### GENERAL NOTES:

- 1. PRIOR TO SUBMITTING BID, VISIT THE JOB SITE AND BECOME FULLY ACQUAINTED WITH THE EXISTING CONDITIONS OF THE PROJECT. REVIEW GENERAL NOTES, SPECIFICATIONS AND OTHER DISCIPLINE'S DRAWINGS FOR ADDITIONAL REQUIREMENTS THAT MAY NOT BE SPECIFICALLY CALLED OUT IN THIS PORTION OF THE CONSTRUCTION DOCUMENTS. NOTIFY ARCHITECT, TENANT AND ENGINEER OF ANY DISCREPANCIES PRIOR TO SUBMISSION OF BID.
- EXISTING CONDITIONS WERE TAKEN FROM AS BUILT DRAWINGS AND SITE VISITS AND MAY NOT REFLECT EXACT "AS-BUILT" CONDITIONS. COORDINATE DEMOLITION WORK AND NEW WORK WITH EXISTING CONDITIONS AND OTHER TRADES PRIOR TO CONSTRUCTION.
- 3. REFER TO ARCHITECTURAL DRAWINGS FOR RELATED CONSTRUCTION DETAILS AS APPLICABLE TO THE PLUMBING SYSTEMS. VERIFY CHASE AND PENETRATION LOCATIONS SHOWN ON THE ARCHITECTURAL DRAWINGS THAT ARE INTENDED FOR PIPING MEET REQUIREMENTS.
- 4. INSTALL PIPING PARALLEL TO BUILDING LINES, UNLESS NOTED OTHERWISE.
- 5. COORDINATE LOCATION OF EQUIPMENT AND SUPPORTS WITH LOCATION OF ACCESS PANELS/DOORS TO ENABLE SERVICE OF EQUIPMENT. IF NO ACCESS PANEL IS SHOWN, PROVIDE ACCESS PANEL IN SIZE REQUIRED FOR MAINTENANCE OF EQUIPMENT. COORDINATE EXACT LOCATION WITH ARCHITECT PRIOR TO INSTALLATION.
- 6. SEAL PENETRATIONS THROUGH BUILDING COMPONENTS IN ACCORDANCE WITH LOCAL CODES. FIREPROOF PENETRATIONS THROUGH FIRE RATED COMPONENTS IN ACCORDANCE WITH U.L. REQUIREMENTS.

### PLAN NOTES:

- 8"Ø OUTSIDE AIR DUCT UP THROUGH ROOF ABOVE. TERMINATE WITH 12"x12" GREENHECK FABRAHOOD IN COLOR SELECTED BY ARCHITECT. PROVIDE WITH GRAVITY INTAKE DAMPER & INSECT SCREEN.
- 4"Ø OUTSIDE AIR DUCT UP THROUGH ROOF ABOVE. TERMINATE WITH 12"X12" GREENHECK FABRAHOOD IN COLOR SELECTED BY ARCHITECT. PROVIDE WITH GRAVITY INTAKE DAMPER & INSECT SCREEN.
- 3 8"Ø EXHAUST AIR DUCT TO 12"x12" GREENHECK ELF375D EXHAUST LOUVER. PROVIDE IN COLOR SELECTED BY ARCHITECT. COORDINATE EXACT MOUNTING LOCATION WITH ARCHITECT PRIOR O INSTALLATION. PROVIDE WITH INSECT SCREEN AND GRAVITY RELIEF DAMPER.
- 4 1" HVAC CONDENSATE DRAIN DOWN TO OX BOX (PROVIDED BY PLUMBING CONTRACTOR) BELOW. COORDINATE EXACT TERMINATE LOCATION WITH PLUMBING CONTRACTOR PRIOR TO INSTALLATION.

