD	MARKER BOARD	TOW	TOP OF WALL		
ES	EXPOSED STRUCTURE	mm	MILLIMETER	TOPO	TOPOGRAPHY, TOPOGRAPHIC		
ETC	ET CETERA	MO	MASONRY OPENING	TRTD	TREATED		
EW	EACH WAY	MTL	METAL	TS	TUBE STEEL		
EWC	ELECTRIC WATER COOLER			TV	TELEVISION		
EXH	EXHAUST	N	NORTH	TYP	TYPICAL		
EXIST	EXISTING	NIC	NOT IN CONTRACT	U	HEAT TRANSFER COEFFICIENT		
EXP	EXPANSION	NO	NUMBER	UH	UNIT HEATER		
EXT	EXTERIOR, EXTERNAL	NOM	NOMINAL	UL	UNDERWRITER'S LABORATORIES		
		NTS	NOT TO SCALE				

DRAWING NUMBER KEY

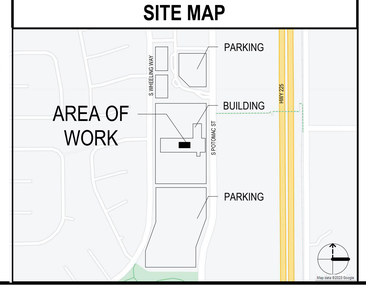


OVERALL MAP

VICINITY MAP



SITE MAP



SYMBOLS

&	AND	∠	ANGLE
@	AT	x	BY (LOWERCASE)
℄	CENTER LINE	[	CHANNEL
X°	DEGREE	Ø	DIAMETER
∡	DOUBLE ANGLE	#	NUMBER, POUNDS
₱	PROPERTY LINE	±	PLUS OR MINUS
⌗	SQUARE FEET	≀	ZEE
▯	COLUMN: TUBE	/	DIVIDED BY
≤	MAXIMUM	≥	MINIMUM
~	RANGE		

MATERIALS AT LARGE SCALES

STRUCTURAL CONCRETE

LIGHTWEIGHT CONCRETE

STEEL

WATERPROOFING/ DAMPROOFING/ AIR/ MOISTURE BARRIER

RIGID INSULATION

BATT INSULATION

SPRAY-ON FIREPROOFING OR INSULATION

PROJECT DATA

- **PROJECT INFORMATION:**
  THIS PROJECT INCLUDES THE ADDITION OF A ROOFTOP MECHANICAL SCREEN THAT IS TO CONCEAL A NEW AIR HANDLER UNIT ON THE EXISTING SOUTH CENTRAL TOWER ON THE MEDICAL CETER OF AURORA'S CAMPUS. THE NEW AIR HANDLER WILL BE ACCESSED VIA THE EXISTING ROOF HATCH. SCOPE INCLUDES A NEW GUARDRAIL BETWEEN THE NEW MECHANICAL SCREEN AND THE EXISTING ROOF HATCH. ARCHITECTURAL SCOPE IS LIMITED TO THE ROOF ONLY. INTERIOR MECHANICAL SCOPE EXISTS ON LEVELS 2, 3, 4, 5, AND ROOF.
- **CODES/ LAWS:**
  CITY OF AURORA:
  2021 INTERNATIONAL BUILDING CODE (IBC)
  2021 INTERNATIONAL EXISTING BUILDING CODE (IEBC)
  2020 NATIONAL ELECTRICAL CODE (NEC)
  2021 INTERNATIONAL MECHANICAL CODE (IMC)
  2021 INTERNATIONAL PLUMBING CODE (IPC)
  2021 INTERNATIONAL FIRE CODE (IFC)
  2021 INTERNATIONAL FUEL AND GAS CODE (IFGC)
  2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)
  2017 ICC/ANSI A117.1 ACCESSIBLE USABLE BUILDINGS AND FACILITIES
  STATE OF COLORADO:
  2012 NFPA 101 - LIFE SAFETY CODE
  2009 CO DEPARTMENT OF HEALTH AND ENVIRONMENT - HOSPITAL LICENSING RULES
  FEDERAL:
  2010 AMERICANS WITH DISABILITIES ACT GUIDELINES
- **OCCUPANCY CLASSIFICATION:**
  2021 IBC - GROUP I-2 (SECTION 308)
  2012 NFPA 101 EXISTING **HEALTHCARE** OCCUPANCY (CHAPTER **18**)
- **CONSTRUCTION TYPE:**
  EXISTING: SBC - TYPE 1A, UNRESTRAINED, FULLY SPRINKLERED
  NEW: 2021 IBC - TYPE 1-A, FULLY SPRINKLERED
- **ALLOWABLE HEIGHT AND BUILD, AREAS:**

MAX ALLOWED	EXISTING	PROPOSED
STORIES: NOT IMPACTED BY PROJECT SCOPE	STORIES: NOT IMPACTED BY PROJECT SCOPE	STORIES: NOT IMPACTED BY PROJECT SCOPE
HEIGHT: 75'-0" (PER CITY CODE)	HEIGHT: 65'-0"	HEIGHT: 75'-0" - TO TOP OF SCREEN WALL
FLOOR AREA:NOT IMPACTED BY PROJECT SCOPE	FLOOR AREA:NOT IMPACTED BY PROJECT SCOPE	FLOOR AREA:NOT IMPACTED BY PROJECT SCOPE

- **FIRE RESISTANCE:**

BUILDING ELEMENT	FIRE RATING	U.L. ASSEMBLY
STRUCTURAL FRAME (INCLUDING COLUMNS & GIRDERS)		
SUPPORTING ROOF ONLY	4-HR	COLUMNS X-772 (W-BEAM) COLUMNS X-771 (TUBES) GIRDERS S-735 (W/ P938) GIRDERS S-734 (W/ P732) COLUMNS X-771 (TUBE) COLUMNS X-772 (W-BEAM)
SUPPORTING ONE OR MORE FLOORS	4-HR	GIRDERS N-782
ROOF CONSTRUCTION (INCLUDING SUPPORTING BEAMS AND JOISTS (SECONDARY MEMBERS))	2-HR	P-936 (W/ LIGHT WEIGHT INSULATING CONCRETE)

- **NOTES:**
  ALL FIRE RESISTIVE DESIGN TO BE CONSIDERED THERMALLY RESTRAINED. ALL BEAM AND COLUMN FIRE PROOFING TO BE ADJUSTED USING W/D RATIO. ALL STRUCTURAL ELEMENTS, OR PORTIONS THEREOF, THAT SUPPORT EXIT COMPONENTS AND EITHER PENETRATE INTO A FIRE RATED ASSEMBLY OR ARE INSTALLED WITHIN A FIRE RATED WALL ASSEMBLY SHALL BE PROTECTED BY A RATING EQUAL TO THE SHAFT.

  SPECIFIC USE & BUILDING UTILITY AREAS (IF PROVIDED):

ELEVATOR / STAIR SHAFT ENCLOSURES:	NOT IMPACTED BY SCOPE OF PROJECT
MECHANICAL SHAFT ENCLOSURES:	[1 OR 2] HR FIRE-BARRIER
ELECTRICAL ROOMS:	0 HR
ELECTRICAL ROOMS WITH 112.5 KVA TRANSFORMERS	1 HR FIRE-BARRIER
EMERGENCY ELECTRICAL ROOMS:	2 HR FIRE-BARRIER
FARS ROOMS:	0 HR
MECHANICAL ROOMS:	0 HR
STORAGE ROOMS:	1 HR (100 SF & GREATER)
FIRE COMMAND ROOM:	2 HR FIRE-BARRIER
FIRE PUMP ROOM:	2 HR FIRE-BARRIER
ELEVATOR MACHINE ROOMS:	2 HR FIRE-BARRIER

GENERAL PROJECT NOTES

1. DO NOT SCALE THE DRAWINGS. IN CASE OF DISCREPANCIES, OR IF DIMENSIONS ARE IN QUESTION, OBTAIN CLARIFICATION FROM ARCHITECT PRIOR TO PROCEEDING WITH THE WORK.
2. "TOP OF SLAB" ELEVATION AS REFERENCED THROUGHOUT THE CONTRACT DOCUMENTS DOES NOT NECESSARILY EQUATE TO "FINISH FLOOR ELEVATION." "TOP OF SLAB" AS REFERENCED HEREINAFTER IS DEFINED AS THE FINAL POURED CONCRETE SUBFLOOR ELEVATION PRIOR TO APPLICATION OF SCHEDULED FLOOR FINISHES. "FINISH FLOOR ELEVATION" IS MEASURED TO OR FROM TOP OF SCHEDULED FLOOR FINISH MATERIAL.
3. UNLESS OTHERWISE INDICATED, DIMENSIONS SHOWN FOR NEW CONSTRUCTION ARE TO FACE OF FINISH OF GYPSUM BOARD PARTITIONS, TO CENTER LINE OF COLUMNS, AND TO FACE OF CONCRETE OR MASONRY WALLS.
4. UNLESS OTHERWISE INDICATED, DIMENSIONS IN RENOVATION AREAS ARE FROM FINISH FACE OF EXISTING WALLS TO FINISH FACE OF NEW CONCRETE, MASONRY, OR GYPSUM BOARD PARTITIONS.
5. PIPING LOCATED ABOVE GRADE AND INSIDE THE BUILDING SHALL BE CONCEALED IN FURRED GYPSUM BOARD ENCLOSURES, WITH THE EXCEPTION OF EQUIPMENT ROOMS, MECHANICAL ROOMS, ELECTRICAL ROOMS, MDF / IDF / DATA CLOSETS, AND FIRE SUPPRESSION PIPING LOCATED IN STAIRWAYS, UNLESS OTHERWISE INDICATED. COORDINATE WITH OTHER TRADES TO PROVIDE GYPSUM BOARD ENCLOSURES FOR PIPING INSTALLED IN FINISHED AREAS.
6. PARTITION TYPE AND FIRE-RESISTANCE RATING INDICATED FOR A GIVEN PARTITION ARE TO BE CONTINUOUS FOR THE LENGTH AND HEIGHT OF THAT PARTITION UNLESS OTHERWISE INDICATED.
7. PENETRATIONS THROUGH FIRE-RESISTANCE-RATED PARTITIONS, FLOORS, CEILINGS AND ROOF ASSEMBLIES SHALL BE SEALED WITH APPROVED FIRE-RESISTANT-RATED PENETRATION FIRESTOPPING SYSTEMS.
8. MAINTAIN THE FIRE-RESISTANCE RATING OF CONSTRUCTION AROUND CABINETS, PANELS, BOXES, AND OTHER ITEMS RECESSED IN FIRE-RESISTANCE-RATED PARTITIONS, AND FLOOR AND CEILING ASSEMBLIES. REFER TO FIRE RESISTANCE DETAILS.
9. COORDINATE LOCATION OF JOINT SEALANTS, AND COMPATIBILITY OF JOINT SEALANTS WITH ADJACENT WORK, INCLUDING MATERIALS AND OTHER JOINT SEALANTS.
10. JOINT SEALANTS EXPOSED TO VIEW SHALL BE CUSTOM COLOR AS SELECTED BY ARCHITECT.
11. COORDINATE SIZE AND LOCATION OF CONCRETE BASES AND HOUSEKEEPING PADS WITH SIZES AND REQUIRED CLEARANCES OF THE EQUIPMENT SCHEDULED TO BE INSTALLED ON THEM.
12. LEVEL EXISTING CONCRETE FLOORS (AND NEW FLOORS THAT WERE INSTALLED OUT OF SPECIFIED TOLERANCES) WITH SELF-LEVELING CEMENT-BASED UNDERLAYMENT SO THAT THEY DO NOT EXCEED A MAXIMUM 1/8-INCH VARIANCE IN A 10'- 0" RADIUS. FEATHER EDGES TO MATCH ADJACENT FLOOR ELEVATIONS.
13. COAT OR OTHERWISE ISOLATE DISSIMILAR METALS TO PREVENT GALVANIC ACTION AND OTHER FORMS OF CORROSION.
14. DO NOT HANG OR SUSPEND ANY ITEMS FROM METAL ROOF DECKING. SUSPENSION SYSTEMS FOR CEILINGS, AND HANGERS AND SUPPORTS FOR DIVISION 21 THROUGH 28 SYSTEMS, SHALL BE ANCHORED TO BEAMS, JOISTS, OR SLOTTED CHANNEL FRAMING SYSTEM.
15. PROPOSED FLOOR OUTLET LOCATIONS SCHEDULED TO BE INSTALLED IN EXISTING CONCRETE FLOORS SHALL BE REVIEWED WITH ARCHITECT AND OWNER PRIOR CUTTING OR CORE-DRILLING FLOORS.
16. FIELD MEASURE AND CONFIRM DIMENSIONS FOR OWNER-FURNISHED / CONTRACTOR-INSTALLED EQUIPMENT AND FURNISHINGS. COORDINATE DELIVERY AND INSTALLATION OF OF/CI EQUIPMENT WITH OWNER. COORDINATE NECESSARY ACCESSIBLE ROUTES, AND MINIMUM CLEARANCES AND OPENING SIZES, TO THE INSTALLATION AREA WITH THE EQUIPMENT / FURNISHINGS SUPPLIER.
17. A CHASE IS AN INACCESSIBLE SPACE THAT DOES NOT EXTEND TO OTHER STORIES WITHIN A BUILDING. A SHAFT IS AN ENCLOSED SPACE EXTENDING THROUGH MORE THAN ONE STORY.

City of Aurora Building Division
Project: *AURORA MEDICAL CENTER*
Address: *1501 S POTOMAC ST*
Occupancy Group: *IBC 1-2*
Construction Type: *IBC TYPE IA-SPK*
RSN: *1741691*
Permit: *23-2376222 -LT*

City of Aurora Building Division
Reviewed for Code Compliance
Approved as Noted: Y. Munoz
Date: *Aug 24, 2023*
2021 INTERNATIONAL CODES & 2023 NEC

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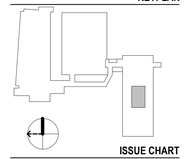
COLORADO LICENSED
Brittany M Carey
ARC.00407023
BC CAEL
ARCHITECT

PROJECT

The Medical Center of Aurora

TMCA CENTRAL TOWER MAU
THE MEDICAL CENTER OF AURORA
1501 SOUTH POTOMAC STREET
AURORA, COLORADO 80012

KEYPLAN



ISSUE CHART

MARK	ISSUE	DATE
2	ISSUE FOR PERMIT	08.08.23
1	90% ISSUE FOR PERMIT	07.14.23
Job Number		222319.000

TITLE

PROJECT INFORMATION & INDEX OF DRAWINGS

SHEET NUMBER

G00-01

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SECTION 01 00 10
SPECIFICATIONS (MAU REPLACEMENT)

DIVISION 02 - EXISTING CONDITIONS AND DEMOLITION

02 10 00 - EXISTING CONDITIONS DOCUMENTATION

A. Existing Facility Record Drawings:
1. A copy may be available upon request; inquire of Architect or building owner regarding existance and availability of record drawings, if any.
2. Contractor is required to visit the existing facility and become acquainted with existing conditions.
3. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   a. Verify that construction and utility arrangements are as shown.
   b. Report discrepancies to Architect before disturbing existing installation.
   c. Beginning of Work constitutes acceptance of existing conditions.

02 30 00 - GENERAL ALTERATION PROCEDURES AND REQUIREMENTS

A. Alterations Procedures:
1. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   a. Provide, erect, and maintain temporary dustproof enclosures.
2. Remove existing work as indicated and as required to accomplish new work.
   a. Where electrical floor boxes, poke-throughs, conduit, plumbing, piping, or other equipment or devices are removed, fire-seal floor penetrations. Refer to Division 03 (Concrete) for holes greater than 1-1/2 inches in diameter and Division 07 (Thermal and Moisture Protection) for firestopping of smaller openings. Coordinate interrelated subcontractor work associated with firestopping and filling floor openings.
   b. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   c. Remove all residual carpet base adhesive remaining after demolition of base. Prepare wall surface as required for specified finish.
3. Existing Facility Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   a. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   b. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   c. Verify that abandoned services serve only abandoned facilities.
   d. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
4. Protect existing work to remain.
   a. Prevent movement of structure; provide shoring and bracing if necessary.
   b. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   c. Repair adjacent construction and finishes damaged during removal work.
5. Adapt existing work to fit new work. Make as neat and smooth transition as possible.
   a. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
6. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
7. Clean existing systems and equipment.

02 40 00 - CUTTING AND PATCHING RESTRICTIONS

A. Cutting:
1. Whenever possible, execute the work by methods that avoid cutting or patching.
2. Perform whatever cutting and patching is necessary to:
   a. Complete the work.
   b. Fit products together to integrate with other work.
   c. Provide openings for penetration of mechanical, electrical, and other services.
   d. Match work that has been cut to adjacent work.
   e. Repair areas adjacent to cuts to required condition.
   f. Repair new work damaged by subsequent work.
   g. Remove samples of installed work for testing when requested.
   h. Remove and replace defective and non-conforming work.
3. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
4. Restore work with new products in accordance with requirements of Contract Documents.
5. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
6. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

B. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   a. Match color, texture, and appearance.
2. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

02 41 19 - SELECTIVE DEMOLITION

A. Section includes demolition and removal of selected portions of building or structure.

B. Unless otherwise indicated, demolition waste becomes property of the Contractor.

C. Preinstallation Meetings: Conduct conference at the Project site.
1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

D. Informational Submittals:
1. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control, and for noise control. Indicate proposed locations and construction of barriers.
2. Schedule of Selective Demolition Activities: Indicate the following:
   a. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenant's on-site operations are uninterrupted.
   b. Indication of how long utility services will be interrupted.
   c. Coordination of shutoff, capping, and continuation of utility services.
   d. Use of elevator and stairs.
   e. Coordination of Owner's continuing occupancy of portions of existing building and Owner's partial occupancy of completed Work.
   f. Arrange selective demolition schedule so as not to interfere with Owner's operations.
3. Documentation indicating that existing warranties are still in effect after completion of selective demolition.

E. Field Conditions:
1. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
2. Conditions existing at time of inspection for bidding purposes will be maintained by the Owner as far as practical.
3. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
4. It is not expected that hazardous materials will be encountered in the Work. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
5. Storage or sale of removed items or materials on-site is not permitted.
6. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
7. Maintain fire-protection facilities in service during selective demolition operations.

F. Warranties:
1. Remove, replace, patch, and repair materials and surfaces cut of damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.
2. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at project closeout.

G. Performance Requirements:
1. Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorites having jurisdiction.
2. Comply with NFPA 241.

H. Examination:
1. Verify that utilities have been disconnected and capped before starting selective demolition operations.
2. Review project record documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing condition are same as those indicated on project record documents.
3. Perform and engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations. Perform surveys as the work progresses to detect hazards resulting from selective demolition activities.
4. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
5. Record existing conditions by use of measured drawings and preconstruction photographs.
6. Maintain services and systems indicated to remain and protect them against damage.

I. Protection:
1. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
3. Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished. Strenghten or add new supports when required during progress of selective demolition.
4. Remove temporary barricades and protections where hazards no longer exist.

J. Selective Demolition, General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering or chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least 4 hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose or off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impace or dust generation.
9. Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings". Do not use methods requiring solvent-based adhesive strippers.
10. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
11. Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
12. Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

K. Disposal of Demolished Materials: Remove demolition waste materials promptly from project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Do not burn demolished materials.

L. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent area to condition existing before selective demolition operations began.

DIVISION 05 - METALS

05 51 19 - METAL GRATING STAIRS

A. Includes industrial-class stair with steel grating treads.

B. Submittals:
1. Product data.
2. Shop drawings.
3. Delegated Design Submittal: Signed and sealed by licensed engineer licensed to practice in the state where the project is located, including analysis data.

C. Performance Requirements:
1. Uniform Load: 100 lbf/ sq.ft. (4.79 kN/ sq.m).
2. Concentrated Load: 300 lbf (1.33 kN) applied on area of 4 sq.in. (2580 sq.mm).
3. Uniform and Concentrated load need not be assumed to act concurrently.
4. Limit deflection of treads, platforms, and framing members to L/360.
5. Stair Framing: Capable of withstanding stresses resulting from railing and guard load in addition to load specified above.
6. Thermal Movement: from ambient and surface temperature changes.
   a. Temerature Change: 120 degrees F (67 degrees C) ambient:180 degrees F (100 degrees C) material surfaces.

D. Materials:
1. Steel Plates, Shapes, Bars: ASTM A36/A36M.
2. Rolled Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M , Grade C or D.
3. Steel Wire Rod for Grating Crossbars: ASTM A510/A510M.

E. Finishes: Provide galvanized finish for exterior installations.
1. Provide shop primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

F. Fasteners: 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 of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated, and capable of withstanding design loads.
2. Bolts and Nuts: Regular hex-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563/A563M; and, where indicated, flat-washers.
3. Anchor Bolts: ASTM F1554, Grade 36, or dimensions indicated; with nuts ASTM A563/A563M; and, where indicated, flat washers.
   a. Provide mechanically-deposited or hot-dip, zinc-coated achor bolts for exterior stairs.
4. Post-Installed Anchors: Torque-controlled expansion achors capable of sustaining, without failure, a load equal to six times the load imposed with installed in unit masonry and four times the load imposed when installed in concrete as determined by testing according to ASTM E488/E488M.

G. Fabrication: Provide complete stair assemblies, including metal framing, railing, guards, clips, brackets, bearing plates, and components necessary to support and anchor stairs and platforms on supporting structure.
1. Assemble stairs in shop to greatest extent possible.
2. Form exposed work with accurate angles and surfaces and straight edges.
3. Join compenents by welding unless otherwise indicated.
4. Fabricate stringers of steel plates or channels.
5. Construct platforms and tread supports of steel plate or channels.
6. Fabricate treads and platforms from welded steel grating with openings in grating no more than 1/2 inch (12 mm) in the least dimension.
7. Risers: Open.

H. Installation: Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

05 52 13 - STEEL PIPE AND TUBE RAILINGS

A. Includes steel pipe and tube railings.

B. Submittals:
1. Product data.
2. Shop drawings.

C. Performance Requirements:
1. Uniform Load: 50 lbf/ft. (0.73 kN/m) applied in any direction.
2. Concentrated Load: 200 lbf (0.89 kN) applied in any direction.
3. Uniform and Concentrated load need not be assumed to act concurrently.
4. Infill of Guards: Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq.ft. (0.093 sq.m).
   a. Infill load and other loads need not be assumed to act concurrently.
5. Thermal Movement: from ambient and surface temperature changes.
   a. Temerature Change: 120 degrees F (67 degrees C) ambient:180 degrees F (100 degrees C) material surfaces.

D. Materials:
1. Steel Tubing: ASTM A500/A500M (cold-formed) or ASTM A513/A513M.
2. Steel Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
3. Plates, Shapes, and Bars: ASTM A36/A36M.

E. Finishes: Provide galvanized finish for exterior installations.
1. Provide shop primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

F. Fasteners: Provide Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc-coating.
1. Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated, and capable of withstanding design loads.
2. Post-Installed Anchors: Torque-controlled expansion achors capable of sustaining, without failure, a load equal to six times the load imposed with installed in unit masonry and four times the load imposed when installed in concrete as determined by testing according to ASTM E488/E488M.
3. Provide concealed fasteners for interconnecting railing componnent and for attached them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.

G. Fabrication: 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. Assemble stairs in shop to greatest extent possible.
2. Form exposed work with accurate angles and surfaces and straight edges.
3. Fabricate railings with welded connections unless otherwise indicated.
4. Form changes in direction by bending or by inserting prefabricated elbow fittings.
5. Close exposed ends of railing members with prefabricated end fittings.
6. Provide wall brackets, flanges miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

H. Installation: Fit exposed connections together to form tight, hairline joints.
1. Prevent galvanic action and other forms of corrosion by insulating metals and other materials for direct contact with incompatible materials.
2. Use fully-welded joints for permanantly connecting railing components.
3. Use metal sleeves present and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

05 52 16 - NON-PENETRATING HANDRAILS AND RAILINGS

A. Includes freestanding roof edge protection system, including pipe railings, uprights, bases, and counterweights.

B. Submittals:
1. Product data.
2. Shop drawings.

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. BlueWater Manufacturing, Inc.
2. CAI Safety Systems.
3. Garlock Safety Systems.
4. Kee Safety, Inc.

D. Performance Requirements:
1. Handrails and Top Rails of Guards:
   a. Uniform Load: 50 lbf/ft. (0.73 kN/m) applied in any direction.
   b. Concentrated Load: 200 lbf (0.89 kN) applied in any direction.
   c. Uniform and Concentrated Loads need not be assumed to act concurrently.
2. Infill of Guards:
   a. Concentrated Load: 50 lbf/ft (0.73 kN/m) applied horizontally on an area of 1 sq.ft. (0.093 sq.m).
   b. Infill load and other loads need not be assumed to act concurrently.
3. Thermal Movement: from ambient and surface temperature changes.
   a. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

E. Materials:
1. Steel Tubing: ASTM A500/A500M (cold-formed) or ASTM A513/A513M.
   a. Galvanized tube, 12-gauge, 0.105-inch (2.67 mm), 1-1/2-inch I.D., 1.90-inch O.D. (48mm) diameter.
2. Steel Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
   a. Galvanized pipe, 1-1/2 inches (38 mm),
3. Plates, Shapes, and Bars: ASTM A36/A36M.
4. Fittings: Including elbows, crossovers, wall flanges, tees, and couplings.
   a. Galvanized Malleable Cast Iron: Clamp structural pipe fittings, ASTM A447 with ASTM A153/A153M galvanizing.
   b. Fasteners: Type 304 or 305 stainless steel or galvanized.
5. Counterweight Levers: Galvanized tube, 12-gauge, 0.105-inch (2.67 mm),1-1/4-inch I.D. 1.660-inch O.D. (38 mm) diameter.
6. Mounting Bases: Galvanized steel bases with rubber pad on underside of the component.
7. Counterweights: Molded recycled PVC with one fixing collar per counterbalance.

F. Finishes: Provide galvanized finish for exterior installations.
1. Provide shop primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

G. Fabrication: 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. Shop-assemble railing to the 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.
2. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
3. Form work true to line and level with accurate angles and surfaces.
4. Fabricate connections in a manner that excludes water. Provide weep holes where water may accumulate.
5. Upright tops shall be plugged with weather and light resistant material.
6. Assemble components with joints tightly fitted and secured. Accurately form components to suit installation.

H. Installation: Install in accordance with manufacturer's instructions.
1. Before installation, inspect all parts to insure no damaged parts are used.
2. Railing must be secured to base with securing pins.
3. Fit exposed connections accurately together to form tight joints. For all connections with fittings, each set screw is to be tightened to 29 foot pounds (39 N-m) of torque.
4. Perform cutting, and fitting required for installation of handrails. Set handrails and accurately in location, alignment, and elevation, measured from established lines and levels.

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

06 10 53 - MISCELLANEOUS CARPENTRY

A. Wood Blocking, Nailers, Grounds, and Furring:
1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.

B. Plywood Blocking/Nailers: PS 1, C-D Plugged or better.

C. Fasteners and Anchors: As required to suit indicated applications. Take care to avoid damage of any kind to existing structure; verify existing conditions before installation.

D. Fire Retardant Treatment: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
1. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
2. Applications: Treat all interior rough carpentry items if required by applicable code.

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 01 53 -ROOF MODIFICATIONS

A. Existing Membrane Roofing System: Thermoplastic Polyolefin (TPO) roofing membrane, surfacing, and components and accessories between deck and roofing membrane. Contractor to verify in field and match existing roofing system.

B. Infill and Patching Materials: Use infill and patching materials, including sheet and adhesive materials, flashings, roof surfacing, fasteners, adhesives, and accessories, matching existing membrane roofing system materials, unless otherwise indicated.

C. Temporary Roofing Materials: Selection of materials and design of temporary roofing is responsibility of Contractor. Select only materials that are compatible with existing roofing system. For pipe penetrations, use flashing materials and techniques as recommended by NRCA, utilizing portals mounted to curbs.

D. Recover Boards: Recover Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum substrate; 1/2 inch (12 mm) thick.
1. Fasteners: Factory-coated steel fasteners, No. 12 or 14, and metal or plastic plates listed in FMG's "Approval Guide," designed for fastening recover boards to deck.

E. Auxiliary Materials: Preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing membrane roofing system.
1. Insulation: Type used in original roof construction in thickness necessary to achieve satisfactory repair of membrane with no ponded water.
2. Wood Blocking and Nailers: As specified in Section 06 10 53.
3. Mechanical Fasteners and Disks: Appropriate for purpose intended and approved by UL or FM; length required for thickness of materials, fluoropolymer finish complete with disks; manufacturer as required by membrane manufacturer.

07 42 52 - ROOF SCREEN AND WALL PANELS

A. Includes fixed extruded screenwall vision barriers, structural supports, and attachment brackets.

B. Submitals:
1. Product data.
2. Shop drawings.
3. Samples for materials and colors.
4. Delegated Design Submittal: Signed and sealed by licensed engineer licensed to practice in the state where the project is located, including analysis data.

C. Performance Requirements: Design all materials to withstand wind and snow loads as required by the applicable building code.
1. Maximum allowable deflection for the louver strucutral members to be L/180 or 3/4 inch (19 mm) whichever is less.
2. Maximum allowable deflection for the louver blades to be L/120 or 1/2 inch (12 mm) across the weak axis, whichever is less.

D. Manufacturers:
1. Products: Vision Barrier Screens by Construction Specialties, Inc.
2. Pattern: Vert-a-Cade 301.
3. Blade Size: minimum 0.068 inch (1.7 mm) thick and spaced approximately 6-3/4 inches (171 mm) on center. Blades to be nominal 4 inches (102 mm) deep.

E. Materials:
1. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, 6036-T6 or 6061-T6.
2. Aluminum Sheet: ASTM B209/B209M, Alloy 1100, 3003, or 5005.

F. Finishes: Provide high-performance organic finish, two-coat PVDF fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by wieght in both color coat and top coat for exterior installations.
1. Prepare, pretreat,and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color: #543 "Medium Bronze".
3. Finish thickness to 1.5 to 3.0 mils.
4. Provide 20 year finish warranty.

G. Fasteners: Provide Type 304 stainless steel fasteners complying with ASTM A153/A153M.
1. Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated, and capable of withstanding design loads.
2. Post-Installed Anchors: Torque-controlled expansion achors capable of sustaining, without failure, a load equal to six times the load imposed with installed in unit masonry and four times the load imposed when installed in concrete as determined by testing according to ASTM E488/E488M.
3. Provide concealed fasteners for interconnecting railing componnent and for attached them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.

H. Fabrication: Provide screenwalls, structural supports, and accessories as shown in Drawings. Materials, sizes, depths, arrangements, and material thickness to be as indicated or as required for optimal performance with respect to strength, durability, and uniform appearance.
1. Screenwall to be mechanically assembled using stainless steel or aluminum fasteners..
2. Screenwall blades to be supported and lined-up with heavy-gauge extruded aluminum blade braces positively interlocked to each blade and mechanically secured to extruded aluminum supports.
3. Aluminum channel supports fixed directly to horizontal steel supports with extruded aluminum clip angle..
4. Material shipped knocked-down for field assembly by the installer.
5. Support braces and mounting clips to be finished in two-coat PVDF fluoropolymer finish, color "Black".

07 54 23 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

A. General Performance: Installed roofing system and flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

D. Thermal Envelope (On Metal Deck W/O Insulated Concrete): Design, fabricate and install insulated membrane roofing system with continuous insulation to provide a thermal envelope.
1. Provide thickness of insulation required to achieve a minimum effective thermal R-value of 20; U value of 0.05.
2. Average R-Value calculations are not acceptable.

E. Roofing System Assemblies: Provide the following roofing system assemblies complete with fasteners and accessories to comply with performance criteria:
1. Type A (On Insulated Concrete and Concrete Deck): Complete TPO assembly, including thermoplastic polyolefin sheet, flashing, edge lap sealant, substrate membrane adhesive, mastics, thinners, sealers, release agents, sheet activators, sheet primers, vented base sheet, tapered insulation, cover board, membrane termination bars, vent and pipe clamping rings, fasteners and other accessories recommended by roof membrane manufacturer for a complete system.
2. Type B (On Metal Deck with Insulated Concrete): Complete TPO assembly, including thermoplastic polyolefin sheet, flashing, edge lap sealant, substrate membrane adhesive, mastics, thinners, sealers, release agents, sheet activators, sheet primers, vented base sheet and tapered insulation, cover board, membrane termination bars, vent and pipe clamping rings, fasteners and other accessories recommended by roof membrane manufacturer for a complete system.
3. Type C (On Metal Deck): Complete TPO assembly, including thermoplastic polyolefin sheet, flashing, edge lap sealant, substrate membrane adhesive, mastics, thinners, sealers, release agents, sheet activators, sheet primers and insulation board, tapered insulation, sheathing board, cover board, vapor barrier, membrane termination bars, vent and pipe clamping rings, fasteners and other accessories recommended by roof membrane manufacturer for a complete system.

F. Auxiliary Roofing Materials: Materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
1. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as TPO sheet.
2. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
3. Roof Vents: As recommended by roof membrane manufacturer.
4. Bonding Adhesive: Manufacturer's standard.
5. Vented Base Sheet: ASTM D4897/D4897M, Type II; nonperforated, asphalt-impregnated fiberglass reinforced, with mineral granular patterned surfacing on bottom surface.
6. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
7. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
8. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

G. Substrate Boards: For metal deck only.
1. ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch (16 mm) thick.
2. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

H. Vapor Retarder: For insulated concrete deck only.
1. SBS-Modified Bitumen Type I, Glass-Fiber-Mat Base Sheet: ASTM D6163/D6163M, Type I, Grade S, SBS-modified asphalt sheet, reinforced with glass fibers, smooth surfaced; suitable for cold adhesive.
2. Cold-Applied Trichloroethylene Asphalt Adhesive: ASTM D3019/D3019M, Type III, roof membrane manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with roofing membrane.
   a. Cold-Applied Trichloroethylene Asphalt Adhesive: ASTM D3019/D3019M, Type III, roof membrane manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with roofing membrane.
   b. Surface: Smooth, flat and with manufacturer's standard clear acrylic coating on both sides.

I. Underlayment Materials:
1. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
   a. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 degrees F (116 degrees C).
   b. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 degrees F (minus 29 degrees C).
2. Slip Sheet: Rosin-sized building paper, 3 pounds/100 sq.ft (0.16 kg/sq.m) minimum.

J. Miscellaneous Materials: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
1. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
   a. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
   b. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
   c. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329/F2329M.
2. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (12 mm) wide and 1/8 inch (3 mm) thick.
3. Elastomeric Sealant: ASTM C920, elastomeric polyurethane or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

K. Roof Insulation: (For metal deck only) Preformed roof insulation boards manufactured or approved by TPO roof membrane manufacturer, approved for use in FM Approvals' RoofNav-listed roof assemblies. Where total insulation thickness exceeds 2-inches, insulation must be applied in 2-layers minimum with joints staggered at each layer.
1. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
2. Compressive Strength: 20 psi (138 kPa).
3. Size: 48 by 96 inch (1220 by 2440 mm).
4. Thickness:
   a. Base Layer: 1-1/2 inches (38 mm).
   b. Upper Layer: As required, to achieve scheduled R-Value.
5. Tapered Insulation: Provide factory-tapered insulation boards.
   a. Material: Match roof insulation.
   b. Minimum Thickness: 1/4 inch (6 mm).
   c. Slope:
      1) Roof Field: 1/4 inch per foot (1:48) unless otherwise indicated on Drawings.
      2) Saddles and Crickets: 1/2 inch per foot (1:24) unless otherwise indicated on Drawings.

L. Insulation Accessories: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
1. Fasteners: Factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate boards roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
2. Insulation Adhesive: Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
3. Cover Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch (13 mm) thick, factory primed.

M. Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer.
1. Size: Approximately 36 by 60 inches (914 by 1524 mm).
2. Color: Contrasting with roof membrane.

07 62 00 - SHEET METAL FLASHING AND TRIM

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

C. Sheet Metals: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
1. Aluminum Sheet: ASTM B209/B209M, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
   a. As-Milled Finish: Standard one-side bright.
   b. Factory Prime Coating: Where painting after installation is required, pretreat mill finish, apply light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil (0.005 mm).
2. Stainless-Steel Sheet: ASTM A240/A240M, Type 316, dead soft, fully annealed; with smooth, flat surface.
   a. Finish: 2D (dull, cold rolled).
3. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 (Z275) coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation, Grade 40 (Grade 275); prepainted by coil-coating process to comply with ASTM A 755/A 755M.
   a. Surface: Smooth, flat and with manufacturer's standard clear acrylic coating on both sides.

D. Underlayment Materials:
1. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
   a. Thermal Stability: ASTM D 1970; stable after testing at 240 degrees F (116 degrees C).
   b. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 degrees F (29 degrees C).
2. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

E. Miscellaneous Materials: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufac

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8. Blocks: Intumescent flexible block. Non-curing, reusable solution for medium to large openings. No compression required.
9. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
10. Foams: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
11. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.
    a. Grade: Pourable, self-leveling, formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions and spray mastic formulation for use with a power sprayer. For use in top of wall joints, edge of slab and expansion joints.
12. Firestop Sleeve Device: Factory-assembled sleeves formed from galvanized steel and lined with intumescent material designed to fit specific diameter of penetration.
13. Polyurethane Firestop Foam: Two-component polyurethane foam created through chemical reaction of polyol, water, and polyisocyanurate, plus flame retardants and other additives (all included in the polyol component). Foam cures within one minute at room temperature to produce non-shrinking smoketight firestopping system and does not require additional firestop coating.

D. Penetration Firestopping Schedule:
1. Where UL classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ. Equivalent approved systems by the following are also acceptable:
    a. Intertek Group-listed systems designs in Intertek Group's "Directory of Listing Building Products" under "Firestop Systems".
    b. FM Global-approved systems designs listed in FM Global's "Building Materials Approval Guide" under "Wall and Floor Penetration Firestops".
    c. Engineered Judgements by firestopping manufacturer meeting the required rating.
2. Penetration Firestopping Systems with No Penetrating Items: Acceptable UL-Classifed System with CAJ/CBJ/FA 0000 Series or other systems meeting the fire and smoke ratings specified or indicated on Drawings. Fill materials, one or more of the following:
    a. Latex sealant.
    b. Silicone sealant.
    c. Acrylic sealant.
    d. Intumescent putty.
    e. Mortar.
    f. Preformed intumescent blocks/plugs.
    g. Pillows/bags.
3. Firestop Systems for Pipes, Plastic or Metal, Conduit in Vertical Runs, Installed Through Firestop Devices: Acceptable UL-Classified Systems with FA 1000 series or other systems meeting the fire and smoke ratings specified or indicated on Drawings. Firestop devices, one of the following:
    a. Cast-in firestop devices.
    b. Drop-in devices.
4. Penetration Firestopping Systems for Metallic Pipes, Conduit, or Tubing: Acceptable UL-Classified Systems with CAJ/CBJ/FA 1000 series or other systems meeting the fire and smoke ratings specified or as indicated on Drawings. Fill materials, one or more of the following:
    a. Latex sealant.
    b. Silicone sealant.
    c. Acrylic sealant.
    d. Intumescent putty.
    e. Mortar.
    f. Polyurethane firestop foam.
5. Penetration Firestopping Systems for Nonmetallic Pipe, Conduit, or Tubing: Acceptable UL-Classified Systems with CAJ/CBJ/WL 2000 series or other systems meeting the fire and smoke ratings specified or as indicated on Drawings. Fill materials, one or more of the following:
    a. Intumescent sealant.
    b. Intumescent putty.
    c. Intumescent wrap strips.
    d. Firestop device.
    e. Firestop sleeve device.
    f. Latex sealant.
6. Penetration Firestopping Systems for Electrical Cables: Acceptable UL-Classified Systems with CAJ/CBJ/WL 3000 series or other systems meeting the fire and smoke ratings specified or as indicated on Drawings. Fill materials, one or more of the following:
    a. Intumescent sealant.
    b. Latex sealant.
    c. Pillows/bags.
    d. Intumescent putty.
    e. Silicone foam.
7. Penetration Firestopping Systems for Cable Trays with Electrical Cables: Acceptable UL-Classified Systems with CAJ/CBJ/WL 4000 series or other systems meeting the fireand smoke ratings specified or as indicated on Drawings. Fill materials, one or more of the following:
    a. Intumescent sealant.
    b. Latex sealant.
    c. Pillows/bags.
    d. Intumescent putty.
    e. Silicone foam.
8. Penetration Firestopping Systems for Insulated Pipes: Acceptable UL-Classified Systems with CAJ/CBJ/WL 5000 Series or other systems meeting the fire and smoke ratings specified or as indicated on Drawings. Fill materials, one or more of the following:
    a. Intumescent sealant.
    b. Silicone foam.
    c. Intumescent wrap strips.
    d. Pre-formed intumescent blocks.
    e. Latex sealant.
9. Penetration Firestopping Systems for Miscellaneous Electrical Penetrants: Acceptable UL-Classified Systems with CAJ/CBJ/WL 6000 series or other systems meeting the fire and smoke ratings specified or as indicated on Drawings. Fill materials, one or more of the following:
    a. Intumescent sealant.
    b. Latex sealant.
    c. Intumescent putty.
    d. Mortar.
10. Penetration Firestopping Systems for Miscellaneous Mechanical Penetrants: Acceptable UL-Classified Systems with CAJ/CBJ/WL 7000 Series or other systems meeting the fire and smoke ratings specified or as indicated on Drawings. Fill materials, one or more of the following:
    a. Intumescent sealant.
    b. Latex sealant.
    c. Mortar.
    d. Acrylic sealant.
    e. Silicone sealant.
11. Penetration Firestopping Systems for Groupings of Penetrants: Acceptable UL-Classified Systems with CAJ/CBJ/WL 8000 Series or other systems meeting the fire and smoke ratings specified or as indicated on Drawings. Fill materials, one or more of the following:
    a. Latex sealant.
    b. Mortar.
    c. Intumescent wrap strips.
    d. Firestop device.
    e. Intumescent composite sheet.
    f. Pre-formed intumescent blocks.
    g. Polyurethane firestop foam.

E. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
1. Joints in or between Fire-Resistance-Rated Construction: In accordance with ASTM E1966 or UL 2709. Fire-resistance rating equal to or exceeding fire-resistance rating of the wall, floor, or roof in or between which it is installed.
2. Joints in Smoke Barriers: In accordance with UL 2709 based on testing at positive pressure differential of 0.30-inch wg (74.7 Pa). L-rating not exceeding 5.0 cfm/ft (0.00775 cu.m/s x m) of joint at both ambient and elevated temperatures.
3. Joints at Intersection Between Rated Wall Assemblies and Nonrated Wall Assemblies: In accordance with ASTM E2837.

F. Joint Firestopping Schedule:
1. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product category XHBN or category XHDG. Equivalent approved systems by the following are acceptable:
    a. Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's "Directory of Listed Building Products" under product category Expansion/Seismic Joints or Firestop Systems.
    b. Engineered Judgements by firestopping manufacturer meeting the required rating.
2. Wall-to-Wall Joint Firestopping Systems: UL-classified WW-D/S systems or other systems meeting the fire and smoke ratings specified or as indicated on Drawings.
    a. Assembly Rating and Nominal Joint Width: As indicated on Drawings.
    b. Movement Capabilities: Class II compression or extension.
3. Floor-to-Wall Joint Firestopping Systems: UL-classified FW-D/S systems or other systems meeting the fire and smoke ratings specified or as indicated on Drawings.
    a. Assembly Rating and Nominal Joint Width: As indicated on Drawings.
    b. Movement Capabilities: Class II compression, extension, or horizontal shear.
4. Head-of-Wall Fire-Resistive Joint Firestopping Systems: UL-classified HW-D/S systems or other systems meeting the fire and smoke ratings specified or as indicated on Drawings.
    a. Assembly Rating and Nominal Joint Width: As indicated on Drawings.
    b. Movement Capabilities: Class II compression or extension.
5. Bottom-of-Wall Joint Firestopping Systems: UL-classified BW-D/S systems or other systems meeting the fire and smoke ratings specified or as indicated on Drawings.
    a. Assembly Rating and Nominal Joint Width: As indicated on Drawings.
    b. Movement Capabilities: Class II compression or extension.
6. Wall-to-Wall Joint Firestopping Systems Intended for Use as Corner Guard: UL-classified CG-D/S systems or other systems meeting the fire and smoke ratings specified or as indicated on Drawings.
    a. Assembly Rating and Nominal Joint Width: As indicated on Drawings.
    b. Movement Capabilities: Class II compression or extension.

G. Mold Resistance of Firestopping: Provide penetration firestopping systems with mold and mildew resistance rating of 0 as determined by ASTM G21.

H. Firestopping flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determine per ASTM E84.

I. Firestopping sealants shall have VOC content of 250 g/L or less.

J. Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required.

K. Identify firestopping with legible metal of plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (152 mm) of firestopping so labels are visible to anyone seeking to remove firestopping system. Use mechanical fasteners or self-adhering labels with adhesive capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
1. Words similar to "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage".
2. Contractor's name, address, and telephone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

L. Installation: Comply with manufacturer's written installation instructions and published drawings for products and applications.
1. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
    a. After installing fill materials and allow them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
2. Install fill materials by proven techniques to produce the following results:
    a. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items to achieve required fire ratings.
    b. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
    c. For fill materials that will remain exposed after completing the work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

07 92 00 - JOINT SEALANTS

A. Joint Sealants - General:
1. Compatibility: Provide sealants, joint fillers, and related materials that are compatible with one another and with substrates and other materials to which they will be exposed in the joint system.
2. Grade: For each application, provide grade of sealant complying with ASTM C920, and as recommended by manufacturer for indicated conditions, to achieve best possible performance. Types, grades, classes, and uses specified are for normal conditions.
3. Colors: As selected from manufacturer's full line, unless otherwise specified.

B. Sealant Scope:
1. Exterior Joints: If applicable or required by indicated work scope, seal open joints, whether or not the joint is indicated on Drawings, unless specifically indicated not to be sealed.
    a. Expansion and control joints.
    b. Joints between different exposed materials.
2. Do not seal the following types of joints:
    a. Intentional weepholes in masonry.
    b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
    c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
    d. Joints where installation of sealant is specified in another Section.
    e. Joints between suspended panel ceilings/grid and walls.

C. Joint Sealant Application: Exterior joints in vertical surfaces and horizontal non-traffic surfaces (Designation S-GP):
1. Joint Locations: Joints, between metal panels, Joints between different materials, and other joints as indicated in Drawings.
2. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
3. Manufacturers:
    a. Dow Corning Corporation; 790.
    b. GE Construction Sealants; Momentive Performance Materials Inc; SCS2700 SilPruf LM.
    c. Tremco Construction Products Group Spectrem 1.
    d. Sika Corporation; Sikasil WS-290

D. Joint Selant Application: Exterior joints in horizontal traffic surfaces (Designation U-TE):
1. Joint Locations: As indicated on Drawings.
2. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.
3. Manufacturers:
    a. Bostik, Inc; Iso-Flex 880 GB.
    b. Master Builders Solutions; MasterSeal-SL-2.
    c. Pecora Corporation; Urexpan NR 200.
    d. Sherwin-Williams Company (The); Stampede-2SL.
    e. Tremco, Inc; THC 900/901.

E. Joint Sealant Application: Concealed mastics (Designation BU):
1. Joint Locations: As indicated on Drawings.
2. Butyl-Rubber-Based Joint Sealants: ASTM C1311.
3. Manufacturers:
    a. Pecora Corporation; BC-158.
    b. Tremco Inc; Butyl.
    c. Sherwin-Williams Company (The); White Lightning Butyl Rubber Caulk.

DIVISION 08 - OPENINGS

08 11 13 - HOLLOW METAL DOORS AND FRAMES

A. Hollow Metal Frames: Comply with frame requirements specified in ANSI A250.8 - SDI-100, Level 2, 14 gauge, 0.067 inch (1.7 mm) minimum, with minimum A60 (ZF180) coating.
1. Construction: Face welded.
2. Finish: Primed and field painted, refer to schedule in Drawings.

B. Exterior Standard Steel Doors: Comply with ANSI/SDI A250.8, Level 3; ANSI/SDI A150.4, Level A.
1. Thickness: 1-3/4 inches (44 mm).
2. Face: Metallic coated sheet steel, 16 gauge, 0.053 inch (1.3 mm) minimum, with minimum A60 (ZF180) coating.
3. Edge Construction: Model 1, full flush.
4. Edge Bevel: Provide manufacturer's standard bevel or square edges.
5. Top-Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
    a. For Outswinging Doors: Flush with top of faces and edges.
6. Bottom Edges: Close bottom edges of doors where required for weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
7. Core: Manufacturer's standard polyurethane.
    a. Reinforcing: 20 gauge channel-shaped or hat-shaped vertical stiffeners at 6 inches (152 mm) on centers, welded to both sheets.
    b. Inulating Value: U-value of 0.38, when tested in accordace with ASTM C1363.
8. Finish: Primed and field painted, refer to schedule in Drawings.

C. Installation:
1. Install doors and frames in accordance with manufacturer's instructions and specified quality standards.
2. Set frames accurately in position; plumb, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed work.
3. Floor Anchors: Secure with post-installed expansion anchors.
4. Solidly pack mineral fiber insulation inside frames.
5. Adjust hollow metal frames to the following tolerances:
    a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch (1.6 mm), maesured at jambs at floor.
6. Fit and adjust hollow metal doors accurately in frames, within clearances specified below.
    a. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
7. Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitve primer.

08 71 00 - DOOR HARDWARE

A. Door Hardware - General
1. See door schedule on Drawings for hardware sets and other requirements.
2. Provide products indicated to match existing.
    a. Provide all items of a single type of the same model by the same manufacturer in accordance with hardware sets indicated.
3. Provide all hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.
4. It is the intent that each door have a complete hardware set package including door hinges, strike plates, silencers, etc. (including smoke seals at rated assemblies, if any) in addition to those special hardware items scheduled on Drawings.
5. Coordination:
    a. Coordinate the manufacture, fabrication, and installation of products onto which door hardware will be installed.
    b. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
    c. Convey Architect's keying requirements to manufacturers.

B. Provide door hardware products that comply with the following:
1. Accessibility: ADA Standards and ICC A117.1.
2. All Hardware: ANSI/BHMA Certified; Grade 1 or 2 as scheduled, listed in BHMA Directory of Certified Products.
3. Provide hardware that enables door assembly to comply with air leakage requirements of the applicable code.
4. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.
5. Comply with applicable requirements of BHMA A156 Series standards, except as otherwise indicated.
6. Provide only hardware which has been tested and listed by UL or FM for types and sizes of doors indicated, and which complies with requirements of scheduled door and frame labels.

C. Hardware Sets:
1. **Set: 1.0:**
   Door: 001

3	Hinge, Full Mortise	TA 2714 (NRP)	US26D	MK
1	Passage Latch	28 10U15 LL	US26D	SA
1	Door Closer	(P) 7500	689	NO
1	Wall Stop	403	US26D	RO
1	Gasketing	S88D @ Head and Jambs		PE

DIVISION 09 - FINISHES

09 90 00 - PAINTING AND COATING

A. Acceptable Manufacturers:
1. Sherwin-Williams Company: www.sherwin-williams.com.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
    a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
    b. Architectural coatings VOC limits of Owner.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Sheens: Provide the sheens as specified on Drawings; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: As scheduled on Drawings.
1. Notify Architect for review of first wall to be painted of each color for approval of color, texture and coverage. Upon approval, the wall shall establish the standard of quality for other installations of the same paint. Provide field mock-ups for review all at one time.
2. Extend colors to surface edges; colors may change at any edge as directed by Architect.
3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under, unless otherwise noted on Drawings. Coordinate with Architect if questions arise.

E. Installation/Application:
1. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
2. Apply products in accordance with manufacturer's written instructions.
3. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
4. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
5. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
6. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
7. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
8. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

This sheet of drawings has not been reviewed for code compliance.

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ARCHITECT

PROJECT

Health ONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU

THE MEDICAL CENTER OF AURORA
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AURORA, COLORADO 80012

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
2	ISSUE FOR PERMIT	08.08.23
1	90% ISSUE FOR PERMIT	07.14.23

Job Number 222319.000

TITLE

SPECIFICATIONS

SHEET NUMBER

G02-03

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GENERAL STRUCTURAL NOTES

1.0 STRUCTURAL ENGINEERING GENERAL REQUIREMENTS:

THE STRUCTURAL SCOPE OF WORK IS LIMITED TO THE NEW ROOF TOP STEEL DUNNAGE, SCREEN WALL SUPPORT, AND GUARDRAIL.

BUILDING CODE:

2021 EDITION OF THE INTERNATIONAL BUILDING CODE / ASCE/SEI 7-16

DESIGN CRITERIA / LOADS:

ALL COMPONENTS REQUIRING DESIGN BY THE CONTRACTOR AND THEIR SUBCONTRACTORS SHALL USE THE DESIGN CRITERIA DEFINED BELOW. ALL FORCES AND PRESSURES LISTED BELOW SHALL BE THE MINIMUM PERMISSIBLE UNLESS SUBSTANTIATING CALCULATIONS USING THE DESIGN CRITERIA SHOWN ARE PROVIDED TO THE FOR REVIEW AND ACCEPTANCE PRIOR TO FABRICATION.

RISK CATEGORY = IV

ROOF:
ROOF LIVE LOAD = 20 PSF (NON-REDUCIBLE)

SNOW:
GROUND SNOW LOAD, Pg = 40 PSF
ROOF SNOW LOAD, Pf = 36.3 PSF (NON-REDUCIBLE)
SNOW DRIFT PER ASCE-7 (Ce = .9, Ct = 1.2, Cs = 1.0)
IMPORTANCE FACTOR, IV = 1.2

WIND DESIGN DATA:
RISK CATEGORY = IV
ULTIMATE DESIGN WIND SPEED, Vult = 120 MPH (3 SEC. GUST)
EQUIVALENT NOMINAL DESIGN WIND SPEED, Vasd = 90 MPH (3 SEC. GUST, USING I = 1.15)
EXPOSURE C
MEAN ROOF HEIGHT USED FOR DESIGN, h = 65 FT
Kd = 0.85
Kzt = 1.0
VELOCITY PRESSURE CONSTANT = 0.83 X 0.00256 = 0.00213 (AMBIENT AIR DENSITY ADJUSTMENT)
INTERNAL PRESSURE COEFFICIENT, GCpi = ±0.18
COMPONENTS AND CLADDING DESIGN WIND PRESSURES:
STRENGTH DESIGN: -32.5 PSF (WALL, FIELD); -59.5 PSF (WALL, CORNER);
-47.5 PSF (ROOF, ZONE 1); -74.6 PSF (ROOF, ZONES 2);
-101.6 PSF (ROOF, ZONE 3); - (BASED ON 10 SF)
ALLOWABLE STRESS DESIGN: -19.5 PSF (WALL, FIELD); -35.7 PSF (WALL, CORNER);
-28.5 PSF (ROOF, ZONE 1); -44.7 PSF (ROOF, ZONES 2);
-61.0 PSF (ROOF, ZONE 3); - (BASED ON 10 SF)

SEISMIC DESIGN DATA:
RISK CATEGORY = IV
SEISMIC IMPORTANCE FACTOR, Ie = 1.5
Ss = 0.199, S1 = 0.056
SITE CLASS: D
SDS = 0.212, SD1 = 0.09
SEISMIC DESIGN CATEGORY C

COORDINATION:

THESE DRAWINGS ARE A SCHEMATIC REPRESENTATION OF THE STRUCTURAL SYSTEM AND REQUIREMENTS FOR THE PROJECT, AND ARE ONLY A PORTION OF THE COMPLETE CONTRACT DOCUMENTS. THE STRUCTURAL SYSTEMS REQUIRE CAREFUL COORDINATION BETWEEN ALL STRUCTURAL COMPONENTS AND MATERIALS SHOWN IN THESE STRUCTURAL DRAWINGS, AND CAREFUL COORDINATION OF INFORMATION SHOWN ON OTHER DISCIPLINES' DRAWINGS IN ORDER TO BE CONSTRUCTED. THE CONTRACTOR SHALL COORDINATE CONSTRUCTION OPERATIONS WITH ALL SUBCONTRACTORS AND OTHER RELATED ENTITIES TO ENSURE EFFICIENT AND ORDERLY INSTALLATION OF EACH PART OF THE WORK. EACH CONTRACTOR SHALL COORDINATE ITS OPERATIONS WITH THE OPERATIONS OF OTHER CONTRACTORS FOR PROPER INSTALLATION, CONNECTION AND OPERATION.

EXISTING CONDITIONS:

CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS PRIOR TO CONSTRUCTION. ANY VARIANCE FROM CONDITIONS SHOWN ON THESE DRAWINGS MUST BE BROUGHT TO THE ATTENTION OF THE ENGINEER IMMEDIATELY.

SHOP DRAWINGS/SUBMITTALS:

SHOP DRAWINGS SHALL BE SUBMITTED FOR ALL STRUCTURAL ITEMS IN ADDITION TO ITEMS REQUIRED BY ARCHITECTURAL SPECIFICATIONS. THE STRUCTURAL SHOP DRAWING REVIEW IS INTENDED TO HELP THE ENGINEER VERIFY THE DESIGN CONCEPT. THE CONTRACTOR SHALL REVIEW ALL SHOP DRAWINGS PRIOR TO SUBMITTAL. ITEMS NOT IN ACCORDANCE WITH CONTRACT DOCUMENTS SHALL BE IDENTIFIED UPON HIS REVIEW AND REVISED PRIOR TO FORWARDING TO ARCHITECT. THE STRUCTURAL SHOP DRAWINGS WILL BE RETURNED FOR RESUBMITTAL IF A CURSORY REVIEW SHOWS MAJOR ERRORS WHICH SHOULD HAVE BEEN FOUND BY THE CONTRACTOR'S CHECKING.

VERIFY ALL DIMENSIONS WITH ARCHITECT AND ALL FINISHED GRADE WITH CIVIL DRAWINGS.

ANY CHANGES, SUBSTITUTIONS, OR DEVIATIONS FROM CONTRACT DOCUMENTS SHALL BE CLOUDED BY MANUFACTURER OR FABRICATOR. ANY OF THE AFOREMENTIONED WHICH ARE NOT CLOUDED OR FLAGGED BY SUBMITTING PARTIES, SHALL NOT BE CONSIDERED APPROVED AFTER ENGINEER'S REVIEW, UNLESS NOTED ACCORDINGLY.

THE ENGINEER HAS THE RIGHT TO APPROVE OR DISAPPROVE ANY CHANGES TO CONTRACT DOCUMENTS AT ANY TIME BEFORE OR AFTER SHOP DRAWING REVIEW.

THE SHOP DRAWINGS DO NOT REPLACE THE CONTRACT DOCUMENTS. ITEMS OMITTED OR SHOWN INCORRECTLY AND ARE NOT FLAGGED BY THE STRUCTURAL ENGINEER OR ARCHITECT ARE NOT TO BE CONSIDERED CHANGES TO CONTRACT DOCUMENTS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO MAKE SURE ITEMS ARE CONSTRUCTED TO CONTRACT DOCUMENTS.

THE ADEQUACY OF ENGINEERING DESIGNS AND LAYOUT PERFORMED BY OTHERS RESTS WITH THE DESIGNING OR SUBMITTING AUTHORITY.

REVIEWING IS INTENDED ONLY AS AN AID TO THE CONTRACTOR IN OBTAINING CORRECT SHOP DRAWINGS. RESPONSIBILITY FOR CORRECTNESS SHALL REST WITH THE CONTRACTOR.

REPRODUCTION OF ANY PORTION OF THE CONTRACT DOCUMENTS FOR USE IN SUBMITTALS IS NOT PERMITTED AND MAY RESULT IN REJECTION.

GENERAL REQUIREMENTS:

ENTIRE CONTRACT DOCUMENTS SHALL BE USED TO BUILD BUILDING. SOME CRITICAL ITEMS REQUIRED BY OTHER DISCIPLINES MAY NOT BE SHOWN ON STRUCTURAL DRAWING (i.e. WALL, FLOOR AND ROOF OPENING, ARCHITECTURAL, MECHANICAL AND PLUMBING LOADS, SUPPORT PLATES ETC.). IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO PERFORM CAREFUL COORDINATION BETWEEN TRADES DURING CONSTRUCTION.

WHERE DISCREPANCIES OCCUR BETWEEN PLANS, DETAILS, GENERAL STRUCTURAL NOTES AND SPECIFICATIONS, THE MORE STRINGENT REQUIREMENTS SHALL GOVERN. SPECIFIC DETAILS ON DRAWINGS SHALL TAKE PRECEDENCE OVER TYPICAL DETAILS AND GENERAL STRUCTURAL NOTES. BRING ALL DISCREPANCIES TO THE ATTENTION OF THE ENGINEER IMMEDIATELY UPON DISCOVERY.

DO NOT SCALE DRAWINGS FOR THE PURPOSE OF ESTABLISHING DIMENSIONS OF ANY KIND.

ALL PROPRIETARY ITEMS, MATERIALS AND COMPONENTS SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS, GUIDELINES AND/OR RECOMMENDATIONS.

ITEMS SHOWN BY OTHER DISCIPLINES WITH REFERENCE TO STRUCTURAL DRAWING BUT NOT SHOWN ON THESE STRUCTURAL DOCUMENTS SHALL BE CONSIDERED DESIGN BUILD ITEMS AND COSTS REQUIRED FOR THESE ITEMS SHALL BE INCLUDED IN CONTRACTOR'S PRICING EXERCISES AND BID. CONTRACTOR SHALL SUBMIT DESIGN BY OTHERS FOR REVIEW.

THE STRUCTURAL CONSTRUCTION DOCUMENTS REPRESENT THE FINISHED STRUCTURE. THEY DO NOT INDICATE THE METHOD OF CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE ALL MEASURES NECESSARY TO PROTECT THE STRUCTURE DURING CONSTRUCTION. SUCH MEASURES SHALL INCLUDE, BUT NOT BE LIMITED TO, BRACING, SHORING FOR LOADS DUE TO CONSTRUCTION EQUIPMENT, ETC. THE STRUCTURAL ENGINEER SHALL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S MEANS, METHODS, TECHNIQUES, SEQUENCES FOR PROCEDURE OF CONSTRUCTION, OR THE SAFETY PRECAUTIONS AND THE PROGRAMS INCIDENT THERETO, NOR SHALL OBSERVATION VISITS TO THE SITE INCLUDE INSPECTION OF THESE ITEMS.

CONSTRUCTION MATERIALS SHALL BE SPREAD OUT IF PLACED ON FRAMED CONSTRUCTION. LOAD SHALL NOT EXCEED THE DESIGN LIVE LOAD PER SQUARE FOOT.

WHERE REFERENCE IS MADE TO VARIOUS TEST STANDARDS FOR MATERIALS, SUCH STANDARDS SHALL BE THE LATEST EDITION AND/OR ADDENDA.

ESTABLISH AND VERIFY ALL OPENINGS AND INSERTS FOR ARCHITECTURAL, MECHANICAL, PLUMBING AND ELECTRICAL WITH APPROPRIATE TRADES, DRAWINGS AND SUBCONTRACTORS PRIOR TO CONSTRUCTION. SHOW PENETRATIONS AND BLOCKOUT LOCATIONS ON SHOP DRAWINGS AND OTHER SUBMITTALS PRIOR TO ENGINEER'S REVIEW.

OPTIONS ARE FOR CONTRACTOR'S CONVENIENCE. IF HE CHOOSES AN OPTION, CONTRACTOR SHALL BE RESPONSIBLE FOR ALL NECESSARY CHANGES AND SHALL COORDINATE ALL DETAILS.

NOTES AND DETAILS ON DRAWINGS SHALL TAKE PRECEDENCE OVER GENERAL STRUCTURAL NOTES AND TYPICAL DETAILS. TYPICAL DETAILS MAY NOT NECESSARILY BE CUT ON PLANS, BUT APPLY UNLESS NOTED OTHERWISE. WHERE NO DETAILS ARE SHOWN, CONSTRUCTION SHALL CONFORM TO SIMILAR WORK ON THE PROJECT.

DETAILS INDICATED AS TYPICAL (i.e., TYP) APPLY TO ALL SIMILAR CONDITIONS.

SOME DETAILS ARE DEFINED AS TYPICAL TO THE PROJECT AND NOT NECESSARILY CUT OR CALLED OUT ON PLANS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO APPLY AND COORDINATE THESE DETAILS WITH CONDITIONS DEFINED THROUGHOUT THE CONTRACT DOCUMENTS AS REQUIRED.

ALL DIMENSIONS SHOWN (INCLUDING ELEVATIONS) ON STRUCTURAL DRAWINGS ARE TO ASSIST CONTRACTOR IN VERIFICATION.

CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFICATION OF ALL DIMENSIONS WITH ARCHITECTURAL DRAWINGS PRIOR TO START OF CONSTRUCTION – RESOLVE ANY DISCREPANCY WITH THE ARCHITECT. CONTRACTOR SHALL COORDINATE ALL FINISHED GRADE ELEVATIONS SHOWN IN CIVIL DRAWINGS WITH MINIMUM FOOTING DEPTHS SHOWN IN STRUCTURAL DRAWINGS – NOTIFY ENGINEER OF ANY DISCREPANCY PRIOR TO START OF CONSTRUCTION.

ANY ENGINEERING DESIGN, PROVIDED BY OTHERS AND SUBMITTED FOR REVIEW, SHALL BEAR THE SEAL OF AN ENGINEER REGISTERED IN THE STATE OF THE PROJECT.

SUPPLIER OF ENGINEERED STRUCTURAL COMPONENTS (i.e. STEEL JOISTS, STAIRS, PRECAST ITEMS) SHALL BE RESPONSIBLE FOR COMPLETE DESIGN AND SHALL USE ENTIRE CONTRACT DOCUMENTS TO INCLUDE ALL LOADS AND DETAIL REQUIREMENTS FROM ALL DISCIPLINES. SUPPLIER SHALL PROVIDE ADDITIONAL MATERIAL REQUIRED TO MEET ALL THEIR REQUIREMENTS FOR INSTALLATION (i.e. WIDER BEARING PLATES, SHIMS, ERECTION BOLTS ETC.).

STRUCTURAL STEEL SUPPLIER SHALL FURNISH BOLTS FOR OSHA CONNECTIONS.

SPECIAL INSPECTION:

THE OWNER SHALL EMPLOY ONE OR MORE SPECIAL INSPECTORS OR AGENCIES WHO SHALL PROVIDE INSPECTIONS DURING CONSTRUCTION FOR THE ITEMS LISTED BELOW. THE CONTRACTOR SHALL COOPERATE WITH THE SPECIAL INSPECTOR AND SHALL FURNISH TOOLS, EQUIPMENT AND ASSISTANCE AS REQUESTED. THE CONTRACTOR SHALL NOTIFY THE INSPECTOR AT LEAST 24 HOURS PRIOR TO EXPECTED TIME FOR OPERATIONS REQUIRING TESTING OR INSPECTION SERVICES. THE INSPECTOR SHALL FAMILIARIZE HIMSELF WITH ALL APPLICABLE PORTIONS OF THE CONTRACT DOCUMENTS PERTAINING TO THE AREA OF INVESTIGATION PRIOR TO PERFORMING SERVICES. COMPENSATION FOR SPECIAL INSPECTION SERVICES SHALL BE PROVIDED BY THE OWNER.

THE ENGINEER IS NOT THE SPECIAL INSPECTOR, AND SHALL NOT PERFORM THESE SERVICES.

INSPECTION BY THE OWNER OR OWNER'S AGENT DOES NOT RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY TO PERFORM THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.

PER IBC SECTION 1704, SPECIAL INSPECTION IS REQUIRED FOR THE ITEMS DEFINED IN THE SPECIAL INSPECTION MATRIX FOR EACH TYPE OF CONSTRUCTION IN THESE STRUCTURAL CONSTRUCTION DOCUMENTS.

DUTIES AND RESPONSIBILITIES OF THE SPECIAL INSPECTOR:
A) THE SPECIAL INSPECTOR SHALL OBSERVE THE WORK ASSIGNED TO BE CERTAIN IT CONFORMS WITH THE APPROVED DESIGN DRAWINGS AND SPECIFICATION.
B) THE SPECIAL INSPECTOR SHALL FURNISH INSPECTION REPORTS TO THE BUILDING OFFICIAL, AND TO THE ENGINEER OR ARCHITECT OF RECORD. ALL DISCREPANCIES SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE CONTRACTOR FOR CORRECTION, THEN, IF UNCORRECTED, TO THE DESIGN AUTHORITY AND THE BUILDING OFFICIAL.
C) UPON COMPLETION OF THE WORK THE SPECIAL INSPECTOR SHALL COMPLETE AND SIGN THE APPROPRIATE FORMS CERTIFYING THAT TO THE BEST OF THEIR KNOWLEDGE THE WORK IS IN CONFORMANCE WITH THE APPROVED PLANS AND SPECIFICATIONS AND THE APPLICABLE WORKMANSHIP PROVISIONS OF THE CODE.

ALL TEST & INSPECTION REPORTS SHALL BE COPIED TO THE STRUCTURAL ENGINEER WITHIN 3 DAYS OF INSPECTION OR TEST.

3.0 CONCRETE:

POST INSTALLED ANCHORS TO CONCRETE:

THE INSTALLATION OF POST INTALLED ANCHORS SHALL BE INSPECTED IN ACCORDANCE WITH SECTION 1.3 OF ACI 318, AND THE GOVERNING BUILDING CODE. ANCHORS SHALL BE INSTALLED BY QUALIFIED PERSONNEL IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND THE MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII). THE FOLLOWING INSTALLATION CONDITIONS ARE REQUIRED:

NORMAL WEIGHT CONCRETE WITH A MIN f'c = 2500 PSI AND MAX f'c = 8000 PSI.
CONCRETE AT TIME OF ANCHOR INSTALLATION SHALL HAVE A MINIMUM COMPRESSION STRENGTH OF 2500 PSI.

ADHESIVE ANCHORS:

THE INSTALLATION OF ADHESIVE ANCHORS HORIZONTALLY OR UPWARDLY INCLINED TO SUPPORT SUSTAINED TENSION LOADS SHALL ONLY BE PERFORMED BY PERSONNEL CERTIFIED BY THE ACI/CRSI ADHESIVE ANCHOR INSTALLER CERTIFICATION PROGRAM. REFER TO THE SPECIAL INSPECTIONS MATRIX FOR ADDITIONAL TESTING AND INSPECTION REQUIREMENTS. THE FOLLOWING INSTALLATION CONDITIONS ARE REQUIRED:

ANCHORS SHALL MEET THE REQUIREMENTS OF ACI 355.4
ANCHORS SHALL BE INSTALLED IN HOLES DRILLED WITH A ROTARY IMPACT DRILL OR ROCK DRILL. CORE DRILLING IS NOT PERMITTED.
CONCRETE AT TIME OF ANCHOR INSTALLATION SHALL HAVE A MINIMUM AGE OF 21 DAYS.
CONCRETE TEMPERATURE AT TIME OF ANCHOR INSTALLATION SHALL BE AT LEAST 50 DEGREES F.
DRY USE CONDITION – UNSATURATED CONCRETE, INSTALLATION HOLE CONTAINS NO WATER.

ACCEPTABLE ADHESIVES:
HILTI HIT-HY 200 ADHESIVE
SIMPSON SET-XP ADHESIVE
DEWALT AC200+ ADHESIVE
DEWALT/POWERS PURE110+ ADHESIVE

TORQUE-CONTROLLED EXPANSION ANCHORS:

REFER TO SPECIAL INSPECTION MATRIX FOR TESTING AND INSPECTION REQUIREMENTS.

ACCEPTABLE TORQUE-CONTROLLED EXPANSION ANCHORS:
HILTI KWIK BOLT-TZ
SIMPSON STRONG-BOLT 2
DEWALT/POWERS POWER-STUD+SD2

CONCRETE SUBMITTALS:

THE FOLLOWING ITEMS SHALL BE SUBMITTED FOR REVIEW FOR THE LIMITED PURPOSE OF CHECKING FOR CONFORMANCE WITH INFORMATION GIVEN AND THE DESIGN CONCEPT EXPRESSED IN THE CONTRACT DOCUMENTS. REFER TO PROJECT SPECIFICATIONS FOR ADDITIONAL REQUIRED SUBMITTALS.

SHOP DRAWINGS: SUBMIT SHOP DRAWINGS FOR FABRICATION, BENDING AND PLACEMENT OF REINFORCEMENT STEEL. COMPLY WITH ACI DETAILING MANUAL, SP-66, AND PROVIDE 1/4" = 1'-0" SCALE ELEVATIONS OF ALL WALLS, BEAMS, GRADE BEAMS, STEM WALLS, TIE BEAMS, CORE WALLS AND OTHER VERTICAL WORK. SHOW ALL OPENINGS IN VERTICAL WORK, SLABS AND BEAMS; ALL POCKETS IN BEAMS AND WALLS; TOP AND BOTTOM ELEVATIONS OF MEMBERS, SECTIONS THROUGH COLUMNS, PILASTERS AND BEAMS; PLAN VIEW OF ALL WALLS AND BEAM/JOIST INTERSECTIONS; PLACING SEQUENCE FOR MULTIPLE LAYERS OF REINFORCING STEEL; LOCATIONS OF ALL CONSTRUCTION JOINTS. ALL OPENINGS SHALL BE REVIEWED BY THE CONTRACTOR PRIOR TO SUBMITTING DRAWINGS FOR REVIEW. SHOW SPECIAL REINFORCEMENT AT OPENINGS.

CERTIFICATION FOR ANCHORAGE INSTALLER
ANCHORAGE ICC APPROVAL
MIX DESIGNS
STEEL REINFORCEMENT SHOP DRAWINGS
FORMWORK SHOP DRAWINGS
WELDING CERTIFICATES
MATERIAL TEST REPORTS
MATERIAL CERTIFICATES
FIELD QUALITY CONTROL TEST AND INSPECTION REPORTS
COLD-WEATHER AND HOT-WEATHER PROCEDURES

5.0 METALS:

STRUCTURAL STEEL:

ALL WORK SHALL CONFORM TO THE LATEST EDITION OF AISC MANUAL OF STEEL CONSTRUCTION, AND LATEST EDITION OF AWS D1.1, UNLESS MORE STRINGENT REQUIREMENTS ARE DEFINED ELSEWHERE IN THE CONTRACT DOCUMENTS. UNLESS AN ACTIVITY OR DUTY IS SPECIFICALLY IDENTIFIED AS BEING PERFORMED BY THE PROJECT STRUCTURAL ENGINEER OF RECORD IN OSHA SUBPART R, IT WILL NOT BE PERFORMED BY THE ENGINEER. IT IS TO BE PERFORMED BY OTHERS.

ALL STRUCTURAL STEEL SHALL BE ASTM A992 (Fy = 50 KSI). ALL CHANNELS, ANGLES, AND PLATES SHALL BE ASTM A36 (Fy = 36 KSI). ALL PIPE STEEL SHALL BE ASTM A501 (Fy = 36 KSI) OR ASTM A53, TYPE E OR S, GRADE B (Fy = 35 KSI). ALL TUBE STEEL SHALL BE ASTM A500 (Fy = 46 KSI). ALL ANCHOR RODS SHALL BE ASTM F1554, GRADE 36 UNLESS NOTED OTHERWISE.

ALL REFERENCE TO HEADED STUDS SHALL BE HIGH STRENGTH HEADED STUDS. ATTACHMENT OF HEADED STUDS SHALL CONFORM TO ALL REQUIREMENTS OF THE LATEST EDITION OF THE "RECOMMENDED PRACTICES FOR STUD WELDING" AND THE "STRUCTURAL WELDING CODE" PUBLISHED BY AWS.

ALL BOLTS, ANCHOR BOLTS, EXPANSION BOLTS, ETC. SHALL BE INSTALLED WITH STEEL WASHERS AT FACE OF WOOD OR AT SLOTTED HOLES IN STEEL SECTIONS.

ALL WELDING SHALL BE PERFORMED BY WELDERS HOLDING VALID CERTIFICATES AND HAVING CURRENT EXPERIENCE IN THE TYPE OF WELD SHOWN ON THE DRAWINGS OR NOTES. CERTIFICATES SHALL BE THOSE ISSUED BY AN ACCEPTED TESTING AGENCY. ALL WELDING DONE BY E70 SERIES LOW HYDROGEN RODS UNLESS NOTED OTHERWISE. FOR GRADE 60 REINFORCING BARS, USE E90 SERIES. ALL WELDING PER LATEST AMERICAN WELDING SOCIETY STANDARDS, (EXCEPT STEEL JOISTS AND JOIST GIRDERS SHALL COMPLY WITH SJI STANDARDS). SHOP WELDS AND FIELD WELDS SHALL BE SHOWN ON THE SHOP DRAWINGS SUBMITTED FOR REVIEW. ALL FULL (COMPLETE) PENETRATION WELDS SHALL BE TESTED AND CERTIFIED BY AN INDEPENDENT TESTING LABORATORY.

FILLET WELD SIZES SHOWN IN CONTRACT DOCUMENTS ARE THE FILLET WELD LEG SIZE. GROOVE WELD SIZES SHOWN IN CONTRACT DOCUMENTS ARE THE REQUIRED WELD SIZE "(E)".

THE ENGINEER SHALL BE COMPENSATED FOR ANY ANALYSIS, RE-DESIGN AND/OR REVIEW OF CONNECTIONS NOT CONFORMING TO THE CONTRACT DOCUMENTS, WHETHER MADE BY THE CONTRACTOR, THEIR SUBCONTRACTOR(S), FABRICATOR, DETAILER OR ERECTOR.

CONTRACTOR SHALL NOT RECEIVE ADDITIONAL COMPENSATION FOR DETAILING, FABRICATION, ERECTION OR SCHEDULE IMPACTS AS A RESULT OF INCORRECT DETAILING IN THE SHOP DRAWINGS.

HIGH STRENGTH BOLTS:

ALL HIGH STRENGTH BOLTS SHALL BE ASTM 7/8" DIAMETER A325 AND SHALL BE INSTALLED AS BEARING-TYPE CONNECTIONS WITH THREADS INCLUDED IN SHEAR PLANE (I.E. A TYPE 'N' CONNECTION) UNLESS NOTED OTHERWISE. UNLESS SPECIFICALLY NOTED OTHERWISE IN THESE STRUCTURAL DRAWINGS, ALL A325 HIGH STRENGTH BOLTS SHALL BE TENSIONED TO THE VALUES SHOWN IN TABLE J3.1 OF THE AISC SPECIFICATION FOR STEEL BUILDINGS, USING ANY AISC APPROVED METHOD. ALL HIGH STRENGTH BOLTING SHALL BE INSPECTED BY AN INDEPENDENT TESTING LABORATORY.

DRYPACK:

DRYPACK SHALL BE 5,000 PSI NON-SHRINK GROUT, FIVE STAR OR EQUIVALENT. INSTALL DRYPACK UNDER BEARING PLATES BEFORE FRAMING MEMBER IS INSTALLED. AT COLUMNS, INSTALL DRYPACK UNDER BASE PLATES AFTER COLUMN HAS BEEN PLUMBED BUT PRIOR TO FLOOR OR ROOF INSTALLATION.

METALS SUBMITTALS:

THE FOLLOWING ITEMS SHALL BE SUBMITTED FOR REVIEW FOR THE LIMITED PURPOSE OF CHECKING FOR CONFORMANCE WITH INFORMATION GIVEN AND THE DESIGN CONCEPT EXPRESSED IN THE CONTRACT DOCUMENTS. REFER TO PROJECT SPECIFICATIONS FOR ADDITIONAL REQUIRED SUBMITTALS.

PRODUCT DATA
SHOP DRAWINGS
STRUCTURAL STEEL
WELDING PROCEDURE SPECIFICATIONS AND PROCEDURE QUALIFICATION RECORDS
QUALIFICATION DATA FOR QUALIFIED INSTALLER, FABRICATOR, PROFESSIONAL ENGINEER, TESTING AGENCY
WELDING CERTIFICATES
MILL TEST REPORTS
PRODUCT TEST REPORTS
SOURCE QUALITY CONTROL REPORTS

DEFERRED SUBMITTALS NOTE (IBC 107.3.4.1):
DEFERRED SUBMITTAL ITEMS SHALL NOT BE INSTALLED UNTIL THE DEFERRED SUBMITTAL DOCUMENTS HAVE BEEN APPROVED BY THE BUILDING OFFICIAL. THE REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE SHALL REVIEW THEM AND FORWARD THEM TO THE BUILDING OFFICIAL WITH A NOTATION INDICATING THAT THE DEFERRED SUBMITTAL DOCUMENTS HAVE BEEN REVIEWED AND FOUND TO BE IN GENERAL CONFORMANCE WITH THE CONSTRUCTION DOCUMENTS.

SPECIAL INSPECTIONS REQUIREMENTS – IBC 1704
PRIOR TO THE START OF CONSTRUCTION, THE OWNER OR OWNER'S AUTHORIZED AGENT SHALL EMPLOY ONE OR MORE APPROVED AGENCIES TO PROVIDE SPECIAL INSPECTIONS AND TESTS DURING CONSTRUCTION AS REQUIRED BY THE STRUCTURAL ENGINEER IN THEIR STATEMENT OF SPECIAL INSPECTIONS. THE SPECIAL INSPECTOR'S QUALIFICATIONS AND WRITTEN REPORTS SHALL BE REVIEWED BY THE ENGINEER OF RECORD AND MADE AVAILABLE TO THE BUILDING INSPECTOR ON THE JOBSITE. THE BUILDING DIVISION WILL ONLY ISSUE A CERTIFICATE OF OCCUPANCY AFTER ALL SPECIAL INSPECTION REPORTS, AND THE FINAL SPECIAL INSPECTION REPORT, HAVE BEEN SUBMITTED AND ACCEPTED.

ABBREVIATIONS

AFF	ABOVE FINISHED FLOOR	IFW	INSIDE FACE OF WALL
ALT	ALTERNATE	IT	PRECAST INVERTED TEE BEAM
AB	ANCHOR BOLT	K (KIP)	1000 POUNDS
ADD'L	ADDITIONAL	LB	PRECAST ELL BEAM
ARCH	ARCHITECT	LBS (#)	POUNDS
ARCH'L	ARCHITECTURAL	LL	LIVE LOAD
@	AT (MEASUREMENT)	LLH	LONG LEG HORIZONTAL
BM	BEAM	LLV	LONG LEG VERTICAL
BFF	BELOW FINISHED FLOOR	LOC	LOCATION
BOB	BOTTOM OF BEAM	LVL	LAMINATED VENEER LUMBER
BOD	BOTTOM OF DECK	MAS	MASONRY
BOF	BOTTOM OF FOOTING	MAS CJ	MASONRY CONTROL JOINT
BOT (B)	BOTTOM	MAX	MAXIMUM
BRG	BEARING	MBM	METAL BUILDING MANUFACTURER
CFS	COLD FORMED STEEL	MECH'L	MECHANICAL
CGS	CENTER OF GRAVITY STRAND	MFR('S)	MANUFACTURER('S)
CIP	CAST IN PLACE	MIN	MINIMUM
CL	CENTERLINE	MPII	MFR PRINTED INSTALLATION INSTRUCTIONS
CJ	CONTROL JOINT	N/A	NOT APPLICABLE
CJP	COMPLETE JOINT PENETRATION	NTS	NOT TO SCALE
		NSHM	NON-SHRINK NON-METALLIC
CTR'D	CENTERED	OC	ON CENTER
CLB	CENTERLINE OF BEAM	OFW	OUTSIDE FACE OF WALL
CLC	CENTERLINE OF COLUMN	OH	OPPOSITE HAND
CLF	CENTERLINE OF FOOTING	OPP	OPPOSITE
CLW	CENTERLINE OF WALL	OPNG	OPENING
CLR	CLEAR	OS	OVERSIZED
COL	COLUMN	OSB	ORIENTED STRAND BOARD
CONC	CONCRETE	PAF	POWDER ACTUATED FASTENER
CMU	CONCRETE MASONRY UNIT	PC	PRECAST CONCRETE
CONN	CONNECTION	PEMB	PRE-ENGINEERED METAL BUILDING
CONT	CONTINUOUS	PFWT	PREFABRICATED WOOD TRUSS
Ø	PENNY (SIZE)	PJ	PANEL JOINT
DAS	DEFORMED ANCHOR STUD	PL	PLATE
DEG	DEGREE	PLF	POUNDS PER LINEAR FOOT
DIA	DIAMETER	PLWD	PLYWOOD
DL	DEAD LOAD	PREFAB	PREFABRICATED
DP	DEEP OR DRILLED PIER	PSF	POUNDS PER SQUARE FOOT
DN	DOWN	PSI	POUNDS PER SQUARE INCH
DTL	DETAIL	PT	POST TENSION
DWG(S)	DRAWING(S)	PTL	PRESSURE TREATED LUMBER
EA	EACH	RB	PRECAST RECTANGLE BEAM
EC	EPOXY COATED	RE:	REFERENCE
EE	EACH END	REINF	REINFORCING
EL	ELEVATION	REQ'D	REQUIRED
ENGR	ENGINEER	RS	ROUGH SAWN
EOS	EDGE OF SLAB	SCHED	SCHEDULE
EQ	EQUAL	SLH	SHORT LEG HORIZONTAL
EQUIP	EQUIPMENT	SLV	SHORT LEG VERTICAL
EXIST (E)	EXISTING	SIM	SIMILAR
EXP ANCH	EXPANSION ANCHOR	SOG	SLAB ON GRADE
EXP JT (EJ)	EXPANSION JOINT	SOV	SLAB ON VOID
EW	EACH WAY	SQ	SQUARE
FDN	FOUNDATION	STD	STANDARD
FF	FINISHED FLOOR	STL	STEEL
FOM	FACE OF MEMBER	T&B	TOP AND BOTTOM
FOW	FACE OF WALL	TL	TOTAL LOAD
FP	FIRE PROOFING	TJI	PLYWOOD WEB JOIST
FTG	FOOTING	TOB	TOP OF BEAM
FV	FIELD VERIFY	TOC	TOP OF CONCRETE
GA	GAGE	TOD	TOP OF DECK
GALV	GALVANIZED	TOF	TOP OF FOOTING
GSN	GENERAL STRUCTURAL NOTES	TOL	TOP OF LEDGER
GLB (GLULAM)	GLUED-LAMINATED BEAM	TOM	TOP OF MASONRY
GT	GIRDER TRUSS	TOP	TOP OF PLATE
HC	PRECAST HOLLOW CORE PLANK	TOS	TOP OF STEEL
HDAS	HEADED ANCHOR STUD	TOW	TOP OF WALL
HDG	HOT-DIP GALVANIZED	TYP	TYPICAL
HK	HOOK	UNO	UNLESS NOTED OTHERWISE
HORIZ	HORIZONTAL	VERT	VERTICAL
HT	HEIGHT	WP	WORK POINT
		WWF	WELDED WIRE FABRIC
		W/ (w/)	WITH
		W/O (w/o)	WITHOUT

INFORMATION ON DRAWINGS

PLAN LEGEND

SYMBOL	DESCRIPTION	REMARKS
X / X	DETAIL CUTS SHOWN ON PLANS	
	CONCRETE WALL UNO	SEE PLANS AND SCHEDULES FOR REINFORCING
	8" MASONRY WALL UNO	OTHER SIZES ARE DIMENSIONED ON PLANS.
	12" MASONRY WALL UNO	OTHER SIZES ARE DIMENSIONED ON PLANS.
	STUD WALL UNO	SEE GSN, PLANS, AND SCHEDULES FOR SIZE AND SPACING OF STUDS.
	MECHANICAL EQUIPMENT	SEE PLANS FOR UNIT WEIGHTS.
	OPENING IN FRAMING	SEE NOTE #4.
Beam Type AT XX" O.C.	INDICATES EXTENTS OF MEMBER	SEE PLANS.

SHEET INDEX

SHEET	DESCRIPTION	ISSUE FOR PERMIT 08.08.2023
S0.1	GENERAL STRUCTURAL NOTES	●
S0.2	SPECIAL INSPECTIONS	●
S1.0	STRUCTURAL PLAN	●
S2.0	STEEL DETAILS	●

MASONRY, STEEL, AND MECHANICAL SUBCONTRACTORS NOTE:
STRUCTURAL DRAWINGS DO NOT INDICATE ALL WALL, FLOOR, OR ROOF PENETRATIONS FOR MECH DUCTS, DRAINS, VENTS, ETC.; DRAWINGS INDICATE TYPICAL AND SPECIAL CONDITIONS FOR FRAMING AT THE PENETRATIONS. GENERAL CONTRACTOR AND SUB CONTRACTORS SHALL BE RESPONSIBLE FOR DETERMINING AND/OR MODIFYING OPENING LOCATIONS, ELEVATIONS, AND DIMENSIONS FOR MECH UNLESS NOTED OTHERWISE. COORDINATION TO BE COMPLETED PRIOR TO FABRICATION OF STRUCTURAL STEEL

STRUCTURAL STEEL
REFERENCE: IBC SECTION 1705.2.1. INSPECTIONS FOR STRUCTURAL STEEL SHALL BE IN ACCORDANCE WITH QUALITY ASSURANCE REQUIREMENTS OF AISC 360, CHAPTER N.

FABRICATOR AND ERECTOR QUALITY CONTROL PROGRAM
REFERENCE AISC 360, CHAPTER N, SECTION N2

THE FABRICATOR'S QUALITY CONTROL INSPECTOR SHALL INSPECT THE FOLLOWING AS A MINIMUM, AS APPLICABLE:

1. SHOP WELDING, HIGH-STRENGTH BOLTING, AND DETAILS IN ACCORDANCE WITH AISC 360 SECTION N5.
2. SHOP CUT AND FINISHED SURFACES IN ACCORDANCE WITH AISC 360, SECTION M2.
3. SHOP HEATING FOR STRAIGHTENING, CAMBERING AND CURVING IN ACCORDANCE WITH AISC 360, SECTION M2.1.
4. TOLERANCES FOR SHOP FABRICATION IN ACCORDANCE WITH SECTION 6 OF THE CODE OF STANDARD PRACTICE.

THE ERECTOR'S QUALITY CONTROL INSPECTOR SHALL INSPECT THE AS A MINIMUM, AS APPLICABLE:

1. FIELD WELDING, HIGH-STRENGTH BOLTING, AND DETAILS IN ACCORDANCE WITH AISC 360, SECTION N5.
2. STEEL DECK AND HEADED STEEL STUD ANCHOR PLACEMENT AND ATTACHMENT IN ACCORDANCE WITH AISC 360, SECTION N6.
3. FIELD CUT SURFACES IN ACCORDANCE WITH AISC 360, SECTION M2.2.
4. FIELD HEATING FOR STRAIGHTENING IN ACCORDANCE WITH AISC 360, SECTION M2.1.
5. TOLERANCES FOR FIELD ERECTION IN ACCORDANCE WITH SECTION 7.13 OF THE CODE OF STANDARD PRACTICE.

FABRICATOR AND ERECTOR DOCUMENTS
REFERENCE AISC 360, CHAPTER N, SECTION N3

SUBMITTALS FOR STEEL CONSTRUCTION AND AVAILABLE DOCUMENTS FOR STEEL CONSTRUCTION SHALL CONFORM TO AISC 360, SECTION N3.

INSPECTION AND NONDESTRUCTIVE TESTING PERSONNEL
REFERENCE AISC 360, CHAPTER N, SECTION N4

QUALITY CONTROL INSPECTOR (FABRICATOR OR ERECTOR) QUALIFICATIONS, QUALITY ASSURANCE INSPECTOR (SPECIAL INSPECTOR) QUALIFICATIONS AND NONDESTRUCTIVE TESTING PERSONNEL (INSPECTION AGENCY PERSONNEL) QUALIFICATIONS SHALL CONFORM TO AISC 360, SECTION N4.

MINIMUM REQUIREMENTS FOR INSPECTION OF STRUCTURAL STEEL BUILDINGS
REFERENCE AISC 360, CHAPTER N, SECTION N5

QUALITY CONTROL INSPECTIONS BY THE FABRICATOR'S OR ERECTOR'S QUALITY CONTROL INSPECTOR (QCI) AND QUALITY ASSURANCE INSPECTIONS OF FABRICATED ITEMS AND THE ERECTED STEEL SYSTEM BY THE SPECIAL INSPECTOR (SI), SHALL CONFORM TO AISC 360, SECTION N5 AND TABLES N5.4-1, N5.4-2, N5.4-3, N5.6-1, N5.6-2, N5.6-3. IN THESE TABLES INSPECTION TASKS ARE AS FOLLOWS:

O-OBSERVE THESE ITEMS ON A RANDOM BASIS. OPERATIONS NEED NOT BE DELAYED PENDING THESE INSPECTIONS.
P-PERFORM THESE TASKS FOR EACH WELDED JOINT OR MEMBER.

NONDESTRUCTIVE TESTING OF WELDED JOINTS

NONDESTRUCTIVE TESTING OF WELDED JOINTS SHALL CONFORM TO AISC 360, SECTION N5 AND SHALL BE PERFORMED BY THE SPECIAL INSPECTOR (QUALITY ASSURANCE INSPECTOR) IN ACCORDANCE WITH AWSD1.1.

MINIMUM REQUIREMENTS FOR INSPECTION OF COMPOSITE CONSTRUCTION
REFERENCE AISC 360, CHAPTER N, SECTION N6

INSPECTION OF COMPOSITE CONSTRUCTION SHALL CONFORM TO AISC 360, SECTION N6 AND TABLE N6.1

INSPECTION OF FABRICATORS AND FABRICATION PROCEDURES
REFERENCE IBC SECTION 1704.2.5

INSPECTION OF FABRICATORS AND FABRICATION PROCEDURES SHALL BE PERFORMED BY THE QUALITY ASSURANCE INSPECTOR (SPECIAL INSPECTOR) AND SHALL CONFORM TO IBC SECTIONS 1704.2.5 AND 1704.2.5.1.

NONCONFORMING MATERIALS AND WORKMANSHIP
REFERENCE AISC 360, CHAPTER N, SECTION N8

IDENTIFICATION AND REJECTION OF MATERIALS OR WORKMANSHIP THAT IS NOT IN CONFORMANCE WITH THE CONSTRUCTION DOCUMENTS SHALL BE PERMITTED AT ANY TIME DURING THE PROGRESS OF THE WORK. NONCONFORMING MATERIAL AND WORKMANSHIP SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE GENERAL CONTRACTOR AND THE FABRICATOR OR ERECTOR, AS APPLICABLE. NONCONFORMING MATERIAL OR WORKMANSHIP SHALL BE BROUGHT INTO CONFORMANCE, OR MADE SUITABLE FOR ITS INTENDED PURPOSE AS DETERMINED BY THE STRUCTURAL ENGINEER OF RECORD.

TABLE N5.4-1
INSPECTION TASKS PRIOR TO WELDING
REFERENCE AISC 360, CHAPTER N

INSPECTION TASKS PRIOR TO WELDING	QC		SI	
WELDING PROCEDURE SPECIFICATIONS (WPS'S) AVAILABLE	P		P	
MANUFACTURER CERTIFICATIONS FOR WELDING CONSUMABLES AVAILABLE	P		P	
MATERIAL IDENTIFICATION (TYPE/GRADE)	O		O	
WELDER IDENTIFICATION SYSTEM*	O		O	
FIT-UP OF GROOVE WELDS (INCLUDING JOINT GEOMETRY - JOINT PREPARATION - DIMENSIONS (ALIGNMENT, ROOT OPENING, ROOT FACE, BEVEL) - CLEANLINESS (CONDITION OF STEEL SURFACES) - TACKING (TACK WELD QUALITY AND LOCATION) - BACKING TYPE AND FIT (IF APPLICABLE)	O		O	
CONFIGURATION AND FINISH OF ACCESS HOLES	O		O	
FIT-UP OF FILLET WELDS - DIMENSIONS (ALIGNMENT, GAPS AND ROOT) - CLEANLINESS (CONDITION OF STEEL SURFACES) - TACKING (TACK WELDS QUALITY AND LOCATION)	O		O	
CHECK WELDING EQUIPMENT	O		-	

* THE FABRICATOR OR ERECTOR, AS APPLICABLE, SHALL MAINTAIN A SYSTEM BY WHICH A WELDER WHO HAS WELDED A JOINT OR MEMBER CAN BE IDENTIFIED. STAMPS, IF USED, SHALL BE THE LOW-STRESS TYPE.

WHERE:
O - OBSERVE THESE ITEMS ON A RANDOM BASIS. OPERATIONS NEED NOT BE DELAYED PENDING THESE INSPECTIONS.
P - PERFORM THESE TASKS FOR EACH WELDED JOINT OR MEMBER.
QC - QUALITY CONTROL INSPECTOR (FABRICATOR OR ERECTOR)
SI - SPECIAL INSPECTOR (QUALITY ASSURANCE INSPECTOR)

TABLE N5.4-2
INSPECTION TASKS DURING WELDING
REFERENCE AISC 360, CHAPTER N

INSPECTION TASKS DURING WELDING	QC		SI	
USE OF QUALIFIED WELDERS	O		O	
CONTROL AND HANDLING OR WELDING CONSUMABLES - PACKAGING - EXPOSURE CONTROL	O		O	
NO WELDING OVER CRACKED TACK WELDS	O		O	
ENVIRONMENTAL CONDITIONS - WIND SPEED WITHIN LIMITS - PRECIPITATION AND TEMPERATURE	O		O	
WPS FOLLOWED - SETTINGS ON WELDING EQUIPMENT - TRAVEL SPEED - SELECTED WELDING MATERIALS - SHIELDING GAS TYPE/FLOW RATE - PREHEAT APPLIED - INTERPASS TEMPERATURE MAINTAINED (MIN./MAX.) - PROPER POSITION (F, V, H, OH)	O		O	
WELDING TECHNIQUES - INTERPASS AND FINAL CLEANING - EACH PASS WITHIN PROFILE LIMITATIONS - EACH PASS MEETS QUALITY REQUIREMENTS	O		O	

WHERE:
O - OBSERVE THESE ITEMS ON A RANDOM BASIS. OPERATIONS NEED NOT BE DELAYED PENDING THESE INSPECTIONS.
P - PERFORM THESE TASKS FOR EACH WELDED JOINT OR MEMBER.
QC - QUALITY CONTROL INSPECTOR (FABRICATOR OR ERECTOR)
SI - SPECIAL INSPECTOR (QUALITY ASSURANCE INSPECTOR)

TABLE N5.4-3
INSPECTION TASKS AFTER WELDING
REFERENCE AISC 360, CHAPTER N

INSPECTION TASKS AFTER WELDING	QC		SI	
WELDS CLEANED	O		O	
SIZE, LENGTH AND LOCATION OF WELDS	P		P	
WELDS MEET VISUAL ACCEPTANCE CRITERIA - CRACK PROHIBITION - WELD/BASE-METAL FUSION - CRATER CROSS SECTION - WELD PROFILES - WELD SIZE - UNDERCUT - POROSITY	P		P	
ARC STRIKES	P		P	
K-AREA*	P		P	
BACKING REMOVED AND WELD TABS REMOVED (IF REQUIRED)	P		P	
REPAIR ACTIVITIES	P		P	
DOCUMENT ACCEPTANCE OR REJECTION OF WELDED JOINT OF MEMBER	P		P	

* WHEN WELDING OF DOUBLER PLATES, CONTINUITY PLATES OR STIFFENERS HAS BEEN PERFORMED IN THE K-AREA, VISUALLY INSPECT THE WEB K-AREA FOR CRACKS WITHIN 3 IN. OF THE WELD.

WHERE:
O - OBSERVE THESE ITEMS ON A RANDOM BASIS. OPERATIONS NEED NOT BE DELAYED PENDING THESE INSPECTIONS.
P - PERFORM THESE TASKS FOR EACH WELDED JOINT OR MEMBER.
QC - QUALITY CONTROL INSPECTOR (FABRICATOR OR ERECTOR)
SI - SPECIAL INSPECTOR (QUALITY ASSURANCE INSPECTOR)

TABLE N5.6-1
INSPECTION TASKS PRIOR TO BOLTING
REFERENCE AISC 360, CHAPTER N

INSPECTION TASKS PRIOR TO BOLTING	QC		SI	
USE OF QUALIFIED WELDERS	O		P	
FASTENERS MARKED IN ACCORDANCE WITH ASTM REQUIREMENTS	O		O	
PROPER FASTENERS SELECTED FOR THE JOINT DETAIL (GRADE, TYPE, BOLT LENGTH IF THREADS ARE TO BE EXCLUDED FROM SHEAR PLANE)	O		O	
PROPER BOLTING PROCEDURE SELECTED FOR JOINT DETAIL	O		O	
CONNECTING ELEMENTS, INCLUDING THE APPROPRIATE FAYING SURFACE CONDITION AND HOLE PREPARATION, IF SPECIFIED, MEET APPLICABLE REQUIREMENTS	O		O	
PRE-INSTALLED VERIFICATION TESTING BY INSTALLATION PERSONNEL OBSERVED AND DOCUMENTED FOR FASTENER ASSEMBLIES AND METHOD USED	P		O	
PROPER STORAGE PROVIDED FOR BOLTS, NUTS, WASHERS AND OTHER FASTENER COMPONENTS	O		O	

WHERE:
O - OBSERVE THESE ITEMS ON A RANDOM BASIS. OPERATIONS NEED NOT BE DELAYED PENDING THESE INSPECTIONS.
P - PERFORM THESE TASKS FOR EACH WELDED JOINT OR MEMBER.
QC - QUALITY CONTROL INSPECTOR (FABRICATOR OR ERECTOR)
SI - SPECIAL INSPECTOR (QUALITY ASSURANCE INSPECTOR)

TABLE N5.6-2
INSPECTION TASKS DURING BOLTING
REFERENCE AISC 360, CHAPTER N

INSPECTION TASKS DURING BOLTING	QC		SI	
FASTENER ASSEMBLIES, OF SUITABLE CONDITION, PLACED IN ALL HOLES AND WASHERS (IF REQUIRED) ARE POSITIONED AS REQUIRED	O		O	
JOINT BROUGHT TO THE SNUG-TIGHT CONDITION PRIOR TO THE PRETENSIONING OPERATION	O		O	
FASTENER COMPONENT NOT TURNED BY THE WRENCH PREVENTED FROM ROTATING	O		O	
FASTENERS ARE PRETENSIONED IN ACCORDANCE WITH RCSC SPECIFICATION, PROGRESSING SYSTEMATICALLY FROM THE MOST RIGID POINT TOWARD THE FREE EDGES	O		O	

WHERE:
O - OBSERVE THESE ITEMS ON A RANDOM BASIS. OPERATIONS NEED NOT BE DELAYED PENDING THESE INSPECTIONS.
P - PERFORM THESE TASKS FOR EACH WELDED JOINT OR MEMBER.
QC - QUALITY CONTROL INSPECTOR (FABRICATOR OR ERECTOR)
SI - SPECIAL INSPECTOR (QUALITY ASSURANCE INSPECTOR)

TABLE N5.6-3
INSPECTION TASKS AFTER BOLTING
REFERENCE AISC 360, CHAPTER N

INSPECTION TASKS AFTER BOLTING	QC		SI	
DOCUMENT ACCEPTANCE OR REJECTION OF BOLTED CONNECTIONS	P		P	

WHERE:
O - OBSERVE THESE ITEMS ON A RANDOM BASIS. OPERATIONS NEED NOT BE DELAYED PENDING THESE INSPECTIONS.
P - PERFORM THESE TASKS FOR EACH WELDED JOINT OR MEMBER.
QC - QUALITY CONTROL INSPECTOR (FABRICATOR OR ERECTOR)
SI - SPECIAL INSPECTOR (QUALITY ASSURANCE INSPECTOR)

SPECIAL STRUCTURAL INSPECTIONS

MATERIAL	VERIFICATION AND INSPECTION TASK	FREQUENCY: CONTINUOUS	FREQUENCY: PERIODIC	REFERENCED STANDARD	IBC REFERENCE
POST INSTALLED ANCHORS	1. EPOXY ANCHORS				
	A) ALL EPOXY BOLTS TO HAVE I.C.C. RATING FOR MATERIAL INTO WHICH INSTALLATION TAKES PLACE. ALL EPOXY BOLTS ARE SUBJECT TO THE FOLLOWING SPECIAL INSPECTION AND TESTING.				
	B) VERIFY ANCHOR TYPE, DIMENSIONS, BASE MATERIAL TYPE & STRENGTH, HOLE DIMENSIONS, HOLE CLEANING PROCEDURES, ANCHOR SPACING, EDGE DISTANCES, BASE MATERIAL THICKNESS, ANCHOR EMBEDMENT, AND TIGHTENING TORQUE.		X		
	C) LOAD TEST THE FIRST 10% OF EACH TYPE OF BOLT TO 150% RECOMMENDED ALLOWABLE WORKING LOAD IN TENSION. IF AT ANYTIME THE NUMBER OF REJECTED BOLTS EXCEEDS 10%, TEST 100% OF REMAINING BOLTS UNTIL NOT MORE THAN 10% FAIL LOAD TEST. COSTS FOR ADDITIONAL TESTING BEYOND THE FIRST 10% OF ANY BOLT TYPE SHALL BE BORNE BY THE CONTRACTOR.		X		
	2. EXPANSION ANCHORS				
	A) ALL EXPANSION BOLTS TO HAVE I.C.C. RATING FOR MATERIAL INTO WHICH INSTALLATION TAKES PLACE. ALL EXPANSION BOLTS ARE SUBJECT TO THE FOLLOWING SPECIAL INSPECTION AND TESTING.				
	B) VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE CLEANLINESS, EMBEDMENT DEPTH, BASE MATERIAL TYPE & STRENGTH, DRILL BIT DIAMETER, HOLE DEPTH, EDGE DISTANCES, ANCHOR SPACING, BASE MATERIAL THICKNESS, AND TIGHTENING TORQUE.	X			

NOTE: THIS TABLE IS NOT COMPREHENSIVE. ALL TESTING AND INSPECTION REQUIREMENTS DEFINED ELSEWHERE IN THE DRAWINGS AND SPECIFICATIONS ARE REQUIRED. CONTRACTOR SHALL COORDINATE ALL REQUIREMENTS AND BRING ANY DISCREPANCIES TO THE ENGINEER'S ATTENTION PRIOR TO BEGINNING THE WORK.

Structural plan review is limited to a general survey for code compliance. No review is implied nor was undertaken to verify structural adequacy.