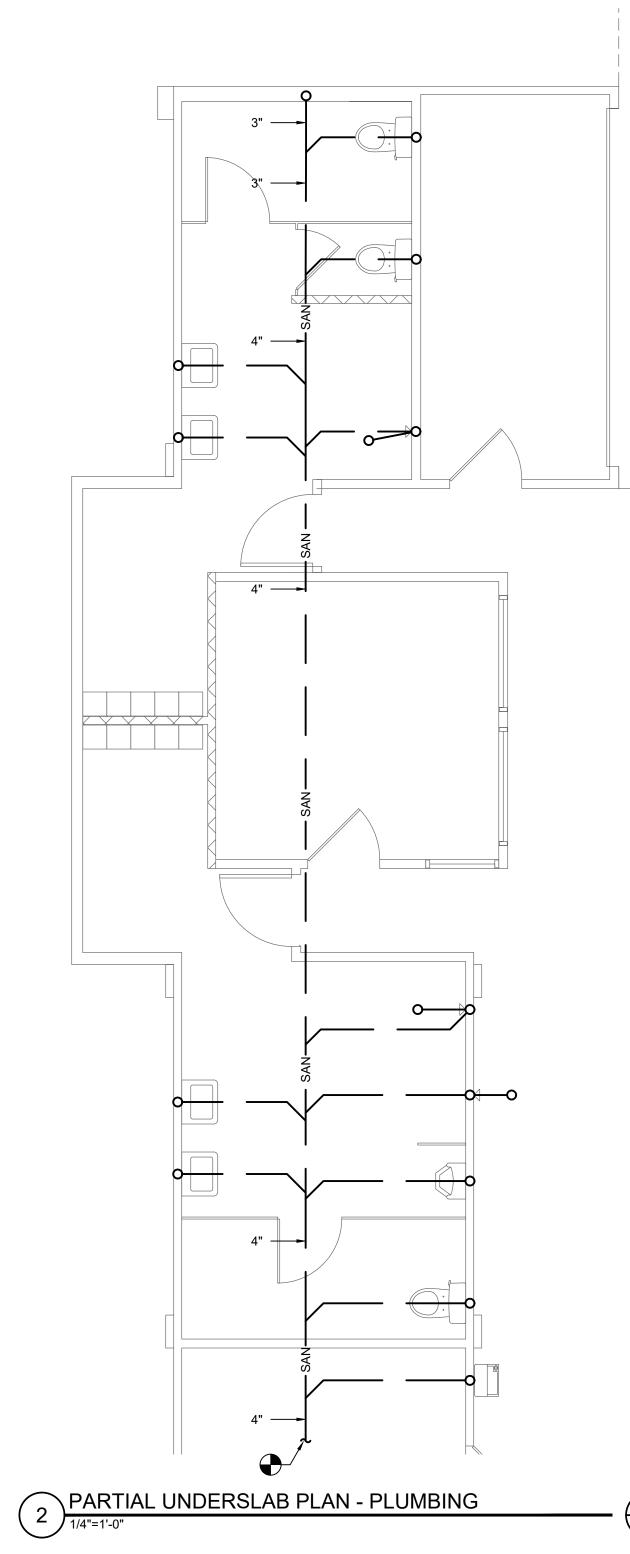
PLUMBING FIXTU	RE CONN. SCH	HEDULE	<b>.</b>		
FIXTURE	MARK	CW	HW	WASTE	VENT
LAVATORY	L-1	1/2"	1/2"	2"	1-1/2"
URINAL	U-1	3/4"		3"	2"
FLUSH TANK WATER CLOSET	WC-1	1/2"		3"	2"
ELECTRIC WATER COOLER	EWC-1	1/2"		2"	1-1/2"
FLOOR DRAIN	FD-1			2"	1-1/2"
SHOWER	SH-1	1/2"	1/2"		

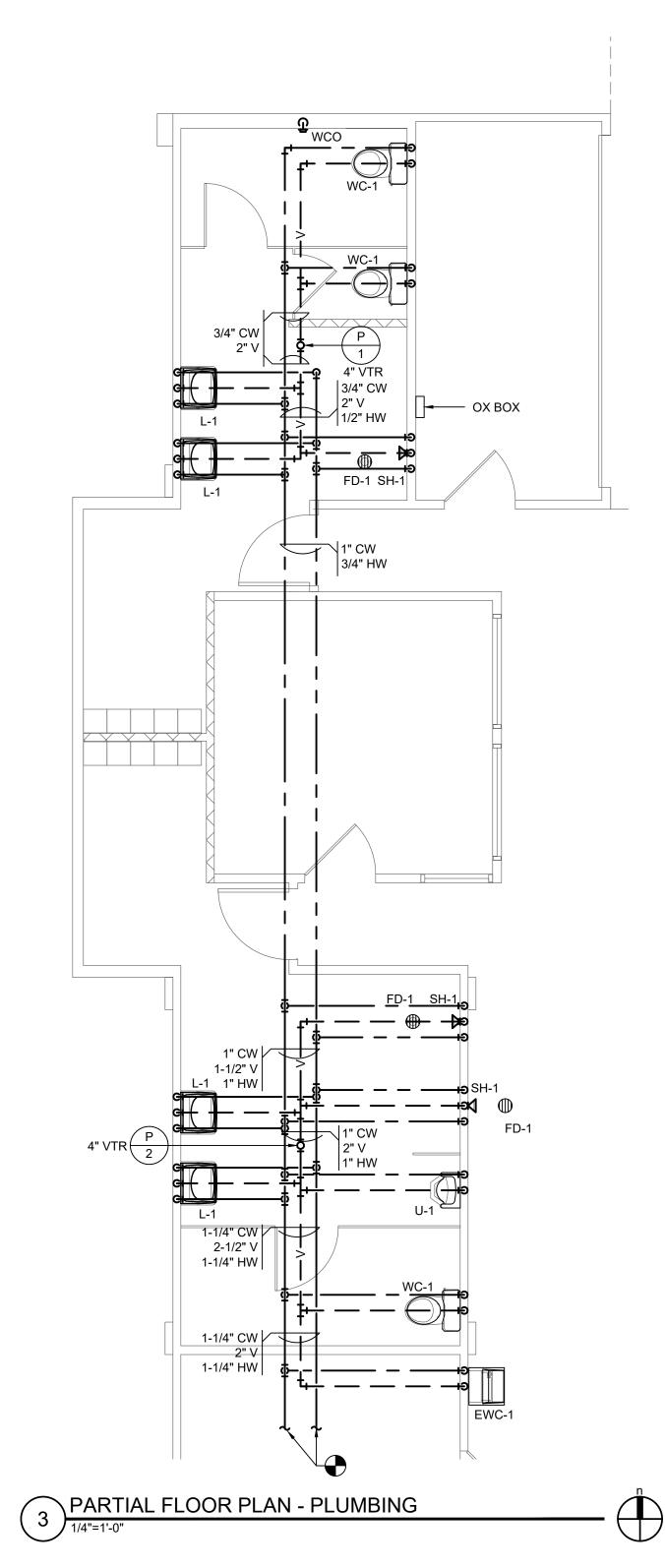
		AIF	RTERM	INAL DE\	ICES SCHE	DULE		
PLAN MARK	QUANTITY	MANUFACTURER	MODEL	SERVICE	MOUNT TYPE	BORDER SIZE	NECK SIZE	VOLUME DAMPE
ER-1	2	TITUS	350FL	EXHAUST	SURFACE		8"X8"	YES
SD-1	2	TITUS	OMNI	SUPPLY	LAY-IN	12"X12"	8"	YES
			•					