City of Aurora Building Division
Reviewed for Code Compliance
Approved as Noted: Y. Munoz
Date: Aug 24, 2023
2021 INTERNATIONAL CODES & 2023 NEC

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COLORADO REGISTERED
RUSSELL D. TAPPER
32622
PROFESSIONAL ENGINEER
8-8-2023

PROJECT
Health ONE The Medical Center of Aurora
TMCA SOUTH CENTRAL TOWER LEVEL O3 REFRESH
1501 S POTOMAC ST
AURORA, CO 80012

ISSUE FOR PERMIT 08.08.2023

KEYPLAN

ISSUE CHART

Ø	ISSUE FOR APPROVAL	------
MARK	ISSUE	DATE

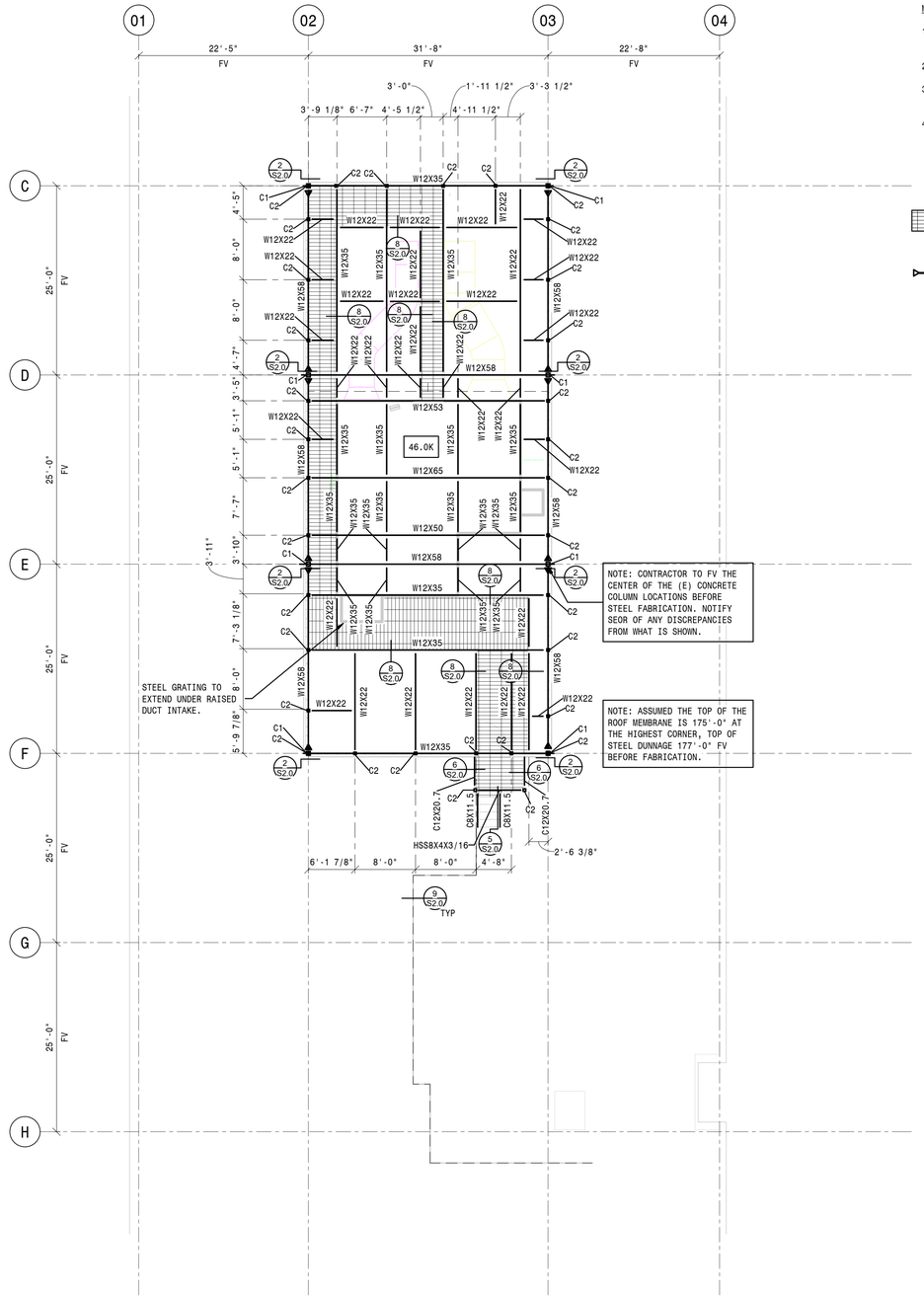
Job Number 2023-01094

TITLE
SPECIAL INSPECTIONS

SHEET NUMBER
S0.2

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COLUMN SCHEDULE		
MARK	**SIZE**	**COMMENTS**
C1	HSS8X8X3/8	DUNNAGE COLUMN
C2	HSS4X4X1/4	SCREEN WALL COLUMN



MAU FRAMING PLAN NOTES:

1. CONTRACTOR TO FIELD VERIFY LAYOUT AND DIMENSIONS.
2. ALL STEEL TO BE HDG.
3. EQUIPMENT TO BE BOLTED TO STEEL DUNNAGE PER MFR REQUIREMENTS.
4. EQUIPMENT WEIGHTS SHOW AS XXK WHERE XX IS IN KIPS. WEIGHT SHOWN INCLUDES ALL INERTIA BASES AND/OR HOUSEKEEPING PADS. IF WEIGHT OF ACTUAL EQUIPMENT IS GREATER THAN SHOWN, OR ADDITIONAL EQUIPMENT NOT SHOWN EXISTS, NOTIFY ENGINEER IMMEDIATELY.

1-1/2"X3/16" 19-W-4 GALVANIZED SERRATED BAR GRATING. PROVIDE MIN. (4) BAR GRATING CLAMPS TO BEAMS BELOW FOR EACH STEEL GRATE SECTION.

MOMENT FRAME CONNECTION SEE: 3/S2.0.

NOTE: EQUIPMENT TO FRAMING CONNECTION BY MANUFACTURER.

NORTH

ROOF PLAN

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

Structural plan review is limited to a general survey for code compliance. No review is implied nor was undertaken to verify structural adequacy.

City of Aurora Building Division
Reviewed for Code Compliance
Approved as Noted: Y. Munoz
Date: Aug 24, 2023
2021 INTERNATIONAL CODES & 2023 NEC

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COLORADO REGISTERED RUSSELL D. TROTTER 32622 PROFESSIONAL ENGINEER 8-8-2023

PROJECT

Health ONE The Medical Center of Aurora

TMCA SOUTH CENTRAL TOWER LEVEL O3 REFRESH
1501 S POTOMAC ST
AURORA, CO 80012

ISSUE FOR PERMIT 08.08.2023

KEYPLAN

ISSUE CHART

Ø	ISSUE FOR APPROVAL	------
MARK	ISSUE	DATE

Job Number 2023-01094

TITLE

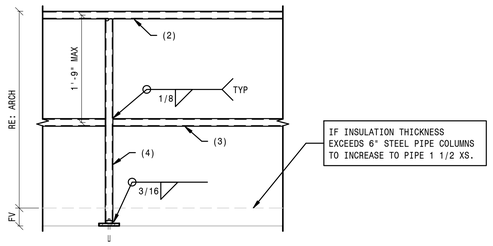
STRUCTURAL PLAN

SHEET NUMBER

S1.0

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NOTES:
1. BEAM PER PLAN.
2. PIPE 1 1/4 STD TOP RAIL.
3. PIPE 1 1/4 STD INTERMEDIATE RAIL.
4. PIPE 1 1/4 XS POST AT 6'-0" OC MAX.
5. PL1/2x4x0'-7" W/ (2) 5/8" DIA HILTI KWIK BOLT TZ2 W/ 3 1/2" MIN EMBED.

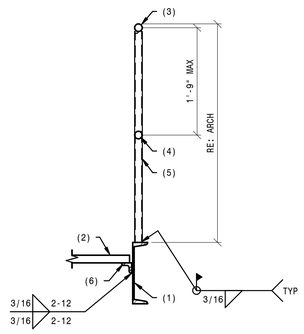


9 ROOF GUARD RAIL TO CONC ROOF

NO SCALE

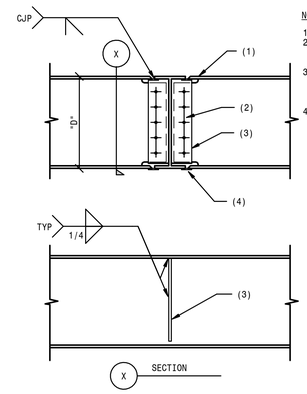
THIS DETAIL IS TYPICAL TO THE PROJECT AND IS NOT NECESSARILY CUT OR CALLED OUT ON PLANS.

NOTES:
1. BEAM PER PLAN.
2. BAR GRATING PER PLAN.
3. PIPE 1 1/4 STD TOP RAIL.
4. PIPE 1 1/4 STD INTERMEDIATE RAIL.
5. PIPE 1 1/4 XS POST AT 6'-0" OC MAX.
6. L2X2X1/4 ANGLE.



6 GUARDRAIL TO CHANNEL

NO SCALE



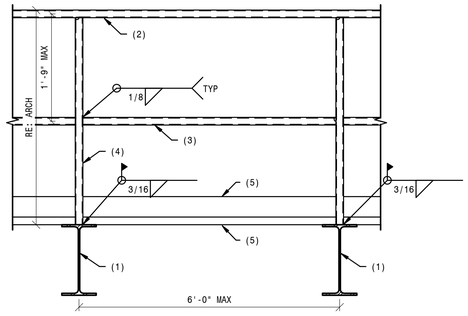
NOTES:
1. STEEL BEAM.
2. FOR SIZE, TYPE AND NUMBER OF BOLTS, SEE TYPICAL BOLT SCHEDULE.
3. 3/8" STEEL SHEAR PLATE - 5/8" STEEL SHEAR PLATE WHERE "D" = 27" OR GREATER.
4. BACKER PLATE.

3 TYPICAL MOMENT CONNECTION - WIDE FLANGE BEAM TO BEAM

NO SCALE

NOTES:
1. STEEL BEAM PER PLAN.
2. SCREEN WALL COLUMN PER PLAN.
3. 1/2" CAP PLATE.
4. L4X4X1/4 HORIZONTAL SUPPORT.
5. HSS4X4X1/4 HORIZONTAL SUPPORT.

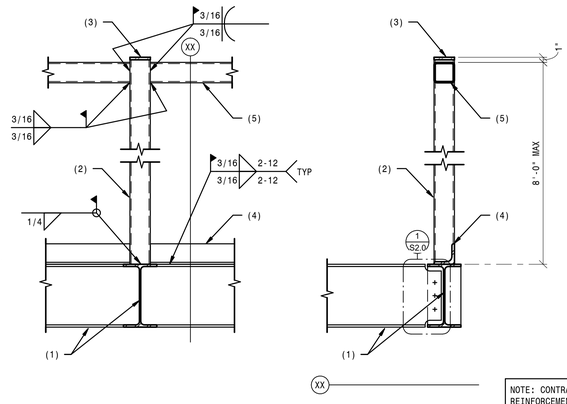
NOTES:
1. BEAM PER PLAN.
2. PIPE 1 1/4 STD TOP RAIL.
3. PIPE 1 1/4 STD INTERMEDIATE RAIL.
4. PIPE 1 1/4 XS POST AT EA BEAM OR 6'-0" MAX.
5. PL1/4x4xCONT KICK PLATE.
6. BAR GRATING PER PLAN.



7 ROOF GUARD RAIL TO STEEL BEAM

NO SCALE

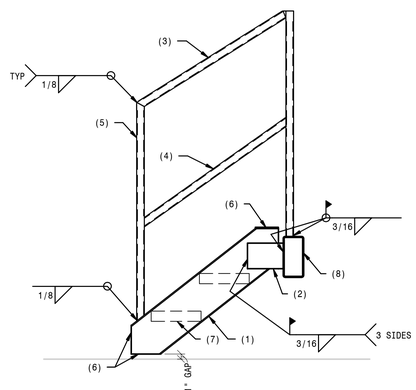
THIS DETAIL IS TYPICAL TO THE PROJECT AND IS NOT NECESSARILY CUT OR CALLED OUT ON PLANS.



4 SCREEN WALL

NO SCALE

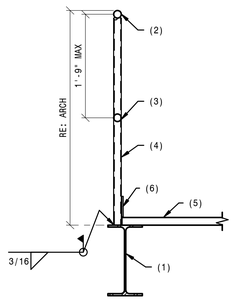
NOTES:
1. C8x11.5 STAIR STRINGER - RE: ARCH FOR RISE AND RUN.
2. PL 1/2x5x0'-7".
3. PIPE 1 1/4 STD TOP RAIL.
4. PIPE 1 1/4 STD INTERMEDIATE RAIL.
5. PIPE 1 1/4 XS POST.
6. 1/4" CAP PLATE.
7. L1 1/2x1 1/2x3/16 TREAD SUPPORT TYP.
8. HSS8X4X3/16



5 NEW MECH STAIRS

NO SCALE

NOTES:
1. BEAM PER PLAN.
2. PIPE 1 1/4 STD TOP RAIL.
3. PIPE 1 1/4 STD INTERMEDIATE RAIL.
4. PIPE 1 1/4 XS POST AT 6'-0" OC MAX.
5. BAR GRATING PER PLAN.
6. PL1/4x4xCONT KICK PLATE.



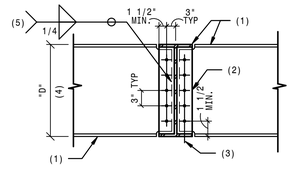
8 ROOF GUARD RAIL TO STEEL BEAM

NO SCALE

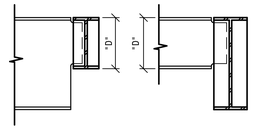
THIS DETAIL IS TYPICAL TO THE PROJECT AND IS NOT NECESSARILY CUT OR CALLED OUT ON PLANS.

BOLTED CONNECTION SCHEDULE	
NOMINAL BEAM DEPTH "D"	NUMBER OF 7/8" DIA. ASTM, A325N BOLTS
UP TO 7"	2
8" - 11"	2
12" - 14"	3
15" - 17"	4
18" - 20"	5
21" - 23"	6
24" - 29"	7
30" - 32"	8
33" - 35"	9
36"	10

FRAMING NOTES:
1. THE TYPICAL STEEL BEAM TO STEEL COLUMN OR STEEL BEAM TO STEEL BEAM CONNECTION CONSISTS OF 3/8" SINGLE SHEAR PLATES WITH 7/8" DIA. ASTM A325N BOLTS. USE 5/8" SHEAR PLATES WHERE "D" = 27" OR GREATER.
2. ALL BOLTS SHALL BE INSTALLED USING SHORT SLOTTED HOLES IN EITHER THE BEAM WEB OR THE SHEAR PLATE PER LATEST AISC SPECIFICATIONS.
3. CONNECTIONS REQUIRING DOUBLE ANGLES OR BENT PLATES WILL BE MARKED ON THE PLANS WITH AN ASTERISK (*).
   ALL DOUBLE ANGLES SHALL BE L4x4x1/4 AND ALL BENT PLATES SHALL BE 1/4" THICK - DETAIL PER SECTION 4 OF THE AISC STEEL CONSTRUCTION MANUAL.



NOTES:
1. STEEL BEAM.
2. 3/8" STEEL SHEAR PLATE -USE 5/8" STEEL SHEAR PLATE WHERE "D" = 27" OR GREATER.
3. FOR SIZE, TYPE & NUMBER OF BOLTS, SEE TYPICAL BOLT SCHEDULE.
4. "D" = LESSER OF BEAM DEPTHS AS OCCURS.
5. WELD 3 SIDES TYPICAL - USE SAME CONNECTION AT STIFFENER PLATES WHEN REQUIRED.



NOTE:
AT ONE SIDED CONNECTIONS, INSTALL 3/8" STIFFENER PLATE OPPOSITE SHEAR PLATE.

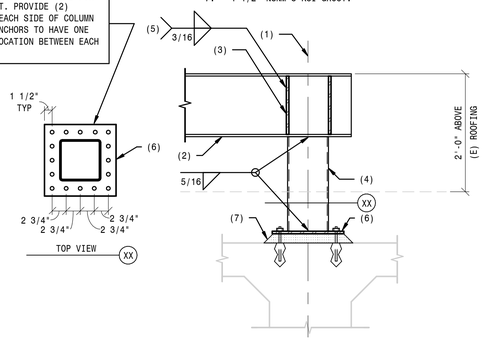
1 BOLT SCHEDULE FOR TYPICAL STEEL CONNECTIONS

NO SCALE

THIS DETAIL IS TYPICAL TO THE PROJECT AND IS NOT NECESSARILY CUT OR CALLED OUT ON PLANS.

NOTES:
1. CENTERLINE OF COLUMN TO BE CENTERED ON CONCRETE COLUMN BELOW.
2. STEEL BEAM PER PLAN.
3. 3/8" STIFFENER PLATE EACH SIDE OF BEAM - TYP.
4. STEEL COLUMN - RE: PLAN.
5. WELD (3) SIDES - TYP.
6. BASEPLATE 3/4x14x1'-2" W/ (8) 7/8" DIA THREADED RODS IN HILTI HIT-HY 200 V3 + HAS-B-105 W/ 5" MIN EMBED.
7. 1-1/2" NSNM 5 KSI GROUT.

NOTE: CONTRACTOR X-RAY SLAB FOR REINFORCEMENT. PROVIDE (2) ANCHORS MIN EACH SIDE OF COLUMN (8) TOTAL. ANCHORS TO HAVE ONE EMPTY HOLE LOCATION BETWEEN EACH OTHER.



2 BEAM TO COLUMN MOMENT CONNECTION

NO SCALE

Structural plan review is limited to a general survey for code compliance. No review is implied nor was undertaken to verify structural adequacy.

City of Aurora Building Division
Reviewed for Code Compliance
Approved as Noted: Y. Munoz
Date: Aug 24, 2023
2021 INTERNATIONAL CODES & 2023 NEC

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475 LINCOLN ST #100
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COLORADO REGISTERED RUSSELL D. TROUTNER 32622 PROFESSIONAL ENGINEER 8-8-2023

PROJECT

The Medical Center of Aurora

TMCA SOUTH CENTRAL TOWER LEVEL O3 REFRESH
1501 S POTOMAC ST
AURORA, CO 80012

ISSUE FOR PERMIT 08.08.2023

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
Ø	ISSUE FOR APPROVAL	-----

Job Number 2023-01094

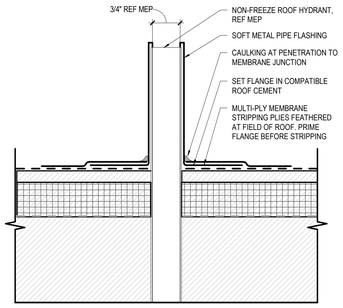
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STEEL DETAILS

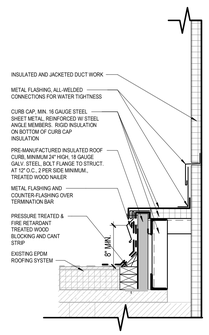
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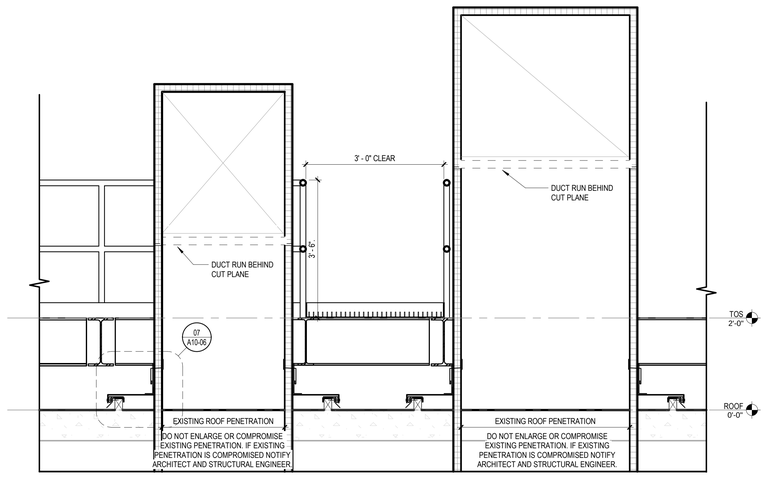
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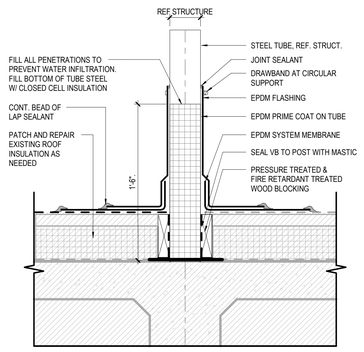
08 ROOF PIPE PENETRATION DETAIL
3" = 1'-0"



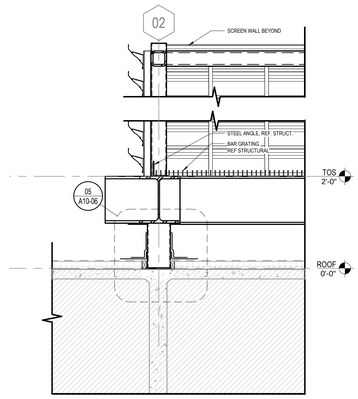
07 DUCT PENETRATION DETAIL
1" = 1'-0"



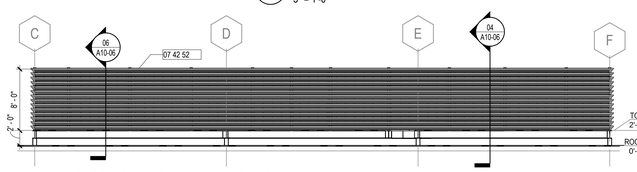
06 DUCT PENETRATION THROUGH ROOF
3/4" = 1'-0"



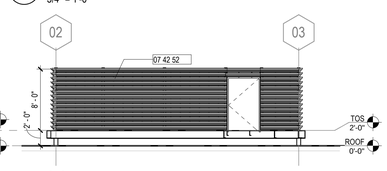
05 ROOF PENETRATION DETAIL
3" = 1'-0"



04 SCREEN WALL SECTION
3/4" = 1'-0"



03 SCREEN WALL ELEVATION - EAST & WEST
1/8" = 1'-0"



02 SCREEN WALL ELEVATION - NORTH & SOUTH
1/8" = 1'-0"



01 ROOF PLAN - OVERALL
1/8" = 1'-0"

ROOF PLAN GENERAL NOTES

1. REFER TO MEP DRAWINGS FOR LOCATIONS OF PIPING, CURBS, VENTS, DUCTS, FANS, AND OTHER ITEMS ON THE ROOF SURFACE.
2. PAINT EXPOSED ROOF MOUNTED EQUIPMENT, PIPING, ETC., EXCEPT THOSE ITEMS WHICH ARE ALUMINUM OR STAINLESS STEEL. COLOR AS SELECTED BY ARCHITECT.
3. CUT EXISTING ROOF AS REQUIRED FOR NEW ROOF. FLASH IN WITH NEW ROOFING MATERIAL TO MATCH EXISTING. COMPLY WITH ALL REQUIREMENTS OF MANUFACTURER OF EXISTING ROOF TO MAINTAIN CURRENT WARRANTY.
4. ALL ROOF FLASHING TO BE ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
5. REFER TO PLUMBING DRAWINGS FOR ROOF DRAIN SIZES.
6. OVERFLOW ROOF DRAIN INLETS SHALL BE 2" ABOVE THE PRIMARY DRAIN INLETS.
7. REFERENCE ELECTRICAL FOR LIGHTNING PROTECTION SYSTEMS.
8. INSTALL OSHA COMPLIANT LADDER TO EACH ROOF HATCH
9. REFER TO STRUCTURAL / MEP DRAWINGS FOR DIMENSIONS OF DUNNAGE AND EQUIPMENT LOCATIONS

ROOF PLAN LEGEND

- BAR GRATING
- EXISTING ROOF DRAIN
- EXISTING ROOF WALK PADS
- NEW ROOF WALK PADS (MATCH EXISTING)
- SLOPE — SLOPE FOR 1/4" PER FOOT MINIMUM FLOW TO DRAIN UNLESS OTHERWISE INDICATED.
- GUARDRAIL
- XX'-XX" — SPOT ELEVATION
- 301A — DOOR TAG
- EXISTING WALKWAY PAD
- PROPOSED WALKWAY PAD

ROOF PLAN NOTES BY NUMBER

<<<	Indicates Sheet Keynote on Plan
07 42 52	ROOF SCREEN AND WALL PANELS
RP1	EXTEND BAR GRATING TO SCREEN WALL
RP2	NEW MAKE-UP AIR HANDLER (MAU-1) , REFER TO MECHANICAL FOR ADDITIONAL INFORMATION.
RP4	EXISTING ROOF HATCH.
RP6	EXISTING ROOFTOP EQUIPMENT
RP8	STRUCTURAL DUNNAGE BELOW. REFER TO STRUCTURAL FOR ADDITIONAL INFORMATION
RP9	SCREEN WALL, REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION
RP10	MAINTENANCE ACCESS POINT

City of Aurora Building Division
Reviewed for Code Compliance
Approved as Noted: Y. Munoz
Date: Aug 24, 2023
2021 INTERNATIONAL CODES & 2023 NEC

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475 LINCOLN ST #100
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STRUCTURAL & MEP
SALAS O'BRIEN
9250 E COSTILLA AVE STE 200,
GREENWOOD VILLAGE, CO 80112

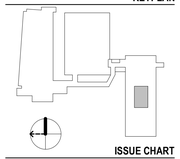
COLORADO LICENSED ARCHITECT
Brittany M Carey
ARC.00407023
BC AEL

PROJECT

The Medical Center of Aurora

TMCA CENTRAL TOWER MAU
THE MEDICAL CENTER OF AURORA
1501 SOUTH POTOMAC STREET
AURORA, COLORADO 80012

KEYPLAN



ISSUE CHART

MARK	ISSUE	DATE
2	ISSUE FOR PERMIT	08.08.23
1	90% ISSUE FOR PERMIT	07.14.23

Job Number 222319.000

TITLE

ROOF PLAN, ELEVATIONS, SECTIONS & DETAILS

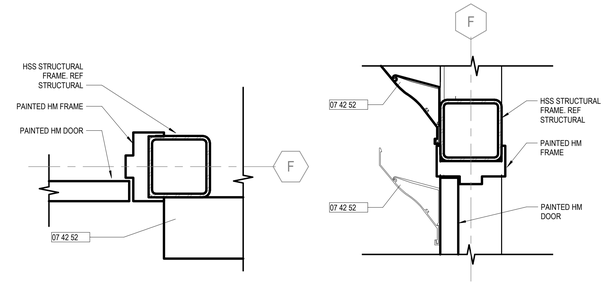
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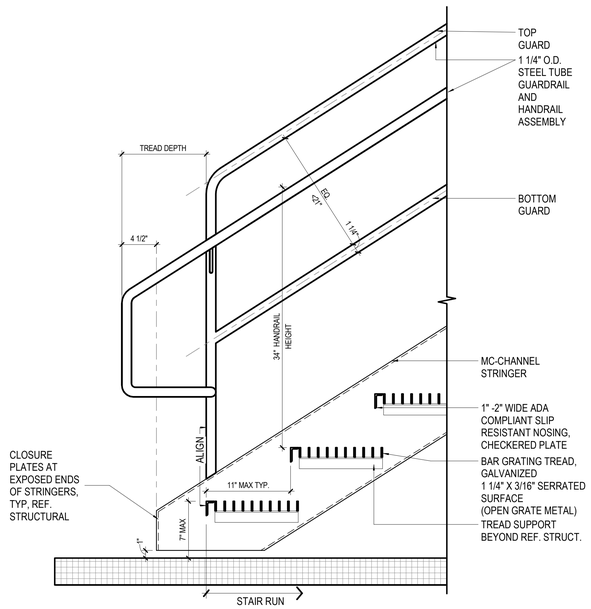
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DOOR SCHEDULE														
MARK		SIZE			DOOR				FRAME					
DOOR NO	ROOM NAME	W	HT	THK	TYPE	MATL	FINISH	GLZ	TYPE	MATL	FINISH	FIRE RATING	HARDWARE SET NO	REMARKS
001	ROOF	4' - 0"	7' - 0"	0' - 1 3/4"	F	HM	PNT	N/A	A	HM	PNT	N/A	1.0	1
Grand total: 1														

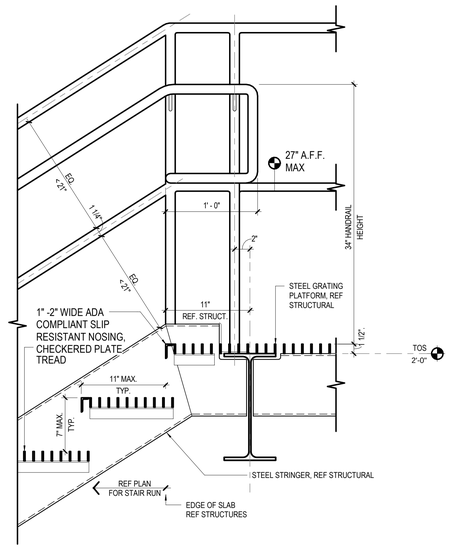


08 JAMB DETAIL
3" = 1'-0"

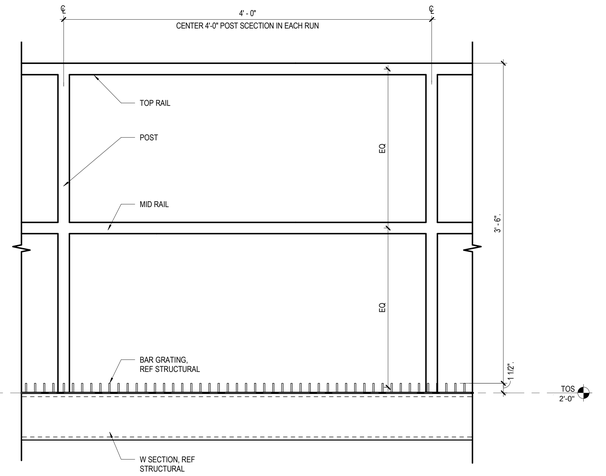
07 HEAD DETAIL
3" = 1'-0"



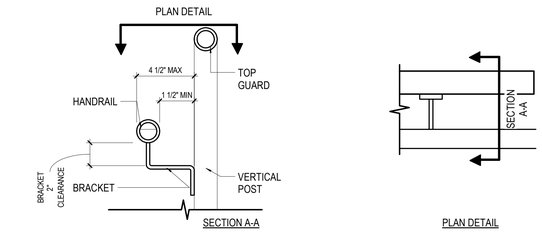
04 STAIR DETAIL - BOTTOM OF STAIR
1 1/2" = 1'-0"



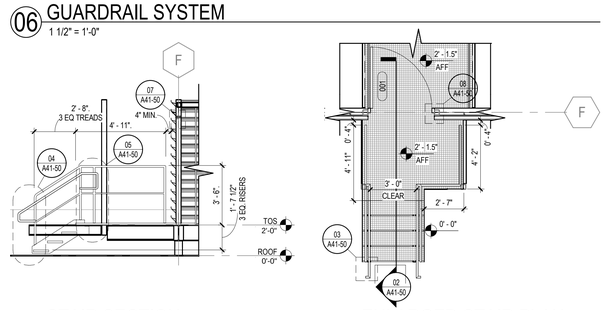
05 STAIR DETAIL - TOP OF STAIR
1 1/2" = 1'-0"



06 GUARDRAIL SYSTEM
1 1/2" = 1'-0"



03 SECTION STAIR DETAIL
3" = 1'-0"



02 STAIR SECTION
1/4" = 1'-0"

01 ENLARGED STAIR PLAN
1/4" = 1'-0"

STAIRS DETAILS GENERAL NOTES

1. STEEL CHANNEL SECTIONS AT STRINGERS AND PERIMETER OF LANDINGS ARE SHOWN AS MC 12X14.3. IF STEEL SECTION OTHER THAN MC 12X14.3 IS REQUIRED BY THE STAIR ENGINEER, NOTIFY ARCHITECT IMMEDIATELY.
2. PROJECTIONS < 4 1/2" INTO THE STAIR WIDTH IS ALLOWED AT OR BELOW HANDRAIL HEIGHT.
3. STEEL TUBE RAILINGS OF HAND AND GUARDS ARE TO BE 1 1/4" I.D.
4. A PROJECTION GREATER THAN 4 1/2" INTO THE STAIR WIDTH IS NOT ALLOWED UNLESS IT IS GREATER THAN 80" ABOVE THE EDGE OF THE NOSINGS INCLUDING ONE TREAD DEPTH BEYOND THE BOTTOM RISER. THIS MINIMUM HEAD ROOM CLEARANCE SHALL BE MAINTAINED ABOVE LANDINGS.
5. GUARD PICKETS SHALL BE EQUALLY SPACED AT 4" MAX. A 4" SPHERE SHALL NOT PASS THROUGH ANY OPENING WITHIN A GUARD. A GUARD EXTENDS FROM TOP OF STRINGER OR CLOSURE PLATE TO THE TOP GUARD.
6. HANDRAIL HEIGHTS ARE PLUMB TO NOSE OF TREADS UNO.
7. PICKETS ARE CONVEYED AS 1/2" X 1/2" BAR (BASIS OF DESIGN).
8. VERTICAL POSTS SUPPORTING GUARDS SHALL BE EQUALLY SPACED AT 48" O.C. MAX.
9. HANDRAIL TRANSITIONS ARE TO HAVE 2" RADIUS @ CENTER OF RAIL.
10. MITER AND EASE CORNERS OF GUARD TRANSITIONS. GRIND ALL WELDS SMOOTH.
11. MOUNT LIGHTS ABOVE 80" A.F.F. LANDINGS. CENTER OVER LANDING WIDTH.
12. PROVIDE 1"WX1/2"H 20 GA. CONT. PAINTED METAL CLOSURE AT ALL STEEL CHANNEL TO WALL GAPS.

ROOF PLAN LEGEND

- BAR GRATING
- EXISTING ROOF DRAIN
- EXISTING ROOF WALK PADS
- NEW ROOF WALK PADS (MATCH EXISTING)
- SLOPE FOR 1/4" PER FOOT MINIMUM FLOW TO DRAIN UNLESS OTHERWISE INDICATED.
- GUARDRAIL
- XX'-XX" SPOT ELEVATION
- 301A DOOR TAG
- EXISTING WALKWAY PAD
- PROPOSED WALKWAY PAD

ROOF PLAN NOTES BY NUMBER

<<< Indicates Sheet Keynote on Plan

07 42 52 | ROOF SCREEN AND WALL PANELS

City of Aurora Building Division
Reviewed for Code Compliance
Approved as Noted: Y. Munoz
Date: Aug 24, 2023
2021 INTERNATIONAL CODES & 2023 NEC

DOOR TYPES

FLUSH
F

DOOR FRAME TYPES

RABBETED
A

DOOR SCHEDULE REMARKS

1. PAINT HOLLOW METAL FRAME AND HOLLOWMETAL DOOR TO MATCH ROOF SCREEN

Perkins&Will
475 LINCOLN ST #100
DENVER, CO 80203
t 303.308.0200
f 303.308.0200

STRUCTURAL & MEP
SALAS O'BRIEN
9250 E COSTILLA AVE STE 220,
GREENWOOD VILLAGE, CO 80112

COLORADO LICENSED
Brittany M Carey
ARC.00407023
AEL
ARCHITECT

PROJECT

Health ONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU
THE MEDICAL CENTER OF AURORA
1501 SOUTH POTOMAC STREET
AURORA, COLORADO 80012

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
2	ISSUE FOR PERMIT	08.08.23
1	90% ISSUE FOR PERMIT	07.14.23

Job Number 222319.000

TITLE

STAIR & DOOR DETAILS

SHEET NUMBER

A41-50

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MECHANICAL ABBREVIATIONS

AAV	AUTOMATIC AIR VENT (VALVE)
AB	AIR BLENDER
AC	AIR CONDITIONING UNIT OR AIR COMPRESSOR
ACH	AIR CHANGES PER HOUR
AD	ACCESS DOOR
AF	AIR FILTER
AFC	AUTOMATIC FLOW CONTROL DEVICE
AFF	ABOVE FINISHED FLOOR
AHU	AIR HANDLING UNIT
ALUM	ALUMINUM
AMP	AMPERE
AMS	AIR FLOW MEASURING STATION
AP	ACCESS PANEL
APD	AIR PRESSURE DROP
ARCH	ARCHITECT/ARCHITECTURAL
AS	AIR SEPARATOR
AUTO	AUTOMATIC
AVG	AVERAGE
BAS	BUILDING AUTOMATION SYSTEM
BD	BALANCING DAMPER
BDD	BACK-DRAFT DAMPER
BHP	BRAKE HORSEPOWER
BOD	BOTTOM OF DUCT
BOP	BOTTOM OF PIPE
BTUH	BRITISH THERMAL UNIT PER HOUR
CAP	CAPACITY
CC	COOLING COIL
CCW	COUNTER CLOCKWISE
CD	CONDENSATE DRAIN
CF	CUBIC FEET
CFH	CUBIC FEET PER HOUR
CFM	CUBIC FEET PER MINUTE
CH	CHILLER
CL	CENTER LINE
CO	CLEAN OUT OR CARBON MONOXIDE
CONT	CONTINUOUS, CONTINUATION
CP	COIL PUMP
CT	COOLING TOWER
CU	CONDENSING/ER UNIT
CU FT	CUBIC FEET
CV	CONSTANT AIR VOLUME
CW	COLD WATER OR CLOCKWISE
D	DRAIN
DB	DECIBEL OR DRY BULB TEMPERATURE
DDC	DIRECT DIGITAL CONTROL
DE	DRYER EXHAUST
DER	DRYER EXHAUST RISER
DEG.F	DEGREE FARENHEIT
DG	DOOR GRILLE
DIA	DIAMETER
DIFF	DIFFUSER
DISCH	DISCHARGE
DN	DOWN
DP	DIFFERENTIAL PRESSURE
DWG	DRAWING
DX	DIRECT EXPANSION
(E)	EXISTING
E	EXHAUST
EA	EACH
EAT	ENTERING AIR TEMPERATURE
EBB	ELECTRIC BASEBOARD HEATER
EC	ELECTRICAL CONTRACTOR
ECH	ELECTRIC CABINET HEATER
EER	ENERGY EFFICIENCY RATIO
EF	EXHAUST FAN
EFF	EFFICIENCY
EG	ETHYLENE GLYCOL-WATER SOLUTION (% GLYCOL BY VOLUME)
EHC	ELECTRIC HEATING COIL
ELEC	ELECTRIC/ELECTRICAL
EL/ELEV	ELEVATION
ENT	ENTERING
EQUIP OR EQT	EQUIPMENT
E/RF	EXHAUST/RETURN FAN
ESP	EXTERNAL STATIC PRESSURE
ET	EXPANSION TANK
EUH	ELECTRIC UNIT HEATER
EWT	ENTERING WATER TEMPERATURE
EXH	EXHAUST
EXIST	EXISTING
F	FILTER
°F	DEGREE FARENHEIT
FA	FREE AREA
FD	FIRE DAMPER
FLA	FULL LOAD AMPERES
FLEX	FLEXIBLE
FOR	FUEL OIL RETURN
FOS	FUEL OIL SUPPLY
FOV	FUEL OIL VENT

FPB	FAN POWERED TERMINAL UNIT
FP	FIRE PROTECTION
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FS	FREEZE STAT
F/SD	COMBINATION FIRE/SMOKE DAMPER
FT	FEET OR FLASH TANK
FTR	FIN TUBE RADIATION (HOT WATER)
FV	FACE VELOCITY
GA	GAUGE
GAL	GALLON
GC	GENERAL CONTRACTOR
GD	GRAVITY DAMPER
GEN	GENERAL
GE	GENERAL EXHAUST
GER	GENERAL EXHAUST RISER
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
H	HUMIDISTAT
HC	HEATING COIL
HORIZ	HORIZONTAL
HP	HORSEPOWER OR HEAT PUMP
HR	HOUR
HTG	HEATING
HUM	HUMIDIFIER
HVAC	HEATING, VENTILATION & AIR CONDITIONING
HX	HEAT EXCHANGER
HZ	HERTZ
ID	INSIDE DIAMETER
IN OR "	INCH
INSUL.	INSULATION
IN W.C.	INCHES WATER COLUMN
IN W.G.	INCHES WATER GAUGE
KE	KITCHEN EXHAUST
KER	KTICHEN EXHAUST RISER
KW	KILOWATT
KWH	KILOWATT HOUR
LAT	LEAVING AIR TEMPERATURE
LBS	POUNDS
LL	LOW LIMIT OR LANDLORD
LP	LOW PRESSURE GAS
LRA	LOCKED ROTOR AMPERES
LVG	LEAVING
LWT	LEAVING WATER TEMPERATURE
MAX	MAXIMUM
MB	MIXING BOX
MBH	THOUSAND BTU PER HOUR
MIN	MINIMUM OR MINUTE(S)
MD	MOTORIZED DAMPER
MP	MEDIUM PRESSURE GAS
NC	NORMALLY CLOSE OR NOISE CRITERIA
NIC	NOT IN CONTRACT
NK	NECK
NO	NORMALLY OPEN
NO OR #	NUMBER
NR	NOT REQUIRED
NTS	NOT TO SCALE
NV	NATURAL VENTILATION
OA	OUTSIDE AIR
OAI	OUTSIDE AIR INTAKE
OBD	OPPOSED BLADE DAMPER
OD	OUTSIDE DIAMETER
OPNG	OPENING
OV	OUTLET VELOCITY OR OVAL
P	PUMP
CTP	COOLING TOWER PUMP
CWP	CONDENSER WATER PUMP
PC	PLUMBING CONTRACTOR
PCD	PUMPED CONDENSATE DISCAHRGE
PG	PROPYLENE GLYCOL-WATER SOLUTION (%GLYCOL BY VOLUME)
PLBG	PLUMBING
PRESS	PRESSURE
PRV	PRESSURE REDUCING VALVE
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSIG	POUNDS PER SQUARE INCH GAUGE
R	RETURN OR RISER
RA	RETURN AIR
REQ'D	REQUIRED
RH	RELATIVE HUMIDITY
RHC	REHEAT COIL
RO	RELIEF OPENING
RP	RADIANT PANEL
RPM	REVOLUTIONS PER MINUTE
RV	RELIEF VALVE (VENT) OR ROOF VENTILATOR
S	SUPPLY
SA	SOUND ATTENUATOR

SF	SUPPLY FAN OR SQUARE FEET
SHT	SHEET
SL	SENSIBLE LOAD
SP	STATIC PRESSURE
SPECS	SPECIFICATIONS
SQ	SQUARE
SQ.FT.	SQUARE FEET
SS	STAINLESS STEEL
STD	STANDARD
STRUC	STRUCTURE/STRUCTURAL
T	THERMOSTAT/TEMPERATURE SENSOR
TD	TEMPERATURE DIFFERENCE OR TRANSFER DUCT
TEF	TOILET EXHAUST FAN
TER	TOILET EXHAUST RISER
TEMP	TEMPERATURE
TO	TRANSFER OPENING
TSP	TOTAL STATIC PRESSURE
TYP	TYPICAL
UC	UNDER-CUT (DOOR)
UH	UNIT HEATER
UON	UNLESS OTHERWISE NOTED
V	VENT
VAV	VARIABLE AIR VOLUME
VD	VOLUME DAMPER
VEL	VELOCITY
VERT	VERTICAL
VFD	VARIABLE FREQUENCY DRIVE
VOL	VOLUME
VSD	VARIABLE SPEED DRIVE
W	WATT
W/	WITH
WC	WATER COLUMN
WFD	WATER PRESSURE DROP
WMS	WIRE MESH SCREEN
WT	WEIGHT
XA	VARIABLE LENGTH ACCESS

SOUND ATTENUATOR

UC OR DG — DG: DOOR GRILLE; UC: DOOR UNDERCUT

T — THERMOSTAT

T — THERMOSTAT MOUNTED TO THERMOISOLATING PAD IF ON EXTERIOR COLUMN

T — DUCT MOUNTED THERMOSTAT

H — HUMIDISTAT

SD — SMOKE DETECTOR

CD — CARBON MONOXIDE DETECTOR

CO2 — CARBON DIOXIDE DETECTOR

N.I.C. - FUTURE TENANT BUILDOUT

REQUIRED MAINTENANCE CLEARANCE

IDENTIFICATION SYMBOLS

X — KEYED NOTE TAG

X / X — EQUIPMENT TAG; EQUIPMENT TAG NO.

X / M-X — SECTION NUMBER; DRAWING ON WHICH SECTION IS SHOWN

AIR DEVICES DATA TAG

NECK SIZE

DIFFUSE MARK — A

QUANTITY (CFM) — 8"ØNK / 105-S

S=SUPPLY R=RETURN T=TRANSFER E=EXHAUST

DUCTWORK SYMBOLS

DOUBLE LINE

(E)12X12 — EXISTING DUCT

EXISTING DUCT OR ITEM TO BE REMOVED

EXISTING DUCT OR ITEM TO REMAIN

BRANCH TAKE-OFF

RADIUS ELBOW

SQUARE TAP COLLAR

RADIUS TEE

BELLMOUTH CONNECTION TO RECT. DUCT

CONICAL TEE

WYE OR TEE

EXHAUST/RETURN AIR DEVICE

24X12 — RECT. DUCT DIMENSIONS (SIZE IN INCHES. FIRST DIM. IS SHOWN)

24Ø — ROUND DUCT DIMENSIONS DIAMETERS

24/12 — FLAT OVAL (SIZE IN INCHES) (FIRST DIM. IS SHOWN)

DUCT TRANSITION

ELBOW TURNED DOWN

ROUND DUCT DN

SUPPLY AIR DUCT

EXHAUST AND RETURN DUCT

OUTSIDE AIR INTAKE

FLEX. DUCT CONNECTION

FD — FIRE DAMPER

CLEAN OUT

MANUAL DAMPER

MD — MOTORIZED (AUTOMATIC) DAMPER

LLMD — LOW LEAKAGE MOTORIZED DAMPER

AD — ACCESS DOOR

CAP

DN — DUCT OFF-SET DN (IN DIRECTION OF FLOW)

UP — DUCT OFF-SET UP (IN DIRECTION OF FLOW)

FLEXIBLE DUCT

AIR TERMINAL UNIT

AIR TERMINAL UNIT W/REHEAT

PIPING SYMBOLS

(E)SERVICE — EXISTING PIPE

EXISTING PIPE OR ITEM TO BE REMOVED

EXISTING PIPE OR ITEM TO REMAIN

CD — CONDENSATE DRAIN

CWR — CONDENSER WATER RETURN

CWS — CONDENSER WATER SUPPLY

CTWR — COOLING TOWER WATER RETURN

CTWS — COOLING TOWER WATER SUPPLY

D — DRAIN

G — NATURAL GAS

HWR — HOT WATER HEATING RETURN

HWS — HOT WATER HEATING SUPPLY

V — V — VENT

AIR SEPARATOR

DIRECTION OF FLOW ARROW

CONCENTRIC REDUCER

ECCENTRIC REDUCER

TEE

TEE TURNED DOWN

TEE TURNED UP

ELBOW 45°

ELBOW TURNED UP

ELBOW TURNED DOWN

PRESSURE GAUGE

FLANGE

CAPPED END CONNECTION

EXPANSION JOINT

FLEXIBLE CONNECTION

FM — FLOW METER

EXPANSION COMPENSATOR

BALL VALVE

PRESSURE INDEPENDANT FLOW CONTROL AND SHUT-OFF VALVE

BUTTERFLY VALVE

CHECK VALVE

HOSE END DRAIN VALVE

TRIPLE DUTY CHECK VALVE

GATE VALVE

GLOBE VALVE

MANUAL AIR VENT

M / M — MOTORIZED 2-WAY OR 3-WAY CONTROL VALVE

SOLENOID VALVE

PRESSURE REDUCING VALVE

PRESSURE RELIEF VALVE

GAS COCK

PIPE UNION

STRAINER

SAFETY VALVE

VACUUM BREAKER

IN-LINE PUMP

PRESSURE GAUGE WITH COCK

THERMOMETER

FLOW SWITCH

PIPE ANCHOR

PIPE GUIDE

UNION

Y-TYPE STRAINER

Y-TYPE STRAINER WITH HOSE ENDED DRAIN VALVE

BASKET STRAINER

FILTER/DRYER

M — MOTOR ACTUATOR

T — CONDENSATE TRAP

PRESSURE-TEMPERATURE PORT

MECHANICAL SHEET LIST

Sheet	Sheet Name
M000	MECHANICAL SYMBOLS , ABBREVIATIONS & NOTES
M001	MECHANICAL SPECIFICATIONS
M002	MECHANICAL SPECIFICATIONS
M003	MECHANICAL SPECIFICATIONS
M004	MECHANICAL SPECIFICATIONS
M005	MECHANICAL SPECIFICATIONS
M101	LEVEL 02 MECHANICAL DEMOLITION PLAN
M102	LEVEL 03 MECHANICAL DEMOLITION PLAN
M103	LEVEL 04 MECHANICAL DEMOLITION PLAN
M104	LEVEL 05 MECHANICAL DEMOLITION PLAN
M111	ROOF MECHANICAL DEMOLITION PLAN
M201	LEVEL 02 MECHANICAL PLAN
M202	LEVEL 03 MECHANICAL PLAN
M203	LEVEL 04 MECHANICAL PLAN
M204	LEVEL 05 MECHANICAL PLAN
M211	ROOF MECHANICAL PLAN
M501	MECHANICAL DETAILS
M502	MECHANICAL DETAILS
M601	MECHNICAL SCHEDULES & RISER DIAGRAM
M701	MECHANICAL CONTROLS

This sheet of drawings has not been reviewed for code compliance.

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CONTRACTOR

COLORADO LICENSED MICHAEL P THOMPSON 54150 PROFESSIONAL ENGINEER
8/15/2023

PROJECT

Health ONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE

Job Number 2023-01094

TITLE
MECHANICAL SYMBOLS , ABBREVIATIONS & NOTES

SHEET NUMBER
M000

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MECHANICAL SPECIFICATIONS

GENERAL PROVISIONS FOR MECHANICAL WORK

1.1 DESCRIPTION
A. The Drawings and Specifications shall be understood to cover systems of Heating, Ventilation and Air Conditioning, Building Automation Systems and Temperature Control, Medical Gas, and Insulation and Pipe Covering as shown on the drawings and as specified. The drawings and specifications are to be taken together. Work specified and not shown, or work shown and not specified, shall be as binding as though required by both, the drawings and specifications.
B. Minor items and accessories or devices not shown but reasonably referred as necessary to the complete and proper operation of any system shall be provided for such systems, whether or not they are specifically called for by the specifications or the drawings.

1.2 CONTRACTOR
A. Where the term "Mechanical Contractor" or "Contractor" is used it shall be understood to be a contractor providing singly or in combination Plumbing systems, Fire Protection systems, Heating, Ventilating and Air Conditioning systems, Temperature Control and Building Automation systems, Medical Gas Systems, Testing and Balancing, or Insulation and Pipe Covering as described in Division 23.

1.3 REQUIREMENTS OF REGULATORY AGENCIES
A. Perform work strictly as required by rules, regulations, standards, codes, ordinances, and laws of Local, State, and Federal Governments, and any other authorities that have legal jurisdiction over the site.
B. Prior to commencement of work, notify State and authorities having jurisdiction as required and submit all of the applicable notifications for construction, operation and/or demolition.
C. This project and all fixtures, equipment and materials shall conform to the following agencies:
1. City of Payson, UT Building Code
2. State of Utah Codes
3. Underwriters' Laboratories, Inc. (UL)
4. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
5. Sheet Metal and Air Conditioning Contracts National Association, Inc. (SMACNA)
6. American National Standard Institute (ANSI)
7. American Society of Mechanical Engineers (ASME)
8. American Standard Testing Materials (ASTM)
9. National Fire Protection Association (NFPA)
10. American Gas Association (AGA)
11. National Electric Code (NEC)
12. Americans with Disabilities Act (ADA)

1.4 OWNER REQUIREMENTS
A. HCA maintains purchasing agreements for select equipment and materials which are outlined in the HCA Innovation Memorandums. All materials and equipment purchased under this contract shall comply with the Innovation memorandums.
1. Innovation Memorandum 07: All piping related items are to be purchased through Ferguson Enterprise (Alton Lassiter - 615-316-1848, alton.lassiter@ferguson.com). Items include but are not limited to:
a. Copper piping
b. Carbon steel piping
c. Polypropylene piping
d. Cross-linked polyethylene (PEX) piping and fittings
e. High-density polyethylene (HDPE)
f. Soil pipe and fittings
g. PVC/ABS pipe and fittings
h. Valves (all)
i. Steel pipe fittings and flanges
j. Brazed and sweat fittings.
2. Innovation memorandum 12: All air handlers and chillers shall be purchased from Johnson Controls Inc.

1.5 RULES AND REGULATIONS
A. All work shall be installed in conformity with all governmental jurisdictional authorities regulations, laws, rules, or ordinances in effect and governing same; such rules and regulations and local ordinances to be considered part of Specifications. The Contractor shall be held strictly responsible for any violation of same and shall change his work to conform without additional cost to Owner.
B. All work shall also conform to the published standards of the National Fire Protection Association and electrical work and equipment shall conform to requirements of the current issue of the National Electrical Code.
C. All materials, in general, shall be Underwriters' Laboratories listed and shall bear UL label where labeling service is available.
D. All Contractors on job shall cooperate and assist each other in conforming with all trade jurisdictional rulings. They shall perform all work covered by drawings and specifications which properly comes under the jurisdiction of the particular trade he represents. In addition, they shall include, by sub-contract if necessary, such work of other trades that is either incidental to his trade, or is specified to be included in his contract or sub-contract.
E. Where jurisdictional rules require assistance of mechanics of trades other than those ordinarily employed by a particular Mechanical Contractor in the handling, storage or setting of special equipment, the Mechanical Contractor shall employ such tradesmen so as to be in conformance with local jurisdictional agreements.

1.6 SCOPE
A. It is the intent of the Specifications and Drawings to establish minimum requirements for methods, products, and equipment, and to ensure systems be finished, tested and ready for operation. Incidental details not usually shown or specified, but necessary for proper installation and operation, shall be included in the work the same as if specified. Locations of all equipment and material shall be adjusted at no extra cost to the Owner, to accommodate the work interferences anticipated and/or encountered. Prior to installation determine the exact route and location of each raceway, pipe and piece of equipment to minimize conflicts with other trades.