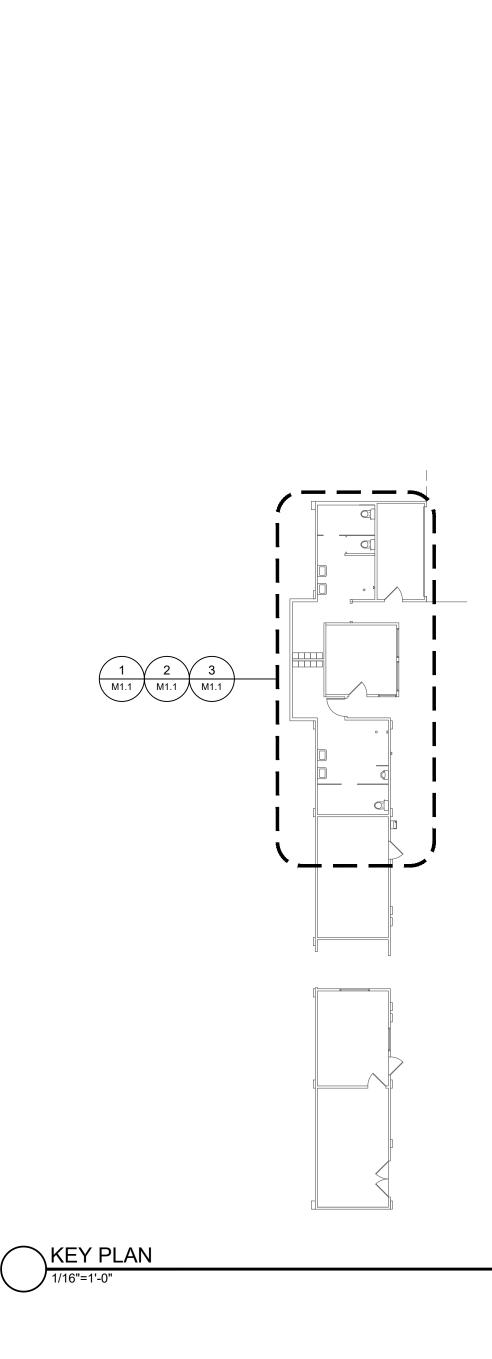
PLUMBING CONTRACTOR PRIOR TO INSTALLATION.  FCU-4 (.75 TON)  FCU-4 (.75 TON)
CP-1 3/4"  3/4"  3/4"
ACCU-1 (2 TON)  SD-1 8" 150 CFM  ER-1 8"X8" 150 CFM  (300 CFM)  (300 CFM)  (300 CFM)
CP-1 FCU-1 (.75 TON) SD-1 8" 150 CFM

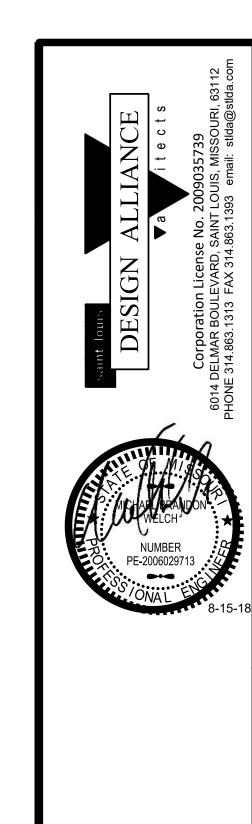
PARTIAL FLOOR PLAN - HVAC

1) 1/4"=1'-0"









REPAIRS TO THE NICE BUILDING

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SHEET TITLE

MECHANICAL PLANS

M1.1

		F	PLUMBING FIXTURE SC	HEDULE		
PLAN MARK	MANUFACTURER AND MODEL	FIXTURE DESCRIPTION	ACCESSORIES MANUFACTURER AND MODEL	ACCESSORIES DESCRIPTION	SIZE	NOTES
EWC-1	HALSEY TAYLOR HVR8-ADA	ONE LEVEL, ADA COMPLIANT, BARRIER FREE, STAINLESS STEEL WATER COOLER	-	-	-	-
FD-1	JAY R SMITH 2010	CAST IRON SHALLOW SUMP FLOOR DRAIN WITH 5" ROUND TOP WITH NICKEL BRONZE STRAINER.	-	-	-	
L-1	AMERICAN STANDARD LUCERNE 0356.041	VITREOUS CHINA, ADA COMPLIANT, D-SHAPED BOWL WALL HUNG LAVATORY.	AMERICAN STANDARD COLONY 2175.205	SINGLE CONTROL CENTERSET FAUCET WITH METAL LEVER HANDLE.	-	PROVIDE CHROME PLATED BRASS TAILPIECE AND GRID DRAIN, CHROME PLATED BRASS P-TRAP, ANGLED STOP VALVES AND FLEXIBLE RISERS. INSULATE EXPOSED TAILPIECE, P-TRAP, AND WATER RISERS WITH ADA COMPLIANT INSULATION. SUPPLY WITH POINT OF USE MIXING VALVE THAT COMPLIES WITH ASSE1070. SET OUTLET TEMPERATURE TO 105° F.
SH-1		SHOWER BASE AND SURROUND PER THE ARCHITECTURAL DRAWINGS.	1.) AMERICAN STANDARD T064.508	1.) SHOWER/BATH TRIM KIT WITH PRESSURE BALANCED SINGLE HANDLE BATH MIXING VALVE, SOLID BRASS BODY, LEVEL HANDLE, CHROME FINISHED DOWNSPOUT AND SHOWER HEAD, 2.0 GPM MAX SHOWERHEAD.		
U-1	AMERICAN STANDARD WASHBROOK 6501.511	WALL HUNG, VITREOUS CHINA URINAL WITH WASH OUT FLUSHING ACTION AND TOP SPUD. MOUNT AT ADA HEIGHT. CHROME PLATED, EXPOSED WATER CLOSET 1.0 GPF FLUSH VALVE WITH 3/4" TOP SPUD.	1.) JAY R SMITH	1.) PROVIDE CARRIER AS REQUIRED TO SUIT APPLICATION.	-	
WC-1	AMERICAN STANDARD CADET 3 FLOWISE 2832.128	ADA COMPLIANT, FLOOR MOUNTED, FLUSH TANK, VITREOUS CHINA WATER CLOSET.	CHURCH 9500 C	SEAT: SOLID PLASTIC, OPEN FRONT, WHITE ELONGATED BOWL, INTEGRAL BUMPERS, EXTERNAL CHECK HINGES WITH STAINLESS STEEL POSTS.	-	