1.7 CONTRACT DOCUMENTS
A. Extent of Drawings does not limit responsibility of determining full extent of work required. Refer to Architectural, HVAC, Plumbing, Fire Protection, Electrical, Structural, Site Utility and all other Drawings and other Documents that indicate types of construction in which work is to be installed and work of other trades with which work of this Division must be coordinated.
B. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.
C. When requirements cited in this specification conflict with each other or with other Contract Documents, the most stringent shall govern work.
D. Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete work.
E. Drawings are diagrammatic. They are not intended to be absolutely precise; they are not intended to specify or to show every offset, fitting, and component. The purpose of the drawings is to indicate a systems concept, the main components of the systems, and the approximate geometrical relationships. Based on the systems concept, the main components, and the approximate geometrical relationships, the Contractor shall provide all other components and materials necessary to make the systems fully complete and operational.
F. The layout of the piping, ductwork, equipment, etc., as shown on the Drawings shall be checked and exact locations shall be determined by the dimensions of equipment approved and Mechanical Contractor shall obtain the Architect/Engineer's approval for any revised layout before the apparatus is installed.
G. Inspect Architectural, Structural, Mechanical, Plumbing, Fire Protection and Electrical Drawings for all dimensions, locations, partitions and walls, structural details and locations of mechanical pipes and ducts so that installation shall be coordinated with the work of the other trades.
H. Information and components shown on riser diagrams but not shown on plans, and vice versa, shall apply or be provided as if expressly required on both.
I. Data that may be furnished electronically by the Architect (on computer tape, diskette, or otherwise) is diagrammatic. Such electronically furnished information is subject to the same limitation of precision as heretofore described. If furnished, such data is for convenience and generalized reference, and shall not substitute for Architect's/Engineers, sealed or stamped construction documents.

1.8 CAD DISKS
A. CAD Discs for the preparation of shop drawings for HVAC, Plumbing, Fire Protection, or Electrical drawings can be furnished by MWA at Contractor's request. A minimum processing fee of $300 will be charged, plus $50 per drawing for each drawing above a total of six. Contractor shall sign a disclaimer regarding the use of the drawings so transmitted.

1.9 DISCREPANCIES IN DOCUMENTS
A. Where Drawings or Specifications conflict or are ambiguous, advise Architect/Engineer in writing before Award of Contract. Otherwise, Architect's/Engineer's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or ambiguities thus resolved.
B. Where Drawings or Specifications do not conform to manufacturer's recommendations, or to applicable codes and standards, alert Architect/Engineer of such non-conformance in writing before installation. Otherwise, make changes in installed work as Architect/Engineer requires within Contract Price.
C. If the required material, installation, or work can be interpreted differently from drawing to drawing, or between drawings and specifications, this Contractor shall provide that material, installation, or work which is of the higher, more stringent standard.
D. It is the requirement of these Contract Documents to have the Contractor provide systems and components that are fully complete, operational and suitable for the intended use. There may be situations in the documents where insufficient information is given to precisely describe a certain component or subsystem, or the routing of a component or its coordination with other building elements. In cases such as this, where the Contractor has failed to notify the Architect of the situation in accordance with Paragraph (A) above, the Contractor shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.
E. In cases covered by Paragraph (D) above, where the Contractor believes he needs engineering guidance, he shall submit a sketch identifying his proposed solution to Architect/Engineer for review and approval.

1.10 MODIFICATIONS IN LAYOUT
A. Division 23 Drawings are diagrammatic. They indicate general arrangements of mechanical and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet Architectural requirements.
B. In order to obtain the Architect's desired aesthetics in areas of the building where the finishes and appearances of material and equipment are visible, (including access panels) review architectural drawings for desired locations, finishes, etc., and where not definitely indicated, request information from architect.
C. Check Contract Documents as well as Shop Drawings of all subcontractors to verify and coordinate spaces in which work of this Division will be installed.
D. Maintain maximum headroom at all locations. All piping, duct, conduit, and associated components to be as tight to underside or structure as possible.
E. Make modifications in layout and components needed to prevent conflict with work of other trades and to coordinate according to Paragraphs A, B, C, D above.

1.11 INTERFERENCES
A. Before making any installation, the Mechanical Contractor shall confer with all other Contractors whose work may affect the work under their sections and make the necessary changes to avoid interferences or improper effect on work to be performed by all other Sections. In the event that interferences develop, the Architect's decision will be final and no additional compensation will be allowed for moving of misplaced piping, ducts, conduit and/or equipment.

1.12 REQUEST FOR INFORMATION (RFIS)
A. If the RFI is a request to resolve a conflict or an ambiguity, or a request for an additional detail, Contractor's RFI shall include a sketch or equivalent description of Contractor's proposed solution, in accordance with paragraphs 1.13 (E).

1.13 PERMITS AND FEES
A. The Mechanical Contractor shall procure and pay for all necessary reviews of plans, permits, license fees, make arrangements for inspections, pay all fees in connection therewith, and pay all applicable Federal, State and Local taxes.

1.14 QUALITY ASSURANCE
A. Code Ratings, labels or other data which are die-stamped or otherwise affixed to the surface of the equipment shall be in visible location.
B. All equipment provided under Division 23 to perform with the least possible noise and vibration consistent with its duty. Quietness of operation of all equipment is a requirement. Any equipment, as determined by the Owner's Representative, or Engineer to be producing objectionable noise or transmitting noise or vibration to the building to be repaired or removed and replaced.
C. All workmanship shall be first class in every respect and shall be performed only by skilled mechanics.
D. Project Certification:
1. Each trade shall submit a project certification, guaranteeing that this project was constructed and will operate in accordance with the performance requirements of the drawings and specifications. This certification shall be signed by a principal of the firm and shall be delivered to the Architect prior to final payment.

1.15 GUARANTEE
E. Guarantee Work in writing for one year following the date of Acceptance. Repair or replace promptly and to the Architecfs/Engineer's satisfaction defective materials, equipment, workmanship and installation that develop within this period. Correct damage caused in making necessary repairs and replacements under guarantee within Contract Price. Any part or component repaired or replaced shall be fully warranted for one year from the date of repair.
F. In addition to guarantee requirements of Division 1 and of Paragraph A above, obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's name.
G. Replace material and equipment that require excessive service during guarantee period as defined and as directed by Architect.
H. Submit copies of equipment and material warranties to Architect before final payment.
I. At end of guarantee period, transfer manufacturer's equipment and material warranties still in force to Owner.
J. This article shall not be interpreted to limit Owner's rights under applicable codes and laws and under this Contract.
K. Problems that develop during the guarantee period should be addressed promptly by the Contractor with the help of the manufacturers engineering and the technical staff if required. If problems cannot be rectified immediately to Owner's satisfaction, advise Architect in writing, describe efforts to rectify situation, and provide analysis of cause of problem. Architect will suggest course of action.

1.16 SHUTDOWN AND NOTIFICATIONS
A. It is imperative that service interruptions on the various existing utilities be held to an absolute minimum. Wherever possible, the Mechanical Contractor shall provide suitable temporary services or connections, where continuity of service for essential systems can be maintained by this means. Consult with Owner/Architect to determine which systems are to be considered essential, and to establish the maximum allowable shutdown time, if any, for each system.
B. No less than 72 hours advance written notice must be given, for the interruption of service in any system is desired. Such notice shall identify the system or systems involved, and shall be submitted in duplicate, one copy of which will be signed and returned by the Owner's authorized representative stating whether the requested shutdown will be permitted or not.

1.17 OVERTIME WORK
A. Work included shall be done during regular working hours on a "straight time" basis.
B. When shutdowns, which interrupt the Owner's operations will require overtime work, the Mechanical Contractor shall include the cost for such overtime work as a part of the Base Bid proposal.

1.18 EXISTING UTILITIES
A. Location of utilities as shown on the drawings has been determined from the best available information and is given for the convenience of the Mechanical Contractor. However, Owner does not assume responsibility that the utilities are in the exact locations shown and that there may be other unrecorded utilities in the area of construction. The Mechanical Contractor shall exercise reasonable care and caution in the performance of his work so that unrecorded utilities are not disturbed.
B. The Mechanical Contractor shall be responsible for any interference with or damage to any existing utilities whether shown on the drawing or not, and shall repair or replace any damaged utilities with the least possible delay and hold the Owner harmless in the event that there is any damage.
C. The Mechanical Contractor shall notify Architect of all broken or open pipes discovered during construction.

1.19 LINES AND LEVELS
A. Each Contractor or Sub_Contractor shall lay out and establish at the job all lines and levels necessary for his own work by Bench Mark established by him.

1.20 MINOR DEVIATIONS
A. The dimensions of equipment herein specified or indicated on the drawings are intended to establish the outlines and characteristics of such equipment in general. Minor deviations in dimensions will be permitted to allow the manufacturers specified to bid on their nearest stock equipment, provided the specified ratings are met or exceeded.
B. Where manufacturer's catalog numbers or types are mentioned in the Specifications or indicated on the drawings, they are intended to be used as a guide only and shall not be interpreted as taking precedence over the basic rating and duty specified. In all cases, manufacturers shall verify the duty specified with particular characteristics of the equipment he intends to offer for approval and shall also pay all additional charges as may be required under this section and section 2.03 hereinafter.
C. Where the equipment furnished differs in physical size, electrical or other requirements or arrangement from that indicated on the Drawings, Contractor shall provide all alterations necessary to accommodate such equipment at no additional cost to the Owner. This shall include any and all additional work required by any other Contractors, the Architect or Engineer.

1.21 MECHANICAL WORK EXPOSED TO WEATHER
A. General: Provide corrosion protection for all ferrous metal portions of mechanical work which are to be exposed to weather including fans, piping and accessories, supports and other items.
B. Protection: All ferrous metal, after fabrication, shall be hot dip galvanized, cadmium plated, painted or similarly protected against corrosion prior to installation as approved by the Architect.

1.22 SAFETY MEASURES TO BE TAKEN
A. The Engineer has no contractual responsibility in connection with job site safety measures or precautions as related to means, methods, techniques, sequences or procedures in that regard. The Mechanical Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours. The Architect/Engineer's observations of the Mechanical Contractor's performance are not intended to include review of the adequacy of the Mechanical Contractor's safety measures in, on or near the construction site. It shall be the Mechanical Contractor's responsibility to comply with all government "Safety and Health Regulations for Construction". The Contractor shall be responsible for providing all such safety measures and shall consult with the State or Federal Safety Inspector for interpretation whenever in doubt as to whether safe conditions do or do not exist; or whether he is or is not in compliance with State or Federal Regulations.

1.23 SUBMITTALS
A. Shop Drawings of all fixtures, equipment, materials, etc., shall be submitted as specified in General Requirements. This paragraph supplements Division 01. See Section 013300 -Submittal Procedures.
B. Definitions:
1. Shop Drawings are
a. Information prepared by the Contractor to illustrate portions of the work, such as ductwork layout arrangements in more detail than shown in the Contract Documents.
b. Coordinated Drawings are detailed, large-scale layout Shop Drawings showing HVAC, Electrical, Plumbing and Fire Protection work superimposed in order to identify conflicts and ensure inter-coordination of Mechanical, Electrical, Architectural, Structural and other work.
C. Installation, maintenance, operating manuals and instructions for all equipment shall be provided as specified in the General Provisions.
D. Any materials, fixtures, apparatus or equipment installed without stamped or written acceptance shall be removed and replaced with designated equipment by the Contractor and without recourse for additional cost incurred.
E. Final review and record copy of shop drawings for all work shall be submitted to all jurisdictional authorities, the City, Local Fire Prevention Bureau and State Fire Marshall as may be required.

1.24 AS_BUILT DRAWINGS
A. On a daily basis, the Mechanical Contractor shall maintain at the job site a set of drawings to accurately locate and record all underground and concealed piping, and all changes from the original design. He shall have these drawings available at all times for periodic review by the Architect/Engineer.
B. At completion of the project, all changes and deviations from the Contract Documents shall be recorded by the Mechanical Contractor on As_Built Drawings. Drawings shall be prepared using the same CAD program, version, and operating system as the original Contract Drawings. Submit CAD drawings on electronic media prior to project completion. Drawings shall be the same size and with the same border lines and title blocks as the Architect/Engineer's Drawings with the Contractor's name added.
C. The Engineer/Architect will not certify the accuracy of the record drawings - this is the sole responsibility of the Contractor.

1.25 OPERATION AND MAINTENANCE INSTRUCTIONS
A. Furnish 6 complete portfolios to the Owner's Representative, containing shop drawings, operating instructions, warranties, parts lists, diagrams etc., on all equipment furnished. As required for any equipment, the Contractor shall furnish a competent instructor to advise the Owner's operating personnel as to the proper operation, servicing, etc., of said equipment.
B. Provide a competent engineer for a period of two (2) 8 hour days for total project, to instruct a representative of Owner's personnel in operation and maintenance of system, and to start up all systems.
C. Furnish six (2) sets of manuals in bound form containing data covering capacities, maintenance and operation of each major item of equipment and apparatus. Operating instructions shall cover all phases of control and shall also include the following for pumps, fans and compressors and similar equipment at operating conditions:
1. Indicate type and frequency of lubrication required.
2. List of Spares: Recommended for normal service.
E. Parts List: Identifying various parts of equipment for repair and replacement purposes. In particular, sheaves, V_belts, bearings and similar items should be clearly identified as to manufacturers, sizes, type and stop points.
F. Instruction Books: May be standard booklets but shall be clearly marked to indicate applicable equipment and paragraphs.
G. Provide to the Owner, plastic laminated wiring diagrams, charts, schedules, control diagrams and schematic systems diagrams as installed.

1.26 OCCUPANCY
A. Refer to General Requirements 01 Section Summary 01100.
B. The Owner, Architect, Engineer or others who they may designate shall be privileged to enter and occupy the building or portions thereof, at any time prior to completion of the mechanical work without prejudice.

1.27 LOCAL CONDITIONS
A. The Mechanical Contractor shall visit the Site prior to submitting bids and determine all existing local conditions which may affect the work. He shall examine the General Contract Drawings and the Structural Drawings to familiarize himself with the various types of constructions and their effect on the installation of work under this Division. Failure of the Mechanical Contractor to do so shall not be cause for additional compensation.

1.30 MANUFACTURER'S RECOMMENDATIONS
A. All materials and/or equipment shall be installed in accordance with manufacturer's recommendations and instructions.

MANUFACTURER'S NAMEPLATES
A. Each major component of the equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent is not acceptable. ASME Code ratings, or other data which is die_stamped into the surface of the equipment shall be in a visible location.

COMMON WORK RESULTS FOR HVAC

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
See Editing Instruction No. 3 in the Evaluations for discussion about how this Section supplements other Division 23 Sections.
A. This Section includes the following:
3. Piping materials and installation instructions common to most piping systems.
4. Transition fittings.
5. Dielectric fittings.
6. Mechanical sleeve seals.
7. Sleeves.
8. Escutcheons.
9. Grout.
10. HVAC demolition.
11. Equipment installation requirements common to equipment sections.
12. Painting and finishing.
13. Concrete bases.
14. Supports and anchorages.

1.3 DEFINITIONS
A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
F. "Install" means to receive, unload, store, protect. Move into final position, set, connect, provide any miscellaneous material, test, adjust as required and put into service.
G. "Provide" means to furnish and install.
H. The following are industry abbreviations for rubber materials:
15. EPDM: Ethylene-propylene-diene terpolymer rubber.
16. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS
I. Welding certificates.

1.5 COORDINATION
A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
C. Coordinate requirements with Installing Trade for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08311 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS
A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS
A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
B. 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 (3.2-mm) 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.
2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 DIELECTRIC FITTINGS
A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
B. Insulating Material: Suitable for system fluid, pressure, and temperature.
C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
1. Manufacturers:
a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.
D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
1. Manufacturers:
a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.
E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
1. Manufacturers:
a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.
2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.
F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
1. Manufacturers:
a. Calpico, Inc.
b. Lochinvar Corp.
G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
1. Manufacturers:
a. Perfection Corp.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Co., Inc.
d. Victaulic Co. of America.

2.5 MECHANICAL SLEEVE SEALS
A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
1. Manufacturers:
a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Plastic, carbon steel or Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 SLEEVES
A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
1. Underdeck Clamp: Clamping ring with set screws.
E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
F. PVC Pipe: ASTM D 1785, Schedule 40.
G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.7 ESCUTCHEONS
A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
C. One-Piece, Cast-Brass Type: With set screw.
1. Finish: Polished chrome-plated or rough brass.
D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

2.8 GROUT
A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION
A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 EXCAVATING, TRENCHING AND BACKFILLING

A. Excavation and backfilling of trenches for installation of all underground utility services and underground piping shall be performed by each trade for its work. Separate trenches shall be provided for water and sewer lines. Different services shall be run in separate trenches.
B. Subsurface Soil Data: Boring logs of subsoil investigations are for information only and not a Contract Document. Information applies only to conditions encountered at locations and depths to which borings were made. Contractor will be permitted to make his own additional soil investigation, as approved, but same shall be made with no cost to the Owner.
C. Trenching: Excavate to required depths, and grade the bottoms of trenches to secure required slope for pipe. Where mud or otherwise unstable soil is encountered in bottom of trench which is incapable of supporting the pipe or utility lines, such soil shall be removed to firm bearing and trench shall be backfilled with sand to proper grade and tamped to provide uniform firm support. Pipe shall not be laid on frozen subgrade or rock.
D. Width of trench at a point 1 ft. above top of pipe shall be not more than O.D. of pipe, expressed in inches, plus 12 inches. Above this point, sides of trenches shall be kept as nearly vertical as possible and shall be braced and shored to protect foundations, utility pipe lines and workmen.
E. Where machines are used to excavate pipe trenches, such machine excavation shall terminate 3 in. above invert of pipe. Final excavation and shaping of trench shall be performed only a few feet in advance of pipe laying.
F. Bottom of trench shall be accurately excavated by hand to provide firm uniform bearing for bottom quarter of pipe. Pipe having bells, sleeves or other enlargements at joints shall have recesses excavated to accommodate these joints.
G. Provide elevations and lines required for underground plumbing installation. Provide stakes and batterboards. Elevation, grades and lines shall be set with aid of transit, or level. Maintain and protect same from alteration.
H. Provide and operate dewatering pumping equipment as necessary to keep trench and other excavation free of water, refer to Division 312319 - Dewatering in the specifications.
I. After installation and piping and equipment test has been completed, backfill all excavations carefully. Place backfill in 6 inch layers and compact to at least 85% of maximum dry density. Compaction under paved areas and streets shall not be less than 95% of maximum dry density and shall be determined according to ASTM 1557.
J. Backfilling material for all storm and sewer drain trenches within walls of building shall consist of lake or bank run sand, or selected excavated material for which approval has been obtained. (Foundry sands are not acceptable.)
K. Backfilling: The trenches shall not be backfilled until piping has been tested as required and approved by the Architect/Engineer and any local authorities having jurisdiction thereof.
L. Exercise special care in backfilling trenches in which sewers are laid to guard against disturbing joints. Such backfilling shall be placed evenly in 6 in. layers and carefully tamped under and around pipe. Puddling with water will not be permitted until backfill has been placed and tamped to a point 24 in. above top of pipe.
M. Remove and dispose off-site any material not used for backfill.
N. Where excavation is necessary in existing pavements or streets, Contractor shall pay fee and costs of opening street or pavement and all costs of filling and repaving in accordance with requirements of and to the satisfaction of the Municipality, Utility or Owner or such paving.
O. Where excavation is necessary in an existing lawn, carefully remove and store sod. After backfilling trench, replace sod or apply top dressing of black dirt and seed to match existing lawn.

3.3 PIPING SYSTEMS - COMMON REQUIREMENTS
A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
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 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. Select system components with pressure rating equal to or greater than system operating pressure.
L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
1. New Piping:
a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with spring clips.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast-brass type with polished chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
2. Existing Piping: Use the following:
a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and spring clips.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with rough-brass finish.
f. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
M. Sleeves are not required for core-drilled holes.
N. Permanent sleeves are not required for holes formed by removable PE sleeves.
O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
a. Steel (or PVC where allowed by authorities having jurisdiction) Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
1) Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve

MECHANICAL SPECIFICATIONS (CONT.)

3.4 PIPING 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. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.
J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.
M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 PIPING CONNECTIONS
A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.6 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS
A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
D. Install equipment to allow right of way for piping installed at required slope.

3.7 SCAFFOLDING
A. Furnish necessary scaffolding, staging or cribbing required for the completion of the work. Such scaffolding, etc., shall be removed from the premises when its use is no longer required on the job.

3.8 CHASES, OPENINGS AND CUTTING AND PATCHING
A. Provide to masonry or concrete trades templates or details for chases and openings to be left in the floors, walls and partitions to accommodate work for each trade.
B. Establish, coordinate and properly set the sizes and locations of chases and openings in walls, floors, partitions, etc. Furnish and install, without delay in the execution of the work of other trades, the sleeves in the walls and floors for pipe, ductwork, and equipment before they are built.
C. Do cutting and patching required for the installation of hangers and other portions of the work of each specific section, including cutting, required for connection to existing services. Cutting of finish materials shall be performed by Section performing the original work.
D. Should damage to any mechanical, electrical or architectural part of the building occur, pay all costs to the respective subcontractors affected on the job to make repairs and/or temporary connections required.
E. Openings made in fire rated wall, ceiling or floor shall be effectively closed and repaired so the fire rating is not reduced below original fire rating requirements.

3.9 PAINTING
A. Painting of equipment such as convector enclosures, grilles, registers, diffusers, etc., will be provided as work of Division 09 of the specifications; however, such items shall be factory-prime-coat painted unless otherwise specified.
B. The Mechanical Contractor shall mask over name plates, identification plates, serial numbers and rating information plates to assure that such data will not be painted over.
C. The Mechanical Contractor shall paint ductwork exposed to view behind grilles, registers, diffusers, etc., with one (1) coat of primer and a flat black finish coat of paint
D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES
A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
C. Field Welding: Comply with AWS D1.1.

3.11 ERECTION OF WOOD SUPPORTS AND ANCHORAGES
A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
C. Attach to substrates as required to support applied loads.

3.12 GROUTING
A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
B. Clean surfaces that will come into contact with grout.
C. Provide forms as required for placement of grout.
D. Avoid air entrapment during placement of grout.
E. Place grout, completely filling equipment bases.
F. Place grout on concrete bases and provide smooth bearing surface for equipment.
G. Place grout around anchors.
H. Cure placed grout.

3.13 WIRING OF MECHANICAL EQUIPMENT AND MOTORS
A. Refer to Division 26 Electrical
B. Unless otherwise specified, all conduit, wiring, disconnects, starters, thermal overload heaters, holding coils, remote pushbutton stations, "Hand-Off-Auto" and multi-speed switches, and pilot lights for all electrically operated mechanical equipment, including final connections to same shall be provided under Division 26 - Electrical Work, leaving same ready for operation.
C. Where motor starters come as an integral part of equipment, starters shall meet the specifications of the Electrical Division including, but not limited to:
1. Overload protection on all three phases.
2. All heating, ventilating, air conditioning and temperature control starters shall have "Hand-Auto-Off" switch, unless noted otherwise.
D. Where starters or control panels come as an integral part of the respective equipment; such as boilers, packaged air conditioning units, sump pumps, sewage ejectors or packaged booster systems, all wiring and final connections to the line side of the starter or disconnect device shall be provided under Division 26, Electrical. All wiring beyond this point shall be by the Division 23 Contractor furnishing the motor.
E. Each respective Trade Contractor shall furnish and install all conduit and wiring for all automatic control devices from the holding coils of the starters or the ungrounded load side of thermal toggle switches. All work shall be done in accordance with the Division 26 (Electrical) of these Specifications. Control wiring shall be 120 volt or less. All control wiring shall be installed in conduit.
F. This Contractor shall verify voltage characteristics of each motor with electrical documents.

3.14 CLEANING OF SYSTEMS
A. Following the completion of system tests, all parts of installation shall be thoroughly cleaned and inspected by Section installing the system. All equipment piping valves and fitting shall be cleaned of grease, metal cuttings and sludge which may have accumulated by operation of system for testing. Any stoppage, discoloration, operational damage or other damage to parts of building, its finish, or furnishing due to Contractor's failure to properly clean piping system shall be repaired by Contractor without cost to the Owner. At completion of work, the system shall be adjusted for proper operation.
B. Gas piping shall be blown clear of chips and scale with compressed air at 100 psi.
C. Compressed air piping shall be blown clear of chips and scale with compressed air at 100 psi.
D. Ductwork: Remove debris and trash from ductwork and vacuum clean ducts before grilles and registers are installed.
E. Heating, and Cooling and Water Piping: Refer to specification Section 232500 HVAC Water Treatment.

3.15 CLEANING OF EQUIPMENT
A. Refer to Division 01 General Requirements Section 01770 "Closeout Procedures".
B. Before turning over the work to the Owner, carefully clean all equipment, provide necessary fittings, lamps, valves, etc., and leave the work clean and in perfect operating condition.

3.16 EQUIPMENT INSTALLATION
A. All equipment items and systems shall be designed and installed to operate quietly and free of vibration. Starting and stopping of equipment during normal operation shall not generate any noticeable vibration. Furnish and install vibration eliminators and isolation equipment for equipment, pumps, motors, and etc., as specified in Division 23 Section 230548.
B. Any rotating shafts, couplings, belt, drives, or other moving or hazardous portion of equipment and machinery shall be provided with detachable mounted guards.
C. Provide oil tube, grease line and sight glass extensions from any bearing housing, or other items of equipment requiring periodic lubrication, if fittings are obscured or blocked.
D. All equipment shall be installed with sufficient unions to allow replacement, testing and servicing without having to disassemble large portions of piping.
E. Provide valved drains for each item of equipment, from all low points of various system components and provide air cocks at all high points to vent trapped gases.

3.17 GASKETS AND PACKING
A. For each flanged joint, provide a composite gasket coated with a small amount of prepared thread lubricant. Gasket material shall be standard catalog product especially selected for the pressure and temperature service under which it will be used. All gasket material shall be stamped with the manufacturer's trademark.
B. Valves shall be tight in operation, and if found to be leaky, packing shall be replaced with the best grade super seal packing.

3.18 CORE DRILLING
A. Set sleeves prior to installation of structure for passage of pipes, conduit, ducts, etc.
B. Where core drilling is unavoidable, or required by renovation projects, locate all required openings prior to coring and submit to Architect for review.
C. Coordinate openings with all other Trade Contractors.
D. Core drilling is to be provided by the mechanical subcontractors.
E. Do not disturb existing systems. Protect all areas from damage of any type.
F. Thoroughly investigate existing conditions in vicinity of required opening prior to coring.

3.19 LUBRICATION
A. Upon completion of the work and before turning it over to the Owner, clean and lubricate all bearings except sealed and permanently lubricated bearings. Use only lubricant recommended by the manufacturer.
B. Contractor is responsible for maintaining lubrication of all mechanical equipment under his contract until work is accepted by Owner.
C. Furnish a typewritten chart with each piece of equipment listed, itemizing locations for lubricant required and recommended periods for lubrication. Incorporate chart in Operation and Maintenance Instructions.
D. Furnish to the Architect for approval, three typewritten lubrication manuals in loose leaf binders. One approved copy shall be returned to the Contractor for his use during the Owner instruction period. At the end of this period it shall be returned to the Architect.
E. Lubrication manual shall consist of a separate page for each item of equipment requiring lubrication, listing locations for lubrication, lubricant required, recommended for periods for lubrication, date last lubricated, and spaces for recording periodic lubrication.

3.20 PROHIBITED INSTALLATION
A. The Contractors shall not install any piping, ductwork or other mechanical equipment in or through electrical rooms, transformer rooms, electrical closets, telephone rooms or elevator machine rooms, unless piping, ductwork or equipment is intended to serve these rooms. If any Contractor violates this requirement, he shall remove and/or relocate all items as required at his expense and to the satisfaction of the Architect.

METERS AND GAGES FOR HVAC PIPING

PART 1 - PRODUCTS

1.1 SOLAR DIGITAL THERMOMETER
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Weiss Instruments, Inc.
B. Case: High impact ABS. Thermometers located outside are to be provided with outdoor waterproof cover.
C. Connector: Variable angle with separable well.
D. Display: 1/2" LCD digits, wide ambient formula
E. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent range.
F. Lux Rating: 10 Lux.

1.2 THERMOWELLS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
3. Ernst Gage Co.
4. Marsh Bellofram.
5. Miljoco Corp.
6. NANMAC Corporation.
7. Noshok, Inc.
8. Palmer - Wahl Instruments Inc.
9. REO TEMP Instrument Corporation.
10. Tel-Tru Manufacturing Company.
11. Trerice, H. O. Co.
12. Weiss Instruments, Inc.
13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
14. WIKA Instrument Corporation.
15. Winters Instruments.
B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

1.3 PRESSURE GAGES
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
3. Ernst Gage Co.
4. Eugene Ernst Products Co.
5. KOBOLD Instruments, Inc.
6. Marsh Bellofram.
7. Miljoco Corp.
8. Noshok, Inc.
9. Palmer - Wahl Instruments Inc.
10. REO TEMP Instrument Corporation.
11. Trerice, H. O. Co.
12. Weiss Instruments, Inc.
13. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
14. WIKA Instrument Corporation.
15. Winters Instruments.
B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
1. Case: Liquid-filled type, drawn steel or cast aluminum, metal 4-1/2-inch diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4 (DN 8), bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red or other dark-color metal.
7. Window: Glass.
8. Ring: Metal.
9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure
11. Range for Fluids under Pressure: Two times operating pressure.

1.4 TEST PLUGS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Flow Design, Inc.
2. MG Piping Products Co.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Co.
6. Trerice, H. O. Co.
7. Watts Industries, Inc.; Water Products Div.
B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.
C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
D. Core Inserts: One or two self-sealing rubber valves.
1. Insert material for air, water, oil, or gas service at 20 to 200 deg F (minus 7 to plus 93 deg C) shall be CR.
2. Insert material for air or water service at minus 30 to plus 275 deg F (minus 35 to plus 136 deg C) shall be EPDM.

1.5 VENTURI FLOWMETERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Armstrong Pumps, Inc.
2. Badger Meter, Inc.; Industrial Div.
3. Bailey-Fischer & Porter Co.
4. Flow Design, Inc.
5. Gerand Engineering Co.
6. Hyspan Precision Products, Inc.
7. Leeds & Northrup.
8. McCrometer, Inc.
9. Preso Meters Corporation.
10. Victaulic Co. of America.
B. Description: Differential-pressure design for installation in piping; with calibrated flow-measuring element, separate flowmeter, hoses or tubing, valves, fittings, and conversion chart compatible with flow-measuring element, flowmeter, and system fluid.
C. Construction: Bronze, brass, or factory-primed steel; with brass fittings and attached tag with flow conversion data.
D. Pressure Rating: 250 psig (1725 kPa).
E. Temperature Rating: 250 deg F (121 deg C).
F. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
G. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged or welded.
H. Range: Flow range of flow-measuring element and flowmeter shall cover operating range of equipment or system served.
I. Permanent Indicators: Suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch- (150-mm-) diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.
1. Scale: Gallons per minute (Liters per second).
2. Accuracy: Plus or minus 1 percent between 20 and 80 percent of range.
J. Operating Instructions: Include complete instructions with each flowmeter.

1.6 TURBINE FLOWMETERS
A. Manufacturers: Subject to compliance with requirements:
1. ONICON Incorporated.
B. Description: Insertion type for inserting turbine into piping and measuring flow directly in gallons per minute (liters per second).
C. Construction: Bronze or stainless-steel body; with plastic turbine or impeller and integral direct-reading scale.
D. Pressure Rating: 150 psig (1035 kPa) minimum.
E. Temperature Rating: 180 deg F (82 deg C) minimum.
F. Display: Visual instantaneous rate of flow, with register to indicate total volume in gallons (liters).
G. Accuracy: Plus or minus 2-1/2 percent.

1.7 FLOW INDICATORS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brooks Instrument Div.; Emerson Electric Co.
2. Dwyer Instruments, Inc.
3. Ernst Gage Co.
4. Eugene Ernst Products Co.
5. McCrometer, Inc.
6. OPW Engineered Systems; Dover Corp.
7. Penberthy, Inc.
B. Description: Instrument for installation in piping systems for visual verification of flow.
C. Construction: Bronze or stainless-steel body; with sight glass and plastic pelton-wheel indicator, and threaded or flanged ends.
D. Pressure Rating: 125 psig (860 kPa).
E. Temperature Rating: 200 deg F (93 deg C).
F. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
G. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged.

1.8 INSERTION-TURBINE, THERMAL-ENERGY METER SYSTEMS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ONICON Incorporated.
B. Description: Flow sensor, strainer, two temperature sensors, transmitter, meter, and connecting wiring.
C. Flow Sensor: Insertion-type turbine or paddle-wheel element with corrosion-resistant-metal body and transmitter.
1. Pressure Rating: 125 psig (860 kPa).
2. Temperature Range: 40 to 250 deg F (5 to 121 deg C).
D. Meter: Solid-state integrating type with integral battery pack.
1. Data Output: Six-digit electromechanical counter with readout in kilowatts per hour or British thermal units (joules).
2. Accuracy: Plus or minus 1 percent.
3. Battery Pack: Five-year lithium battery.
E. Strainer: Full size of main line piping.

1.9 ULTRASONIC, THERMAL-ENERGY METER SYSTEMS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Controlotron Corporation.
2. Engineering Measurements Company.
3. Mesa Laboratories, Inc.; Nusonics Div.
B. Description: Flow sensor, two temperature sensors, transmitter, meter, and connecting wiring.
C. Flow Sensor: Strap-on or integral ultrasonic type with transmitter.
D. Meter: Solid-state integrating type with integral battery pack.
1. Data Output: Six-digit electromechanical counter with readout in kilowatts per hour or British thermal units (joules).
2. Accuracy: Plus or minus 1 percent.
3. Battery Pack: Five-year lithium battery.
E. Strainer: Full size of main line piping.

PART 2 - EXECUTION

2.1 THERMOMETER APPLICATIONS
A. Install liquid-in-glass thermometers in the following locations:
1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler and chiller.
3. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
4. Inlet and outlet of each hydronic heat exchanger.
5. Inlet and outlet of each hydronic heat-recovery unit.
6. Inlet and outlet of each thermal storage tank.
7. Outside-air, return-air, and mixed-air ducts.
B. Install solar digital thermometers in the following locations:
1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler and chiller.
3. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
4. Inlet and outlet of each hydronic heat exchanger.
5. Inlet and outlet of each hydronic heat-recovery unit.
6. Inlet and outlet of each thermal storage tank.
C. Provide the following temperature ranges for thermometers:
1. Heating Hot Water: 50 to 400 deg F, with 5-degree scale divisions (10 to 205 deg C, with 2-degree scale divisions).
2. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions (Minus 18 to plus 38 deg C, with 1-degree scale divisions).
3. Steam and Condensate: 30 to 300 deg F, with 5-degree scale divisions (Minus 1 to plus 150 deg C, with 2-degree scale divisions).
4. Air Ducts: 0 to plus 110 deg F, with 2-degree scale divisions.

2.2 GAGE APPLICATIONS
A. Install liquid-filled-case-type pressure gages at chilled- and condenser-water inlets and outlets of chillers.
B. Install liquid-filled-case-type pressure gages at suction and discharge of each pump.

2.3 INSTALLATIONS
A. Install direct-mounting thermometers and adjust vertical and tilted positions.
B. Install remote-mounting dial thermometers on panel, with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.
C. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.
D. Duct Thermometer Support Flanges: Install in wall of duct where duct thermometers are indicated. Attach to duct with screws.
E. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
F. Install remote-mounting pressure gages on panel.
G. Install needle-valve and snubber fitting in piping for each pressure gage for fluids (except steam).
H. Install needle-valve and syphon fitting in piping for each pressure gage for steam.
I. Install test plugs in tees in piping.
J. Install flow indicators, in accessible positions for easy viewing, in piping systems.
K. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters as prescribed by manufacturer's written instructions.
L. Install flowmeter elements in accessible positions in piping systems.
M. Install differential-pressure-type flowmeter elements with at least minimum straight lengths of pipe upstream and downstream from element as prescribed by manufacturer's written instructions.
N. Install wafer-orifice flowmeter elements between pipe flanges.
O. Install permanent indicators on walls or brackets in accessible and readable positions.
P. Install connection fittings for attachment to portable indicators in accessible locations.
Q. Install flowmeters at discharge of hydronic system pumps and at inlet of hydronic air coils.
R. Assemble components and install thermal-energy meters.
S. Mount meters on wall if accessible; if not, provide brackets to support meters.

2.4 CONNECTIONS
A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.
B. Connect flowmeter-system elements to meters.
C. Connect flowmeter transmitters to meters.
D. Connect thermal-energy-meter transmitters to meters.

2.5 ADJUSTING
A. Calibrate meters according to manufacturer's written instructions, after installation.
B. Adjust faces of meters and gages to proper angle for best visibility.

GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - PRODUCTS

1.1 MANUFACTURERS
A. All piping related items are to be purchased through Ferguson Enterprise (Alton Lassiter - 615-316-1848, alton.lassiter@ferguson.com).
B. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

1.2 VALVES, GENERAL
A. Refer to Part 3 "Valve Applications" Article for applications of valves.
B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.
C. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.
D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
F. Valve Actuators:
1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
2. Gear Drive: For quarter-turn valves NPS 8 (DN 200) and larger.
3. Handwheel: For valves other than quarter-turn types.
4. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.
5. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.
G. Extended Valve Stems: On insulated valves.
H. Extend operating handle on insulated ball valves.
I. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
J. Butterfly valves: Extended necks insulated valved.
K. Valve Grooved Ends: AWWA C606.
1. Solder Joint: With sockets according to ASME B16.18.
a. Caution: Use solder with melting point below 840 deg F (454 deg C) for angle, check, gate, and globe valves; below 421 deg F (216 deg C) for ball valves.
2. Threaded: With threads according to ASME B1.20.1.
L. Valve Bypass and Drain Connections: MSS SP-45.

1.3 COPPER-ALLOY BALL VALVES
A. Manufacturers:
1. Kitz
2. Nibco
3. Apollo
4. Watts
5. Milwaukee
6. Hammond
B. Copper-Alloy Ball Valves, General: MSS SP-110.
C. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.
D. Three-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.
E. Safety-Exhaust, Copper-Alloy Ball Valves: Two-piece bronze body with exhaust vent opening, chrome-plated ball with vent, blowout-proof stem, locking handle, and working pressure rating of 600-psig (4140-kPa) CWP.

1.4 FERROUS-ALLOY BALL VALVES
A. Manufacturers
1. Kitz
2. Nibco
3. Crane
4. Grinnell
5. Milwaukee
B. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flanged ends.
C. Ferrous-Alloy Ball Valves: Class 150, full port.
D. Ferrous-Alloy Ball Valves: Class 300, full port.

1.5 FERROUS-ALLOY BUTTERFLY VALVES
A. Manufacturers:
1. Kitz
2. Nibco
3. Crane
4. Centerline
5. Grinnell
6. Keystone
7. Hammond
B. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated.
C. Clamp lock hand lever operator.

1.6 BRONZE CHECK VALVES
A. Manufacturers:
1. Kitz
2. Nibco
3. Grinnell
4. Milwaukee
5. Kennedy
B. Bronze Check Valves, General: MSS SP-80.
C. Type 2, Class 125, Bronze, Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
D. Type 2, Class 125, Bronze, Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
E. Type 2, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
F. Type 2, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
G. Type 2, Class 200, Bronze, Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
H. Type 2, Class 200, Bronze, Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
I. Type 4, Class 125, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.
J. Type 4, Class 150, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.
K. Type 4, Class 200, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

PART 2 - EXECUTION

2.1 EXAMINATION
A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.
B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
D. Examine threads on valve and mating pipe for form and cleanliness.
E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
F. Do not attempt to repair defective valves; replace with new valves.

2.2 VALVE APPLICATIONS
A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:
1. Shutoff Duty:
a. 2" and smaller: ball.
b. 2 ½" and larger: butterfly.
2. Throttling Duty:
a. 2" and smaller: globe.
b. 2-1/2" and larger: globe or butterfly.
B. Heating Water Systems: Use the following valve types:
1. Ball Valves: Class 150, 600-psi CWP, with stem extension and memory stop.
2. Butterfly Valves: Nickel-plated ductile iron, aluminum bronze, or epoxy-coated ductile iron disc; EPDM or Buna N sleeve and stem seals.
3. Bronze Swing Check: Class 150, with composition seat.
4. Check Valves: Iron swing, wafer, or lift type, as indicated. Swing check shall be Class 150 with bronze seat ring.
C. Low-Pressure Steam and Condensate Return Systems: Use the following valve types:
1. Ball Valves: Class 150, 600-psi CWP, with stem extension.
2. Check Valves: Class 150, bronze body swing check with composition seat; Class 150, cast-iron body swing check with bronze seat ring; or Class 125, cast-iron body wafer check.
D. Chilled-Water Systems: Use the following valve types:
1. Ball Valves: Class 150, 600-psi CWP, with stem extension and memory stop.
2. Butterfly Valves: Nickel-plated ductile iron, aluminum bronze, or elastomer-coated ductile iron disc; EPDM sleeve and stem seals.
3. Check Valves: Class 125, bronze body swing check with rubber seat; Class 125, cast-iron body swing check; Class 125, cast-iron body wafer check; or Class 125, cast-iron body lift check.

2.3 VALVE INSTALLATION
A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install shutoff-duty valves at each branch connection to supply mains, at supply connections to each piece of equipment, and elsewhere as indicated.
C. Install throttling-duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.
D. Install calibrated plug valves on the outlet of each heating or cooling element and elsewhere as required to facilitate system balancing.
E. Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage.
F. Install check valves on each pump discharge and elsewhere as required to control flow direction.
G. Install safety relief valves on hot water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Pipe discharge to floor without valves. Comply with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements.
H. Install pressure-reducing valves on hot water generators and elsewhere as required to regulate system pressure.
I. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
J. Locate valves for easy access and provide separate support where necessary.
K. Install valves in horizontal piping with stem at or above center of pipe.
L. Install valves in position to allow full stem movement.
M. Install check valves for proper direction of flow and as follows:
1. Swing Check Valves: In horizontal position with hinge pin level.

This sheet of drawings has not been reviewed for code compliance.

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PROFESSIONAL ENGINEER
8/15/2023

PROJECT
Health ONE The Medical Center of Aurora
TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
Job Number		2023-01094

TITLE
MECHANICAL SPECIFICATIONS

SHEET NUMBER
M002

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MECHANICAL SPECIFICATIONS (CONT.)

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - PRODUCTS

1.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:
1. Material and Thickness: Brass, 0.032-inch (0.8-mm), Stainless steel, 0.025-inch (0.64-mm) Aluminum, 0.032-inch (0.8-mm) or anodized aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number. Coordinate final tag number with facilities.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

1.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
B. Letter Color: Black.
C. Background Color: White.
D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
G. Fasteners: Stainless-steel rivets or self-tapping screws.
H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
I. Label Content: Include caution and warning information, plus emergency notification instructions.

1.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm) high.

1.4 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
B. Letter Color: Black.
C. Background Color: White.
D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
G. Fasteners: Stainless-steel rivets or self-tapping screws.
H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm) high.

1.5 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches (32 mm) for ducts; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.
1. Stencil Material: Aluminum.
2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

1.6 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.

1.7 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 2 - EXECUTION

2.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

2.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.
B. Locate equipment labels where accessible and visible.

2.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 20 feet (15 m) along each run.
7. At least once in each separate space through which the pipe passes.
8. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:
1. Chilled-Water Piping:
a. Background Color: Blue.
b. Letter Color: Black.
2. Heating Water Piping:
a. Background Color: Red.
b. Letter Color: Black.
3. Steam Piping:
a. Background Color: Yellow.
b. Letter Color: Black.

2.4 DUCT LABEL INSTALLATION

A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
1. Blue: For cold-air supply ducts.
2. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
3. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 20 feet in each space where ducts are exposed or concealed by removable ceiling system. At least once in each separate space through which the duct passes.

2.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
1. Valve-Tag Size and Shape:
a. Chilled Water: 1-1/2 inches (38 mm), square.
b. Hot Water: 1-1/2 inches (38 mm), square.
2. Valve-Tag Color:
a. Chilled Water: Green.
b. Hot Water: Green.
3. Letter Color:
a. Chilled Water: Black.
b. Hot Water: Black.

2.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - EXECUTION

1.1 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:
1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

1.2 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve-position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

1.3 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling unit components.

L. Check for proper sealing of air duct system.

1.4 PROCEDURES FOR MULTIZONE SYSTEMS

A. Set unit at full flow through the cooling coil if coil has that capacity.

B. Adjust each zone damper to indicated airflow.

1.5 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
1. Open all manual valves for maximum flow.
2. Check expansion tank liquid level.
3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

1.6 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

1.7 PROCEDURES FOR HEAT-TRANSFER COILS

A. Water Coils: Measure the following data for each coil:
1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

1.8 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

1.9 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate drain trap.
7. Check bearings and other lubricated parts for proper lubrication.
8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished.
1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan, speed, filter, and coil face velocity.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the airflow and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.
4. Air balance each air outlet.

1.10 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.
B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
C. Record controller settings and note variances between set points and actual measurements.
D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
E. Check free travel and proper operation of control devices such as damper and valve operators.
F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.
G. Check the interaction of electrically operated switch transducers.
H. Check the interaction of interlock and lockout systems.
I. Check main control supply-air pressure and observe compressor and dryer operations.
J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
K. Note operation of electric actuators using spring return for proper fail-safe operations.

1.11 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.
3. Heating-Water Flow Rate: 0 to minus 10 percent.
4. Cooling-Water Flow Rate: 0 to minus 5 percent.

1.12 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

1.13 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
1. Include a list of instruments used for procedures, along with proof of calibration.

C. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data: Include the following:
a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches (mm), and bore.
i. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
j. Number of belts, make, and size.
k. Number of filters, type, and size.
2. Motor Data:
a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
3. Test Data (Indicated and Actual Values):
a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Filter static-pressure differential in inches wg (Pa).
f. Preheat coil static-pressure differential in inches wg (Pa).
g. Cooling coil static-pressure differential in inches wg (Pa).
h. Heating coil static-pressure differential in inches wg (Pa).
i. Outside airflow in cfm (L/s).
j. Return airflow in cfm (L/s).
k. Outside-air damper position.
l. Return-air damper position.
m. Vortex damper position.

D. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
a. System and air-handling unit number.
b. Location and zone.
c. Traverse air temperature in deg F (deg C).
d. Duct static pressure in inches wg (Pa).
e. Duct size in inches (mm).
f. Duct area in sq. ft. (sq. m).
g. Indicated airflow rate in cfm (L/s).
h. Indicated velocity in fpm (m/s).
i. Actual airflow rate in cfm (L/s).
j. Actual average velocity in fpm (m/s).
k. Barometric pressure in psig (Pa).

E. Air-Terminal-Device Reports:
1. Unit Data:
a. System and air-handling unit identification.
b. Location and zone.
c. Test apparatus used.
d. Area served.
e. Air-terminal-device make.
f. Air-terminal-device number from system diagram.
g. Air-terminal-device type and model number.
h. Air-terminal-device size.
i. Air-terminal-device effective area in sq. ft. (sq. m).
2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm (L/s).
b. Air velocity in fpm (m/s).
c. Preliminary airflow rate as needed in cfm (L/s).
d. Preliminary velocity as needed in fpm (m/s).
e. Final airflow rate in cfm (L/s).
f. Final velocity in fpm (m/s).
g. Space temperature in deg F (deg C).

F. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
a. System and air-handling unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.
2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm (L/s).
b. Entering-water temperature in deg F (deg C).
c. Leaving-water temperature in deg F (deg C).
d. Water pressure drop in feet of head or psig (kPa).
e. Entering-air temperature in deg F (deg C).
f. Leaving-air temperature in deg F (deg C).

G. Instrument Calibration Reports:
1. Report Data:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

1.14 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

HVAC INSULATION

PART 1 - PRODUCTS

1.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Cell-U-Foam Corporation; Ultra-CUF.
b. Pittsburgh Corning Corporation; Foamglas Super K.
2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Board Insulation: ASTM C 552, Type IV.
5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, provide one of the following:
a. CertainTeed Corp.; Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; All-Service Duct Wrap.

H. Mineral-Fiber, Preformed Pipe Insulation:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000 Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Phenolic:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Kingspan Corp.; Koolphen K.
2. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
3. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
5. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.
a. Preformed Pipe Insulation: ASJ.

1.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-96.
b. Foster Products Corporation, H. B. Fuller Company; 81-33.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

E. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Red Devil, Inc.; Celulon Ultra Clear.
e. Speedline Corporation; Speedline Vinyl Adhesive.

1.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
1. Products: Subject to compliance with requirements provide one of the following:
a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-30.
b. Foster Products Corporation, H. B. Fuller Company; 30-35.
c. ITW TACC, Division of Illinois Tool Works; CB-25.
d. Marathon Industries, Inc.; 501.
e. Mon-Eco Industries, Inc.; 55-10.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; Encacel.
b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
c. Marathon Industries, Inc.; 570.
d. Mon-Eco Industries, Inc.; 55-70.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-10.
b. Foster Products Corporation, H. B. Fuller Company; 35-00.
c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
d. Marathon Industries, Inc.; 550.
e. Mon-Eco Industries, Inc.; 55-50.
f. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 3 perms (2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F (Minus 29 to plus 93 deg C).
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

1.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-52.
b. Foster Products Corporation, H. B. Fuller Company; 81-42.
c. Marathon Industries, Inc.; 130.
d. Mon-Eco Industries, Inc.; 11-30.
e. Vimasco Corporation; 136.
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F (Minus 46 to plus 82 deg C).
4. Color: White.

1.5 SEALANTS

A. Joint Sealants:
1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-76.
b. Foster Products Corporation, H. B. Fuller Company; 30-45.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.
f. Vimasco Corporation; 750.
2. Joint Sealants for Polystyrene Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-70.
b. Foster Products Corporation, H. B. Fuller Company; 30-45/30-46.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.
3. Materials shall be compatible with insulation materials, jackets, and substrates.
4. Permanently flexible, elastomeric sealant.
5. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
6. Color: White or gray.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: White.

1.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto PVC Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
5. Factory-fabricated tank heads and tank side panels.

This sheet of drawings has not been reviewed for code compliance.

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CONTRACTOR

COLORADO LICENSED PROFESSIONAL ENGINEER 55450 8/15/2023

PROJECT

Health ONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
Job Number	2023-01094	

TITLE

MECHANICAL SPECIFICATIONS

SHEET NUMBER

M003

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MECHANICAL SPECIFICATIONS (CONT.)

1.7 TAPES
A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Compac Corp.; 104 and 105.
c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

1.8 SECUREMENTS
A. Bands:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
B. Insulation Pins and Hangers:
1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-(2.6-mm-) diameter shank, length to suit depth of insulation indicated.
a. Products: Subject to compliance with requirements, provide one of the following:
1) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.
3) Midwest Fasteners, Inc.; CD.
4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-(2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
a. Products: Subject to compliance with requirements, provide one of the following:
1) AGM Industries, Inc.; CWP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
a. Products: Subject to compliance with requirements, provide one of the following:
1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.
b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
a. Products: Subject to compliance with requirements, provide one of the following:
1) GEMCO; Nylon Hangers.
2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
b. Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.
c. Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
a. Products: Subject to compliance with requirements, provide one of the following:
1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
2) GEMCO; Press and Peel.
3) Midwest Fasteners, Inc.; Self Stick.
b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
d. Adhesive-backed base with a peel-off protective cover.
6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
a. Products: Subject to compliance with requirements, provide one of the following:
1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.
b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
a. Products: Subject to compliance with requirements, provide one of the following:
1) GEMCO.
2) Midwest Fasteners, Inc.
C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
D. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.
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. C & F Wire.
b. Childers Products.
c. PABCO Metals Corporation.
d. RPR Products, Inc.

1.9 CORNER ANGLES
A. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
B. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005; Temper H-14.
C. Stainless-Steel Corner Angles: 0.024 inch (0.61 mm) thick, minimum 1 by 1 inch (25 by 25 mm), stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304.

PART 2 - EXECUTION

2.1 PREPARATION
A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

2.2 GENERAL INSTALLATION REQUIREMENTS
A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
G. Keep insulation materials dry during application and finishing.
H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
I. Install insulation with least number of joints practical.
J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
P. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

2.3 PENETRATIONS
A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.
B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.
D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).
1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fire-resistive joint sealers.
F. Insulation Installation at Floor Penetrations:
1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

2.4 GENERAL PIPE INSULATION INSTALLATION
A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flanged units from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with be wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

2.5 CELLULAR-GLASS INSULATION INSTALLATION
A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.
C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.
D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

2.6 MINERAL-FIBER INSULATION INSTALLATION
A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.
C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.
E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Impale insulation over pins and attach speed washers.
f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).
5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.
F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
b. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

2.7 PHENOLIC INSULATION INSTALLATION
A. General Installation Requirements:
1. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6-mm) wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.
B. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
C. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
D. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
E. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

2.8 FIELD-APPLIED JACKET INSTALLATION
A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.
B. Where PVDC jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
C. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
D. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.
E. Where PVDC jackets are indicated, install as follows:
1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches (50 mm) over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches (850 mm) or less. The 33-1/2-inch- (850-mm-) circumference limit allows for 2-inch- (50-mm-) overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

2.9 FINISHES
A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
a. Finish Coat Material: Interior, flat, latex-emulsion size.
B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
D. Do not field paint aluminum or stainless-steel jackets.