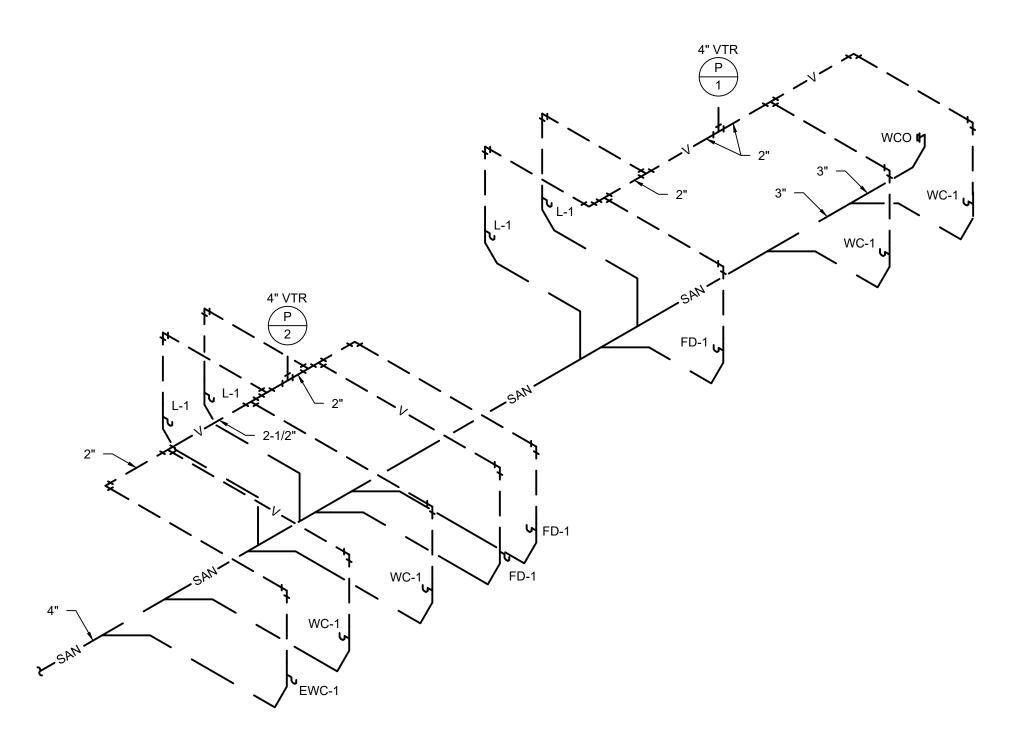
				AIR	COOLED	CONDENSI	NG UNIT S	CHEDULE						
			UNIT I	NFORMATION				COND. F	AN DATA	C	CONDENSING	INFORMATION	٧	
UNIT	SYSTEM	MFG	MODEL	VOLT/	MCA	MOCP	REFRIG.	TYPE	NUM	# OF	TONS	THC	AMB	NOTES
CALLOUT			NO.	PHASE		(AMPS)				COMP		(MBH)	TEMP	
													(°F)	
ACCU-1	FCU'S	DAIKIN	4MXS36RMVJU	208/230/1	23.9	25	R-410a	PROP	1	1	3	36.0	100	1
		<u> </u>					-							-

NOTES:

1. SUPPLY WITH LOW AMBIENT KIT FOR OPERATION DOWN TO 0 DEGREES F.

				FAN C	OIL UNIT	SCHEDULE					
	l	JNIT INFORMATION	l		HEATING INF	<del>-</del> 0		DX COIL I	NFORMATION	J	
UNIT CALLOUT	MFG	MODEL NO.	FLOW (CFM)	EAT (°F)	LAT (°F)	CAP (MBH)	EAT (°F)	LAT (°F)	SHC (MBH)	THC (MBH)	NOTES
FCU-1	DAIKIN	FTXS-09-LVJU	279	68	98	9.0	82	54	8.4	9	
FCU-2	DAIKIN	FFQ-09-Q2VJU	339	68	92.5	9.0	80	57	8.4	9	
FCU-3	DAIKIN	FTXS-09-LVJU	279	68	98	9.0	82	54	8.4	9	
FCU-4	DAIKIN	FTXS-09-LVJU	279	68	98	9.0	82	54	8.4	9	

						E	NERGY F	RECOVER	Y UNIT S	CHEDULE							
		_		_			ENERGY RECOVERY INFORMATION							FILTER			
UNIT	MFG	MODEL	VOLT/PH	FLA	MOCP		AIRFLOW INFORMATION				SUMMER AIR TEMP (°F)			WINTER AIR TEMP (°F)			TYPE
CALLOUT		NO.			(AMPS)	MOTOR	SUPPLY	OUTDOOR	RETURN	EXHAUST	SUPPLY	OUTDOOR	RETURN	SUPPLY	OUTDOOR	RETURN	
						HP	CFM	CFM	CFM	CFM	DB/WB	DB/WB	DB/WB	DB/WB	DB/WB	DB/WB	
ERU-1	RENEWAIRE	EV300	120/1	3.3	15	0.2	300	300	300	300	81.2/69.8	100/78	72/60	48.2/41.6	0/-1	72/60	1" THROWAWAY



Az= Floor area

PZ= Zone Population

Rp= People Outdoor Air Rate

Ra= Area Outdoor Air Rate

FCU -1 (4 Ton) Ventilation Calculation

FCU -1 (4 Ton) Ventil	ation Calculation						
Room Name	Occupancy Classification	Occupant Density	Az	Pz	Rp	Ra	Voz
Staff 104	Conference	50	135	7	5	0.06	42
		Vot					42

1 VENTILATION CALCULATIONS
NO SCALE



GENERAL PLUMBING MECHANICAL NOTE REFERENCE SOIL OR WASTE ABOVE GRADE OR FLOOR DEMOLITION NOTE REFERENCE ──SAN── SOIL OR WASTE BELOW GRADE OR FLOOR REVISION NOTE REFERENCE ---v-- PLUMBING VENT ——— — DOMESTIC COLD WATER CONNECT TO EXISTING WORK —— – – — DOMESTIC HOT WATER — G — GAS (NATURAL) <u>HVAC</u> FLOOR CLEAN OUT □ FCO —— D —— HVAC CONDENSATE DRAIN WALL CLEAN OUT THERMOSTAT + HB HOSE BIBB SUPPLY DIFFUSER FLOOR SINK, FLOOR DRAIN, AREA DRAIN RETURN GRILLE/EXHAUST REGISTER RETURN AND EXHAUST AIR FLOW INDICATOR PLUMBING VENT RISER CALL-OUT DUCT MOUNTED MANUAL BALANCING DAMPER **ELBOW DOWN** ELBOW UP ————— TEE UP

MECHANICAL SYMBOLS

———— TEE DOWN

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MECHANICAL
SCHEDULES & DETAILS

M2.1

NUMBER
PE-2006029713
8-1

REPAIRS TO THE NICE BUILDING

### PRODUCTS

Refer to individual piping sections for pipe, tube, and fitting materials and Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings. JOINING MATERIALS Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise

Welding Filler Metals: Comply with AWS D10.12.

MECHANICAL SLEEVE SEALS

Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe. Pressure Plates: Plastic. Include two for each sealing element. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one

for each sealing element. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round 3.HVAC INSULATION

tube closed with welded longitudinal joint. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain

Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

### **EXECUTION**

PIPING SYSTEMS - COMMON REQUIREMENTS Install piping above accessible ceilings to allow sufficient space for ceiling panel removal. Install piping to permit valve servicing. Install piping at indicated slopes. Install piping free of sags and bends. Install fittings for changes in direction and branch connections. Install piping to allow application of insulation. Select system components with pressure rating equal to or greater than system operating pressure. Install escutcheons for penetrations of walls, ceilings, and floors. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop Verify final equipment locations for roughing-in Refer to manufacturer's equipment specifications for roughing-in requirements. PIPING JOINT CONSTRUCTION Join pipe and fittings according to the following requirements and Ss specifying piping systems. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel

Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly

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. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance"

Install shut off valves with unions, in piping, adjacent to each valve and at final connection to each piece of equipment Install shut off valves with

unions, in piping, adjacent to each valve and at final connection to each

piece of equipment. EQUIPMENT INSTALLATION - COMMON REQUIREMENTS Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless

otherwise indicated. 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. Install equipment to allow right of way for piping installed at required slope.

2.HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT

Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports." PERFORMANCE REQUIREMENTS Design supports for multiple pipes capable of supporting combined weight of

supported systems, system contents, and test water. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

## PRODUCTS

STEEL PIPE HANGERS AND SUPPORTS Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

TRAPEZE PIPE HANGERS Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

METAL FRAMING SYSTEMS Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

## EXECUTION

HANGER AND SUPPORT APPLICATIONS Specific hanger and support requirements are specified in sections specifying piping systems and equipment. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system sections. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system sections, install the following types:

Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).

Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not

Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system sections, install the following types: Carbon- or Allov-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types: Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations

Building Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types: Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom

flange of beams, channels, or angles. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom C-Clamps (MSS Type 23): For structural shapes. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden

Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required. Saddles and Shields: Unless otherwise indicated and except as specified in piping system sections, install the following types: Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior

Protection Shields (MSS Type 40): Of length recommended in writing

by manufacturer to prevent crushing insulation. Thermal-Hanger Shield Inserts: For supporting insulated pipe. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system sections. Comply with MFMA-102 for metal framing system selections and

voids with insulation that matches adjoining insulation.

applications that are not specified in piping system sections.

**INSULATION MATERIALS** 

Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied. Fiberglass: Inorganic, incombustible, fiberglass with factory applied All Service Jacket (ASJ) painted in color selected by architect. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

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 Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA

MASTICS Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on

below ambient services. SEALANTS Joint Sealants: Materials shall be compatible with insulation materials, jackets, and substrates.

FACTORY-APPLIED JACKETS Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the

ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with

# acrylic adhesive, complying with ASTM C 1136.

Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water. GENERAL INSTALLATION REQUIREMENTS 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. 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. 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. Install insulation with longitudinal seams at top and bottom of horizontal runs. Install multiple layers of insulation with longitudinal and end seams

Do not weld brackets, clips, or other attachment devices to piping, fittings. and specialties. Keep insulation materials dry during application and finishing. Install insulation with tight longitudinal seams and end joints. Bond seams

and joints with adhesive recommended by insulation material manufacturer. Install insulation with least number of joints practical. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

Install insulation continuously through hangers and around anchor attachments. 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 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. 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. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses. Apply mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings. Cut insulation in a manner to avoid compressing insulation more than 75

percent of its nominal thickness. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement. 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.