2.10 FIELD QUALITY CONTROL
A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
B. Perform tests and inspections.
C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

2.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE
A. Concealed, rectangular round and flat-oval, supply-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
B. Concealed, rectangular round and flat-oval, return-air duct insulation shall be the following:
1. Not insulated.
C. Concealed, rectangular round and flat-oval, outdoor-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
D. Concealed, rectangular round and flat-oval, exhaust-air duct insulation shall be the following:
1. Not insulated.
E. Temporary, rectangular round and flat-oval, ductwork:
1. Not insulated.

2.12 PIPING INSULATION SCHEDULE, GENERAL
A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

2.13 INDOOR AND OUTDOOR PIPING INSULATION SCHEDULE
A. Chilled Water and Brine, above 40 Deg F (5 Deg C):
1. NPS 12 (DN 300) and Smaller: Insulation shall be one of the following:
a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Phenolic: 1 inch (25 mm) thick.
2. Insulation exposed to the weather shall be protected damage, including that caused by sunlight, moisture, equipment maintenance and wind. adhesive tape shall not be permitted.
B. Heating-Hot-Water Supply and Return, 200 Deg F (93 Deg C) and below:
1. NPS 4 and Smaller: Insulation shall be the following:
a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches (50 mm) thick.
C. Condensate Drain:
1. NPS 3/4 (DN 20) and Smaller: Insulation shall be the following:
a. Mineral-Fiber, Preformed Pipe, Type I or II: 2 inches (50 mm).
2. NPS 1 (DN 25) and Larger: Insulation shall be the following:
a. Mineral-Fiber, Preformed Pipe, Type I or II: 3 inches (75 mm).

2.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE
A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. If more than one material is listed, selection from materials listed is Contractor's option.
C. Ducts and Plenums, Concealed:
1. Aluminum, Smooth: 0.016 inch (0.41 mm) thick.
D. Piping, Concealed:
1. All Service Jacket
E. Equipment, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):
1. PVC, Color-Coded by System: 20 mils (0.5 mm) thick.

HYDRONIC PIPING

PART 1 - PRODUCTS

1.1 OWNER PURCHASING AGREEMENT
A. All piping related items are to be purchased through Ferguson Enterprise (Alton Lassiter - 615-316-1848, alton.lassiter@ferguson.com).

1.2 COPPER TUBE AND FITTINGS
A. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).
B. Annealed-Temper Copper Tubing: ASTM B 88, Type K (ASTM B 88M, Type A).
C. Wrought-Copper Fittings: ASME B16.22.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Anvil International, Inc.
b. S. P. Fittings; a division of Star Pipe Products.
D. Wrought-Copper Unions: ASME B16.22.

1.3 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.
E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.
F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.
H. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

1.4 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 (3.2-mm) 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.

MECHANICAL SPECIFICATIONS (CONT.)

1.7 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: 150 psig (1035 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

E. Expansion fittings are specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

PART 2 - EXECUTION

2.1 PIPING APPLICATIONS
A. Hot-water heating piping, aboveground, NPS 2 (DN 50) and smaller, shall be any of the following:
1. Type L (B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
B. Hot-water heating piping, aboveground, NPS 2-1/2 (DN 65) and larger, shall be 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. Chilled-water piping, aboveground, NPS 2 (DN 50) and smaller, shall be any of the following:
1. Type L (B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
D. Chilled-water piping, aboveground, NPS 2-1/2 (DN 65) and larger, shall be any of the following:
1. Type L (B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

2.2 VALVE APPLICATIONS
A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
B. Install calibrated-orifice, balancing valves at each branch connection to return main.
C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01, for installation requirements.
F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

2.3 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. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
E. Install piping to permit valve servicing.
F. Install piping at indicated slopes.
G. Install piping free of sags and bends.
H. Install fittings for changes in direction and branch connections.
I. Install piping to allow application of insulation.
J. Select system components with pressure rating equal to or greater than system operating pressure.
K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
L. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
O. Install branch connections to mains using 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 (DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
R. Install flanges in piping, NPS 2-1/2 (DN 65) and larger, at final connections of equipment and elsewhere as indicated.
S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 (DN 20) nipple and ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 (DN 50).
T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."
U. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

2.4 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 hangers for steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4 (DN 20): Maximum span, 7 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 1 (DN 25): Maximum span, 7 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1-1/2 (DN 40): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
4. NPS 2 (DN 50): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).
5. NPS 2-1/2 (DN 65): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (10 mm).
6. NPS 3 (DN 80): Maximum span, 12 feet (3.7 m); minimum rod size, 3/8 inch (10 mm).
7. NPS 4 (DN 100): Maximum span, 14 feet (4.3 m); minimum rod size, 1/2 inch (13 mm).
8. NPS 6 (DN 150): Maximum span, 17 feet (5.2 m); minimum rod size, 1/2 inch (13 mm).
9. NPS 8 (DN 200): Maximum span, 19 feet (5.8 m); minimum rod size, 5/8 inch (16 mm).
10. NPS 10 (DN 250): Maximum span, 20 feet (6.1 m); minimum rod size, 3/4 inch (19 mm).
11. NPS 12 (DN 300): Maximum span, 23 feet (7 m); minimum rod size, 7/8 inch (22 mm).
12. NPS 14 (DN 350): Maximum span, 25 feet (7.6 m); minimum rod size, 1 inch (25 mm).
13. NPS 16 (DN 400): Maximum span, 27 feet (8.2 m); minimum rod size, 1 inch (25 mm).
14. NPS 18 (DN 450): Maximum span, 28 feet (8.5 m); minimum rod size, 1-1/4 inches (32 mm).
15. NPS 20 (DN 500): Maximum span, 30 feet (9.1 m); minimum rod size, 1-1/4 inches (32 mm).

C. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4 (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 1 (DN 25): Maximum span, 6 feet (1.8 m); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1-1/2 (DN 40): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
4. NPS 2 (DN 50): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
5. NPS 2-1/2 (DN 65): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
6. NPS 3 (DN 80): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).

D. 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.
E. Fiberglass 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 (3-m) intervals between floors.

2.5 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. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
I. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

2.6 HYDRONIC SPECIALTIES INSTALLATION
A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.
C. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

2.7 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 "Meters and Gages for HVAC Piping."

2.8 FIELD QUALITY CONTROL
A. Prepare hydronic piping according to ASME B31.9 and as follows:
1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:
1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

METAL DUCTS

PART 1 - PRODUCTS

1.1 MANUFACTURERS
A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

1.2 SHEET METAL MATERIALS
A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G60 (Z180) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
D. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

1.3 SEALANT MATERIALS
A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.
B. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
C. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.
D. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
E. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

1.4 HANGERS AND SUPPORTS
A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.
C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.

1.5 RECTANGULAR DUCT FABRICATION
A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
1. Manufacturers:
a. Ductmate Industries, Inc.
b. Nexus Inc.
c. Ward Industries, Inc.
C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
1. Manufacturers:
a. Ductmate Industries, Inc.
b. Lockformer.
2. Duct Size: Maximum 30 inches (750 mm) wide and up to 2-inch wg (500-Pa) pressure class.
3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.
D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of nonbraced panel area unless ducts are lined.

1.6 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION
A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.
B. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
C. Flat-Oval, Spiral Lock-Seam Ducts: Fabricate supply ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible.
1. Manufacturers:
a. McGill AirFlow Corporation.
b. SEMCO Incorporated.
D. Duct Joints:
1. Ducts up to 20 Inches (500 mm) in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches (535 to 1830 mm) in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Ducts Larger Than 72 Inches (1830 mm) in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
a. Manufacturers:
1) Ductmate Industries, Inc.
2) Lindab Inc.
5. Flat-Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.
a. Manufacturers:
1) Ductmate Industries, Inc.
2) McGill AirFlow Corporation.
3) SEMCO Incorporated.
E. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.
F. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
G. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa):
a. Ducts 3 to 36 Inches (75 to 915 mm) in Diameter: 0.034 inch (0.85 mm).
b. Ducts 37 to 50 Inches (940 to 1270 mm) in Diameter: 0.040 inch (1.0 mm).
c. Ducts 52 to 60 Inches (1320 to 1525 mm) in Diameter: 0.052 inch (1.3 mm).
d. Ducts 62 to 84 Inches (1575 to 2130 mm) in Diameter: 0.064 inch (1.6 mm).
3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg (500 to 2500 Pa):
a. Ducts 3 to 26 Inches (75 to 660 mm) in Diameter: 0.034 inch (0.85 mm).
b. Ducts 27 to 50 Inches (685 to 1270 mm) in Diameter: 0.040 inch (1.0 mm).
c. Ducts 52 to 60 Inches (1320 to 1525 mm) in Diameter: 0.052 inch (1.3 mm).
d. Ducts 62 to 84 Inches (1575 to 2130 mm) in Diameter: 0.064 inch (1.6 mm).
4. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal-seam flat-oval duct.
5. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
6. Round Elbows 8 Inches (200 mm) and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
7. Round Elbows 9 through 14 Inches (225 through 355 mm) in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
8. Round Elbows Larger Than 14 Inches (355 mm) in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
9. Die-Formed Elbows for Sizes through 8 Inches (200 mm) in Diameter and All Pressures 0.040 inch (1.0 mm) thick with 2-piece welded construction.
10. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
11. Flat-Oval Elbow Metal Thickness: Same as longitudinal-seam flat-oval duct specified above.
12. Pleated Elbows for Sizes through 14 Inches (355 mm) in Diameter and Pressures through 10-Inch wg (2500 Pa): 0.022 inch (0.55 mm).

PART 2 - EXECUTION

2.1 DUCT APPLICATIONS
A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
1. Supply Ducts (before Air Terminal Units): 4-inch wg (750 Pa).
2. Supply Ducts (in Mechanical Equipment Rooms): 4-inch wg (750 Pa).
3. Return Ducts (Negative and Positive Pressure): 2-inch wg (250 Pa).
4. Exhaust Ducts (Negative and Positive Pressure): 2-inch wg (250 Pa).
B. All ducts shall be galvanized steel

2.2 DUCT INSTALLATION
A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
B. Install round and flat-oval ducts in lengths not less than 12 feet (3.7 m) unless interrupted by fittings.
C. Install ducts with fewest possible joints.
D. Install fabricated fittings for changes in directions, size, and shape and for connections.
E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches (300 mm), with a minimum of 3 screws in each coupling.
F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches (38 mm).
N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Air Duct Accessories." Firestopping materials and installation methods are specified in Division 07 Section "Penetration Firestopping."
O. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."
P. Paint interiors of metal ducts, that do not have duct liner, for 24 inches (600 mm) upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

2.3 SEAM AND JOINT SEALING
A. Seal duct seams and joints according to Paragraph 3.1.C Ductwork Seal Class Schedule and SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.
1. Seal Class A: Seal all transverse joints, longitudinal seams and duct wall penetrations.
2. Seal Class B: Seal all transverse joints and longitudinal seams only.
3. Seal Class C: Seal transverse joints only.
B. Seal ducts before external insulation is applied.

2.4 HANGING AND SUPPORTING
A. Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
B. Support vertical ducts at maximum intervals of 16 feet (5 m) and at each floor.
C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
D. Install concrete inserts before placing concrete.
E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

2.5 CONNECTIONS
A. Make connections to equipment with flexible connectors according to Division 23 Section "Air Duct Accessories."
B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

2.6 FIELD QUALITY CONTROL
A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:
1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (500 Pa) (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg (500 to 2500 Pa).
4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

2.7 CLEANING NEW SYSTEMS
A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.
B. Use service openings, as required, for physical and mechanical entry and for inspection.
1. Create other openings to comply with duct standards.
2. Disconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling sections to gain access during the cleaning process.
C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.
D. Clean the following metal duct systems by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
E. Mechanical Cleaning Methodology:
1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
F. Cleanliness Verification:
1. Visually inspect metal ducts for contaminants.
2. Where contaminants are discovered, re-clean and reinspect ducts.

2.8 CLEANING EXISTING SYSTEMS
A. Use service openings, as required, for physical and mechanical entry and for inspection.
1. Use existing service openings where possible.
2. Create other openings to comply with duct standards.
3. Disconnect flexible ducts as needed for cleaning and inspection.
4. Reseal rigid fiberglass duct systems according to NAIMA recommended practices.
5. Remove and reinstall ceiling sections to gain access during the cleaning process.
B. Mark position of dampers and air-directional mechanical devices before cleaning, and restore to their marked position on completion.
C. Particulate Collection and Odor Control:
1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron size (or larger) particles.
2. When venting vacuuming system to the outside, use filtration to contain debris removed from HVAC system, and locate exhaust down wind and away from air intakes and other points of entry into building.
D. Clean the following metal duct systems by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

AIR DUCT ACCESSORIES

PART 1 - PRODUCTS

1.1 FIRE DAMPERS
A. Manufacturers:
1. Air Balance, Inc.
2. CESCO Products.
3. Greenheck.
4. McGill AirFlow Corporation.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Penn Ventilation Company, Inc.
8. Prefco Products, Inc.
9. Ruskin Company.
10. Vent Products Company, Inc.
11. Ward Industries, Inc.
B. Fire dampers shall be labeled according to UL 555.
C. Fire Rating: 1-1/2 hours.
D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.
E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
1. Minimum Thickness: 0.052 or 0.138 inch (1.3 or 3.5 mm) thick as indicated and of length to suit application.
2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
F. Mounting Orientation: Vertical or horizontal as indicated.
G. Blades: Roll-formed, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.
H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

Fusible Links: Replaceable, 165 deg F (74 deg C) rated.

1.2 TURNING VANES
A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- (38-mm-) wide, double-vane, curved blades of galvanized sheet steel set 3/4 inch (19 mm) o.c.; support with bars perpendicular to blades set 2 inches (50 mm) o.c.; and set into vane runners suitable for duct mounting.
1. Manufacturers:
a. Ductmate Industries, Inc.
b. Duro Dyne Corp.
c. METALAIRE, Inc.
d. Ward Industries, Inc.
C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
D. Pressure Relief Access Door: Double wall and duct mounting; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated, latches, and retaining chain.
1. Manufacturers:
a. American Warming and Ventilating.
b. CESCO Products.
c. Ductmate Industries, Inc.
d. Greenheck.
e. KEES, Inc.
f. McGill AirFlow Corporation.
g. Nexus PDQ.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
E. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
F. Insulation: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.

PART 2 - EXECUTION

2.1 APPLICATION AND INSTALLATION
A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
C. Provide test holes at fan inlets and outlets and elsewhere as indicated.
D. Install fire and smoke dampers according to manufacturer's UL-approved written instructions in all penetrations of fire rated assemblies as indicated on architectural drawings.

2.2 Install fusible links in fire dampers.

2.3 ADJUSTING
A. Adjust duct accessories for proper settings.
B. Adjust fire and smoke dampers for proper action.
C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
1. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Metal floor plate, stairs and supports.
4. Loose bearing and leveling plates for applications where they are not specified in other Sections.
B. 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.

1.2 COORDINATION
A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

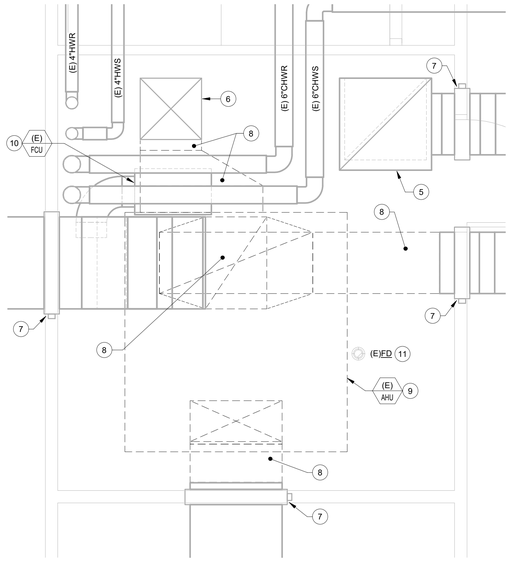
1.3 ACTION SUBMITTALS
A. Product Data: For the following:
1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.
3. Grout.
B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for all items listed in summary above:
1. Include shop drawings and structural analysis data signed and sealed by the qualified professional engineer licensed to practice in the location

GENERAL NOTES:

A. REFER TO M10-00 FOR LEGENDS, GENERAL NOTES, AND ABBREVIATIONS. REFER TO M10-01 FOR PROJECT SPECIFICATIONS.
B. AT NO TIME SHALL THE EXISTING HOSPITAL SYSTEMS BE SHUT DOWN WITHOUT PRIOR NOTICE AND APPROVAL OF THE OWNER. MINIMUM (5) DAYS NOTICE SHALL BE PROVIDED FOR ALL SYSTEM SHUTDOWNS. QUANTITY OF ANTICIPATED SYSTEM SHUTDOWNS EXPECTED TO BE LONGER THAN (4) HOURS MUST BE DISCLOSED AT THE TIME OF BID.
C. EXISTING INFRASTRUCTURE SHOWN IS BASED ON THE BEST INFORMATION AVAILABLE. THE CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS FOR TIE-INS AND FIT OF NEW INFRASTRUCTURE PRIOR TO RELEASING MATERIAL.
D. ALL EXISTING FIRE DAMPERS IN NON RATED WALLS ARE TO BE REMOVED.
E. CONTRACTOR SHALL CAP AND SEAL ALL UNUSED DUCT TAPS AIR TIGHT.
F. ALL EXISTING INSULATION ACCESSIBLE DURING RENOVATION SHALL BE INSPECTED, REPAIRED, AND/OR REPLACED AS APPROPRIATE.
G. CONTRACTOR SHALL ENSURE THE DUCT SYSTEMS ARE FREE OF DEBRIS OR DUST.
H. CONTRACTOR SHALL PROVIDE AS-BUILT DOCUMENTATION DEPICTING NEW AND EXISTING CONDITIONS.
J. NEW MAU TO BE OPERATIONAL BEFORE DEMOLITION OF EXISTING AIR HANDLING UNIT ON EACH FLOOR.

(#) LEGEND NOTES:

1. EXISTING 6" CHILLED WATER AND HEATING WATER PIPING RISERS TO REMAIN.
2. EXISTING SUPPLY AIR DUCTWORK THROUGH 2-HR FIRE-RATED WALL, WITH EXISTING FIRE DAMPER, TO REMAIN. DUCTWORK TO BE DEMOLISHED WITHIN MECHANICAL ROOM. FIELD VERIFY SIZE OF DUCTWORK TO REMAIN.
3. EXISTING RETURN AIR DUCTWORK THROUGH 2-HR FIRE-RATED WALL, WITH EXISTING FIRE DAMPER, TO REMAIN. DUCTWORK TO BE DEMOLISHED WITHIN MECHANICAL ROOM. FIELD VERIFY SIZE OF DUCTWORK TO REMAIN.
4. EXISTING EXHAUST DUCTWORK THROUGH 2-HR FIRE RATED WALL, WITH EXISTING FIRE DAMPER, TO REMAIN.
5. EXISTING EXHAUST DUCT RISER (UP TO 3RD & DOWN TO 1ST) TO REMAIN. CONTRACTOR TO PERFORM PRE-CONSTRUCTION TEST AND BALANCE (TAB) REPORT TO DETERMINE EXISTING AIR FLOW COMING UP FROM 1ST FLOOR. PROVIDE TAB REPORT TO EOR.
6. EXISTING OUTSIDE AIR DUCT RISER (UP TO 3RD) TO REMAIN.
7. EXISTING FIRE DAMPER TO REMAIN.
8. ALL DUCT MAINS FROM EXISTING AIR HANDLING UNIT TO BE DEMOLISHED (SUPPLY & RETURN). EXISTING DUCTWORK TO BE DEMOLISHED WITHIN MECHANICAL ROOM UP TO EXISTING FIRE DAMPER, AS NECESSARY TO FACILITATE NEW CONNECTION TO RISER.
9. EXISTING AIR HANDLING UNIT WITHIN MECHANICAL ROOM TO BE DEMOLISHED, AND ALL ASSOCIATED PIPING AND CONTROLS. DEMOLISH CHILLED WATER & HEATING WATER PIPING BACK TO SHUT-OFF VALVE AT BRANCH OFF MAIN. REMOVE ALL DRAIN PIPING.
10. EXISTING FAN COIL TO REMAIN, SERVING EXISTING IT RACK. FIELD VERIFY EXACT LOCATION AND DIMENSIONS. EXISTING CHILLED WATER PIPING BRANCHES TO REMAIN.
11. EXISTING FLOOR DRAIN TO REMAIN.



2 ENLARGED LEVEL 02 DEMO PLAN
1/2" = 1'-0"



1 LEVEL 02-OVERALL DEMOLITION PLAN
3/32" = 1'-0"

This sheet of drawings has not been reviewed for code compliance.

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COLORADO LICENSED MICHAEL P THOMPSON 54150 PROFESSIONAL ENGINEER
8/15/2023

PROJECT

HealthONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
Job Number		2023-01094

TITLE

LEVEL 02 MECHANICAL DEMOLITION PLAN

SHEET NUMBER

M101

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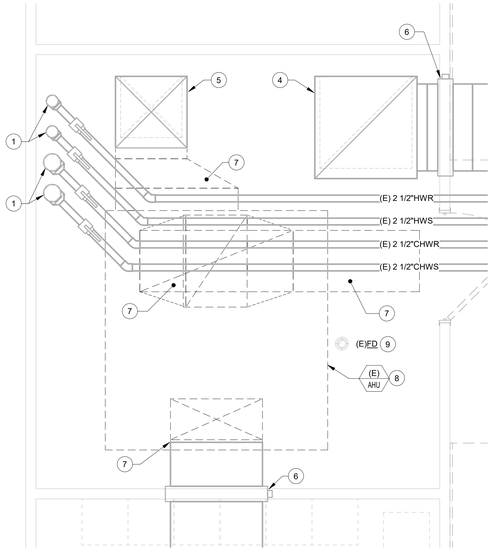
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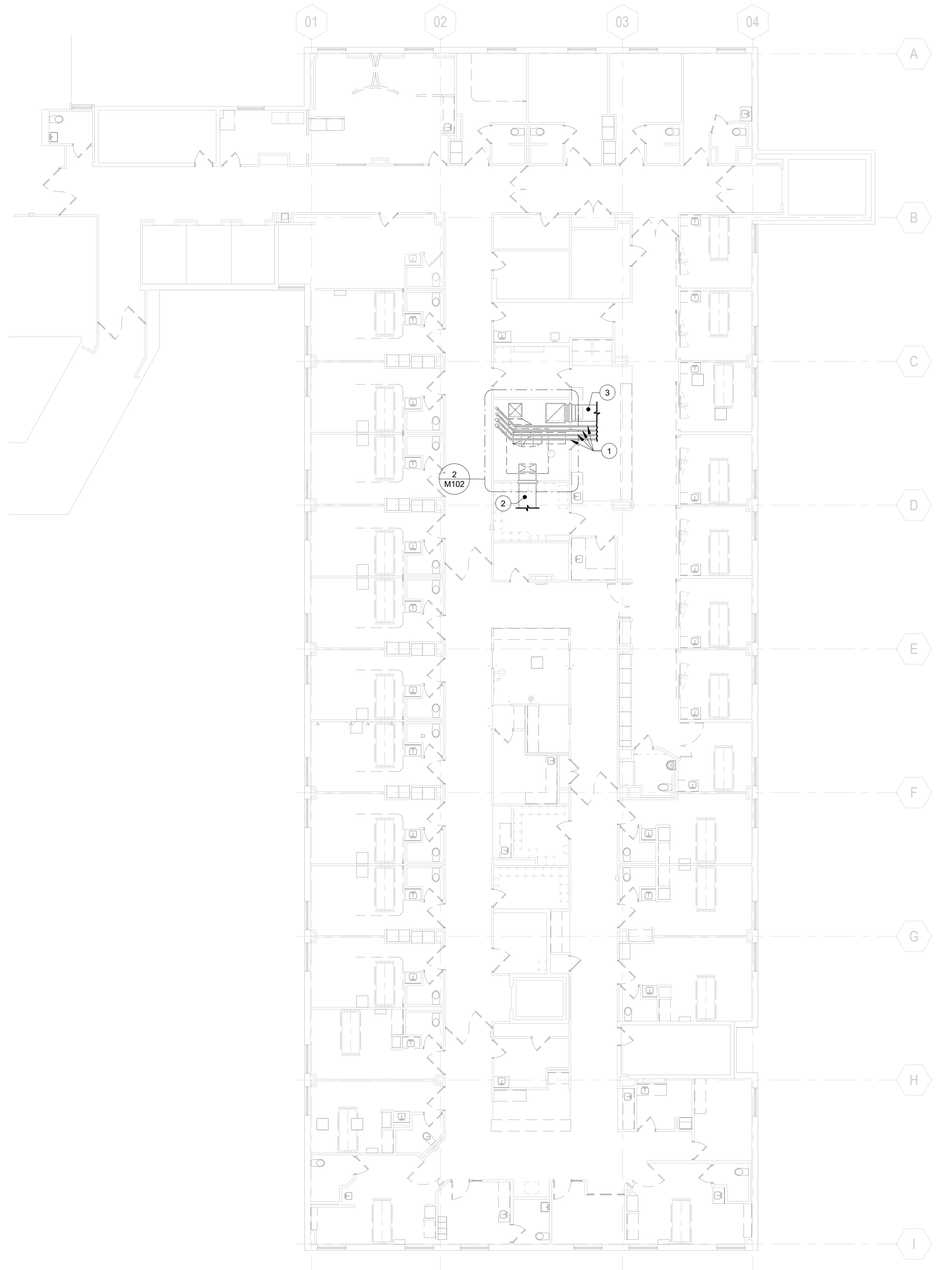
(#) LEGEND NOTES:

1. EXISTING 6" CHILLED WATER AND HEATING WATER PIPING RISERS TO REMAIN. EXISTING 2-1/2" CHILLED WATER AND HEATING WATER PIPING SERVING 3RD FLOOR TO REMAIN. FIELD VERIFY EXACT LOCATION.
2. EXISTING SUPPLY AIR DUCTWORK THROUGH 2-HR FIRE-RATED WALL, WITH EXISTING FIRE DAMPER, TO REMAIN. DUCTWORK TO BE DEMOLISHED WITHIN MECHANICAL ROOM. FIELD VERIFY SIZE OF DUCTWORK TO REMAIN.
3. EXISTING EXHAUST DUCTWORK THROUGH 2-HR FIRE RATED WALL, WITH EXISTING FIRE DAMPER, TO REMAIN.
4. EXISTING EXHAUST DUCT RISER (UP TO 4TH & DOWN TO 2ND) TO REMAIN.
5. EXISTING OUTSIDE AIR DUCT RISER (UP TO 4TH & DOWN TO 2ND) TO REMAIN.
6. EXISTING FIRE DAMPER TO REMAIN.
7. ALL DUCT MAINS FROM EXISTING AIR HANDLING UNIT TO BE DEMOLISHED (SUPPLY & RETURN). EXISTING DUCTWORK TO BE DEMOLISHED WITHIN MECHANICAL ROOM UP TO EXISTING FIRE DAMPER, AS NECESSARY TO FACILITATE NEW CONNECTION TO RISER.
8. EXISTING AIR HANDLING UNIT WITHIN MECHANICAL ROOM TO BE DEMOLISHED, AND ALL ASSOCIATED PIPING AND CONTROLS. DEMOLISH CHILLED WATER & HEATING WATER PIPING BACK TO SHUT-OFF VALVE AT BRANCH OFF MAIN. REMOVE ALL DRAIN PIPING.
9. EXISTING FLOOR DRAIN TO REMAIN.



2 ENLARGED LEVEL 03 DEMO PLAN

1/2" = 1'-0"



1 LEVEL 03-OVERALL DEMOLITION PLAN

3/32" = 1'-0"

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KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE

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TITLE

LEVEL 03 MECHANICAL DEMOLITION PLAN

SHEET NUMBER

M102

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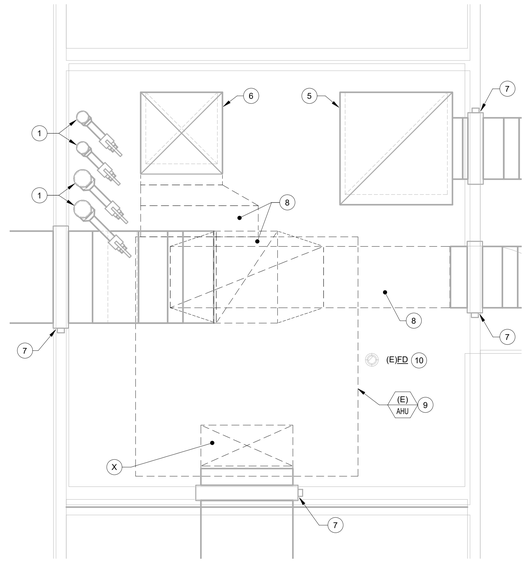
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GENERAL NOTES:

A. REFER TO M10-00 FOR LEGENDS, GENERAL NOTES, AND ABBREVIATIONS. REFER TO M10-01 FOR PROJECT SPECIFICATIONS.
B. AT NO TIME SHALL THE EXISTING HOSPITAL SYSTEMS BE SHUT DOWN WITHOUT PRIOR NOTICE AND APPROVAL OF THE OWNER. MINIMUM (5) DAYS NOTICE SHALL BE PROVIDED FOR ALL SYSTEM SHUTDOWNS. QUANTITY OF ANTICIPATED SYSTEM SHUTDOWNS EXPECTED TO BE LONGER THAN (4) HOURS MUST BE DISCLOSED AT THE TIME OF BID.
C. EXISTING INFRASTRUCTURE SHOWN IS BASED ON THE BEST INFORMATION AVAILABLE. THE CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS FOR TIE-INS AND FIT OF NEW INFRASTRUCTURE PRIOR TO RELEASING MATERIAL.
D. ALL EXISTING FIRE DAMPERS IN NON RATED WALLS ARE TO BE REMOVED.
E. CONTRACTOR SHALL CAP AND SEAL ALL UNUSED DUCT TAPS AIR TIGHT.
F. ALL EXISTING INSULATION ACCESSIBLE DURING RENOVATION SHALL BE INSPECTED, REPAIRED, AND/OR REPLACED AS APPROPRIATE.
G. CONTRACTOR SHALL ENSURE THE DUCT SYSTEMS ARE FREE OF DEBRIS OR DUST.
H. CONTRACTOR SHALL PROVIDE AS-BUILT DOCUMENTATION DEPICTING NEW AND EXISTING CONDITIONS.
J. NEW MAU TO BE OPERATIONAL BEFORE DEMOLITION OF EXISTING AIR HANDLING UNIT ON EACH FLOOR.

(#) LEGEND NOTES:

1. EXISTING 6" CHILLED WATER AND HEATING WATER PIPING RISERS TO REMAIN.
2. EXISTING SUPPLY AIR DUCTWORK THROUGH 2-HR FIRE-RATED WALL, WITH EXISTING FIRE DAMPER, TO REMAIN. DUCTWORK TO BE DEMOLISHED WITHIN MECHANICAL ROOM. FIELD VERIFY SIZE OF DUCTWORK TO REMAIN.
3. EXISTING RETURN AIR DUCTWORK THROUGH 2-HR FIRE-RATED WALL, WITH EXISTING FIRE DAMPER, TO REMAIN. DUCTWORK TO BE DEMOLISHED WITHIN MECHANICAL ROOM. FIELD VERIFY SIZE OF DUCTWORK TO REMAIN.
4. EXISTING EXHAUST DUCTWORK THROUGH 2-HR FIRE RATED WALL, WITH EXISTING FIRE DAMPER, TO REMAIN.
5. EXISTING EXHAUST DUCT RISER (UP TO 3RD & DOWN TO 1ST) TO REMAIN.
6. EXISTING OUTSIDE AIR DUCT RISER (UP TO 3RD) TO REMAIN.
7. EXISTING FIRE DAMPER TO REMAIN.
8. ALL DUCT MAINS FROM EXISTING AIR HANDLING UNIT TO BE DEMOLISHED (SUPPLY & RETURN). EXISTING DUCTWORK TO BE DEMOLISHED WITHIN MECHANICAL ROOM UP TO EXISTING FIRE DAMPER, AS NECESSARY TO FACILITATE NEW CONNECTION TO RISER.
9. EXISTING AIR HANDLING UNIT WITHIN MECHANICAL ROOM TO BE DEMOLISHED, AND ALL ASSOCIATED PIPING AND CONTROLS. DEMOLISH CHILLED WATER & HEATING WATER PIPING BACK TO SHUT-OFF VALVE AT BRANCH OFF MAIN. REMOVE ALL DRAIN PIPING.
10. EXISTING FLOOR DRAIN TO REMAIN.



2 ENLARGED LEVEL 04 DEMO PLAN
1/2" = 1'-0"



1 LEVEL 04-OVERALL DEMOLITION PLAN
3/32" = 1'-0"

This sheet of drawings has not been reviewed for code compliance.

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AURORA, CO 80012

CONTRACTOR

COLORADO LICENSED MICHAEL P THOMPSON 55450 PROFESSIONAL ENGINEER
8/15/2023

PROJECT

HealthONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
Job Number		2023-01094

TITLE

LEVEL 04 MECHANICAL DEMOLITION PLAN

SHEET NUMBER

M103

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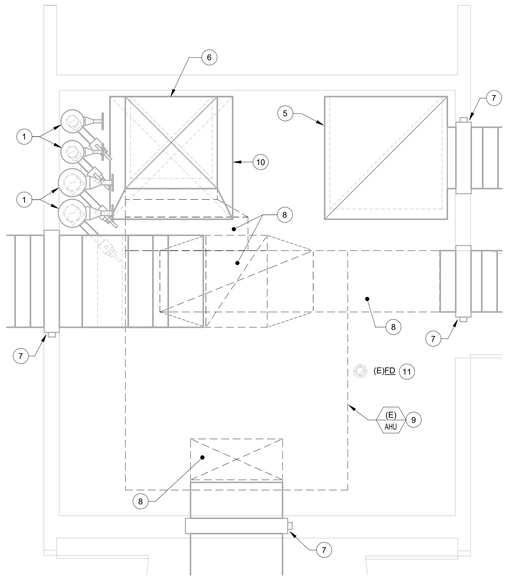
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GENERAL NOTES:

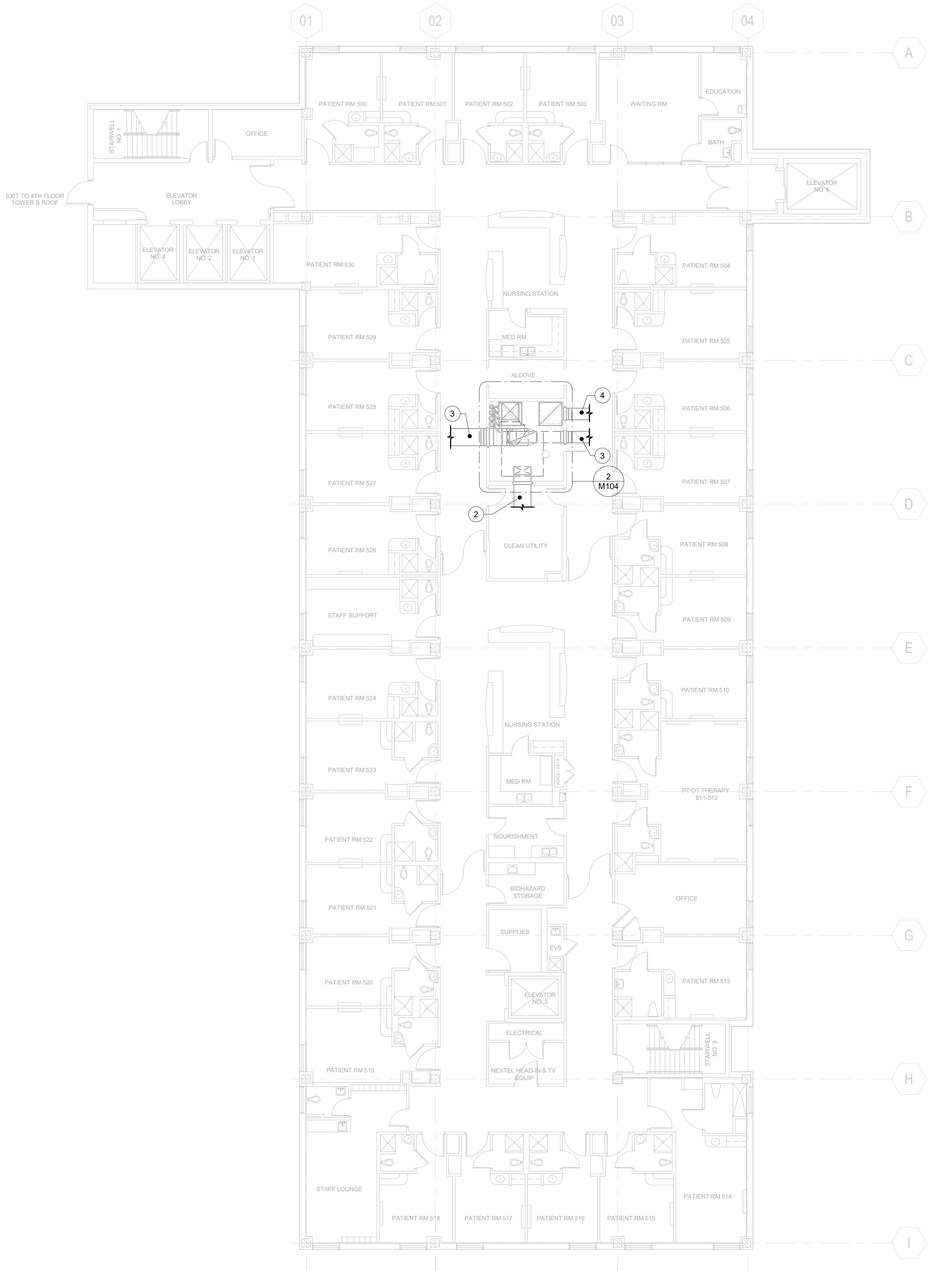
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J. NEW MAU TO BE OPERATIONAL BEFORE DEMOLITION OF EXISTING AIR HANDLING UNIT ON EACH FLOOR.

(#) LEGEND NOTES:

1. EXISTING 6" CHILLED WATER AND HEATING WATER PIPING RISERS TO REMAIN. FIELD VERIFY LOCATION OF ALL EXISTING SHUT-OFF VALVES AND MODIFY PIPING AS NECESSARY FOR CONNECTION TO NEW UNIT ON ROOF.
2. EXISTING SUPPLY AIR DUCTWORK THROUGH 2-HR FIRE-RATED WALL, WITH EXISTING FIRE DAMPER, TO REMAIN. DUCTWORK TO BE DEMOLISHED WITHIN MECHANICAL ROOM.
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9. EXISTING AIR HANDLING UNIT WITHIN MECHANICAL ROOM TO BE DEMOLISHED, AND ALL ASSOCIATED PIPING AND CONTROLS. DEMOLISH CHILLED WATER & HEATING WATER PIPING BACK TO SHUT-OFF VALVE AT BRANCH OFF MAIN. REMOVE ALL DRAIN PIPING.
10. EXISTING DUCT COIL TO REMAIN. DEMOLISH ALL PIPING TO/FROM EXISTING COIL AND CAP AT POINTS OF CONNECTION TO COIL. EXISTING PIPING AND ASSOCIATED EQUIPMENT, INCLUDING PUMP, SERVING EXISTING DUCT COIL TO BE REMOVED. FIELD VERIFY ALL EXISTING PIPING AND COORDINATE DEMOLITION WITH OWNER.
11. EXISTING FLOOR DRAIN TO REMAIN.



2 ENLARGED LEVEL 05 DEMO PLAN
1/2" = 1'-0"



1 LEVEL 05 OVERALL DEMOLITION PLAN
3/32" = 1'-0"

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CONTRACTOR

COLORADO LICENSED MICHAEL P THOMPSON 56150 PROFESSIONAL ENGINEER
8/15/2023

PROJECT

Health ONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
Job Number		2023-01094

TITLE

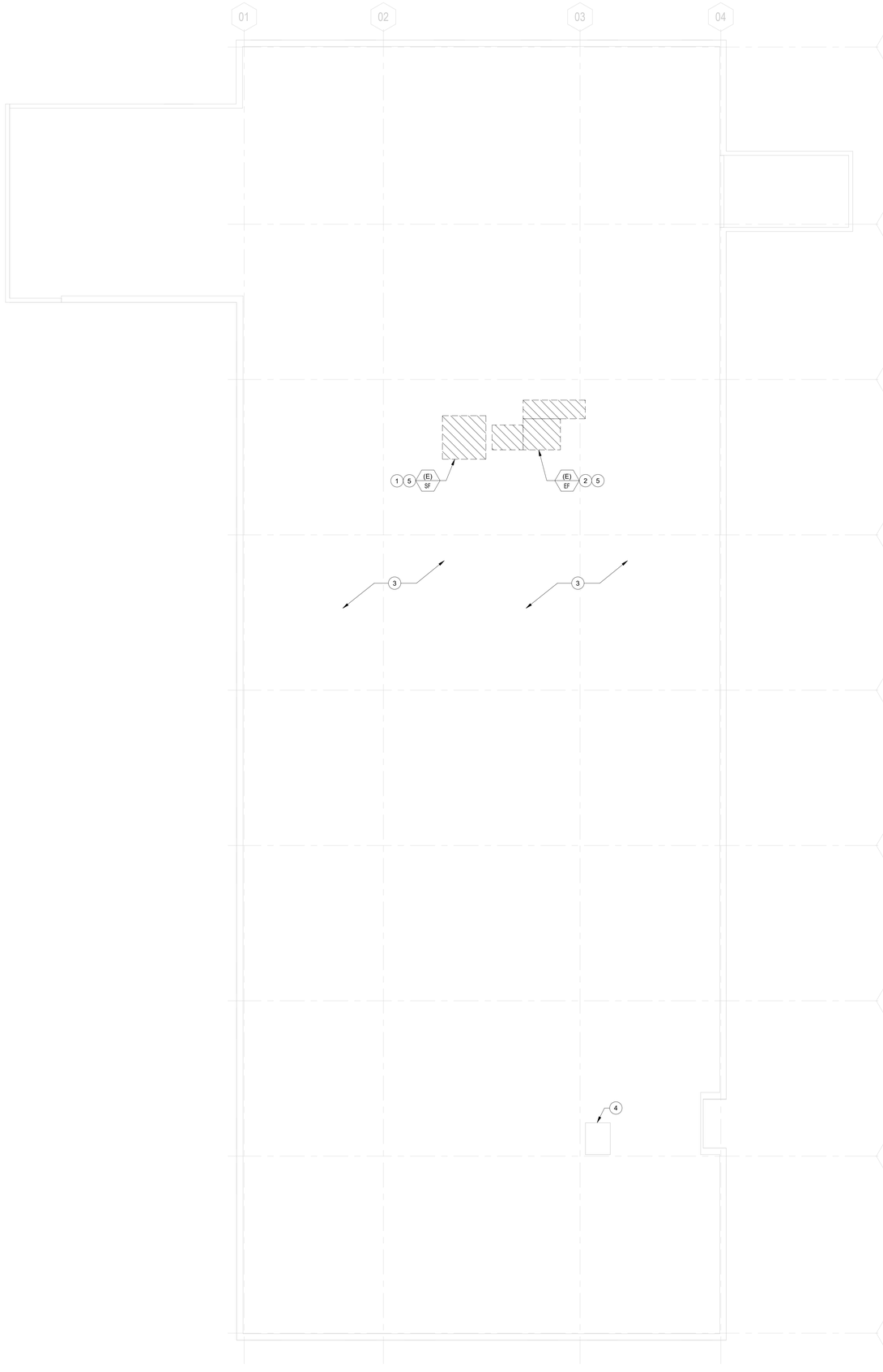
LEVEL 05 MECHANICAL DEMOLITION PLAN

SHEET NUMBER

M104

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G. CONTRACTOR SHALL ENSURE THE DUCT SYSTEMS ARE FREE OF DEBRIS OR DUST.
H. CONTRACTOR SHALL PROVIDE AS-BUILT DOCUMENTATION DEPICTING NEW AND EXISTING CONDITIONS.

(#) LEGEND NOTES:

1. DEMOLISH EXISTING SUPPLY FAN ON ROOF. EXISTING 36"x36" OUTSIDE AIR RISER TO REMAIN. PROVIDE TEMPORARY CAP OVER EXPOSED DUCT END DURING CONSTRUCTION. FIELD VERIFY EXACT LOCATION.
2. DEMOLISH EXISTING EXHAUST FAN ON ROOF. EXISTING 48"x48" EXHAUST AIR RISER TO REMAIN FOR CONNECTION TO NEW AIR HANDLER. COORDINATE SHUTDOWN AND REMOVAL OF EXISTING EXHAUST FAN WITH OWNER. FIELD VERIFY EXACT LOCATION.
3. FIELD VERIFY EXACT LOCATION OF ALL EXISTING VENT PIPING TERMINATING ON ROOF.
4. EXISTING ROOF ACCESS HATCH.
5. MAINTAIN OPERATION OF EXISTING SYSTEM AS LONG AS POSSIBLE BEFORE MAU IS ONLINE. COORDINATE ANY SHUT-DOWN WITH OWNER.

1 ROOF MECHANICAL DEMOLITION PLAN

1/8" = 1'-0"

This sheet of drawings has not been reviewed for code compliance.

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CONTRACTOR

COLORADO LICENSED MICHAEL P THOMPSON 56150 PROFESSIONAL ENGINEER
8/15/2023

PROJECT

Health ONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
Job Number		2023-01094

TITLE

ROOF MECHANICAL DEMOLITION PLAN

SHEET NUMBER

M111

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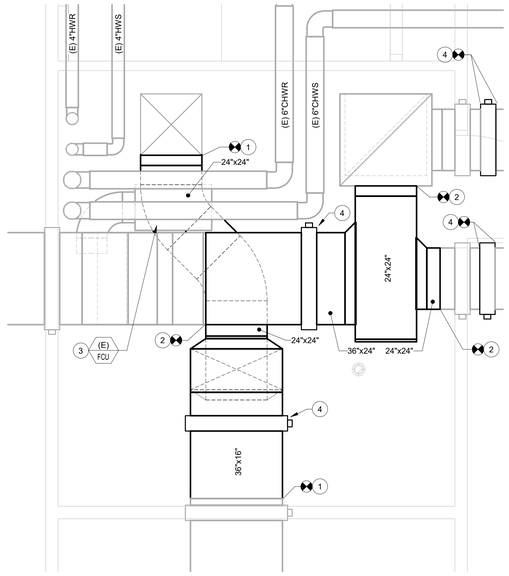
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(#) LEGEND NOTES:

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2. EXISTING EXISTING RETURN AIR DUCT TO EXISTING EXHAUST MAIN. PROVIDE NEW FULL SIZE TAP OFF DUCT MAIN. FIELD VERIFY EXACT LOCATION OF ALL EXISTING PIPING AND CONDUIT ROUTED THROUGH MECHANICAL ROOM. MAINTAIN ALL REQUIRED CLEARANCES FOR EXISTING ELECTRICAL EQUIPMENT.
3. EXISTING 2-PIPE FAN COIL UNIT TO REMAIN. RELOCATE AND MODIFY EXISTING SUPPLY DUCTWORK AS NECESSARY TO ACCOMMODATE NEW DUCTWORK.
4. ADD MANUAL BALANCING DAMPER TO EACH EXISTING SUPPLY DUCT FROM MECHANICAL ROOM & EACH EXISTING EXHAUST DUCT INTO MECHANICAL ROOM. RE-BALANCE AIR FLOW TO EXISTING AIR VOLUME.



2 ENLARGED LEVEL 02 MECHANICAL PLAN
1/2" = 1'-0"



1 LEVEL 02-OVERALL PLAN
3/32" = 1'-0"

Code violations that are found during inspection are required to be corrected. Permit issuance does not grant approval of a code violation. **2021 IBC 105.4**

THIS WORK MUST ALSO COMPLY WITH **2021 IECC**

City of Aurora Building Division
Reviewed for Code Compliance
Approved as Noted: Y. Munoz
Date: **Aug 24, 2023**
2021 INTERNATIONAL CODES & **2023** NEC

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CONTRACTOR

COLORADO LICENSED MICHAEL P THOMPSON 55150 PROFESSIONAL ENGINEER
8/15/2023

PROJECT

Health ONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
Job Number		2023-01094

TITLE

LEVEL 02 MECHANICAL PLAN

SHEET NUMBER

M201

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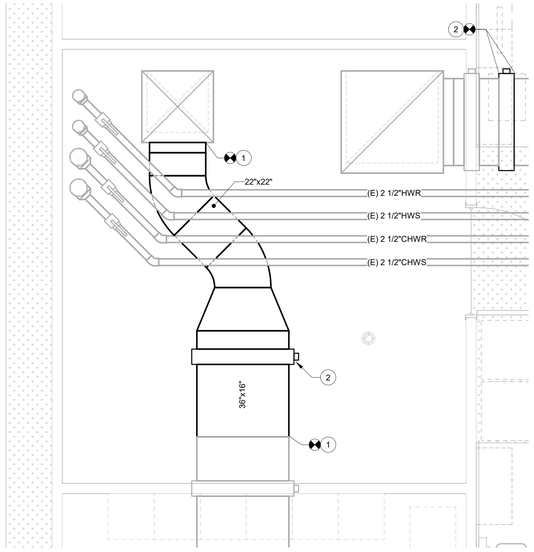
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2. ADD MANUAL BALANCING DAMPER TO EACH EXISTING SUPPLY DUCT FROM MECHANICAL ROOM & EACH EXISTING EXHAUST DUCT INTO MECHANICAL ROOM. RE-BALANCE AIR FLOW TO EXISTING AIR VOLUME.



2 ENLARGED LEVEL 03 MECHANICAL PLAN

1/2" = 1'-0"



1 LEVEL 03-OVERALL PLAN

3/32" = 1'-0"

City of Aurora Building Division
Reviewed for Code Compliance
Approved as Noted: Y. Munoz
Date: Aug 24, 2023
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CONTRACTOR

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8/15/2023

PROJECT

Health ONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
Job Number		2023-01094

TITLE

LEVEL 03 MECHANICAL PLAN

SHEET NUMBER

M202

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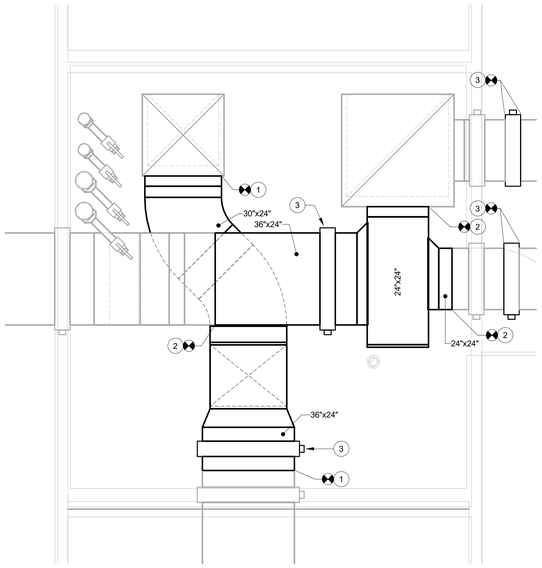
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2 ENLARGED LEVEL 04 MECHANICAL ROOM
1/2" = 1'-0"



1 LEVEL 04-OVERALL PLAN
3/32" = 1'-0"

City of Aurora Building Division
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Approved as Noted: Y. Munoz
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TMCA CENTRAL TOWER MAU REPLACEMENT

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KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
Job Number		2023-01094

TITLE

LEVEL 04 MECHANICAL PLAN

SHEET NUMBER

M203

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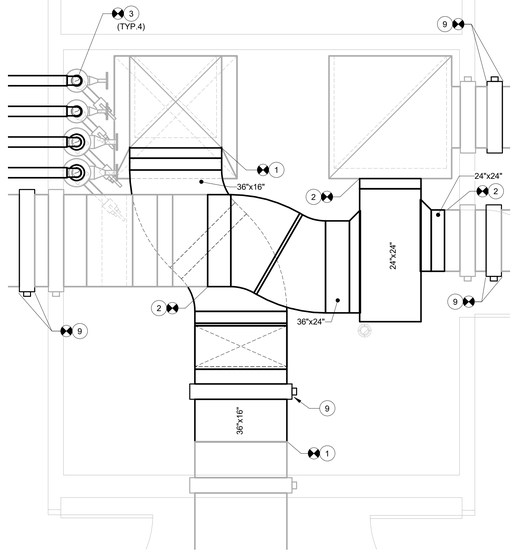
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H. CONTRACTOR SHALL PROVIDE AS-BUILT DOCUMENTATION DEPICTING NEW AND EXISTING CONDITIONS.