PENETRATIONS Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions. 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).

Insulation Installation at Floor Penetrations: 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).

Pipe: Install insulation continuously through floor penetrations. Seal penetrations through fire-rated assemblies. GENERAL PIPE INSULATION INSTALLATION Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation

material installation articles. Insulation Installation on Fittings, Valves, and Unions: Install insulation over fittings, valves, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

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

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. DUCT INSULATION SCHEDULE, GENERAL Plenums and Ducts Requiring Insulation:

Indoor, exposed outdoor air. Indoor, concealed return located in nonconditioned space. INDOOR DUCT AND PLENUM INSULATION SCHEDULE Supply-Air, Return-Air and Make Up Air Duct Insulation: Fiberglass blanket, 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. M) nominal density. PIPING INSULATION SCHEDULE, GENERAL Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one

Indoor, concealed supply and outdoor air.

Contractor's option. INDOOR PIPING INSULATION SCHEDULE Domestic Cold Water and Hot Water. Fiberglass Blanket: 1-1/2 inches

material is listed for a piping system, selection from materials listed is

Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric.

# DOMESTIC WATER PIPING

PRODUCTS

Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes. PLASTIC PIPE

COPPER TUBE AND FITTINGS Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) PIPING JOINING MATERIALS

Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813. FLEXIBLE CONNECTORS

Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise

Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping

flange. Include clamping ring and bolts and nuts for membrane flashing.

Install copper tubing under building slab according to CDA's "Copper Tube Install piping concealed from view and protected from physical contact by

JOINT CONSTRUCTION

building occupants unless otherwise indicated and except in equipment rooms and service areas. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or Install piping above accessible ceilings to allow sufficient space for ceiling

panel removal, and coordinate with other services occupying that space. Install piping adjacent to equipment and specialties to allow service and maintenance. Install piping to permit valve servicing. Install piping free of sags and bends.

Install fittings for changes in direction and branch connections. Install shut off valves with unions in copper tubing at final connection to each piece of equipment, machine, and specialty. Install thermometers on outlet piping from water heater.

Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly

Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook." Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by

**VALVE INSTALLATION** Install shutoff (ball) valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Install drain valves for equipment at base of each water riser, at low points in

horizontal piping, and where required to drain water piping. TRANSITION FITTING INSTALLATION

Install transition couplings at joints of dissimilar piping. CONNECTIONS Drawings indicate general arrangement of piping, fittings, and specialties. Install piping adjacent to equipment and machines to allow service and maintenance.

Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials. **ESCUTCHEON INSTALLATION** Install escutcheons for penetrations of walls, ceilings, and floors.

PIPING SCHEDULE Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated. Flanges and unions may be used for aboveground piping joints unless otherwise indicated

Under-building-slab, domestic water, building service piping shall be Soft copper tube: Aboveground domestic water piping, shall be any of the following: Hard copper tube, ASTM B 88, Type L. Pex Pipe and Fittings

SDR 35 VALVE SCHEDULE Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply: Shutoff Duty: Use ball valves for piping NPS 2 (DN 50) and smaller.

Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger. Drain Duty: Hose-end drain valves. Use check valves to maintain correct direction of domestic water flow to and

Iron grooved-end valves may be used with grooved-end piping.

## 5.INDOOR SANITARY WASTE AND VENT PIPING

PRODUCTS

**EXECUTION** 

PIPING MATERIALS Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

PIPING APPLICATIONS Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated. Flanges and unions may be used on aboveground pressure piping, unless

otherwise indicated. Aboveground, soil, waste, and vent piping shall be Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and

compression joints. Underground, soil, waste, and vent shall be PVC Pipe with socket fittings and solvent welded joints.

PIPING INSTALLATION Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Section "Common Work Results for Mechanical." Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and

Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is

Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and

pull past each joint as completed. Install soil and waste drainage and vent piping at the code required minimum

Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing. Install PVC soil and waste drainage and vent piping according to ASTM D 2665. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Basic piping joint construction requirements are specified in Section "Common Work Results for Mechanical." Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

### 6.ELECTRIC WATER HEATERS

Operation and maintenance data.

JOINT CONSTRUCTION

Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories Shop Drawings: Diagram power, signal, and control wiring.

Commercial, Storage, Electric Water Heaters. WATER HEATER ACCESSORIES Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1-2004.