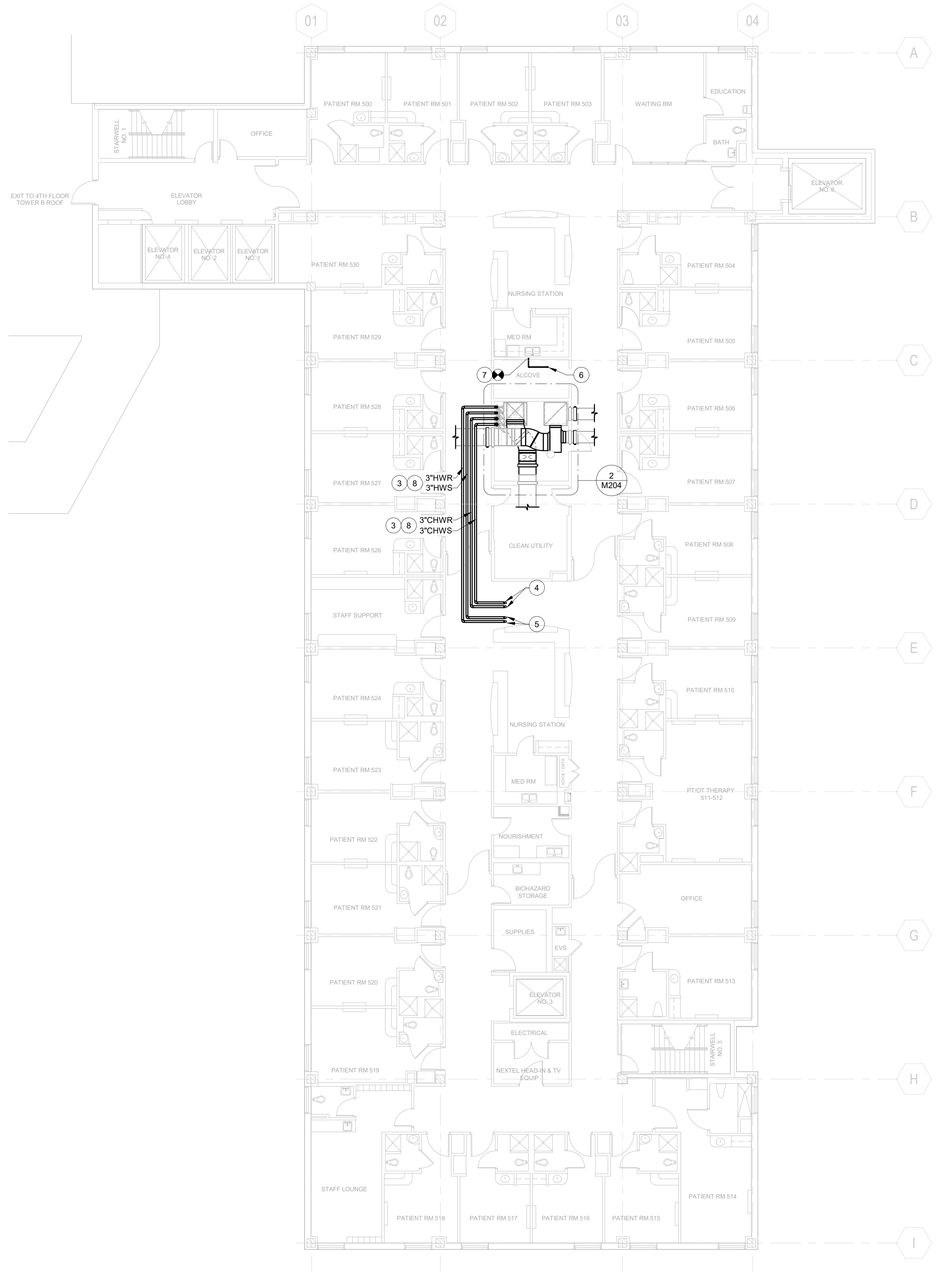
(#) LEGEND NOTES:

1. EXTEND EXISTING SUPPLY AIR DUCT TO EXISTING OUTSIDE AIR MAIN. PROVIDE NEW FULL SIZE TAP OFF DUCT MAIN. FIELD VERIFY EXACT LOCATION OF ALL EXISTING PIPING AND CONDUIT ROUTED THROUGH MECHANICAL ROOM. MAINTAIN ALL REQUIRED CLEARANCES FOR EXISTING ELECTRICAL EQUIPMENT.
2. EXISTING EXISTING RETURN AIR DUCT TO EXISTING EXHAUST MAIN. PROVIDE NEW FULL SIZE TAP OFF DUCT MAIN. FIELD VERIFY EXACT LOCATION OF ALL EXISTING PIPING AND CONDUIT ROUTED THROUGH MECHANICAL ROOM. MAINTAIN ALL REQUIRED CLEARANCES FOR EXISTING ELECTRICAL EQUIPMENT.
3. EXTEND NEW 3" CHILLED WATER & HEATING WATER PIPING FROM EXISTING SHUT-OFF VALVE ON RISER THROUGH MECHANICAL ROOM. REFER TO ARCHITECTURAL DRAWINGS FOR PIPING DETAIL THROUGH FIRE-RATED WALL. ROUTE NEW 3" PIPING OVER CORRIDOR. FIELD VERIFY EXISTING CONDITIONS ABOVE CEILING.
4. 3" CHILLED WATER PIPING UP THROUGH ROOF INTO NEW AIR HANDLER. PROVIDE HEAT TRACE ON SECTION OF PIPING BETWEEN ROOF DECK AND PENETRATION INTO MAU-1 SERVICE CORRIDOR.
5. 3" HEATING WATER PIPING UP THROUGH ROOF INTO NEW AIR HANDLER. PROVIDE HEAT TRACE ON SECTION OF PIPING BETWEEN ROOF DECK AND PENETRATION INTO MAU-1 SERVICE CORRIDOR.
6. 3/4" CW (DOMESTIC COLD WATER) UP TO NEW ROOF HYDRANT.
7. TAP OFF EXISTING DOMESTIC COLD WATER PIPING WITH NEW 3/4" CW BRANCH TO SERVE NEW ROOF HYDRANT. FIELD VERIFY EXACT LOCATION AND SIZE(S) OF EXISTING PIPING.
8. CONTRACTOR SHALL REMOVE AND REPLACE DAMAGED EXISTING CEILING TILE AND GRID AS REQUIRED TO ACCOMODATE THEIR WORK. CARE MUST BE TAKEN IN THIS SPACE TO NOT DAMAGED EXISTING FINISHES AND CLEAN ALL CONSTRUCTION DUST AND DEBRIS BEFORE OCCUPANCY.
9. ADD MANUAL BALANCING DAMPER TO EACH EXISTING SUPPLY DUCT FROM MECHANICAL ROOM & EACH EXISTING EXHAUST DUCT INTO MECHANICAL ROOM. RE-BALANCE AIR FLOW TO EXISTING AIR VOLUME.



2 ENLARGED LEVEL 05 MECHANICAL PLAN

1/2" = 1'-0"



1 LEVEL 05 OVERALL PLAN

3/32" = 1'-0"

City of Aurora Building Division
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CONTRACTOR

COLORADO LICENSED MICHAEL P THOMPSON 55150 PROFESSIONAL ENGINEER
8/15/2023

PROJECT

Health ONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE

Job Number 2023-01094

TITLE

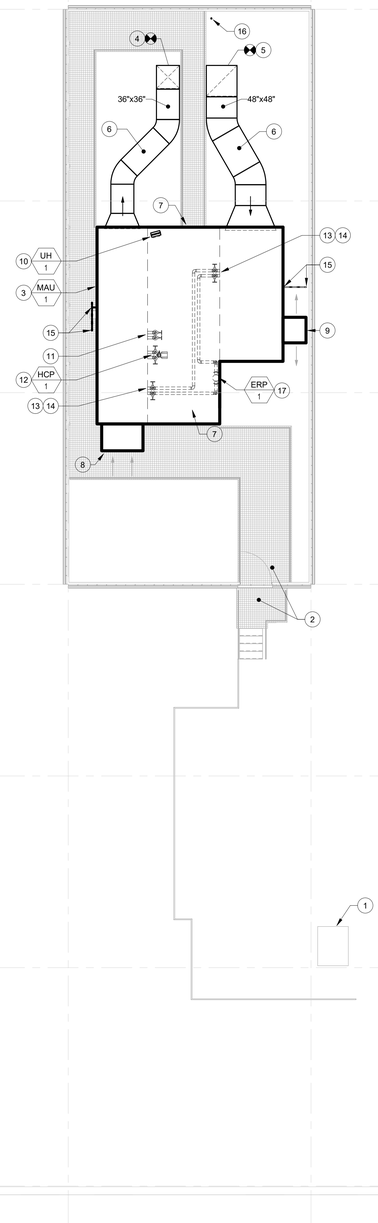
LEVEL 05 MECHANICAL PLAN

SHEET NUMBER

M204

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GENERAL NOTES:

A. REFER TO M10-00 FOR LEGENDS, GENERAL NOTES, AND ABBREVIATIONS. REFER TO M10-01 FOR PROJECT SPECIFICATIONS.
B. AT NO TIME SHALL THE EXISTING HOSPITAL SYSTEMS BE SHUT DOWN WITHOUT PRIOR NOTICE AND APPROVAL OF THE OWNER. MINIMUM (5) DAYS NOTICE SHALL BE PROVIDED FOR ALL SYSTEM SHUTDOWNS. QUANTITY OF ANTICIPATED SYSTEM SHUTDOWNS EXPECTED TO BE LONGER THAN (4) HOURS MUST BE DISCLOSED AT THE TIME OF BID.
C. EXISTING INFRASTRUCTURE SHOWN IS BASED ON THE BEST INFORMATION AVAILABLE. THE CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS FOR TIE-INS AND FIT OF NEW INFRASTRUCTURE PRIOR TO RELEASING MATERIAL.
D. ALL EXISTING FIRE DAMPERS IN NON RATED WALLS ARE TO BE REMOVED.
E. CONTRACTOR SHALL CAP AND SEAL ALL UNUSED DUCT TAPS AIR TIGHT.
F. ALL EXISTING INSULATION ACCESSIBLE DURING RENOVATION SHALL BE INSPECTED, REPAIRED, AND/OR REPLACED AS APPROPRIATE.
G. CONTRACTOR SHALL ENSURE THE DUCT SYSTEMS ARE FREE OF DEBRIS OR DUST.
H. CONTRACTOR SHALL PROVIDE AS-BUILT DOCUMENTATION DEPICTING NEW AND EXISTING CONDITIONS.

(#) LEGEND NOTES:

1. EXISTING ROOF ACCESS HATCH.
2. REFER TO ARCHITECTURAL DRAWINGS FOR NEW SCREEN WALL, ROOF PATH, STAIRS AND GUARD RAIL. REFER TO STRUCTURAL DRAWINGS FOR NEW STEEL DUNNAGE AND SUPPORT STRUCTURE.
3. NEW MAKE-UP AIR HANDLER MAU-1 TO BE INSTALLED ON THE ROOF.
4. CONNECT NEW 36"x36" SUPPLY AIR DUCTWORK TO EXISTING RISER AT ROOF.
5. CONNECT NEW 48"x48" EXHAUST AIR DUCTWORK TO EXISTING RISER AT ROOF.
6. NEW INSULATED DUCTWORK ON ROOF. DUCT LINER NOT ALLOWED (NO EXCEPTIONS). DUCT SIZES ON DRAWINGS ARE FREE INSIDE DIMENSIONS. PROVIDE DUCT SMOKE DETECTOR ON 36"x36" SUPPLY DUCT FROM UNIT AND ON 48"x48" EXHAUST DUCT INTO UNIT.
7. APPROXIMATE LOCATION OF ACCESS DOOR TO MAU-1 SERVICE CORRIDOR.
8. INTAKE AIR HOOD ON MAU-1. RE-ROUTE ANY EXISTING VENT PIPING UP THRU ROOF TO TERMINATE NO LESS THAN 25'-0" FROM INTAKE AIR HOOD.
9. EXHAUST AIR RELIEF HOOD ON MAU-1.
10. NEW ELECTRIC UNIT HEATER INSTALLED IN MAU-1 SERVICE CORRIDOR. INSTALL NO LESS THAN 8'-0" ABOVE CORRIDOR FLOOR, PER MANUFACTURER RECOMMENDATIONS. MAINTAIN ALL REQUIRED CLEARANCES FOR INTERNAL ACCESS DOORS, VFDS AND OTHER ELECTRICAL EQUIPMENT.
11. 3" CHILLED WATER PIPING UP THROUGH ROOF (AND SUPPORT STRUCTURE) INTO MAU-1 SERVICE CORRIDOR. REFER TO M502 FOR COIL CONNECTION DIAGRAM AND COORDINATE EXACT LOCATION OF PIPING WITH STRUCTURAL.
12. 3" HEATING WATER PIPING UP THROUGH ROOF (AND SUPPORT STRUCTURE) INTO MAU-1 SERVICE CORRIDOR. REFER TO M502 FOR COIL CONNECTION DIAGRAM AND COORDINATE EXACT LOCATION OF PIPING WITH STRUCTURAL.
13. 3" PIPING (ENERGY RECOVERY LOOP) ROUTED HIGH IN MAU-1 SERVICE CORRIDOR DOWN TO CONNECTION WITH ENERGY RECOVERY COIL. REFER TO M502 FOR COIL CONNECTION DIAGRAM. MAINTAIN ALL REQUIRED CLEARANCES WITHIN SERVICE CORRIDOR.
14. GENERAL CONTRACTOR TO CHARGE ENERGY RECOVERY LOOP WITH 40% PROP. GLYCOL MIXTURE. GLYCOL INJECTION FEEDER NOT PROVIDED ON THIS PROJECT.
15. 1-1/4" DRAIN PIPING FROM COIL DRAIN PAN. REFER TO M502 FOR DRAIN TRAP DIAGRAM. ROUTE CONDENSATE THROUGH RAISED PLATFORM TO NEAREST ROOF DRAIN.
16. NEW LEAD-FREE NON-FREEZE ROOF HYDRANT, ZURN #Z1388XL OR EQUAL. 3/4" C/W UP FROM LEVEL 05. ROUTE DRAIN PIPING FROM NEW HYDRANT TO APPROVED FIXTURE OR LAVATORY TAILPIECE.
17. IN-LINE ENERGY RECOVERY PUMP TO BE INSTALLED WITHIN MAU-1 SERVICE CORRIDOR. PUMP TO BE INSTALLED NO HIGHER THAN 3'-0" ABOVE FLOOR OF CORRIDOR. REFER TO M502 FOR INLINE PUMP DIAGRAM.

1 ROOF MECHANICAL PLAN

1/8" = 1'-0"

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COLORADO LICENSED
RACHEL P THOMPSON
54150
PROFESSIONAL ENGINEER
8/15/2023

PROJECT

HealthONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
Job Number		2023-01094

TITLE

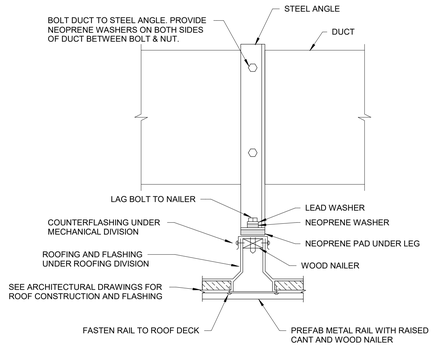
ROOF MECHANICAL PLAN

SHEET NUMBER

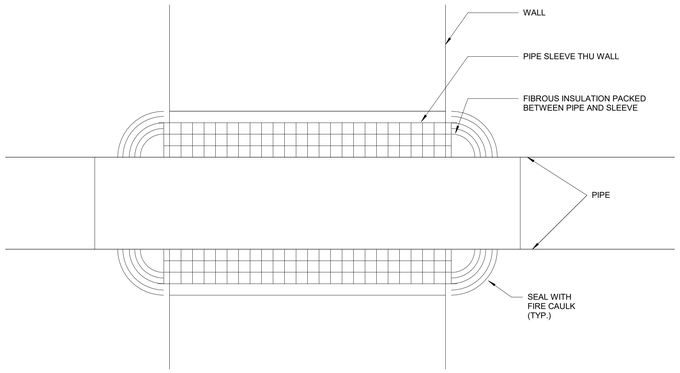
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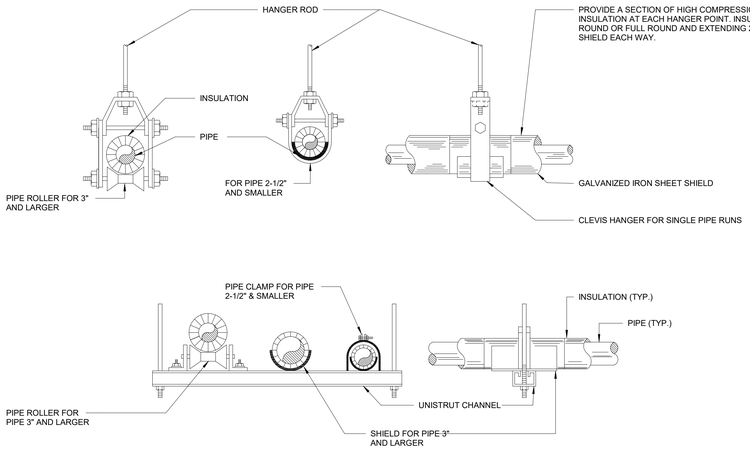


1 SUPPORT DETAIL FOR ROOF MOUNTED DUCTWORK
NTS



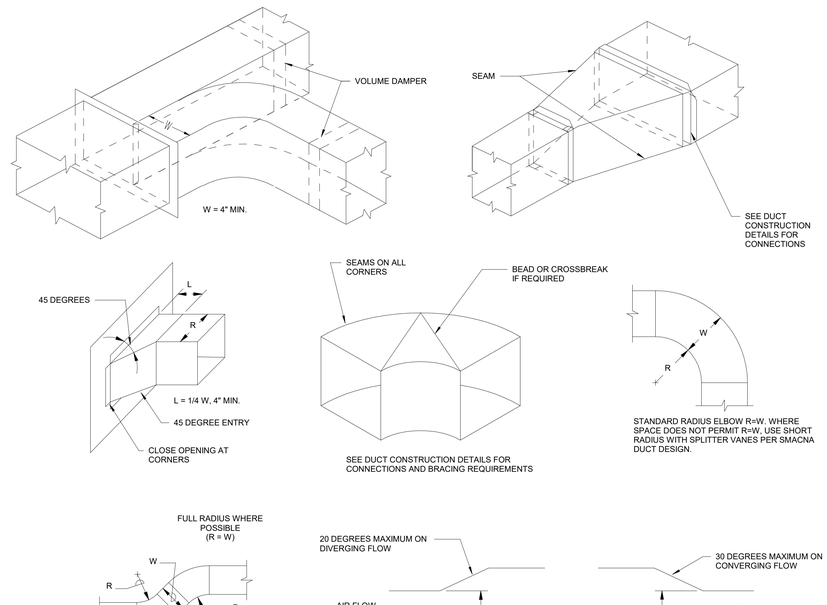
PIPE SHALL BE SUPORTED ON EITHER SIDE OF WALL. PIPE SUPPORT SHALL BE COMPLETELY INDEPENDANT OF WALL

2 PIPE THRU WALL
1/8" = 1'-0"

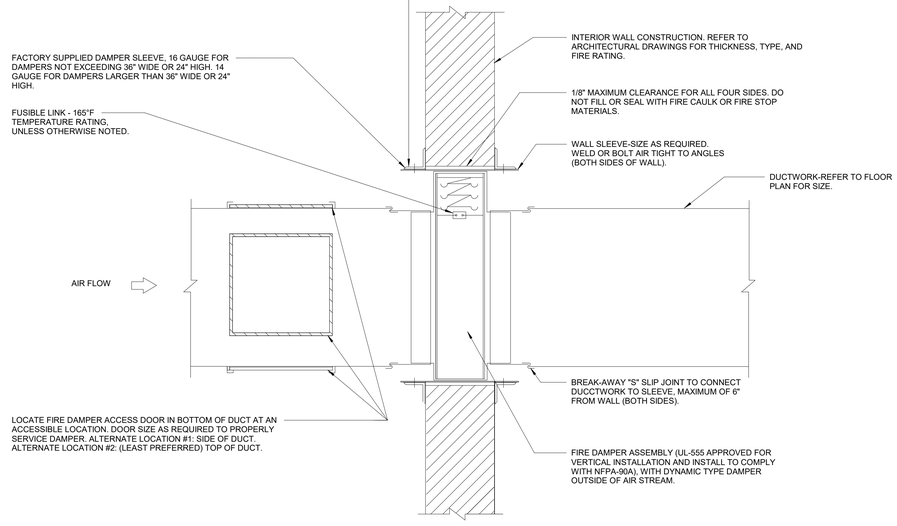


NOTE: PROVIDE SPRING VIBRATION INSOLATION HANGERS WITHIN MECHANICAL ROOMS

3 PIPE SUPPORT AND HANGERS
NTS



4 DUCT CONSTRUCTION
NTS



NOTES:

1. FOLLOW THIS DETAIL, UNLESS THE DAMPER MANUFACTURER'S INSTALLATION DETAILS AND INSTRUCTIONS (AS TESTED AND APPROVED BY UL) OR THE PROJECT SPECIFICATION IS MORE STRINGENT.
2. LABEL THE ACCESS DOORS" "FIRE DAMPER ACCESS".
3. WHERE ACCESS DOORS ARE INSTALLED ON THE SIDE OF A DUCT, PROVIDE A LABEL OR SIGN AT THE BOTTOM OF THE DUCT WITH AN ARROW AND "FIRE/SMOKE DAMPER ACCESS DOOR" TEXT POINTING TO THE ACCESS DOOR. WHERE ACCESS DOORS ARE INSTALLED ON THE TOP OF THE DUCT, PROVIDE LABEL OR SIGN AT THE BOTTOM OF THE DUCT WITH "FIRE/SMOKE DAMPER ACCESS DOOR ON TOP OF DUCT".
4. SEQUENCE OF OPERATION:
   4.1. FIRE DAMPER MODE: HIGH TEMPERATURE MELTS FUSIBLE LINK, CLOSING FIRE DAMPER.
5. REFER TO FIRE DAMPER SCHEDULE FOR FURTHER INFORMATION.

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5 FIRE DAMPER THRU WALL DETAIL
1/8" = 1'-0"

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8/15/2023

PROJECT
Health ONE The Medical Center of Aurora
TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

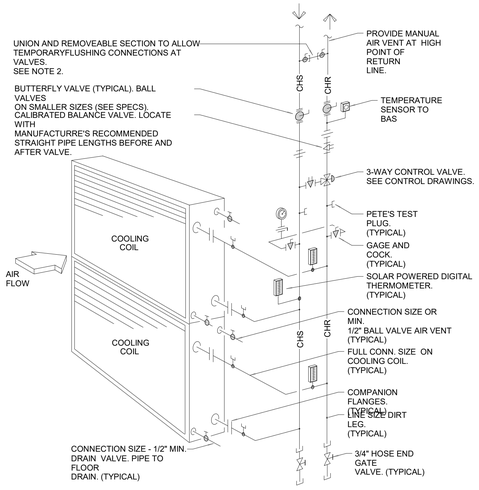
MARK	ISSUE	DATE
Job Number		2023-01094

TITLE
MECHANICAL DETAILS

SHEET NUMBER
M501

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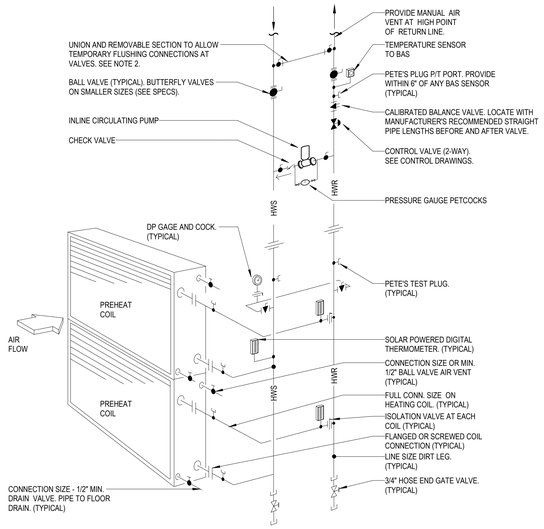
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NOTES:

1. WATER SHALL ENTER COIL ON THE AIR LEAVING SIDE. OFFSET PIPING AS SHOWN TO ALLOW COIL PULL ACCESS WITHOUT DISMANTLING VERTICAL RISERS.
2. PROVIDE MINIMUM 2" FLUSH CONNECTION WITH 2" BALL VALVES. CONNECT TO SUPPLY AND RETURN MAINS WITH TEMPORARY FLUSH PIPE. PIPE MAY BE CLEAR PLASTIC SECURED WITH RADIATOR CLAMPS. AFTER FLUSHING REMOVE TEMPORARY PIPING, CAP EACH END OF PIPE, CLOSE FLUSHING VALVES AND REMOVE HANDLES.

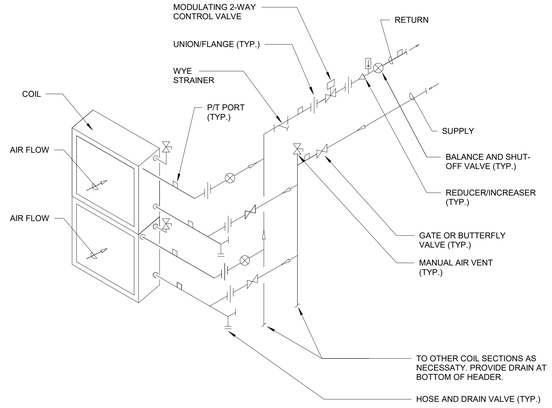
1 CHILLED WATER PIPING AT MULTIPLE COOLING COIL
NTS



NOTES:

1. WATER SHALL ENTER COIL ON THE AIR LEAVING SIDE. OFFSET PIPING AS SHOWN TO ALLOW COIL PULL ACCESS WITHOUT DISMANTLING VERTICAL RISERS.
2. PROVIDE MINIMUM 2" FLUSH CONNECTION WITH 2" BALL VALVES. CONNECT TO SUPPLY AND RETURN MAINS WITH TEMPORARY FLUSH PIPE. PIPE MAY BE CLEAR PLASTIC SECURED WITH RADIATOR CLAMPS. AFTER FLUSHING REMOVE TEMPORARY PIPING, CAP EACH END OF PIPE, CLOSE FLUSHING VALVES AND REMOVE HANDLES.

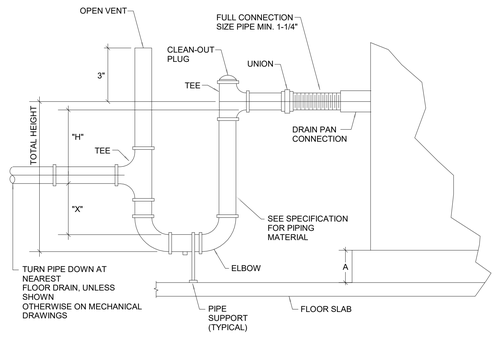
2 HOT WATER PIPING AT MULTIPLE PREHEAT COIL
NTS



3 ENERGY RECOVERY LOOP COIL PIPING DIAGRAM
NTS

NOTE:

1. ELEVATED A/C UNIT SUFFICIENT DISTANCE ABOVE FLOOR OR ROOF TO ALLOW FOR INSTALLATION OF TRAP WITH ADEQUATE DIMENSIONS TO WITHSTAND SYSTEM OPERATING PRESSURE. COORDINATE WITH DETAIL FOR A/C UNIT MOUNTING.

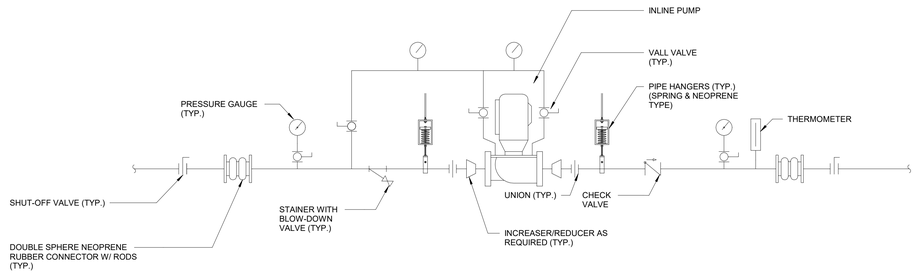


TOTAL HEIGHT OF TRAP = X+H+(1.5 x PIPE DIAMETER)

FOR DRAW THRU UNITS
X = MIN. 1H (PREFERRED 1.5 H)
H = NEGATIVE STATIC PRESSURE + 1"

A= HOUSE KEEPING PAD MINIMUM 4", ACTUAL PAD DIMENSION IS SUBJECT TO CALCULATION OF PIPE TRAP DEPTH ON A UNIT BY UNIT BASIS.

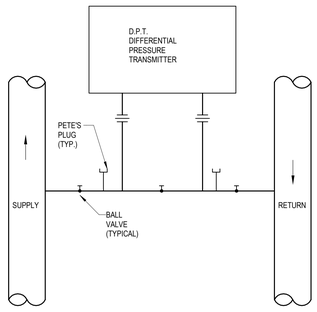
4 COOLING COIL CONDENSATE DRAIN
NTS



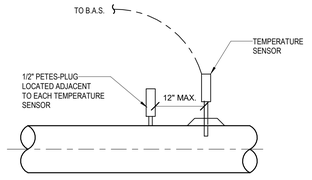
NOTES:

1. SUPPORT PUMP INDEPENDENTLY FROM PIPING PER MANUFACTURER'S RECOMMENDATIONS.

5 INLINE PUMP
NTS



6 DIFF. PRESSURE SENSOR DETAIL
NOT TO SCALE



7 TEMPERATURE SENSOR DETAIL
NOT TO SCALE

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CONTRACTOR

COLORADO LICENSED MICHAEL P THOMAS 55450 PROFESSIONAL ENGINEER
8/15/2023

PROJECT
The Medical Center of Aurora
TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
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TITLE
MECHANICAL DETAILS

SHEET NUMBER
M502

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MAKE-UP AIR HANDLING UNIT SCHEDULE

GENERAL DATA						SUPPLY FAN DATA									EXHAUST FAN DATA								HYDRONIC COILS				CIRCUIT 1				CIRCUIT 2				UNIT DIMENSIONS	OPERATING WEIGHT (LBS.)	MANUFACTURER	MODEL	REMARKS
TAG	LOCATION	SERVICE	SUPPLY AIR (CFM)	OUTSIDE AIR (CFM)	EXHAUST AIR (CFM)	QUANTITY	TSP (IN.WC.)	ESP (IN.WC.)	FAN TYPE	RPM	BHP (EA.)	HP (EA.)	PRE- FILTER	FINAL FILTER	QUANTITY	TSP (IN.WC.)	ESP (IN.WC.)	FAN TYPE	RPM	BHP (EA.)	HP (EA.)	PRE-FILTER	FINAL FILTER	COOLING COIL	HEATING COIL	SUPPLY COIL	EXHAUST COIL	V / PH / HZ	FLA	MCA	MOCP	V / PH / HZ	FLA	MCA	MOCP					
MAU-1	CENTRAL TOWER ROOF	FRESH AIR: PATIENT ROOMS LEVEL 2-5 EXHAUST AIR: LEVELS 1-5	18,000	18,000	25,000	2	6.87	3.00	SWSI AIRFOIL	2,216	6.96	20	MERV-11	MERV-14	2	3.44	1.50	SWSI AIRFOIL	1,878	7.84	15	MERV-11	-	CC-1	HC-1	ERC-1	ERC-2	460 / 3 / 60	80.6	86.4	100	120 / 1 / 60	-	-	20	350" x 291" x 113"	45,000	YORK	YCO-105x79	ALL

REMARKS:

1. AIR HANDLER AND EQUIPMENT IDENTIFIED ON THIS SCHEDULE HAVE BEEN PURCHASED BY OWNER, TO BE INSTALLED BY CONTRACTOR. UNIT SHALL BE PURCHASED FROM JCI PER HCA PURCHASING AGREEMENT. ALTERNATE MANUFACTURERS WILL NOT BE CONSIDERED.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR RECEIVING UNITS, STORING (IF NECESSARY), DIS-ASSEMBLING AS REQUIRED FOR INSTALLATION, RE-ASSEMBLING, INSTALLATION, PIPE/DUCT CONNECTIONS, CONTROLS, STARTUP, INSTALLATION WARRANTY, AND FACILITATING EQUIPMENT WARRANTY. CONTRACTOR'S SCOPE INTENDED TO RESULT IN A FULLY OPERATIONAL SYSTEM.
3. MAU-1 IS INTENDED TO BE CRANED ONTO THE CENTRAL TOWER ROOF. IT IS LEFT TO THE BIDDING CONTRACTOR'S JUDGMENT TO DETERMINE IF THE SPLITS WILL NEED TO BE BROKEN DOWN BASED ON THE INFORMATION IN THIS DRAWING SET.
4. UNIT DESIGNED WITH INTERIOR SERVICE CORRIDOR WIDE ENOUGH TO REMOVE AND SERVICE ALL MOTORS AND COILS, SERVICE CORRIDOR TO HAVE TWO ENTRY/EXIT DOORS AND MINIMUM R-16 FOAM PANEL INSULATION.
5. TWO (2) VARIABLE FREQUENCY DRIVES (VFD) FOR EACH FAN ARRAY TO BE INSTALLED IN SERVICE CORRIDOR. PROVIDE INTEGRAL DISCONNECT FOR EACH VFD. VFD SHALL BE PROVIDED WITH A MANUAL BYPASS..
6. SERVICE CORRIDOR TO HAVE INTERIOR ACCESS DOOR TO EACH SECTION OF EQUIPMENT, SWITCHED INTERNAL LIGHT AND CONVENIENCE OUTLET FOR EACH ACCESSIBLE SECTION. PROVIDE SINGLE-POINT CONNECTION FOR ALL 120V CONTROLS, OUTLETS AND LIGHTS.
7. PROVIDE SINGLE-POINT CONNECTION FOR ALL 460V EQUIPMENT.
8. ALL INTERNAL RACEWAY FOR POWER AND TEMPERATURE CONTROL WIRING. EXTEND RACEWAY TO OUTSIDE OF UNIT CASING. COORDINATE WITH TEMPERATURE CONTROL CONTRACTOR.
9. FLOW MONITORING STATION FOR EACH FAN MEASURING PRESSURE DROP ACROSS INLET VENTURI. INLET PROBES NOT PERMITTED.
10. FAN SYSTEMS SHALL BE CAPABLE OF MEETING AT LEAST 75% DESIGN CRITERIA IF ONE (1) FAN IS TAKEN OUT OF SERVICE.
11. EACH SUPPLY FAN AND EXHAUST FAN TO BE INSTALLED WITH MOTOR REMOVAL RAILS ACCESSIBLE FROM BOTH THE INTERIOR SERVICE CORRIDOR AND UNIT EXTERIOR.
12. MAU-1 INTENDED TO BE INSTALLED ON STRUCTURAL PLATFORM. REFER TO STRUCTURAL AND ARCHITECTURAL PLANS.
13. UNIT TO MEET IBC SEISMIC REQUIREMENTS FOR NON-CRITICAL EQUIPMENT (IP = 1.0).
14. REFER TO SPECIFICATIONS FOR CONSTRUCTION REQUIREMENTS. SEAL UNIT CASING.

(MAU) ENERGY RECOVERY COIL SCHEDULE

GENERAL DATA								AIR DATA (WINTER)						FLUID DATA (WINTER)				REMARKS
TAG	SERVICE	FLUID	AIR FLOW (CFM)	TOTAL (MBH)	SENSIBLE (MBH)	ROWS	FPI	FACE VEL. (FPM)	APD (IN.WG.)	EAT (DB F)	EAT (WB F)	LAT (DB F)	LAT (WB F)	EWT (F)	LWT (F)	GPM	WPD (IN.WG.)	
ERC-1	SUPPLY	40% PROP. GLYCOL	18,000	524	524	8	8	419	0.48	-5.0	-	23.2	-	37.4	30.6	168.3	11.7	1, 2
ERC-2	EXHAUST	40% PROP. GLYCOL	25,000	527	442	4	9	436	0.30	70.0	57.5	50.3	48.8	30.6	37.4	168.3	13.5	1, 2, 3

REMARKS:

1. COIL COMPOSED OF (3) INDIVIDUAL COILS WITHIN STAINLESS STEEL COIL RACK FOR A TOTAL OF (12) POINTS OF CONNECTION.
2. PERFORMANCE INDICATED FOR ENTIRE COIL RACK, NOT INDIVIDUAL COILS.
3. PROVIDE WITH ASHRAE IAQ COMPLIANT STAINLESS STEEL DRIP PAN AND SUPPORTS.

(MAU) COOLING COIL SCHEDULE

GENERAL DATA								AIR DATA						FLUID DATA				REMARKS
TAG	SERVICE	FLUID	AIR FLOW (CFM)	TOTAL (MBH)	SENSIBLE (MBH)	ROWS	FPI	FACE VEL. (FPM)	APD (IN.WG.)	EAT (DB F)	EAT (WB F)	LAT (DB F)	LAT (WB F)	EWT (F)	LWT (F)	GPM	WPD (IN.WG.)	
CC-1	SUPPLY	CHILLED WATER	18,000	694	694	6	10	419	0.29	95.0	63.0	49.8	47.1	45	55	138.0	19.8	ALL

REMARKS:

1. COOLING COIL COMPOSED OF (3) INDIVIDUAL COILS WITHIN STAINLESS STEEL COIL RACK FOR A TOTAL OF (12) POINTS OF CONNECTION.
2. PERFORMANCE INDICATED FOR ENTIRE COIL RACK, NOT INDIVIDUAL COILS.
3. PROVIDE WITH ASHRAE IAQ COMPLIANT STAINLESS STEEL DRIP PAN AND SUPPORTS.

PUMP SCHEDULE

GENERAL DATA					DUTY POINT				PUMP SUMMARY					REMARKS
TAG	SERVICE	COUPLING	FLUID TYPE / TEMP (°F)	VFD	GPM	FT.HD	NPSHR (FT.)	BHP	HP	V / PH / HZ	MANUFACTURER	MODEL	IMPELLER DIA. (IN.)	
ERP-1	ENERGY RECOVERY	SPLIT COUPLED	40% PROP. GLYCOL / 30°F	YES	170	60	6.28	4.35	7.5	460 / 3 / 60	BELL & GOSSETT	E-80SC 2.5x2.5x7B	5.25	ALL
HCP-1	HHW CIRCULATION	-	HEATING WATER	NO	60	10	-	0.29	1	460 / 3 / 60	BELL & GOSSETT	ECOCIRC XL 40-200	-	ALL

REMARKS:

1. PROVIDE WITH SPRING VIBRATION ISOLATION HANGERS.
2. NEMA PREMIUM EFFICIENCY MOTOR.

(MAU) HEATING COIL SCHEDULE

GENERAL DATA								AIR DATA						FLUID DATA				REMARKS
TAG	SERVICE	FLUID	AIR FLOW (CFM)	TOTAL (MBH)	SENSIBLE (MBH)	ROWS	FPI	FACE VEL. (FPM)	APD (IN.WG.)	EAT (DB F)	EAT (WB F)	LAT (DB F)	LAT (WB F)	EWT (F)	LWT (F)	GPM	WPD (IN.WG.)	
HC-1	SUPPLY	HEATING WATER	18,000	1809	1809	4	8	419	0.26	-5.0	-	92.5	-	140	110	122.9	1.6	ALL

REMARKS:

1. HEATING COIL COMPOSED OF (3) INDIVIDUAL COILS WITHIN STAINLESS STEEL COIL RACK FOR A TOTAL OF (12) POINTS OF CONNECTION.
2. PERFORMANCE INDICATED FOR ENTIRE COIL RACK, NOT INDIVIDUAL COILS.

ELECTRIC UNIT HEATER SCHEDULE

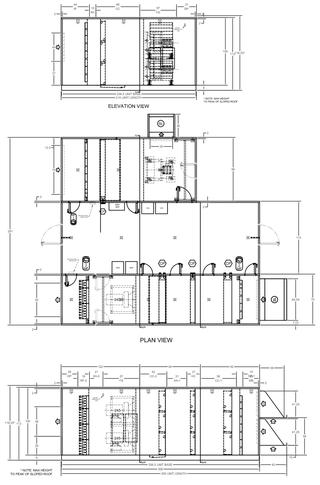
TAG	KW	AIR FLOW (CFM)	MOTOR (HP)	V / PH / HZ	WEIGHT (LBS.)	MANUFACTURER	MODEL	REMARKS
UH-1	3	510	1/30	277 / 1 / 60	50	REZNOR	EGHB-3	ALL

REMARKS:

1. THERMALLY PROTECTED MOTOR.
2. AUTOMATIC SHUTOFF ON HIGH TEMPERATURE.
3. PROVIDE WITH DISCONNECT SWITCH.
4. PROVIDE WITH BUILT-IN THERMOSTAT.
5. MOTOR TO BE ENCLOSED WITH PROTECTIVE SCREEN.
6. PROVIDE WITH WALL MOUNTING BRACKETS.

SEISMIC CERTIFICATION REQUIRED
BUILD UNIT TO ENHANCED CONSTRUCTION Ip1.5

PRELIMINARY



UNIT CONSTRUCTION
Model: YCO-105x79 Construction: Outdoor
Motor Location:
Unit Weight: 44,447 lbs. (+/- 10%)
PLAN VIEW — Right; Rear (Supply); Front (Return); Left; AIRFLOW

NOTES
Units with a baserail and a bottom opening: Duct connection flush with the bottom of unit, not flush with bottom of baserail.
Refer to performance report for shipping split data.
Allow sufficient space around the unit for removing the access panels and various parts of the unit. A minimum clearance equal to the width of the unit must be provided on one side of the unit for removing the coil or fan assembly.
Contractor responsible for penetrations and connections of all electrical boxes and internal coil piping.
Overall dimensions account for: outdoor roof peak and overhang, motor control and/or factory package control boxes, coil connections, rain hoods, pipe chases, AMS-60 damper/EARL louver (if applicable,) base rail - in order to convey the true space requirements for the unit.
Certain items may extend beyond cabinet dimensions including: door handles, light switches, electrical boxes, lifting lugs, gas fuel system, etc.
The overall unit length includes an additional 1/4" per shipping split due to additional gasketing and split connection hardware.
Dimension tolerances: Unit (+/- 1/2"), Piping (+/- 2")
(S) - Designates Shipped Loose Item(s)

PIPING CONNECTIONS (In order of Airflow)

Segment	Type	Hand	Quantity	Supply	Return
CC	MPT	Right	1 Sup 1 Ret	3"	3"
CC	MPT	Right	1 Sup 1 Ret	3"	3"
CC	MPT	Right	1 Sup 1 Ret	3"	3"
HC	MPT	Right	1 Sup 1 Ret	3"	3"
HC	MPT	Right	1 Sup 1 Ret	3"	3"
HC	MPT	Right	1 Sup 1 Ret	3"	3"
CC	MPT	Right	1 Sup 1 Ret	3"	3"
CC	MPT	Right	1 Sup 1 Ret	3"	3"
CC	MPT	Right	1 Sup 1 Ret	3"	3"

SECTION LIST

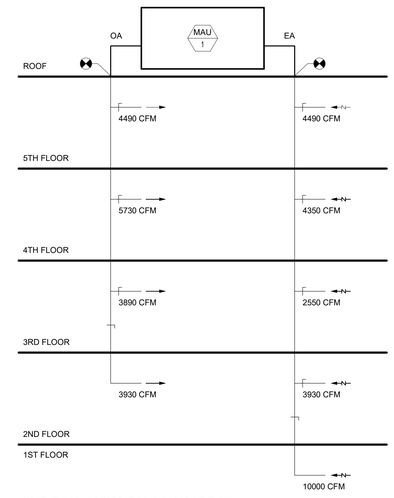
SECT	DESCRIPTION
MB	Mixing Box
RF-1	High Efficiency Filter
CC-1	Cooling Coil
HC	Heating Coil
XA-1	Variable Length Access
CC-2	Cooling Coil
FS	Supply Fan - 245 - MPQS 20.00 HP
XA-3	Variable Length Access
RF-2	High Efficiency Filter
DP	Discharge Plenum

PRODUCT DRAWING YORK CUSTOM AIR HANDLING UNIT DETAIL MODEL: YCO-105x79 **NOT FOR CONSTRUCTION**	Project Name: HCA-AuroraSouth-MAU 7-17-23 Location: Engineer: Contractor: For:	Sold To: Cust Purch Order#: Contract#: UNIT TAG: MAU-1	Date: 7/17/2023 17:8:10 Version: Form No.: Dwg. Lev.: 5/03 Dwg. Scale: NTS	Serial Number: SO Database Number: YORKworks Release: Dwg. Name: Dwg. Location:

Johnson Controls

This detail, not approved per this permit

1 MAU-1 DIMENSIONAL LAYOUT - FOR REFERENCE
NTS



NOTE: THESE ARE TARGET CALCULATED AIR FLOW VALUES. BALANCER TO BALANCE TO EXISTING AIR FLOW.

2 MAU-1 AIR FLOW DIAGRAM
NTS

City of Aurora Building Division
Reviewed for Code Compliance
Approved as Noted: Y. Munoz
Date: Aug 24, 2023
2021 INTERNATIONAL CODES & 2023 NEC

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CONTRACTOR

COLORADO LICENSED PROFESSIONAL ENGINEER 55150 8/15/2023

PROJECT
Health ONE The Medical Center of Aurora
TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

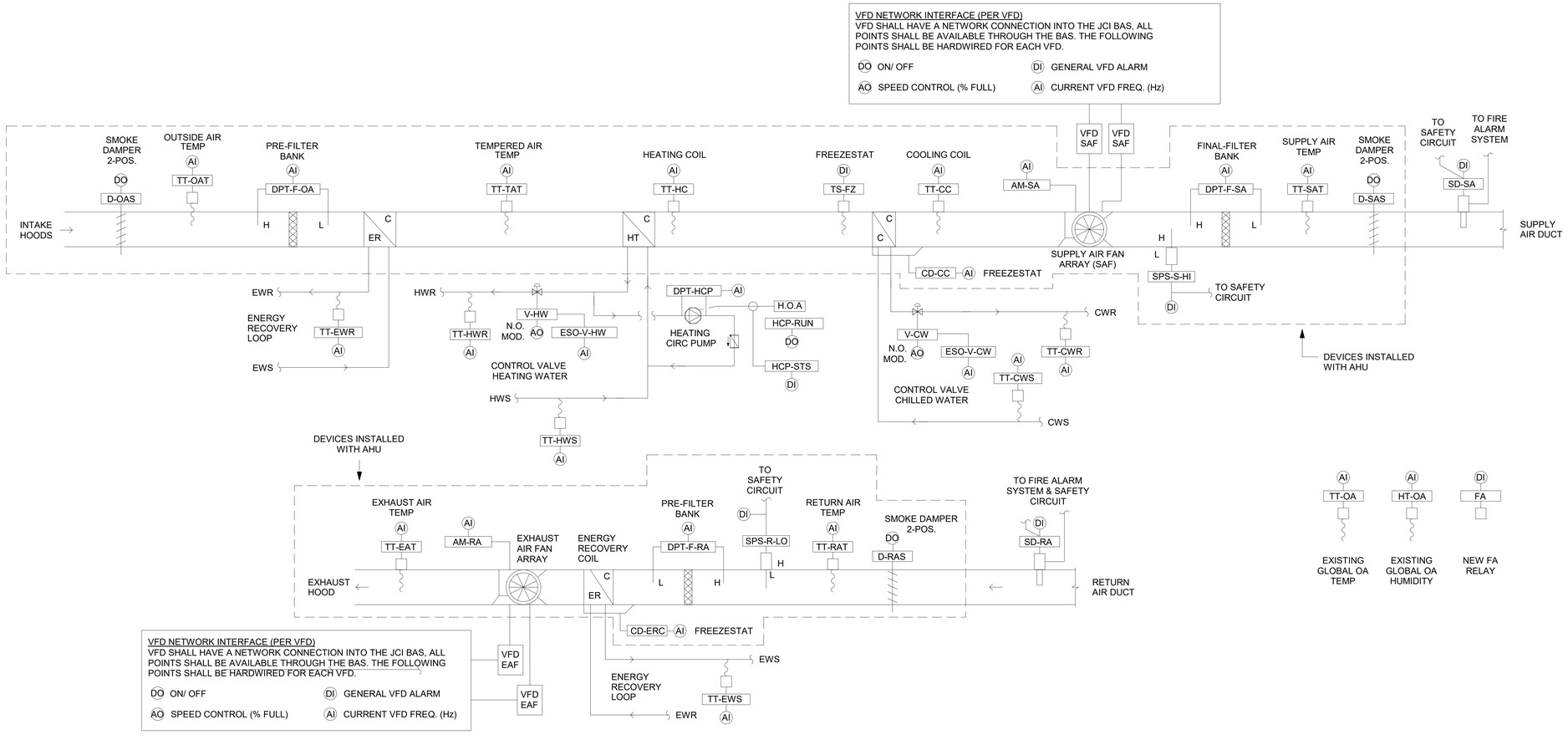
MARK	ISSUE	DATE
Job Number	2023-01094	

TITLE
MECHNICAL SCHEDULES & RISER DIAGRAM

SHEET NUMBER
M601

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SUPPLY AND EXHAUST FANS
SUPPLY AIR AND EXHAUST AIR FANS SHALL BE ENERGIZED / DE-ENERGIZED FROM THE VFDS IN 'HAND' POSITION OR THE DDC SYSTEM WHEN IN 'AUTO' MODE. THE DDC CONTROL SYSTEM SHALL SENSE WHEN THE FANS ARE IN 'HAND' POSITION BY THE FAN STATUS VERIFICATION AND INITIATE THE MAU CONTROL SEQUENCE.

IN 'AUTO' MODE THE OUTSIDE AIR DAMPER SHALL FULLY OPEN. ONCE THE DAMPER IS OPEN, THE SUPPLY FANS SHALL START AND THE DDC SYSTEM SHALL SIGNAL THE ASSOCIATED EXHAUST FANS TO START. IF THE FANS ARE STARTED IN 'HAND' POSITION, THE OUTSIDE AIR DAMPER SHALL FULLY OPEN IMMEDIATELY UPON SENSING FAN STATUS AS 'ON'. THE DISCHARGE AIR DAMPER SHALL REMAIN OPEN UNLESS COMMANDED CLOSED BY THE FIRE ALARM SYSTEM.

WHENEVER THE SWITCH IS IN 'AUTO' MODE, THE MAU SHALL BE STARTED AND STOPPED BY THE BAS ACCORDING TO A PRE-DETERMINED TIME SCHEDULE OR COMMAND OVERRIDE. THE MAU SHALL DEFAULT TO OPERATING 24/7. WHENEVER THE MAU IS OPERATIONAL, AS PROVED BY CURRENT SENSING RELAY, THE CONTROL SYSTEM SHALL BE ENERGIZED.

FANS SHALL SHUT DOWN FROM A SIGNAL FROM:
* THE FIRE ALARM PANEL THRU THE F/A RELAY.
* THE SUPPLY AIR OR RETURN AIR SMOKE DETECTOR.
* THE HIGH LIMIT OR LOW LIMIT STATIC PRESSURE SWITCHES.
* THE HIGH LIMIT CONDENSATE SWITCH.
* THE FREEZESTAT.

A DUCT MOUNTED HIGH STATIC PRESSURE SENSOR SHALL SHUT DOWN THE FANS WHENEVER IT SENSES A HIGH STATIC PRESSURE DOWNSTREAM OF THE SUPPLY FANS. AN ALARM SHALL INITIATE AT THE BAS AND REQUIRE A LOCAL MANUAL RESET TO RESTART THE FANS.

A DUCT MOUNTED LOW STATIC PRESSURE SENSOR SHALL SHUT DOWN THE FANS WHENEVER IT SENSES A LOW STATIC PRESSURE UPSTREAM OF THE EXHAUST FANS. AN ALARM SHALL INITIATE AT THE BAS AND REQUIRE A LOCAL MANUAL RESET TO RESTART THE FANS.

A CONDENSATE OVERFLOW SENSOR IN THE COOLING COIL DRAIN PAN SHALL BE WIRED TO SHUT DOWN THE FANS IF HIGH LEVELS OF WATER ARE DETECTED IN THE DRAIN PAN. AN ALARM SHALL INITIATE AT THE BAS AND REQUIRE A LOCAL MANUAL RESET TO RESTART THE FANS.

A CONDESATE OVERFLOW SENSOR IN THE ENERGY RECOVERY COIL (EXHAUST-SIDE) DRAIN PAN SHALL BE WIRED TO SHUT DOWN THE FANS IF HIGH LEVELS OF WATER ARE DETECTED IN THE DRAIN PAN. AN ALARM SHALL INITIATE AT THE BAS AND REQUIRE A LOCAL MANUAL RESET TO RESTART THE FANS.

A MANUAL RESET FREEZESTAT LOCATED ON THE ENTERING SIDE OF THE CHILLED WATER COIL SHALL STOP THE FANS ANY TIME THE TEMPERATURE OF THE AIR ENTERING THE COOLING COIL IS LESS THAN 36 DEGREES F (ADJ.). THE BAS SHALL:
* ISSUE A UNIQUE ALARM.
* FULLY OPEN THE CHILLED WATER VALVE.
* OPEN THE LEAD CHILLER CHILLED WATER ISOLATION VALVE, IF APPLICABLE.
* COMMAND 'ON' THE VARIABLE PRIMARY OR SECONDARY CHILLED WATER PUMP AND CONTROL SPEED TO MAINTAIN THE DIFFERENTIAL PRESSURE SETPOINT. A LOCAL MANUAL RESET AT THE MAU SHALL BE REQUIRED TO RESTART THE FANS.

WHEN THE SUPPLY FANS SHUT DOWN THE FOLLOWING SHALL OCCUR:
* THE EXHAUST FANS SHALL SHUTDOWN.
* THE OUTSIDE AIR DAMPER SHALL CLOSE.
* THE CHILLED WATER AND HEATING WATER VALVES SHALL CLOSE, UNLESS THE FREEZESTAT ALARM IS ACTIVE.
* THE ENERGY RECOVERY LOOP PUMP SHALL DE-ENERGIZE.

WHEN THE SUPPLY FANS ARE COMMANDED TO SHUT DOWN BY THE F/A RELAY, THE SUPPLY SMOKE DETECTOR, OR THE RETURN SMOKE DETECTOR, THE DISCHARGE AIR DAMPER SHALL CLOSE. THE DISCHARGE AIR DAMPER SHALL REMAIN CLOSED UNTIL THE ALARMS HAVE CLEARED. THE DISCHARGE AIR DAMPER SHALL BE FULLY OPEN DURING NORMAL OPERATION.

THE SUPPLY FANS SHALL BE SET AT 100% AIRFLOW BY MODULATING THE VFDS. THE SUPPLY FANS SHALL RUN CONTINUOUSLY AT THIS SPEED WHENEVER THE MAU HAS BEEN COMMANDED TO RUN. THE SUPPLY FANS SHALL NOT RUN UNLESS BOTH THE OUTSIDE AIR DAMPER AND DISCHARGE AIR DAMPER ARE FULLY OPEN. IN THE EVENT OF A FAILURE OF ONE SUPPLY FAN, THE REMAINING OPERATIONAL SUPPLY FAN SHALL MODULATE TO 100% SPEED. WHEN THE OTHER SUPPLY FAN BECOMES OPERATIONAL AGAIN, THE SUPPLY FANS SHALL MODULATE TO THE SPEED CORRELATED TO 100% AIRFLOW.

THE EXHAUST FANS SHALL BE SET TO 100% AIRFLOW BY MODULATING THE VFDS. THE EXHAUST FANS SHALL RUN CONTINUOUSLY AT THIS SPEED WHENEVER THE MAU HAS BEEN COMMANDED TO RUN. IN THE EVENT OF A FAILURE OF ONE EXHAUST FAN, THE REMAINING OPERATIONAL EXHAUST FAN SHALL MODULATE TO 100% SPEED. WHEN THE OTHER EXHAUST FAN BECOMES OPERATIONAL AGAIN, THE EXHAUST FANS SHALL MODULATE TO THE SPEED CORRELATED TO 100% AIRFLOW.

FILTERS
ALL FILTERS SHALL HAVE A DIFFERENTIAL PRESSURE SWITCH MEASURING THE DROP ACROSS THE FILTER BANKS. EACH SHALL ALARM THE BAS WHENEVER THE PRESSURE DROP ACROSS THE FILTERS IS EXCESSIVE. THIS ALARM SHALL NOT SHUT OFF THE FANS.

MAU OPERATING STATES
THE MAU SHALL OPERATE IN THREE (3) DISTINCT STATES. CRITERIA TO TRANSITION BETWEEN THE STATES ARE INDICATED BELOW. TO TRANSITION BETWEEN STATES THE SPECIFIED CRITERIA SHALL BE MET FOR 5 MINUTES (ADJ.). IT IS POSSIBLE FOR THE MAU TO BE IN (STATE 1 OR STATE 2) AND (STATE 3) SIMULTANEOUSLY, BUT NOT (STATE 1) AND (STATE 2).

THE DISCHARGE TEMPERATURE SETPOINT SHALL BE SET TO 58 DEGREES F (ADJ.).
THE DISCHARGE LOW TEMPERATURE SETPOINT SHALL BE SET TO 54 DEGREES F (ADJ.).
THE DISCHARGE HIGH TEMPERATURE SETPOINT SHALL BE SET TO 62 DEGREES F (ADJ.).

THE TEMPERED AIR TEMPERATURE SHALL BE MEASURED DOWNSTREAM OF THE ENERGY RECOVERY COIL (SUPPLY-SIDE) AND UPSTREAM OF THE HEATING COIL. THE OUTSIDE AIR TEMPERATURE SHALL BE MEASURED UPSTREAM OF THE ENERGY RECOVERY COIL (SUPPLY-SIDE). THE GLOBAL OUTSIDE AIR TEMPERATURE MEASUREMENT SHALL ALSO BE PROVIDED FOR REFERENCE.
THE ENERGY RECOVERY DEADBAND SETPOINT SHALL BE SET AT 8 DEGREES F (ADJ.).

THE MAU SHALL RESTART AUTOMATICALLY AFTER A POWER FAILURE AND OPERATE IN THE SAME STATE IT WAS IN PRIOR TO THE POWER FAILURE.

STATE 1 - COOLING
WHEN THE TEMPERED AIR TEMPERATURE IS HIGHER THAN THE DISCHARGE HIGH TEMPERATURE SETPOINT FOR 5 MINUTES (ADJ.), THE MAU SHALL ENTER COOLING MODE. THE COOLING COIL CONTROL VALVE SHALL MODULATE OPEN UNTIL THE DISCHARGE TEMPERATURE MEETS THE DISCHARGE TEMPERATURE SETPOINT. WHEN THE DISCHARGE TEMPERATURE FALLS BELOW THE DISCHARGE TEMPERATURE SETPOINT, THE COOLING COIL SHALL MODULATE CLOSED UNTIL THE DISCHARGE TEMPERATURE MEETS THE DISCHARGE TEMPERATURE SETPOINT.

WHEN THE TEMPERED AIR TEMPERATURE FALLS BELOW THE DISCHARGE HIGH TEMPERATURE SETPOINT FOR 5 MINUTES (ADJ.), THE MAU SHALL EXIT COOLING MODE. THE COOLING COIL CONTROL VALVE SHALL MODULATE CLOSED.

STATE 2 - HEATING
WHEN THE TEMPERED AIR TEMPERATURE IS LOWER THAN THE DISCHARGE LOW TEMPERATURE SETPOINT FOR 5 MINUTES (ADJ.), THE MAU SHALL ENTER HEATING MODE. THE HEATING COIL CONTROL VALVE SHALL MODULATE OPEN UNTIL THE DISCHARGE TEMPERATURE MEETS THE DISCHARGE TEMPERATURE SETPOINT. WHEN THE DISCHARGE TEMPERATURE RISES ABOVE THE DISCHARGE TEMPERATURE SETPOINT, THE HEATING COIL SHALL MODULATE CLOSED UNTIL THE DISCHARGE TEMPERATURE MEETS THE DISCHARGE TEMPERATURE SETPOINT.

WHEN THE TEMPERED AIR TEMPERATURE RISES ABOVE THE DISCHARGE LOW TEMPERATURE SETPOINT FOR 5 MINUTES (ADJ.), THE MAU SHALL EXIT HEATING MODE. THE HEATING COIL CONTROL VALVE SHALL MODULATE CLOSED.

STATE 3 - ENERGY RECOVERY
WHEN THE OUTSIDE AIR TEMPERATURE IS LOWER THAN [(DISCHARGE TEMPERATURE SETPOINT) MINUS (ENERGY RECOVERY DEADBAND SETPOINT)] FOR 5 MINUTES (ADJ.), THE MAU SHALL ENTER ENERGY RECOVERY MODE. (EXAMPLE: 58 - 8 = 50).
THE ENERGY RECOVERY PUMP SHALL BE ALLOWED TO START. THE ENERGY RECOVERY PUMP SHALL MODULATE TO 100% FLUID FLOW BY MODULATING THE VFD. THE ENERGY RECOVERY PUMP SHALL RUN CONTINUOUSLY UNTIL THE MAU EXITS ENERGY RECOVERY MODE.

WHEN THE OUTSIDE AIR TEMPERATURE IS HIGHER THAN [(DISCHARGE TEMPERATURE SETPOINT) PLUS (ENERGY RECOVERY DEADBAND SETPOINT)] FOR 5 MINUTES (ADJ.), THE MAU SHALL ENTER ENERGY RECOVERY MODE. (EXAMPLE: 58 + 8 = 66).
THE ENERGY RECOVERY PUMP SHALL BE ALLOWED TO START. THE ENERGY RECOVERY PUMP SHALL MODULATE TO 100% FLUID FLOW BY MODULATING THE VFD. THE ENERGY RECOVERY PUMP SHALL RUN CONTINUOUSLY UNTIL THE MAU EXITS ENERGY RECOVERY MODE.

WHEN THE OUTSIDE AIR TEMPERATURE IS BETWEEN [(DISCHARGE TEMPERATURE SETPOINT) MINUS (ENERGY RECOVERY DEADBAND SETPOINT)] AND [(DISCHARGE TEMPERATURE SETPOINT) PLUS (ENERGY RECOVERY DEADBAND SETPOINT)] FOR 5 MINUTES (ADJ.), THE MAU SHALL EXIT ENERGY RECOVERY MODE. (EXAMPLE: BETWEEN 50 AND 66).
THE ENERGY RECOVERY PUMP SHALL DE-ENERGIZE AND REMAIN OFF UNTIL THE MAU ENTERS ENERGY RECOVERY MODE AGAIN.

HEATING COIL CIRCULATING PUMP
THE HEATING COIL CIRCULATING PUMP SHALL BE ENERGIZED WHENEVER THE OUTSIDE AIR TEMPERATURE FALLS BELOW 36 DEGREES F (ADJ.) WITHOUT REGARD TO WHETHER THE SUPPLY FANS ARE RUNNING. THIS PUMP SHALL DE-ENERGIZE WHENEVER THE OUTSIDE AIR TEMPERATURE RISES ABOVE 38 DEGREES F (ADJ.). A DIFFERENTIAL PRESSURE TRANSMITTER ACROSS THE CIRCULATING PUMP AND PUMP STATUS SHALL SENSE THE PRESENCE OF FLOW THROUGH THE HEATING COIL. IF A LOSS OF FLOW IS DETECTED AND THE OUTSIDE AIR TEMPERATURE IS BELOW 36 DEGREES F (ADJ.), THE HEATING COIL CONTROL VALVE SHALL FULLY OPEN AND THE BAS SHALL GENERATE AN ALARM.

STATUS DISPLAY
SOFTWARE STATUS POINTS SHALL BE CREATED FOR THE FOLLOWING LOCKOUTS AND FINITE STATES. THE CURRENT STATUS OF THE SOFTWARE LOCKOUT POINTS, ENABLED OR DISABLED, SHALL BE DISPLAYED AT THE BAS FRONT END:
* CHILLED WATER CONTROL VALVE CONTROL LOCKOUT, AND HEATING WATER CONTROL VALVE CONTROL LOCKOUT
* OUTSIDE AIR DAMPER FULLY OPEN LOCKOUT, AND DISCHARGE AIR DAMPER FULLY OPEN LOCKOUT
* ENERGY RECOVERY PUMP CONTROL LOCKOUT
* STATE #1 (COOLING), STATE #2 (HEATING), STATE #3 (ENERGY RECOVERY)

City of Aurora Building Division
Reviewed for Code Compliance
Approved as Noted: Y. Munoz
Date: Aug 24, 2023
2021 INTERNATIONAL CODES & 2023 NEC

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COLORADO LICENSED PROFESSIONAL ENGINEER 55150 CHRISTOPHER T. HOLLOWAY
8/15/2023

PROJECT
Health ONE The Medical Center of Aurora
TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE
Job Number		2023-01094

TITLE
MECHANICAL CONTROLS

SHEET NUMBER
M701

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GENERAL ELECTRICAL SYMBOLS

	CONDUIT RUN CONCEALED IN CEILING OR WALL
	CONDUIT RUN CONCEALED IN OR BELOW FLOOR
	CONDUIT RUN EXPOSED ON CEILING OR WALL

ARROWHEAD DENOTES HOMERUN TO PANELBOARD. SLASH LINES INDICATE QUANTITY OF WIRE; NEUTRAL WIRE SHOWN AS A LONG LINE, PHASE WIRES AND SWITCH LEGS SHOWN AS SHORT LINES, AND GROUND WIRE SHOWN AS A LONG LINE WITH A DOT.

X — CONDUIT, WHERE "X" IS THE TYPE OR FUNCTION OF CONDUIT.

"C"	INDICATES CLOCK	"S"	INDICATES SOUND
"CO"	INDICATES CONDUIT ONLY	"T"	INDICATES TELEPHONE
"CTV"	INDICATES CCTV	"TVA"	INDICATES TELEVISION ANTENNA
"D"	INDICATES DATA	"TVC"	INDICATES CABLE TELEVISION
"FA"	INDICATES FIRE ALARM		
"I"	INDICATES INTERCOM		
"LV"	INDICATES LOW VOLTAGE		
"NC"	INDICATES NURSE CALL		

	CONDUIT STUBBED UP
	CONDUIT STUBBED DOWN
	FLEXIBLE CONDUIT
XX	CONDUIT TERMINATION: "CS" INDICATES CAP AND STAKE; "GB" INDICATES GROUNDING BUSHING; "IB" INDICATES INSULATING BUSHING; "TB" INDICATES TERMINAL BUSHING
	MULTI-OUTLET ASSEMBLY
W W	WIREWAY
CT CT	CABLE TRAY
B B	BUSWAY (BUSDUCT)
	UNDERGROUND DUCTBANK
	UNDERGROUND DIRECT BURIAL CABLE
	UNDERFLOOR DUCT SYSTEM: ——— INDICATES POWER DUCT; – – – INDICATES TELEPHONE DUCT; - - - - INDICATES SYSTEM DUCT
	VARIOUS SYMBOLS IDENTIFY LOCATION OF DIFFERENT TYPES OF OUTLETS OR CONNECTIONS TO UNDERFLOOR DUCT SYSTEM.
PB	PULL BOX
J	JUNCTION BOX- EXPOSED OR IN CEILING
J	JUNCTION BOX - WALL MOUNTED
J	JUNCTION BOX FOR HAND DRYER CONNECTION - WALL MOUNTED
J	JUNCTION BOX WITH FLEXIBLE CONDUIT AND FINAL CONNECTION TO EQUIPMENT.
PDQ 13	EQUIPMENT IDENTIFICATION TAG

LIGHTING SYMBOLS

2' X 4' F1 1a	LIGHTING FIXTURE.
F1 2' X 2' 1a	LIGHTING FIXTURE.
F1 1' X 4' 1a	LIGHTING FIXTURE.
F1 1a	LINEAR LIGHTING FIXTURE- LENGTH AS INDICATED.
T F1 1a	WALL MOUNTED LINEAR LIGHTING FIXTURE- LENGTH AS INDICATED.
F1 1a, F1 1a	LED LIGHTING FIXTURE.
F1 1a, F1 1a	WALL MOUNTED LED LIGHTING FIXTURE.
F1 E1	2' X 4' LIGHTING FIXTURE CONNECTED TO EMERGENCY CIRCUIT.
F1 E1	LINEAR LIGHTING FIXTURE CONNECTED TO EMERGENCY CIRCUIT.
F1 E1, F1 E1	LED LIGHTING FIXTURE CONNECTED TO EMERGENCY CIRCUIT.

LIGHTING FIXTURES: "F1" INDICATES LIGHTING FIXTURE TYPE. REFER TO LIGHTING FIXTURE SCHEDULE FOR DESCRIPTION AND MOUNTING. "1" INDICATES CIRCUIT NUMBER. "a" INDICATES SWITCH CONTROL. SHADING OF LIGHTING FIXTURE OR "E" INDICATES LIGHTING FIXTURE CONNECTED TO EMERGENCY CIRCUIT.

F1 E2	BATTERY PACK, EMERGENCY LIGHTING UNIT
	REMOTE HEAD CONNECTED TO BATTERY PACK.
	TRACK LIGHTING

NEW: #3 E3; #21 E5 — NEW: #3N E3; #21N E5 — EXISTING: #3E E3; #21E E5

"#X" INDICATES INSCRIPTION, ARROWS, AND SINGLE OR DOUBLE FACED, AS SHOWN BELOW. SHADED QUADRANTS INDICATES DIRECTION OF LIGHTED FACES.

"#1"	FIRE ESCAPE	"#14"	TRIANGLE
"#2A"	STAIRS	"#15"	ELEVATOR
"#3"	EXIT	"#16"	FIRE ESCAPE
"#4"	FIRE ESCAPE →	"#17A"	STAIRS
"#5A"	STAIRS →	"#18"	EXIT
"#6"	EXIT →	"#19"	FIRE ESCAPE ⇉
"#7"	FIRE ESCAPE ←	"#20A"	STAIRS ⇉
"#8A"	STAIRS ←	"#21"	EXIT ⇉
"#9"	EXIT ←	"#22"	FIRE ESCAPE ⇉⇇
"#10"	FIRE ESCAPE ←→	"#23A"	STAIRS ⇉⇇
"#11A"	STAIRS ←→	"#24"	EXIT ⇉⇇
"#12"	EXIT ←→		
"#13"	EXIT - RECESSED		

3W XXa — LIGHT SWITCH, SINGLE POLE UNLESS NOTED OTHERWISE:

"a"	INDICATES LIGHTS CONTROLLED	"XX"	INDICATES CIRCUIT NUMBER
"D"	INDICATES DIMMER SWITCH	"WP"	INDICATES WEATHERPROOF
"K"	INDICATES KEY OPERATED	"2P"	INDICATES 2 POLE
"LV"	INDICATES LOW VOLTAGE	"3P"	INDICATES THREE POLE
"MC"	INDICATES MOMENTARY CONTACT	"3W"	INDICATES THREE-WAY
"P"	INDICATES PILOT LIGHT	"4W"	INDICATES FOUR-WAY
"TH"	INDICATES THERMAL OVERLOAD PROTECTION		

POWER DEVICE SYMBOLS

WALL	FLOOR BOX	POKE-THROUGH	
			DUPLEX RECEPTACLE
			DOUBLE DUPLEX RECEPTACLE
			DUPLEX RECEPTACLE - SPLIT WIRED
			SINGLE RECEPTACLE
			COMBINATION DUPLEX RECEPTACLE TELEPHONE/ DATA SYSTEMS OUTLET
			COMBINATION DOUBLE DUPLEX RECEPTACLE TELEPHONE/ DATA SYSTEMS OUTLET
			SPECIAL RECEPTACLE - NEMA TYPE AS INDICATED
P	P	P	JUNCTION BOX WITH FLEXIBLE CONDUIT AND FINAL EQUIPMENT OR FURNITURE SYSTEM POWER CONNECTION

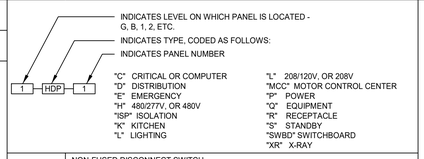
WP, XX — ADJACENT LETTERS IN THE SYMBOLS ABOVE INDICATE THE FOLLOWING:

"CR"	INDICATES CHILD RESISTANT (SAFETY TYPE)
"E"	INDICATES RECEPTACLE FED BY EMERGENCY CIRCUIT
"EP"	INDICATES RECEPTACLE IS EXPLOSION PROOF
"GFI"	INDICATES RECEPTACLE HAS GROUND FAULT CIRCUIT INTERRUPTER
"IG"	INDICATES RECEPTACLE HAS ISOLATED GROUND
"TVS"	INDICATES RECEPTACLE HAS TRANSIENT VOLTAGE SURGE SUPPRESSION
"WP"	INDICATES RECEPTACLE HAS WATERPROOF COVER
"XX"	INDICATES RECEPTACLE CIRCUIT NUMBER

	DUPLEX RECEPTACLE MOUNTED ABOVE COUNTER TOP
	CLOCK OUTLET RECEPTACLE
	CLOCK OUTLET AND CLOCK FOR INTEGRATED CLOCK SYSTEM.
LC	LIGHTING CONTACTOR IN ENCLOSURE
LRC	LIGHTING RELAY CABINET
TC	TIME CLOCK
PC	PHOTOCELL
OS XX, OS XX	CEILING OR WALL MOUNTED OCCUPANCY SENSOR

POWER EQUIPMENT SYMBOLS

	SURFACE MOUNTED DISTRIBUTION PANELBOARD
	SURFACE MOUNTED BRANCH CIRCUIT PANELBOARD
	RECESSED MOUNTED BRANCH CIRCUIT PANELBOARD
1-HDP-1	SWITCHBOARDS, DISTRIBUTION PANELBOARDS, MOTOR CONTROL CENTERS, PANELBOARDS, CABINETS, AND RELATED EQUIPMENT



INDICATES LEVEL ON WHICH PANEL IS LOCATED - G, B, 1, 2, ETC.
INDICATES TYPE, CODED AS FOLLOWS:
INDICATES PANEL NUMBER

"C"	CRITICAL OR COMPUTER	"L"	208/120V, OR 208V
"D"	DISTRIBUTION	"MCC"	MOTOR CONTROL CENTER
"E"	EMERGENCY	"P"	POWER
"H"	480/277V, OR 480V	"Q"	EQUIPMENT
"ISP"	ISOLATION	"R"	RECEPTACLE
"K"	KITCHEN	"S"	STANDBY
"L"	LIGHTING	"SWBD"	SWITCHBOARD
		"XR"	X-RAY

AS	NON-FUSED DISCONNECT SWITCH, "AS" INDICATES AMPERE RATING OF SWITCH
AS/AF	FUSED DISCONNECT SWITCH, "AS" INDICATES AMPERE RATING OF SWITCH AND "AF" INDICATES AMPERE RATING OF FUSE
	MAGNETIC MOTOR STARTER - NEMA SIZE AS INDICATED
AS	COMBINATION MOTOR STARTER AND NON-FUSED DISCONNECT, "AS" INDICATES AMPERE RATING OF SWITCH
T	TRANSFORMER
BGB	BUILDING GROUND BOX
ST	SHUNT TRIP
SPD	SURGE PROTECTION DEVICE
CM	CUSTOMER METER
EPO	EMERGENCY POWER OFF MUSHROOM PUSHBUTTON CONTROL STATION

FIRE ALARM SYMBOLS

FS	FIRE ALARM MANUAL PULL STATION
SD	SMOKE DETECTOR
D	HEAT DETECTOR
S	VOICE SPEAKER
SV	VOICE SPEAKER WITH VISUAL ALARM
V	VISUAL STROBE
AV	AUDIBLE GENERAL ALARM WITH VISUAL STROBE
A	AUDIBLE GENERAL ALARM
RA	REMOTE INDICATOR LIGHT FOR SMOKE DETECTOR
DGP	FIRE ALARM TRANSPONDER PANEL

SECURITY SYMBOLS

	PUSH-BUTTON STATION "DB" DOORBELL "DR" DOOR RELEASE
	BUZZER
	BELL
CH	CHIME
T pTH	LOW VOLTAGE TRANSFORMER WITHIN PLENUM BOX
CCTV	CLOSED CIRCUIT TELEVISION CAMERA
CR	CARD READER
ES	ELECTRIC STRIKE
DC	DOOR CONTACT
MS	MOTION SENSOR

COMMUNICATIONS SYMBOLS

TTC	TELEPHONE TERMINAL CABINET

WALL	FLOOR BOX	POKE-THROUGH	
			SUBSCRIPT INDICATES THE FOLLOWING FOR BELOW WALL MOUNTED OUTLETS. (U.N.O.): "H" HANDICAP MOUNTED AT 48" A.F.F. "W" WALL MOUNTED AT 54" A.F.F. "P" PAY PHONE MOUNTED AT 54" A.F.F.
			TELEPHONE OUTLET
			DUPLEX TELEPHONE OUTLET
			DATA SYSTEMS OUTLET
			DUPLEX DATA SYSTEMS OUTLET
			COMBINATION TELEPHONE/ DATA SYSTEMS OUTLET
T	T/D	D	JUNCTION BOX WITH FLEXIBLE CONDUIT AND FINAL EQUIPMENT OR FURNITURE SYSTEM CONNECTION. SUBSCRIPTS INDICATE THE FOLLOWING: "T" - TELEPHONE "D" - DATA SYSTEMS "T/D" - COMBINATION TELEPHONE/ DATA SYSTEMS

I I	INTERCOM, WALL OR CEILING MOUNTED
S S	SPEAKER, WALL OR CEILING MOUNTED

ABBREVIATIONS

NOTE: ABBREVIATIONS ARE ALPHABETICALLY LISTED BY DESCRIPTION.

ABBREV.	DESCRIPTION
AFF	ABOVE FINISHED FLOOR
ACL	ACROSS THE LINE
ALM	ALARM
AC	ALTERNATING CURRENT
A	AMPERE
AMP	AMPERE
AIC	AMPERES INTERRUPTING CAPACITY
AL	ALUMINUM
ANN	ANNUNCIATOR
ATS	AUTOMATIC TRANSFER SWITCH
BAL	BALLAST
BR	BRANCH
BRKR	BREAKER
BGB	BUILDING GROUND BOX
CAB	CABINET
CATV	CABLE TELEVISION
C.B.	CIRCUIT BREAKER
CCT	CIRCUIT
CCTV	CLOSED CIRCUIT TELEVISION
CLO	CLOSET
COAX	COAXIAL
C.U.	COEFFICIENT OF UTILIZATION
COMED	COMMONWEALTH EDISON COMPANY
C	CONDUIT
CONN	CONNECTION
CONV	CONVENIENCE
CU	COPPER
CUH	CABINET UNIT HEATER
CT	CURRENT TRANSFORMER
HZ	HERTZ (CYCLES/SECOND)
DC	DIRECT CURRENT
DS	DISCONNECT SWITCH
DPDT	DOUBLE POLE DOUBLE THROW
DPST	DOUBLE POLE SINGLE THROW
DO	DRAWOUT
DT	DUSTTIGHT
ELEC	ELECTRIC
EWC	ELECTRIC WATER COOLER
EWH	ELECTRIC WATER HEATER
EM	EMERGENCY
EMT	ELECTRIC METALLIC TUBING (THIN WALL CONDUIT)
EQ	EQUIPMENT
EUH	ELECTRIC UNIT HEATER
EX	EXISTING
EP	EXPLOSION PROOF
FPB	FAN POWERED BOX
FA	FIRE ALARM
FDC	FIRE DEPARTMENT CONNECTION
FB	FLOORBOX
FLUOR	FLUORESCENT
F	FUSE
F.S.	FUSED SWITCH
GEN	GENERATOR
GRD	GROUND
GFI	GROUND FAULT INTERRUPTER
GHW	GALVANIZED HEAVYWALL STEEL CONDUIT
HV	HIGH VOLTAGE
HP	HORSE POWER
INC	INCANDESCENT
IC	INTERRUPTING CAPACITY
IMC	INTERMEDIATE GRADE CONDUIT
JB	JUNCTION BOX
KW	KILOWATT
KWH	KILOWATT-HOUR

ABBREV.	DESCRIPTION
KVA	KILOVOLT-AMPERE
KO	KNOCKOUT
LTG	LIGHTING
LS	LOUD SPEAKER
LV	LOW VOLTAGE
MH	MANHOLE
MFR	MANUFACTURER
MV	MULTI VAPOR
MERC.	MERCURY VAPOR
MTR	MOTOR
MCC	MOTOR CONTROL CENTER
MTD	MOUNTED
NEC	NATIONAL ELECTRICAL CODE
NEUT	NEUTRAL
NC	NORMALLY CLOSED
NO	NORMALLY OPENED
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
PNL	PANEL
PH	PHASE
PT	POTENTIAL TRANSFORMER
PWR	POWER
PRI	PRIMARY
PROT.	PROTECTION OR PROTECTIVE
PA	PUBLIC ADDRESS
PB	PULL BOX
RT	RAINTIGHT
RECP	RECEPTACLE
RC	REMOTE CONTROL
R	RESISTANCE
REL	RELOCATE
SEC	SECONDARY
SC	SHORT CIRCUIT
SP	SINGLE POLE
SPST	SINGLE POLE SINGLE THROW
SPDT	SINGLE POLE DOUBLE THROW
SPKR	SPEAKER
SPEC	SPECIFICATION
SS	STAINLESS STEEL
STA	STATION
S	SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
SYM	SYMMETRICAL
SYS	SYSTEM
TC	TERMINAL CABINET
TEL	TELEPHONE
TEL CL.	TELEPHONE CLOSET
TTC	TELEPHONE TERMINAL CABINET
TV	TELEVISION
TERM.	TERMINAL
TX	TRANSFORMER
T	TRIP
TL	TWIST LOCK
UL	UNDERWRITER'S LABORATORIES
UNG	UNGROUNDED
UH	UNIT HEATER
UNO	UNLESS NOTED OTHERWISE
VP	VAPORPROOF
VT	VAPORTIGHT
V	VOLT
VA	VOLT-AMPERE
WT	WATERTIGHT
W	WATT
WP	WEATHERPROOF
XR	EXISTING TO BE REMOVED
XRL	EXISTING TO BE RELOCATED
XRW	EXISTING TO BE REWIRED

DEMOLITION NOTES

1. REFER TO ARCHITECTURAL DEMOLITION DRAWINGS FOR FULL EXTENT AND SCOPE OF PARTITION AND CEILING MODIFICATIONS.

   A. EXISTING CEILINGS TO REMAIN SHALL NOT BE ALTERED EXCEPT WHERE REMOVAL AND REPLACEMENT OF SURFACES IS REQUIRED TO MODIFY SYSTEMS WITHIN CEILING SPACE.

   B. EXISTING CEILINGS TO BE REMOVED SHALL INCLUDE DEMOLITION OF ALL FIXTURES, EQUIPMENT, SPEAKERS, RACEWAY, AND WIRE, INCLUDING ANY OBSOLETE OR PREVIOUSLY ABANDONED PRODUCTS. REMAINING AREAS SHALL ONLY BE ALTERED AS REQUIRED AND IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.

   C. EXISTING PARTITIONS TO REMAIN SHALL NOT BE ALTERED EXCEPT WHERE REMOVAL AND REPLACEMENT OF SURFACES IS REQUIRED TO MODIFY SYSTEMS WITHIN PARTITIONS.

   D. EXISTING PARTITIONS TO BE REMOVED SHALL INCLUDE DEMOLITION OF ALL DEVICES, RACEWAY AND WIRE INCLUDING ANY OBSOLETE OR PREVIOUSLY ABANDONED PRODUCTS. RACEWAY AND WIRING SYSTEMS SERVING OTHER REMAINING AREAS SHALL ONLY BE ALTERED AS REQUIRED AND IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.

   E. EXISTING FLOOR MOUNTED DEVICES SHALL BE DEMOLISHED. PROVIDE ABANDONING PLATES AND FIRE PROOFING AS REQUIRED.

2. REFER TO MECHANICAL AND PLUMBING DEMOLITION DRAWINGS FOR FULL EXTENT AND SCOPE OF ELECTRICALLY OPERATED EQUIPMENT MODIFICATIONS.

   A. DEMOLITION OF EXISTING MECHANICAL EQUIPMENT SHALL INCLUDE ASSOCIATED DISCONNECTS, RACEWAY, WIRE, CONTROLS.

BRANCH CIRCUIT WIRING SCHEDULE

OCPD	1P & 2P	2P-3W & 3P-3W	3P-4W
15	2#12, 1#12G, 3/4"C	3#12, 1#12G, 3/4"C	4#12, 1#12G, 3/4"C
20	2#12, 1#12G, 3/4"C	3#12, 1#12G, 3/4"C	4#12, 1#12G, 3/4"C
25	2#10, 1#10G, 3/4"C	3#10, 1#10G, 3/4"C	4#10, 1#10G, 3/4"C
30	2#10, 1#10G, 3/4"C	3#10, 1#10G, 3/4"C	4#10, 1#10G, 3/4"C
35	2#8, 1#10G, 3/4"C	3#8, 1#10G, 3/4"C	4#8, 1#10G, 3/4"C
40	2#8, 1#10G, 3/4"C	3#8, 1#10G, 3/4"C	4#8, 1#10G, 3/4"C
45	2#6, 1#10G, 3/4"C	3#6, 1#10G, 3/4"C	4#6, 1#10G, 1"C
50	2#6, 1#10G, 3/4"C	3#6, 1#10G, 3/4"C	4#6, 1#10G, 1"C
60	2#4, 1#10G, 3/4"C	3#4, 1#10G, 1"C	4#4, 1#10G, 1 1/4"C
70	2#4, 1#8G, 3/4"C	3#4, 1#8G, 1"C	4#4, 1#8G, 1 1/4"C
80	2#3, 1#8G, 1"C	3#3, 1#8G, 1"C	4#3, 1#8G, 1 1/4"C
90	2#2, 1#8G, 1"C	3#2, 1#8G, 1 1/4"C	4#2, 1#8G, 1 1/4"C
100	2#1, 1#8G, 1 1/4"C	3#1, 1#8G, 1 1/4"C	4#1, 1#8G, 1 1/2"C

ELECTRICAL SHEET INDEX

E000 - ELECTRICAL SYMBOLS , ABBREVIATIONS & NOTES
E001 - ELECTRICAL SPECIFICATIONS
E002 - ELECTRICAL SCHEDULES & ONE-LINE DIAGRAM
E100 - ELECTRICAL OVERALL PLAN - FEEDER ROUTING
E101 - LEVEL 02 ELECTRICAL DEMOLITION PLAN
E102 - LEVEL 03 ELECTRICAL DEMOLITION PLAN
E103 - LEVEL 04 ELECTRICAL DEMOLITION PLAN
E104 - LEVEL 05 ELECTRICAL DEMOLITION PLAN
E105 - ROOF ELECTRICAL DEMOLITION PLAN
E205 - ROOF ELECTRICAL POWER PAN

GENERAL NOTES

1. ALL EXPOSED RACEWAYS ARE TO BE INSTALLED PARALLEL OR PERPENDICULAR TO WALLS OR STRUCTURAL MEMBERS SUCH THAT THEY FOLLOW STRUCTURAL SURFACE CONTOURS AND SHALL BE INSTALLED SUCH THAT THEY DO NOT OBSTRUCT PASSAGEWAYS OR ACCESS TO EQUIPMENT. MULTIPLE RACEWAYS SHOULD BE INSTALLED GROUPED TOGETHER. THE LOCATION OF PUBLICLY VISIBLE RACEWAYS SHALL BE APPROVED BY THE ARCHITECT PRIOR TO INSTALLATION. (EXTRA TIME SHOULD BE ALLOWED FOR THIS REVIEW AND APPROVAL).
2. THE DISCONNECTING MEANS FOR ALL MECHANCIAL EQUIPMENT SHALL BE ACCESSIBLE AND HAVE THE CLEARANCE IN FRONT AS REQUIRED BY NEC AMENDMENTS.
3. ALL CEILING ATTACHED OBJECTS AND FLOOR ATTACHED EQUIPMENT INCLUDING BUT NOT LIMITED TO PENDANT LIGHTING FIXTURES, GENERAL LIGHTING, MULTIPLE RACEWAYS, GENERATOR, TRANSFORMER, ELECTRICAL SWITCHGEAR, AND SWITCHBOARDS SHALL BE INSTALLED IN ACCORDANCE WITH SUPPORTING OBJECTS FOR SEISMIC ZONE AS REQUIRED BY STATE AND LOCAL CODES.
4. ALL SWITCHGEAR, SWITCHBOARDS AND TRANSFORMERS SHALL HAVE A 4 INCH HOUSEKEEPING PAD. UNDER NO CONDITION SHALL THE HIGHEST SWITCH OR BREAKER EXCEED 6'-6" AFF.
5. DATA GIVEN ON THE DRAWINGS IS AS EXACT AS COULD BE SECURED. ABSOLUTE ACCURACY IS NOT GUARANTEED AND THE CONTRACTOR SHALL OBTAIN AND VERIFY EXACT LOACTIONS, MEASUREMENTS, LEVELS, SPACE REQUIREMENTS, POTENTIAL CONFLICTS WITH OTHER TRADES, ETC. AT THE SITE AND SHALL SATISFACTORILY ADAPT HIS WORK TO ACTUAL CONDITIONS AT THE BUILDINGS. THE DRAWINGS ARE DIAGRAMMATICAL IN NATURE AND SHALL NOT BE SCALED. HOWEVER THIS DOES NOT RELIEVE ANY SUBCONTRACTOR FROM COORDINATING HIS WORK WITH ALL OTHER TRADES AND FROM ADJUSTING HIS WORK AS REQUIRED BY THE ACTUAL CONDITIONS OF THE PROJECT. THE CONTRACTOR SHALL CISIT THE SITE BEFORE SUBMITTING COSTS TO BECOME THOROUGHLY FAMILIAR WITH THE ACTUAL CONDITIONS OF THE PROJECT.
6. COORDINATE AND ADJUST ALL WORK BETWEEN TRADES AND EXISTING CONDITIONS IN ORDER TO ACCOMPLISH A NEAT, INTEGRATED AND EFFICIENT INSTALLATION WHICH INCLUDE BUT ARE NOT LIMITED TO:
   A. EXAMINE THE CONTRACT DOCUMENTS OF ALL TRADES (IE. THE ARCHITECTURAL REFLECTED CEILING PLAN, MECHANICAL HVAC DRAWINGS, ELECTRICAL LIGHTING PLAN, FIRE PROTECTION PLAN, ETC.)
   B. COORDINATE NECESSARY EQUIPMENT, FIXTURES, ETC. SO THAT THE FINAL INSTALLATION IS COMPATIBLE WITH THE MATERIALS AND EQUIPMENT OF THE OTHER TRADES.
   C. THIS CONTRACTOR SHALL ASSIST THE DIVISION 23 CONTRACTOR IN PREPARING SHOP DRAWINGS FOR COORDINATING INSTALLATION OF ALL WORK (IE. LOCATING ALL LIGHTING FIXTURES IN CEILING WITH CEILING CLEARANCES, RACEWAYS, PIPING, EQUIPMENT FOR CLEARANCE THROUGHOUT.
   D. THE ELECTRICAL DRAWINGS INDICATE THE ELECTRICAL REQUIREMENTS FOR A SIGNIFICANT PORTION OF THE MECHANICAL AND PLUMBING SYSTEMS. ADDITIONAL MECHANICAL AND PLUMBING EQUIPMENT IS INDICATED ON THE DICISION 23 DRAWINGS. REFER TO MEANICAL DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL INFORMATION. PROVIDE COMPLETE WIRING AND FUSIBLE DISCONNECTING MEANS FOR ALL MECHANICAL AND PLUMBING EQUIPMENT.
7. DEFINITIONS:
   A. "FURNISH" MEANS TO "SUPPLY" AND USUALLY REFERS TO AN ITEM OF EQUIPMENT.
   B. "INSTALL" MEANS TO "SET IN PLACE, CONNECT AND PLACE IN FULL OPERATIONAL ORDER".
   C. "PROVIDE" MEANS TO "FURNISH AND INSTALL".
   D. "EQUIVALENT" MEANS "MEET THE SPECIFICATIONS OF THE REFERENCE PRODUCT OR ITEM IN ALL SIGNIFICANT ASPECTS." SIGNIFICANT ASPECTS SHALL BE DETERMINED BY THE ENGINEER.
   E. "BE ... DIVISION", AND SIMILAR EXPRESSIONS MEANS WORK TO BE PERFORMED UNDER THE CONTRACT DOCUMENTS, BUT NOT NECESSARILY UNDER THE DIVISION OR SECTION OF THE WORK ON WHICH THE NOTE APPEARS. IT IS THE CONTRACTORS SOLE RESPONSIBILITY TO COORDINATE THE WORK OF THE CONTRACT BETWEEN HIS/HER SUPPLIERS, SUBCONTRACTORS, AND EMPLOYEES. IF CLARIFICATION IS REQUIRED, CONSULT ARCHITECT.
8. "FIRESTOPPING" REQUIREMENT. ALL PENETRATIONS THROUGH RATED WALLS AND FLOORS SHALL BE SEALED WITH MATERIAL CAPABLE OF PREVENTING THE PASSAGE OF FLAMES AND HOT GASSES WHEN SUBJECTED TO THE REQUIREMENTS OF THE TEST STANDARD SPECIFIC FOR FIRE STOPS ASTM-E-814. ALL PENETRATIONS SHALL MEET F AND T RATINGS AS REQUIRED BY THE BUILDING CODE.
9. WHERE DISCONNECTS ARE INDICATED ON DRAWINGS CONTRACTOR SHALL PROVIDE FINAL CONNECTION FROM DISCONNECT TO EQUIPMWNT BEING SERVED.
10. CONTRACTOR SHALL PROVIDE ALL MISCELLANEOUS SUPPORTS AS REQUIRED FOR A COMPLETE OPERABLE ELECTRICAL INSTALLATION INCLUDING MISCELLANEOUS STEEL, UNI-STRUT, ALL-THREAD, AIRCRAFT CABLE, ETC.
11. PROVIDE A DEDICATED NEUTRAL CONDUCTOR FOR ALL SINGLE PHASE CIRCUITS. A SHARED NEUTRAL CONDUCTOR IS NOT ACCEPTABLE ON SINGLE PHASE CIRCUITS.
12. EQUIPMENT INTERRUPTING RATINGS INDICATED ON THE DRAWINGS ARE BASED ON PRELIMINARY INFORMATION AND ARE SHOWN FOR BIDDING PURPOSES ONLY. VERIFY EQUIPMENT INTERRUPTING CAPACITY REQUIREMENTS PRIOR TO ORDERING ANY RELATED ELECTRICAL DISTRIBUTION EQUIPMENT.
13. PROVIDE NEW TYPE WRITTEN DIRECTORIES FOR ALL PANELBOARDS INSTALLED OR MODIFIED UNDER THIS CONTRACT.
14. ALL CIRCUIT BREAKER LUGS SHALL BE RATED FOR A MINIMUM OF 75 DEGREES CELSIUS.
15. ALL MATERIALS IN CEILING PLENUMS NOT ENCLOSED IN METALLIC CONDUIT SHALL HAVE CLASS, FLAME SPREAD AND SMOKE DEVELOPMENT RATINGS AS REQUIRED FOR USE IN OPEN PLENUMS.
16. VOLTAGE DROP- THE ELECTRICAL CONTRACTOR SHALL ENSURE THAT VOLTAGE DROP FOR FEEDERS TO DISTRIBUTION EQUIPMENT DOES NOT EXCEED 2% AND VOLTAGE DROP IN BRANCH CIRCUITING DOES NOT EXCEED 3% FOR OVERALL VOLTAGE DROP 5% (MAXIMUM). FEEDERS LISTED ON SCHEDULES AND THE ELECTRICAL ONE-LINE DIAGRAM ARE A BASE FEEDER/BRANCH CIRCUIT SIZE AND SHALL BE ADJUSTED AS NEEDED BASED ON ACTUAL LENGTH OF CONDUCTORS.
17. REFER TO GENERAL NOTES FOR NUMBER OF PANEL SECTIONS AND QUANTITY OF CIRCUIT BREAKERS PANEL SCHEDULES SUPERCEDE ALL NOTES.
18. REFER TO SPECIFICATIONS FOR ADDITIONAL PROJECT REQUIREMENTS.
19. BRANCH CIRCUIT WIRING FOR 120 VOLT 20 AMP CIRCUITS WIRE TO 208Y/120V SYSTEMS SHALL BE AS FOLLOWS:
   A. GENERAL RECEPTACLES AND LIGHTING LOADS:
      UP TO 100 FEET IN LENGTH: 3#12, 1#12N, 1#12G -3/4"C.
      OVER 100 FEET IN LENGTH: 3#10, 1#10N, 1#10G-3/4"C.
   B. COMPUTER (NON ISOLATED GROUND) RECEPTACLE LOADS:
      UP TO 100 FEET IN LEGNTH: 3#12, 1#10N, 1#12G-3/4"C.
      OVER 100 FEET IN LENGTH: 3#10, 1#8N, 1#10G-3/4"C.
   C. ISOLATED GROUND RECEPTACLE LOADS:
      UP TO 80 FEET IN LENGTH: 3#12, 3#10N, 1#12G, 1#12IG-3/4"C.
      OVER 80 FEET IN LENGTH: 3#10, 1#8N, 1#10, 1#10IG-3/4"C.
1. BRANCH CIRCUIT WIRING FOR 277 VOLT 20 AMP CIRCUITS WIRED TO 480Y/277V SYSTEMS SHALL BE AS FOLLOWS:
   A. ELECTRICAL HEATING LOADS:
      UP TO 150 FEET IN LENGTH: 3#12, 1#12N, 1#12G-3/4"C.
      OVER 150 FEET IN LENGTH: 3#10, 1#10N, 1#10G-3/4"C.
   B. LIGHTING LOADS:
      UP TO 150 FEET IN LENGTH: 3#12, 1#10N, 1#12G-3/4"C.
      OVER 150 FEET IN LENGTH: 3#10, 1#8N, 1#10G-3/4"C.
21. MOUNTING HEIGHTS OF ELECTRICAL ITEMS SHALL BE AS LISTED BELOW ABOVE FINISHED FLOOR TO CENTERLINE, UNLESS NOTED OTHERWISE:

A.	GENERAL RECEPTACLES	15"
B.	RESIDENT RECEPTACLES	18"
C.	OUTDOOR RECEPTACLES	24"
D.	GENERAL TELE AND DATA OUTLETS	15"
E.	RESIDENT TELE AND DATA OUTLETS	18"
F.	GENERAL TOGGLE SWITCHES	48"
G.	RESIDENT TOGGLE SWITCHES	45"
H.	FIRE ALARM PULL STATIONS	48"
I.	SECURITY CALL STATIONS	48"
J.	GENERAL TELEVISION OUTLETS	15"
K.	CLOCK AND PAGING SPEAKER OUTLETS	84"
L.	FIRE ALARM AUDIO VISUAL DEVICES	80"
M.	GENERAL WALL MOUNTED LIGHTS	90"
N.	CORRIDOR WALL SCONCES (>4" DEEP)	66"
O.	EXIT SIGNS	90"
P.	INDIVIDUAL DISCONNECTS AND STARTERS	60"
Q.	GROUPED DISCONNECTS AND STARTERS	> 12" < 72"
R.	PANELBOARD OVERCURRENT DEVICES	> 12" 72"
S.	GROUPED UTILITY REVENUE METERS	> 30"

REFER TO ARCHITECTURAL DRAWINGS FOR MOUNTING HEIGHTS OF RECEPTACLES, TELE/DATA DEVICES, AND TOGGLE SWITCHES, UNLESS NOTE OTHERWISE.

22. PROVIDE RACEWAY AND GROUNDING FOR COMMUNICATIONS SYSTEMS INCLUDING TELEPHONE, DATA, SECURITY, CABLE TELEVISION, PAGING, INTERCOM, ETC. VERIFY REQUIREMENTS WITH COMMUNICATIONS CONSULTANTS AND CONTRACTORS.
23. VOICE AND DATA RACEWAY FOR WALL MOUNTED OUTLETS SHALL BE AS FOLLOWS: PROVIDE A TWO-GANG J-BOX AND SINGLE OR DOUBLE GANG FLUSH WALL OPENING AS REQUIRED FOR EACH VOICE/DATA OUTLET. CONDUITS SHALL INCLUDE PULL STRINGS AND 48" RADIUS BENDS. CONDUIT STUBS SHALL INCLUDE INSULATING BUSHING. CONDUIT FROM OUTLET BOX SHALL BE 3/4" MINIMUM AND

A full-size set of City approved colored stamped drawings and Building Permit must stay on site and be available at the time of inspection for the Inspector.

Code violations that are found during inspection are required to be corrected. Permit issuance does not grant approval of a code violation.

SPECIFICATIONS

DIVISION 16000 - ELECTRICAL

1. GENERAL

A. Requirements

1. Products and execution shall be provided for a complete and fully operational electrical system throughout the extent of the project, in conformance with applicable codes, laws, ordinances and agency standards of governing bodies having jurisdiction, and in strict accordance with the contract documents, and building standards.

2. Products, including equipment, devices, fixtures, and materials shall be new unless noted otherwise, UL listed, and bear appropriate label.

3. Execution, including preparation, installation, starting, and testing shall be performed by skilled trades personnel, in compliance with the associated manufacturers recommendations, and coordinated with the other construction trades.

B. Applicable Codes

1. National Electrical Code	NEC
2. Local Amendments	

C. Applicable Laws and Agency Standards

1. American National Standards Institute	ANSI
2. American Society for Testing and Materials	ASTM
3. Americans with Disabilities Act	ADA
4. Association of Edison Illuminating Companies	AEIC
5. Certified Ballast Manufacturers	CBM
6. Electrical Testing Laboratories	ETL
7. Electronic/Telecommunications Industries Association	EIA/TIA
8. Energy Policy Act of 1992	EPACT
9. Federal Aviation Administration	FAA
10. Illuminating Engineering Society of North America	IESNA
11. Institute of Electrical and Electronics Engineers	IEEE
12. Insulated Cable Engineers Association	ICEA
13. National Electrical Manufacturers Association	NEMA
14. National Fire Protection Association	NFPA
15. Underwriters' Laboratories	UL

D. Approvals

1. Emergency and Exit Lighting Documents shall be prepared and submitted to the Local Fire Department for their approval of system layout, circuiting, and fixture type. Approved drawings shall be submitted for review prior to construction.

2. Fire Alarm and Life Safety Documents shall be prepared and submitted to the Local Fire Department for their approval of system expansion, layout, circuiting, equipment and device type. The base building fire alarm and life safety system manufacturer/installer shall be retained to produce or update the building fire alarm and life safety documents, and to make final connections and alterations to the existing system. Approved drawings shall be submitted for review prior to construction.

E. Submittals

1. Product Data shall be prepared and submitted for review prior to construction for the following products: cabinets, access panels, supports, wire, fuses, circuit breakers, receptacles, toggle switches, disconnect switches, motor starters, contactors, lighting fixtures, ballasts, lamps, controls, fire alarm devices and life safety devices.

2. Shop Drawings shall be prepared and submitted for review prior to construction for the following products: distribution panelboards, branch panelboards, transformers.

3. Manufacturers Instructions shall be prepared and submitted prior to construction including installation manuals with application conditions and limitations for electrical apparatus use, storage, handling, protection, examination, preparation, installation, and starting.

4. Project Record Documents shall be prepared using AutoCAD or equivalent CAD package. Project Record Documents shall be submitted on reproducible media prior to project completion for electrical systems. Record actual location of equipment, devices, fixtures, etc. Record actual routing of overhead feeders. Record actual routing of feeders below slab and branch circuits within or below slab.

5. Maintenance Data shall be prepared and submitted prior to project completion for electrical apparatus including operation manuals and maintenance manuals.

F. Coordination

1. Electrical Engineer: Notify the Engineer of any conflicting design information or any design intentions which are not readily interpreted from the contract documents prior to any product selection or execution of work. Notify the Engineer of any products which are damaged, unsuitable, incompatible, or non-compliant with any applicable codes or ordinances of any governing bodies having lawful jurisdiction.

2. Construction Trades: Coordinate work with other construction trades.

3. Building Management: Meet on site with the building engineer to become familiar with building standards. Normal building working hours shall be recognized. After-hours work or temporary services shall be with prior written approval from building management. Enclose construction area from other areas to prevent transmission of dust, dirt and noise into other existing tenant areas. Product and waste transfer shall be coordinated with building management for scheduling of the elevators, deliveries, and waste removal.

4. Existing Building Systems: Review building standards with the building engineer. Perform a site visit to verify the existing site conditions. Costs associated with unforseen conditions as result of not performing a site visit shall not be an entitlement for an increase to the contract. Construction shall be performed without interruption to the building power, communications, security, fire alarm and life safety systems, or interference to common areas, corridors, exits or existing tenants. Where any construction would interfere with the daily operations of the building or other tenants, after-hours work or temporary services shall be provided at no increase to the contract.

G. Warrantee and Guarantee

1. Provide warrantee and manufacturers certificate for each product, minimum of one year or longer as specified, from the date of occupancy. Repair and/or replace any equipment, devices, fixtures, materials, etc. with defect as required at no increase to the contract.

2. Provide guarantee of installation for a period of one year from the date of occupancy. Repair and/or reinstall any work with defect as required at no increase to the contract. Provide guarantee of rework for a period of one year from the completion of repair or reinstallation.

3. Damage caused to finishes, surfaces, ceiling tiles, equipment, etc. shall be repaired and/or replaced to match the pre-existing condition at no increase to the contract.

H. Pay fees and other charges incidental to the electrical work and obtain and pay for required liability and casualty insurance, permits, licenses, inspections, taxes, etc.

I. Construction shall be done during regular working hours and days, unless otherwise specified. Work required to be performed during overtime hours or days shall be as indicated.

J. Allow for 8 man-hours of training to the Owners staff for the operation of the electrical systems.

K. Substitutions are not acceptable.

2. PRODUCTS

A. Cabinets, enclosures and access panels shall be code gage steel with baked enamel finish and flangeless hinges and fasteners. Equipment bases shall be 3 inch high concrete, steel traced and reinforced with 1/4 inch chamfer, and shall extend a minimum of 2 inches around base of equipment. Vibration isolation shall be spring elements in suspended rods and isolation pads below equipment, electrical connections shall be flexible conduit.

B. Conduits shall be hot-dipped galvanized or electro-galvanized steel, minimum size shall be 3/4 inch, except power branch circuits may be 1/2 inch (unless noted otherwise) and flexible connections to recessed lighting fixtures which may be 3/8 inch. Flexible steel conduit shall be galvanized steel, with UL listed liquid tight jacket as required, for final connections to motors, recessed lighting fixtures, and life safety devices. Supports, including channels, angles, rods, and fasteners shall be hot-dipped galvanized steel. Manufacturer shall be Allied, LTV/Republic, Steelduct, or Wheatland.

C. Conduit fittings shall be steel, die cast fittings of pot metal are not acceptable. Electrical metallic tubing (EMT) fittings shall be compression type with insulated throats; set screw fittings are not acceptable. Intermediate metal conduit (IMC) and heavy wall conduit (HWG) fittings shall be of threaded joints; set screw and compression fittings are not acceptable. Manufacturer shall be Appleton, Crouse Hinds/Midwest, OZ/GGedney, Raco, Steel City, or T&B.

D. Outlet boxes for all toggle switches, receptacles, communications devices, fire alarm devices, and life safety devices shall include plaster rings, device plates, and cover plates where required. Provide boxes suitable for plenum, wet, or hazardous locations as required. Device cover plates shall be stainless steel painted to match finish. Multi-gang outlet boxes shall include suitable one-piece device cover plate. Outlets located on opposite sides of a partition shall be staggered by 12 inches, minimum. Manufacturer shall be Appleton, Raco, or Steel City.

E. Distribution panelboards shall be fully rated with copper phase, neutral, and ground bus, braced at 65,000 AIC for 480Y/277 Volt systems and 42,000 AIC for 208Y/120 Volt systems, or more to be greater than the available short circuit current. Isolated ground bus shall be as required. Overcurrent protection shall be fusible switches. Manufacturers shall be Cutler-Hammer, Siemens/ITE, or Square D.

F. Branch panelboards shall be fully rated with copper phase, neutral, and ground d at 14,000 AIC for 480Y/277 Volt systems and 10,000 AIC for 208Y/120 Volt systems, or more to be greater than the available short circuit current. Neutral bus shall be rated at 200 percent within panels serving non-linear loads. Isolated ground bus shall be as required. Overcurrent protection shall be Cutler-Hammer, Siemens/ITE, or Square D.

G. Individual motor starters shall include two sets of normally open contacts, one set of normally closed contacts, three overload relays, individually fused control transformer, hand-off-auto selector switch for automatic start, and pilot light(s) as required. Combination starter disconnects shall include fusible switches. Contactors shall be NEMA type, with replaceable coil and contact tips. Manufacturer shall be Cutler-Hammer, Siemens/ITE, or Square D.

H. Local disconnect switches for electrically operated equipment shall be heavy duty within enclosure suitable for the location. Fusible disconnect switches 800 Amps and larger shall be bolted pressure, load-break type. Fusible and non-fusible disconnect switches 600 Amps and smaller shall be quick-make, quick-break type. Manufacturer shall be Cutler-Hammer, Siemens/ITE, or Square D.

I. Overcurrent and short circuit protection within fusible switches shall be Class L current limiting time delay fuses for switches rated 800 Amps and larger, and Class RK-1 current limiting time delay fuses for switches rated 600 Amps and smaller. Manufacturer shall be Bussmann.

J. Transformers shall be copper wound, dry type ventilated, 115°C rise with NEMA standard voltage taps and sound ratings. Transformers serving non-linear loads shall be K-13 rated or better for the order and magnitude of harmonic content. Transformers serving isolated ground distribution systems shall be shielded isolation type. Manufacturer shall be Magnetek/Jefferson, Sola/Heavy Duty, Square D/Sorgel.

K. Grounding system, including service and equipment grounding and bonding, shall be in accordance with code and shall connect all electrically operated equipment. Provide a separate green ground wire for each branch circuit and feeder.

L. Receptacles shall be duplex NEMA 5-20R, back and side wired, specification grade, unless noted otherwise. Special receptacle configurations, duplex isolated ground receptacles, and duplex ground fault interrupter receptacles shall be as required or as indicated on the contract documents. General receptacle color shall be white and IG receptacle color shall be orange unless specified otherwise, verify color with Architect. Manufacturer shall be Bryant, Hubbell, Leviton, or Pass & Seymour.

M. Toggle switches shall be single pole 20 Amp, 120-277 Volt, back and side wired, specification grade, unless noted otherwise. Special switches, including 3-way, pilot light and momentary contact, shall be as required or as indicated on the contract documents. Color shall be white unless specified otherwise, verify color with Architect. Manufacturer shall be Bryant, Hubbell, Leviton, or Pass & Seymour.

N. Lighting contactors shall be enclosed and mechanically held, and shall include all required control modules, timeclocks, and remote photocells. Main contactors for panelboard feeders shall match the panel ratings. Multiple pole contactors for branch circuits shall be rated at 20 Amps, or more, as required for the specific load type. Manufacturer shall be ASCO 920 & 917 or Zenith MVP & MMC.

O. Lighting fixtures shall include all appropriate accessories, mounting frame and trim for ceiling type. Fluorescent fixtures shall include rapid-start standard-output electronic ballasts with ninety percent (90%) ballast factor and total harmonic distortion of (10%) or less, type or appropriate compact type lamps. Lighting fixtures shall include coordinated air handling capability, plenum rating, damp label, wet label, and shall be explosion proof where required. Lighting fixtures recessed within grid type ceilings shall include securing clips as required by the local authority. Fixture manufacturer shall be as indicated; Electronic ballast manufacturer shall be Advance, Motorola, or MagneTek with minimum 3 year warrantee; Lamp manufacturer shall Osram Sylvania, General Electric, or Phillips.

P. New fire alarm devices provided within existing systems shall match existing device manufacturer and type. Strobes shall meet ADA guidlines for the application and shall be rated 75cd, except in sleeping areas which shall be rated 110cd. Strobes rated 15/75cd with 75cd on axis are not acceptable except in small conference rooms. Existing fire alarm devices shall be extended as required. Existing fire alarm equipment shall be expanded as required with any additional components for proper operation of new devices on existing equipment.

3. EXECUTION

A. Penetrations and channels in floors and walls shall be via cutting and coring as required for the size of product, only in accordance with the Architect and Engineer recommendations, and as scheduled with the building management. Patch and fill sleeves, inserts, penetrations, and channels with appropriate code approved fire safing or filling to match or restore the original fire rating of the construction.

B. Install 3 inch concrete pad below floor mounted equipment including distribution panelboards, transformers, etc.

C. Make final connections to vibrating equipment, fixtures, and devices with flexible metal conduit or liquid tight flexible metal conduit as required. Extend ground wire through flexible connections.

D. Install conduit, fittings, supports, etc. in accordance with codes, standards, and manufacturers recommendations. The voltages identified in the following schedules are line-to-line or line-to-neutral. Interior concealed locations are those locations which are above ceilings, within walls, within floor slabs, and within dedicated electrical rooms. Conduit installation shall be as follows unless noted otherwise:

Voltage / Location	0V thru 50V	Above 50V thru 250V	Above 250V thru 600V	Above 600V
Interior Concealed	EMT Concealed	EMT	< 2"EMT > 2 1/1"IMC	HWG
Interior Exposed	EMT	< 2"EMT > 2 1/2"IMC	IMC	HWG
Exterior and Hazardous Locations	IMC	IMC	HWG	HWG

E. Installations within air handling spaces, including plenum ceilings and built up air handling systems shall be approved for plenum installation and shall be in strict accordance with all applicable codes.

F. Installations within hazardous locations shall be listed for the Classification and Division of hazard. Install wiring and conduit complete with seals and explosion proof fittings in strict accordance with all applicable codes.

G. Communications raceway shall include square outlet box and single or double gang flush wall opening as required for each telephone/data device. Conduits shall include pull strings and wide radius bends. Conduit stubs shall include insulating bushings. Conduit from outlet box shall be 3/4 inch minimum.

H. Install pull boxes, junction boxes, and outlet boxes in accordance with codes, standards, and manufacturers recommendations. Boxes shall include accessible covers, shall be fabricated of heavy gage galvanized steel, and shall be sized in accordance with code to adequately facilitate pulling and connecting the quantity and size of wires, cables, and feeders contained. Conduit terminations shall be made with bushings and locknuts. Supports for conduits and boxes shall be suspended directly to the building structural components and in no case shall they be attached to suspended ceiling grid, duckwork, or piping components.

I. Install feeders and branch circuit wiring in accordance with codes, standards, and manufacturers recommendations. Install normal power, emergency power, fire alarm, and life safety systems within continuous metal raceways. Install concealed security and communications wiring within continuous metal raceways. Separate each system into independent raceways. Provide cable supports as required. Terminate cables per code and manufacturers recommendations. Provide (2) hole lugs for cables 250 kcmil and larger. Power wiring insulation shall be as follows unless noted otherwise:

Wire Location	300 kcmil and smaller	350 kcmil and larger	Environmental Conditions
Interior Locations	THHN/THWN	XHHW	dry
Exterior Locations	THHN/THWN THHN/THWN	XHHW XHHW-2	damp wet

J. Install electrical distribution equipment and devices, including distribution panelboards, branch panelboards, motor starters, local disconnect switches, overcurrent protection, transformers, main contactors, receptacles, etc. in accordance with codes, standards, and manufacturers recommendations.

K. Install grounding systems in accordance with codes, standards, and manufacturers recommendations. Provide a #6 AWG bare copper conductor routed in 3/4" conduit to the building ground from a lug mounted on the communication equipment mounting board.

L. Install lighting and associated controls, including fixtures, ballasts, lamps, toggle switches, lighting contactors, etc in accordance with codes, standards, and manufacturers recommendations.

M. Install single and multiple device cover plates as required. Extend existing devices to finished surface as required.

N. Install fire alarm and other life safety systems in accordance with codes, standards, and manufacturers recommendations.

O. Install inscription plates and identification markings for products and wiring including the same inscriptions where indicated on the contract documents. Install plastic laminate nameplates on enclosures for each device within metering equipment, distribution panelboards, branch panelboards, motor starters, disconnect switches, transformers, and contactors. Nameplates shall be white with black core, 1-1/4 inches by 3 inches minimum, with 3/16 inch lettering, secured to equipment with two machine screws. Prepare and install type-written panel directory within each branch panel. Device plates shall be engraved for toggle switches and other devices whose function is not readily apparent. Markers shall be self-sticking for each wire and cable at terminations and at each accessible point in equipment and raceway.

P. Clean electrical apparatus prior to completion of construction. Keep work areas clean at all times.

Q. Alterations and Demolition of existing systems shall be as follows:

1. Provide all alterations and demolition of the existing electrical installation as required, including any incidental materials to execute all removal, rerouting, relocation, and any other modifications for proper accommodation of all new construction as indicated on the contract documents. All alterations and demolition shall be as indicated on the contract documents or as required, including any modifications not specifically identified on any contract documents but required to complete all new construction.

2. Provide all modifications to existing equipment as required or as indicated on the contract documents in strict accordance with the existing product manufacturers recommendations.

3. Existing raceway, wire and cable extending through the construction area but serving areas outside the contract shall be rerouted and reconnected as required. All modifications shall be without any interruption to the building power, communications, security, fire alarm and life safety systems, or interference to other areas or tenants. Where any modifications would interfere with the daily operations of the building or other tenants, after-hours work or temporary services shall be provided with prior written approval from the building.

4. Existing conduit, wire, cable, supports, hangers, and other electrical installation which is removed, shall be completely removed, back to the first device or that equipment which is unaffected by the modifications. Conduit which is buried in concrete or otherwise inaccessible may be abandoned and capped at each end. All wire and cable shall be removed from any abandoned conduit.

5. Existing electrical materials and equipment, including lighting fixtures, switches, receptacles, speakers, conduit, outlet boxes, fittings, wire, cable, and other equipment and devices which are removed shall remain the property of the Owner and shall be stored or discarded as directed.

6. Reuse existing electrical products as indicated on the contract documents only as is found practical. Examine the condition of all such products, determine suitability for re-use, and periodically notify the Architect/Engineer of findings for final acceptance of re-use. Wire and cable for new construction or extension of an existing installation shall be new, in no case shall existing wire and cable be reused.

This sheet of drawings has not been reviewed for code compliance.

City of Aurora Building Division
Reviewed for Code Compliance
Approved as Noted: A. Sharpley
Date: Aug 28, 2023
2021 INTERNATIONAL CODES & 2023 NEC

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CONTRACTOR

COLORADO LICENSED MICHAEL P THOMAS 56150 PROFESSIONAL ENGINEER
8/15/2023

PROJECT
Health ONE The Medical Center of Aurora
TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE

Job Number 2023-01094

TITLE
ELECTRICAL SPECIFICATIONS

SHEET NUMBER
E001

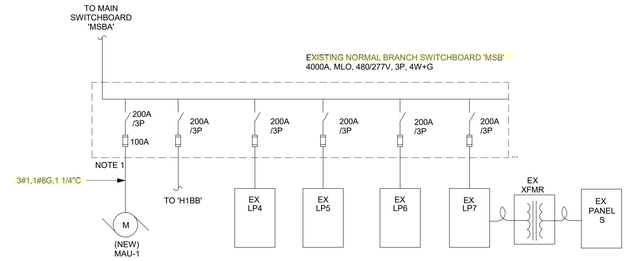
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Code violations that are found during inspection are required to be corrected. Permit issuance does not grant approval of a code violation.

Every circuit and circuit modification shall be provided with a legible and permanent description that complies with all of the following conditions as applicable (see 1-6). 2023 NEC 408.4

Locate the required overcurrent Protection per 2023 NEC 240.21



1 ELECTRICAL ONE-LINE DIAGRAM

NOT TO SCALE

NOTES:

1. PROVIDE NEW 100A FUSE THAT MATCHES MAKE AND MODEL OF EXISTING FUSE AND 3#1,1#6G,1 1/4"C COPPER FEEDER.

MOTOR/EQUIPMENT SCHEDULE - NOTES 1,2

TAG	DESCRIPTION	LOCATION	ELECTRICAL RATING					FEEDER/SOURCE - NOTE 1				DISCONNECT		STARTER		NOTES
			KW	FLA	HP	VOLT	PH	PANEL	CCT	OCPD	WIRING	INTEGRAL	BY EC	SIZE	TYPE	
MAU-1	MAKE-UP AIR HANDLING UNIT	ROOF		80.6		480	3	MSB	-	100A FUSE	3P-3W+G	X	-	NOTE 3		3,4,6,8
ERP-1	ENERGY RECOVERY PUMP	MAU-1 VESTIBULE			7.5	480	3	LP7	7,9,11	20A/3P	3P-3W+G	-	X	-	VFD	5
UH-1	ELECTRIC UNIT HEATER	MAU-1 VESTIBULE	3			277	1	LP7	14	20A/1P	1P-2W+G	X	-	-	-	7
HCP-1	HEATING CIRCULATION PUMP				3	480	3	LP6	7,9,11	15A/3P	3P-3W+G	-	X	1	FVNR	

NOTES:
1. REFER TO BRANCH CIRCUIT WIRING SCHEDULE ON SHEET E000.
2. COORDINATE EXACT EQUIPMENT REQUIREMENTS WITH OTHER TRADES PRIOR TO ROUGH-IN AND INSTALLATION.
3. INSTALL AND WIRE TWO VFDs FURNISHED BY MECHANICAL CONTRACTOR FOR EACH FAN ARRAY TO BE INSTALLED IN SERVICE CORRIDOR.
4. FEED 120V 20A CIRCUIT VIA PANEL S, CCT 8 FOR 120V CONTROLS, RECEPTACLES, AND LIGHTS (SINGLE-POINT CONNECTION).
5. INSTALL AND WIRE VFD FURNISHED BY MECHANICAL CONTRACTOR.
6. PROVIDE DUCT-MOUNTED FIRE ALARM SYSTEM SMOKE DETECTOR ON THE MAIN SUPPLY AND EXHAUST DUCTS. LOCATE REMOTE ANNUNCIATOR/TEST SWITCH IN LEVEL 05 MECHANICAL ROOM BELOW. COORDINATE ALL WORK WITH JCI.
7. INSTALL AND WIRE UNIT HEATER FURNISHED BY MECHANICAL CONTRACTOR. LOCAL DISCONNECT SWITCH IS PROVIDED INTEGRAL TO THE UNIT.
8. REPLACE FUSE IN SPARE SWITCH OF SWITCHBOARD 'MSB' WITH NEW 100A FUSE THAT MATCHES MAKE AND MODEL OF EXISTING FUSE.

PANEL DESIGNATION: LP4 (EX) — LOCATION: MECH 2ND — MOUNTING: **SURFACE** — FAULT DUTY: 18,000
MLO: N — MAIN:125A — BUS: — VOLTS: **480/277** — PHASE: **3** — WIRE: 4

EQUIPMENT DESCRIPTION	DMD	WATTS A	WATTS B	WATTS C	BRKR SIZE			BRKR SIZE	WATTS A	WATTS B	WATTS C	DMD	EQUIPMENT DESCRIPTION
SPARE	G				20/1	1	2	20/1				G	SPARE
LIGHTS CENTER CORE (EX)	G				20/1	3	4	20/1				G	EAST ZONE LIGHTS REAR (EX)
LIGHTS MAIN CORRIDOR (EX)	G				20/1	5	6	20/1				G	WEST ZONE LIGHTS REAR (EX)
SPACE	G					7	8	15/3				G	SPARE
SPACE	G					9	10					G	
SPACE	G					11	12					G	
LABOR DELIVERY LIGHTS (EX)	G				20/1	13	14	15/3				G	**AHU 2A (XR)(3)**
SPARE	G				20/1	15	16					G	
FRONT LIGHTS WEST (EX)	G				20/1	17	18					G	
WALL SCONCES (EX)	G				20/1	19	20					G	SPACE
SPARE	G				20/1	21	22					G	SPACE
SPACE	G					23	24					G	SPACE

TOTAL "A"	0			0	0.0 CONN.KVA
TOTAL "B"		0		0	0.0 CONN. AMPS
TOTAL "C"			0	0	0.0 DEMAND KVA
TOTAL "A,B,C "				0 CONN.	0.0 DEMAND AMPS
				0 DEMAND	0.0 DESIGN KVA
				0 DESIGN	0.0 DESIGN AMPS

NOTES:
1. BOLDED ITEMS REPRESENT SCOPE OF WORK.
2. ELECTRICAL CONTRACTOR TO FIELD VERIFY PANELBOARD EXISTING CONDITIONS PRIOR TO WORK.
3. EXISTING LOAD TO BE DEMOLISHED, LABEL CIRCUIT AS SPARE.

PANEL DESIGNATION: LP5 (EX) — LOCATION: MECH 3RD — MOUNTING: **SURFACE** — FAULT DUTY: 18,000
MLO: N — MAIN:125A — BUS: — VOLTS: **480/277** — PHASE: **3** — WIRE: 4

EQUIPMENT DESCRIPTION	DMD	WATTS A	WATTS B	WATTS C	BRKR SIZE			BRKR SIZE	WATTS A	WATTS B	WATTS C	DMD	EQUIPMENT DESCRIPTION
LGTS CENTER AREA (EX)	G				20/1	1	2	20/1				G	NURSE STN. LGTS PEDS (EX)
CORRIDOR LGTS (EX)	G				20/1	3	4	20/1				G	LGTS PEDS (EX)
LGTS IN HALLWAY (EX)	G				20/1	5	6	20/1				G	LGTS PEDS (EX)
SPACE	G					7	8	15/3				G	**AHU-3 (XR)(3)**
SPACE	G					9	10					G	
SPACE	G					11	12					G	
SE AND EAST ENT LGTS (EX)	G				20/1	13	14	20/1				G	HUMIDIFIER H-1 (EX)
NORTHEAST LGTS (EX)	G				20/1	15	16	20/1				G	HUMIDIFIER H-1 (EX)
SOUTH SIDE LGTS (EX)	G				20/1	17	18	20/1				G	HUMIDIFIER H-1 (EX)

TOTAL "A"	0			0	0.0 CONN.KVA
TOTAL "B"		0		0	0.0 CONN. AMPS
TOTAL "C"			0	0	0.0 DEMAND KVA
TOTAL "A,B,C "				0 CONN.	0.0 DEMAND AMPS
				0 DEMAND	0.0 DESIGN KVA
				0 DESIGN	0.0 DESIGN AMPS

NOTES:
1. BOLDED ITEMS REPRESENT SCOPE OF WORK.
2. ELECTRICAL CONTRACTOR TO FIELD VERIFY PANELBOARD EXISTING CONDITIONS PRIOR TO WORK.
3. EXISTING LOAD TO BE DEMOLISHED, LABEL CIRCUIT AS SPARE.

PANEL DESIGNATION: LP6 (EX) — LOCATION: MECH 4TH — MOUNTING: **SURFACE** — FAULT DUTY: 18,000
MLO: N — MAIN:125A — BUS: — VOLTS: **480/277** — PHASE: **3** — WIRE: 4

EQUIPMENT DESCRIPTION	DMD	WATTS A	WATTS B	WATTS C	BRKR SIZE			BRKR SIZE	WATTS A	WATTS B	WATTS C	DMD	EQUIPMENT DESCRIPTION
SPARE	G				20/1	1	2	20/1				G	SPACE
HALL LIGHTS (EX)	G				20/1	3	4	20/1				G	SPACE
SPARE	G				20/1	5	6	20/1				G	SPACE
	G	1333				7	8					G	
HCP-1	G		1333		15/3	9	10	20/3				G	SPARE
	G			1333		11	12					G	
SPARE	G				20/1	13	14					G	
REHEAT (EX)	G				20/1	15	16	15/3				G	SPARE
SPARE	G				20/1	17	18					G	

TOTAL "A"	1333			1333	4.0 CONN.KVA
TOTAL "B"		1333		1333	4.8 CONN. AMPS
TOTAL "C"			1333	1333	4.0 DEMAND KVA
TOTAL "A,B,C "				3999 CONN.	4.8 DEMAND AMPS
				3999 DEMAND	4.0 DESIGN KVA
				3999 DESIGN	4.8 DESIGN AMPS

NOTES:
1. BOLDED ITEMS REPRESENT SCOPE OF WORK.
2. ELECTRICAL CONTRACTOR TO FIELD VERIFY PANELBOARD EXISTING CONDITIONS PRIOR TO WORK.
3. EXISTING LOAD TO BE DEMOLISHED AND REPLACED WITH NEW EQUIPMENT.

PANEL DESIGNATION: LP7 (EX) — LOCATION: MECH 5TH — MOUNTING: **SURFACE** — FAULT DUTY: 18,000
MLO: N — MAIN:125A — BUS: — VOLTS: **480/277** — PHASE: **3** — WIRE: 4

EQUIPMENT DESCRIPTION	DMD	WATTS A	WATTS B	WATTS C	BRKR SIZE			BRKR SIZE	WATTS A	WATTS B	WATTS C	DMD	EQUIPMENT DESCRIPTION
HALL LIGHTS (EX)	G				20/1	1	2	20/1				G	EXTERIOR LIGHTING (EX)
OUTSIDE LIGHTS NORTH (EX)	G				20/1	3	4	20/1				G	TIME CLOCK OUTSIDE N (EX)
OUTSIDE LIGHTS SOUTH (EX)	G				20/1	5	6	20/1				G	TIME CLOCK OUTSIDE S (EX)
	G	3047				7	8					G	
ERP-1 (3)	G		3047		**20/3**	9	10	15/3				G	FRESH AIR INTAKE (EX)
	G			3047		11	12					G	
FRESH AIR INTAKE FAN (EX)	G				20/1	13	14	20/1	3000			H	**UH-1**
FRESH AIR INTAKE FAN (EX)	G				20/1	15	16	20/1				G	LIGHTING (EX)
FRESH AIR INTAKE FAN (EX)	G				20/1	17	18	20/1				G	SPARE

TOTAL "A"	3047			6047	12.1 CONN.KVA
TOTAL "B"		3047		3047	14.6 CONN. AMPS
TOTAL "C"			3047	3047	12.1 DEMAND KVA
TOTAL "A,B,C "				12141 CONN.	14.6 DEMAND AMPS
				12141 DEMAND	12.9 DESIGN KVA
				12891 DESIGN	15.5 DESIGN AMPS

NOTES:
1. BOLDED ITEMS REPRESENT SCOPE OF WORK.
2. ELECTRICAL CONTRACTOR TO FIELD VERIFY PANELBOARD EXISTING CONDITIONS PRIOR TO WORK.
3. EXISTING LOAD TO BE DEMOLISHED AND REPLACED WITH NEW EQUIPMENT, PROVIDE NEW CIRCUIT BREAKER.

PANEL DESIGNATION: PNL S (EX) — LOCATION: MECH 5TH — MOUNTING: **SURFACE** — FAULT DUTY: 10,000
MLO: N — MAIN:100A — BUS: — VOLTS: **208/120** — PHASE: **3** — WIRE: 4

EQUIPMENT DESCRIPTION	DMD	WATTS A	WATTS B	WATTS C	BRKR SIZE			BRKR SIZE	WATTS A	WATTS B	WATTS C	DMD	EQUIPMENT DESCRIPTION
	G					1	2						SPACE
MAIN	G				100/3	3	4						SPACE
	G					5	6						SPACE
LIGHTS ROOF (EX)	L				20/1	7	8	20/1	650			G	**MAU CONTROLS**
SPARE	G				20/1	9	10	20/1				G	SPARE
SPACE						11	12	20/1				G	SPARE
SPACE						13	14	20/1				G	SPARE
SPACE						15	16	20/1				G	MAG STARTER COIL (EX)
SPACE						17	18	20/1				G	ROOF GFI (EX)
SPACE						19	20	20/1				G	SPARE

TOTAL "A"	0			650	0.7 CONN.KVA
TOTAL "B"		0		0	1.8 CONN. AMPS
TOTAL "C"			0	0	0.7 DEMAND KVA
TOTAL "A,B,C "				650 CONN.	1.8 DEMAND AMPS
				650 DEMAND	0.7 DESIGN KVA
				650 DESIGN	1.8 DESIGN AMPS

NOTES:
1. BOLDED ITEMS REPRESENT SCOPE OF WORK.
2. ELECTRICAL CONTRACTOR TO FIELD VERIFY PANELBOARD EXISTING CONDITIONS PRIOR TO WORK.

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CONTRACTOR

COLORADO LICENSED MICHAEL P THOMAS 55450 PROFESSIONAL ENGINEER
8/15/2023

PROJECT

Health ONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

City of Aurora Building Division
Reviewed for Code Compliance
Approved as Noted: A. Sharpley
Date: Aug 28, 2023
2021 INTERNATIONAL CODES & 2020 NEC

MARK	ISSUE	DATE

Job Number 2023-01094

TITLE

ELECTRICAL SCHEDULES & ONE-LINE DIAGRAM

SHEET NUMBER

E002

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GENERAL NOTES:

1. REFER TO SHEET E000 FOR ELECTRICAL SYMBOLS.
2. REFER TO SHEET E001 FOR ELECTRICAL SPECIFICATIONS.
3. REFER TO MECHANICAL MOTOR/EQUIPMENT SCHEDULE ON SHEET E002 FOR EQUIPMENT ELECTRICAL REQUIREMENTS.
4. REFER TO MECHANICAL DRAWINGS FOR ADDITIONAL EQUIPMENT REQUIREMENTS.

KEYED NOTES: (#)

1. PROPOSED ROUTING OF FEEDER TO MAU-1 FROM SWITCHBOARD 'MSB'. CONTRACTOR SHALL FIELD-VERIFY EXACT ROUTING ON SITE.



1 ELECTRICAL OVERALL PLAN - FEEDER ROUTING

1/8" = 1'-0"

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CONTRACTOR

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PROJECT

Health ONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

MARK	ISSUE	DATE

Job Number 2023-01094

TITLE

ELECTRICAL OVERALL PLAN - FEEDER ROUTING

SHEET NUMBER

E100

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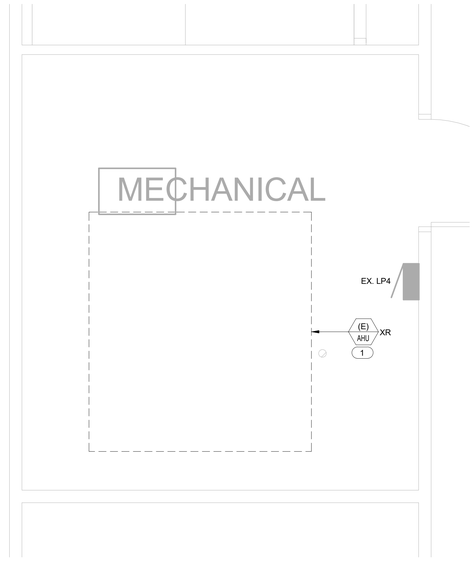
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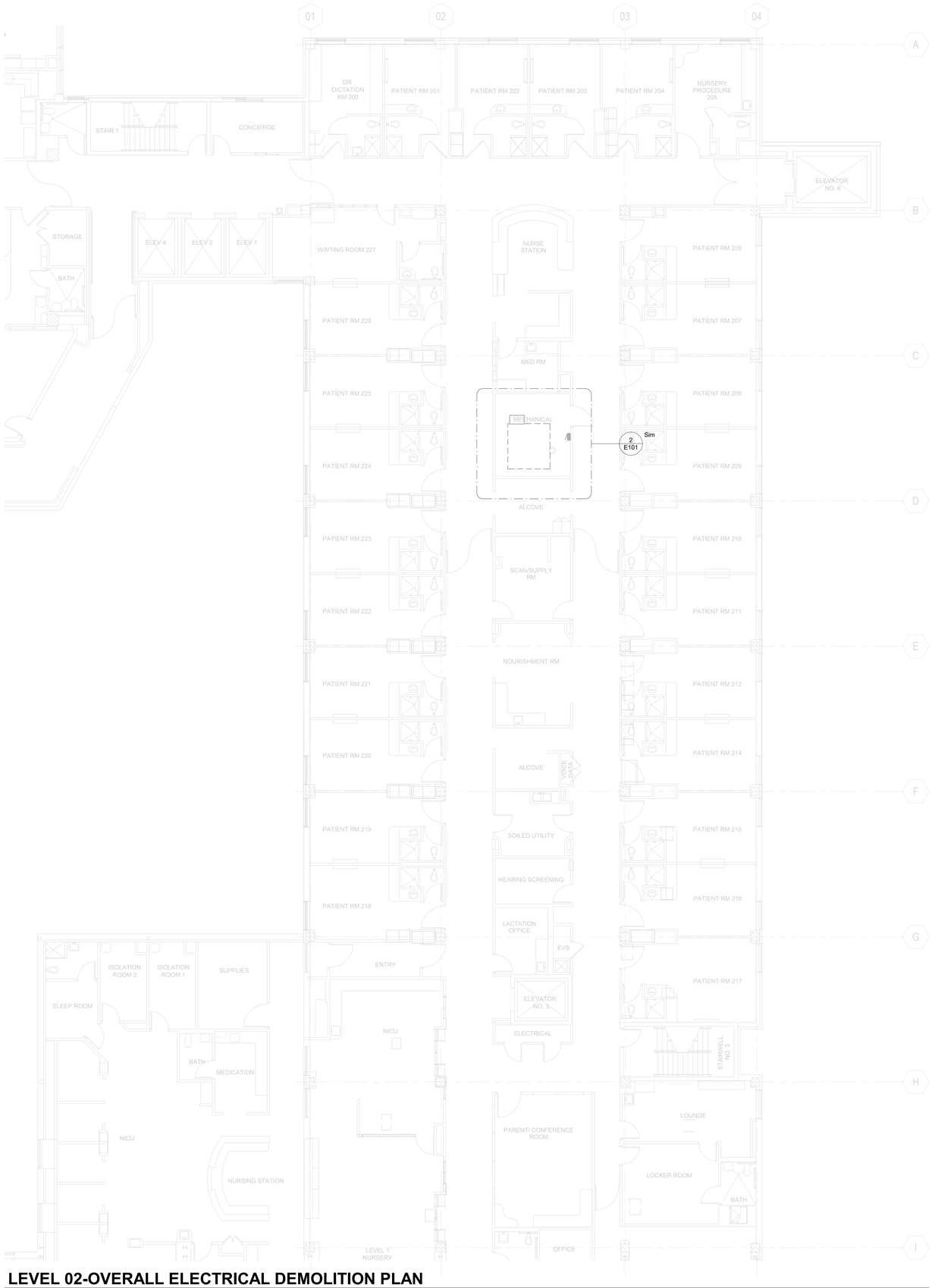
KEYED NOTES: (#)

1. REMOVE EXISTING ELECTRICAL FEEDS TO AHU SUPPLY AND EXHAUST FANS BEING REMOVED BY THE MECHANICAL CONTRACTOR. ALSO REMOVE ASSOCIATED DUCT-MOUNTED SMOKE DETECTION AND RELATED COMPONENTS. COORDINATE ALL FIRE ALARM WORK WITH JCI.



2 LEVEL 02-ELECTRICAL DEMOLITION PLAN

1/2" = 1'-0"



1 LEVEL 02-OVERALL ELECTRICAL DEMOLITION PLAN

1/8" = 1'-0"

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8/15/2023

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Health ONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

City of Aurora Building Division
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Job Number		2023-01094

TITLE

LEVEL 02 ELECTRICAL DEMOLITION PLAN

SHEET NUMBER

E101

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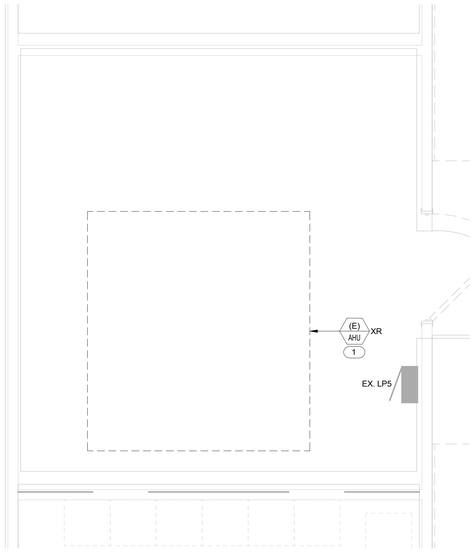
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GENERAL NOTES:

1. REFER TO SHEET E000 FOR ELECTRICAL SYMBOLS.
2. REFER TO SHEET E001 FOR ELECTRICAL SPECIFICATIONS.
3. REFER TO MECHANICAL MOTOR/EQUIPMENT SCHEDULE ON SHEET E002 FOR EQUIPMENT ELECTRICAL REQUIREMENTS.
4. REFER TO MECHANICAL DRAWINGS FOR ADDITIONAL EQUIPMENT REQUIREMENTS.

KEYED NOTES: (#)

1. REMOVE EXISTING ELECTRICAL FEEDS TO AHU SUPPLY AND EXHAUST FANS BEING REMOVED BY THE MECHANICAL CONTRACTOR. ALSO REMOVE ASSOCIATED DUCT-MOUNTED SMOKE DETECTION AND RELATED COMPONENTS. COORDINATE ALL FIRE ALARM WORK WITH JCI.



2 LEVEL 03-ELECTRICAL DEMOLITION PLAN
1/2" = 1'-0"



1 LEVEL 03-OVERALL ELECTRICAL DEMOLITION PLAN
1/8" = 1'-0"

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TITLE

LEVEL 03 ELECTRICAL DEMOLITION PLAN

SHEET NUMBER

E102

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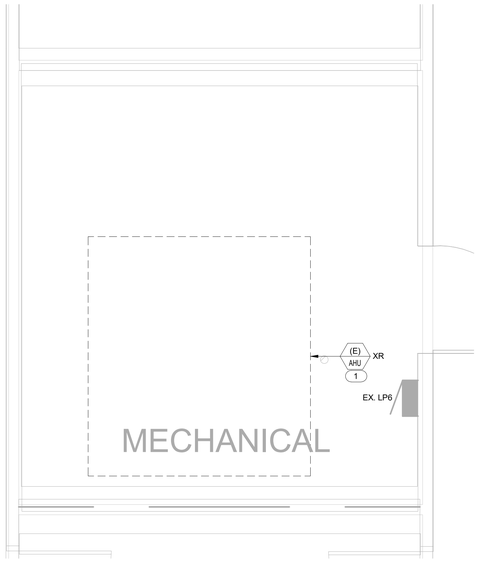
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GENERAL NOTES:

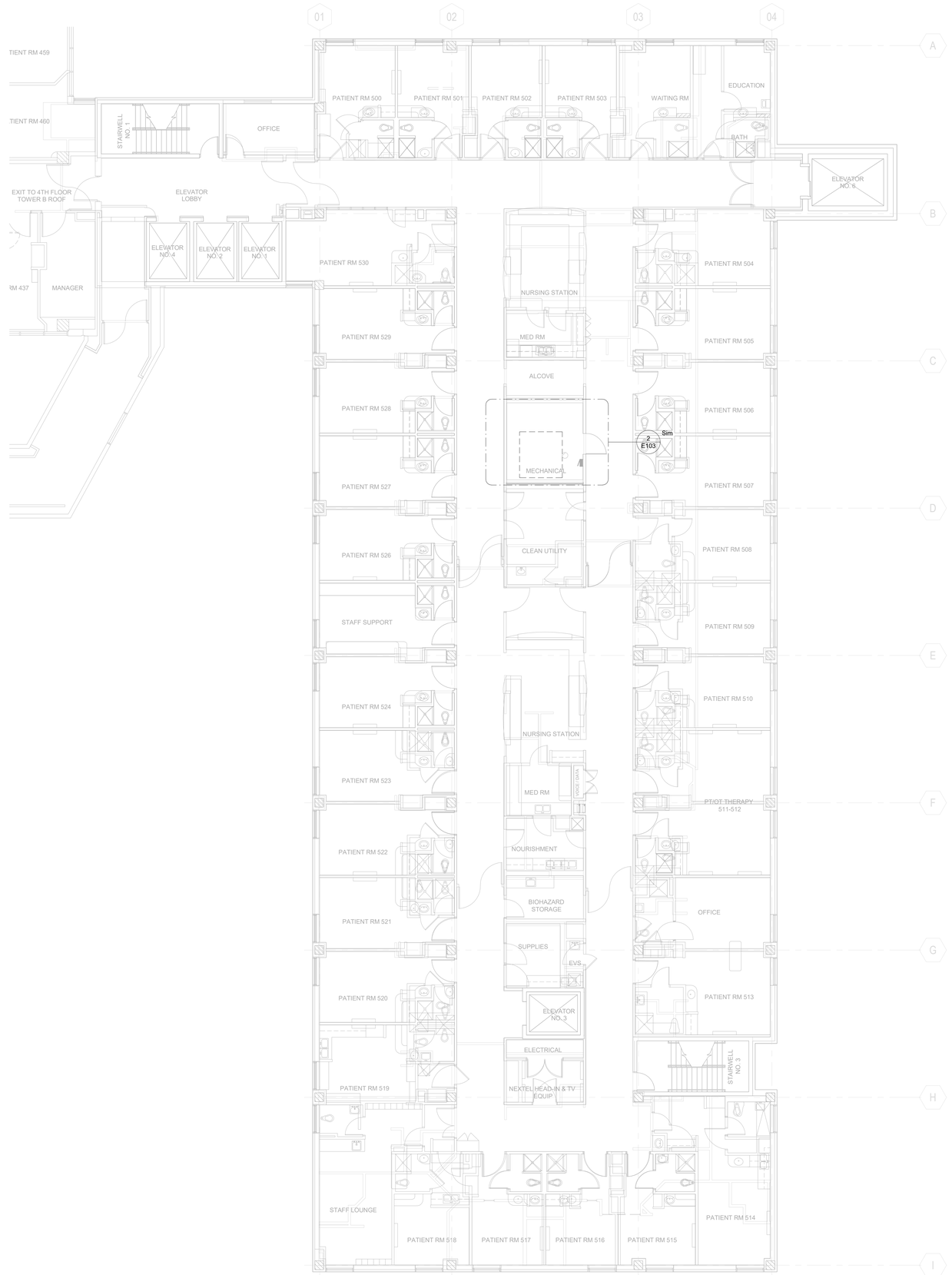
1. REFER TO SHEET E000 FOR ELECTRICAL SYMBOLS.
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3. REFER TO MECHANICAL MOTOR/EQUIPMENT SCHEDULE ON SHEET E002 FOR EQUIPMENT ELECTRICAL REQUIREMENTS.
4. REFER TO MECHANICAL DRAWINGS FOR ADDITIONAL EQUIPMENT REQUIREMENTS.

KEYED NOTES: (#)

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2 LEVEL 04- ELECTRICAL DEMOLITION PLAN
1/2" = 1'-0"



1 LEVEL 04-OVERALL ELECTRICAL DEMOLITION PLAN
1/8" = 1'-0"

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8/15/2023

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Health ONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU REPLACEMENT

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KEYPLAN

ISSUE CHART

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TITLE

LEVEL 04 ELECTRICAL DEMOLITION PLAN

SHEET NUMBER

E103

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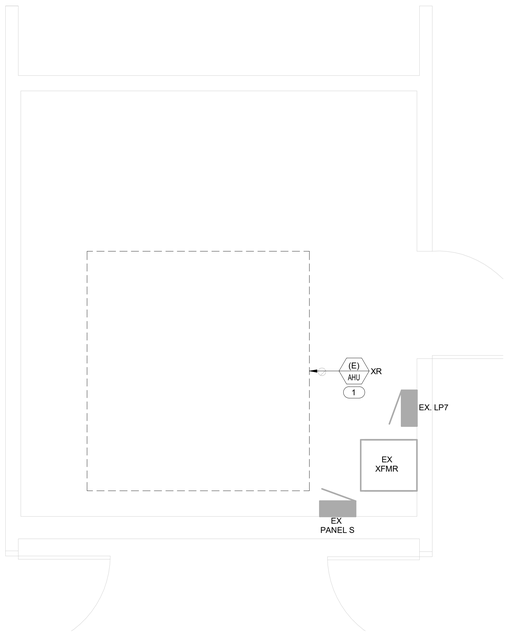
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GENERAL NOTES:

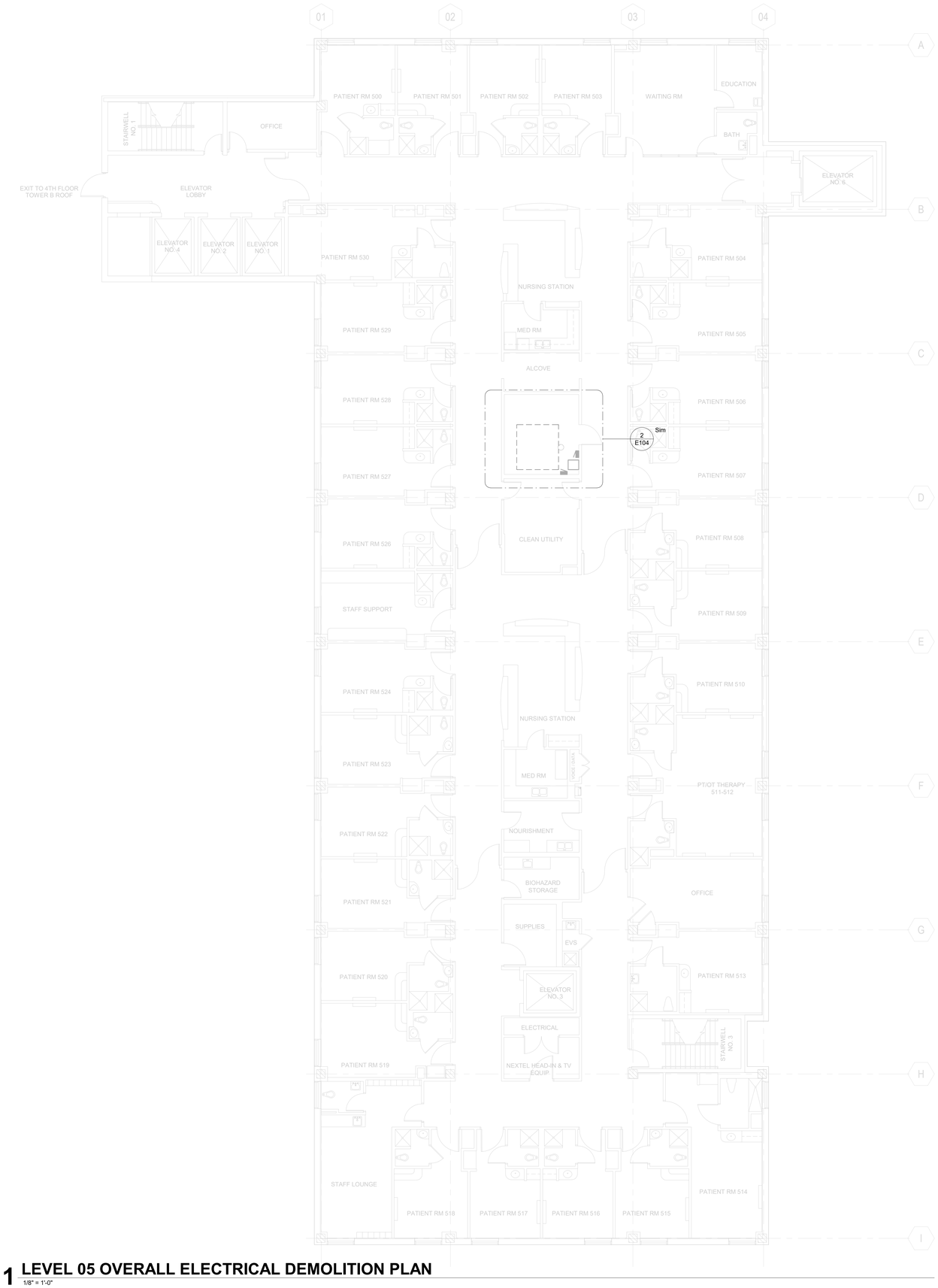
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3. REFER TO MECHANICAL MOTOR/EQUIPMENT SCHEDULE ON SHEET E002 FOR EQUIPMENT ELECTRICAL REQUIREMENTS.
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KEYED NOTES: (#)

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2 LEVEL 05 - ELECTRICAL DEMOLITION PLAN
1/2" = 1'-0"



1 LEVEL 05 OVERALL ELECTRICAL DEMOLITION PLAN
1/8" = 1'-0"

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Health ONE The Medical Center of Aurora

TMCA CENTRAL TOWER MAU REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

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TITLE

LEVEL 05 ELECTRICAL DEMOLITION PLAN

SHEET NUMBER

E104

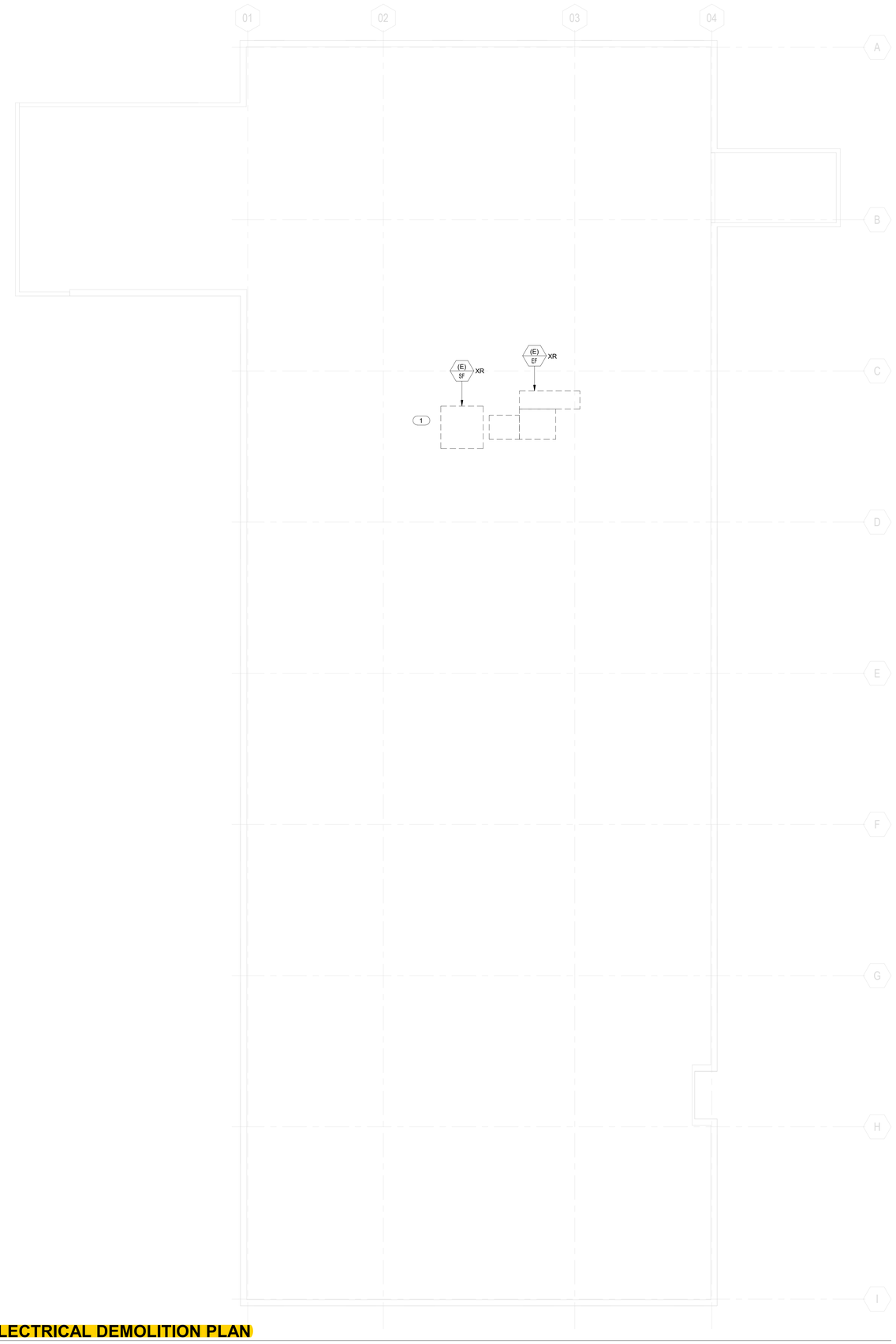
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GENERAL NOTES:

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2. REFER TO SHEET E001 FOR ELECTRICAL SPECIFICATIONS.
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KEYED NOTES: (#)

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1 ROOF ELECTRICAL DEMOLITION PLAN
1/8" = 1'-0"

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CONTRACTOR

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8/15/2023

PROJECT

Health ONE The Medical Center of Aurora

TMCA CENTRAL
TOWER MAU
REPLACEMENT

PERMIT SET 08.08.2023

KEYPLAN

ISSUE CHART

City of Aurora Building Division
Reviewed for Code Compliance
Approved as Noted: A. Sharpley
Date: Aug 28, 2023
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TITLE

ROOF ELECTRICAL
DEMOLITION PLAN

SHEET NUMBER

E105

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GENERAL NOTES:

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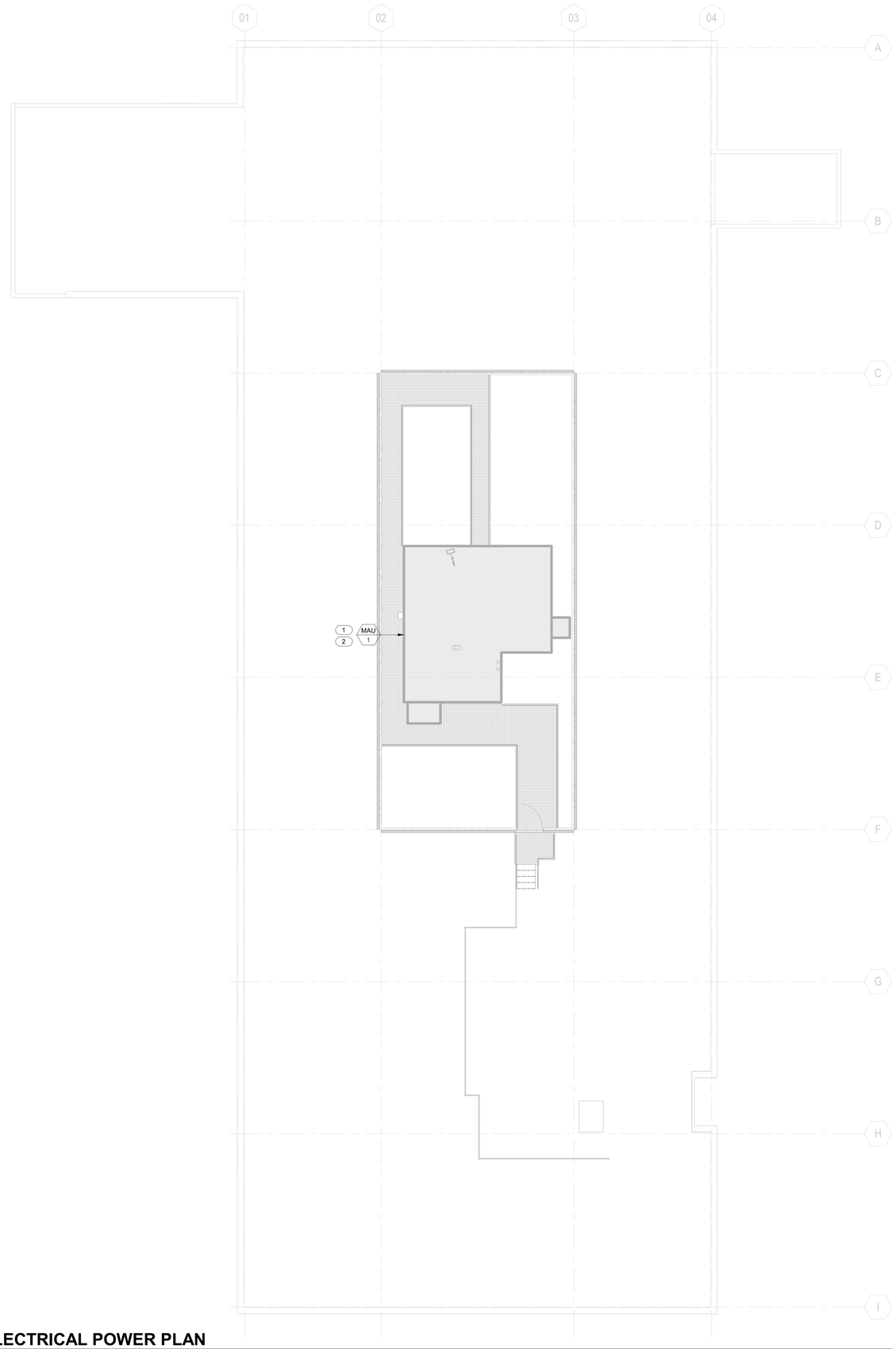
KEYED NOTES: (#)

1. MAU-1 TO BE FED FROM SWITCHBOARD 'MSB' VIA 200A/3P SWITCH AND 100A FUSE. MAU-1 120V CONTROLS TO BE FED FROM PANEL S CIRCUIT 8 VIA 20A CB.
2. PROVIDE DUCT-MOUNTED FIRE ALARM SYSTEM SMOKE DETECTOR ON THE MAIN SUPPLY AND EXHAUST DUCTS. LOCATE REMOTE ANNUNCIATOR/TEST SWITCH IN LEVEL 05 MECHANICAL ROOM BELOW. COORDINATE ALL WORK WITH JCI.

- RTU must be rated for the calculated AIC at the RTU.

Raceways exposed to different temperatures shall comply with A and B of the 2023 NEC 300.7(A)

A receptacle installed outdoors in a location protected from the weather or in other damp locations shall comply with 406.9(A) 2023 NEC



1 ROOF ELECTRICAL POWER PLAN

1/8" = 1'-0"

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8/15/2023

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TITLE

ROOF ELECTRICAL POWER PLAN

SHEET NUMBER

E205

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