# EXECUTION

WATER HEATER INSTALLATION

Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible. Install combination temperature and pressure relief valves in top portion of

storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial, water-heater, relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low

points in water piping for water heaters that do not have tank drains. Install thermometer on outlet piping of water heaters. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps. Fill water heaters with water.

CONNECTIONS Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

## 7.BLOWER COIL UNITS WITH ELECTRIC COILS

Product Data: Include rated capacities, furnished specialties, and accessories

# **PRODUCTS**

Factory-assembled, prewired, self-contained unit consisting of cabinet, supply fan, controls, filters, and electric heat blower coils. AIR FILTERS Comply with NFPA 90A.

CONTROLS Factory-wired, fuse-protected control transformer, connection for power supply and field-wired unit to remote thermostat.

# EXECUTION

INSTALLATION Suspend unit from structure, mount horizontally as high as possible. Provide neoprene isolators on uni-strut support. Provide secondary drain pan. Route condensate piping and second drain pan piping to drain as indicated on drawings. Make connections to remote thermostat and associated outdoor heat pump

## 8.HEAT PUMP UNITS

unit for control.

PRODUCT DATA: FOR EACH CONDENSING UNIT, INCLUDE RATED CAPACITIES, OPERATING CHARACTERISTICS, FURNISHED SPECIALTIES, AND ACCESSORIES. INCLUDE EQUIPMENT DIMENSIONS, WEIGHTS AND STRUCTURAL LOADS, REQUIRED CLEARANCES, METHOD OF FIELD ASSEMBLY, COMPONENTS, AND

LOCATION AND SIZE OF EACH FIELD CONNECTION.

## PRODUCTS

VIBRATION ISOLATORS.

HEAT PUMP UNITS, AIR COOLED, 1 TO 5 TONS (3.5 TO 17.6 KW) CARRIER CORPORATION; CARRIER AIR CONDITIONING DIV.

TRANE CO. (THE); WORLDWIDE APPLIED SYSTEMS GROUP. YORK INTERNATIONAL CORP. DESCRIPTION: FACTORY ASSEMBLED AND TESTED, CONSISTING OF COMPRESSOR, CONDENSER COIL, FAN, MOTORS, REFRIGERANT RESERVOIR, AND OPERATING CONTROLS. COMPRESSOR: SCROLL, HERMETICALLY SEALED, WITH RUBBER

MOTOR: SINGLE SPEED, AND INCLUDES THERMAL- AND CURRENT-SENSITIVE OVERLOAD DEVICES, START CAPACITOR, RELAY, AND CONTACTOR. ACCUMULATOR: SUCTION TUBE. REFRIGERANT CHARGE: R-22. CONDENSER COIL: SEAMLESS COPPER-TUBE, ALUMINUM-FIN COIL;

CIRCUITED FOR INTEGRAL LIQUID SUBCOOLER, WITH REMOVABLE

DRAIN PAN AND BRASS SERVICE VALVES WITH SERVICE PORTS.

CONDENSER FAN: DIRECT-DRIVE, ALUMINUM PROPELLER FAN;

WITH PERMANENTLY LUBRICATED. TOTALLY ENCLOSED FAN MOTOR WITH THERMAL-OVERLOAD PROTECTION. ACCESSORIES:

CYCLE PROTECTOR: AUTOMATIC-RESET TIMER TO PREVENT RAPID COMPRESSOR CYCLING. ELECTRONIC PROGRAMMABLE THERMOSTAT TO CONTROL CONDENSING UNIT AND EVAPORATOR FAN.

FILTER-DRYER. HIGH-PRESSURE SWITCH: AUTOMATIC-RESET SWITCH CYCLES COMPRESSOR OFF ON HIGH REFRIGERANT PRESSURE. LOW AMBIENT CONTROLLER: CYCLES CONDENSER FAN TO PERMIT OPERATION DOWN TO 0 DEG F (MINUS 18 DEG C). LOW-PRESSURE SWITCH: AUTOMATIC-RESET SWITCH CYCLES COMPRESSOR OFF ON LOW REFRIGERANT PRESSURE. PRECHARGED AND INSULATED SUCTION AND LIQUID TUBING THERMOSTATIC EXPANSION VALVE. TIME-DELAY RELAY: CONTINUES OPERATION OF EVAPORATOR

FAN AFTER COMPRESSOR SHUTS OFF. UNIT CASING: GALVANIZED STEEL, FINISHED WITH BAKED ENAMEL; WITH REMOVABLE PANELS FOR ACCESS TO CONTROLS, WEEP HOLES FOR WATER DRAINAGE, AND MOUNTING HOLES IN BASE. MOUNT SERVICE VALVES, FITTINGS, AND GAGE PORTS ON

### EXECUTION

EXTERIOR OF CASING.

INSTALLATION INSTALL UNITS LEVEL AND PLUMB, FIRMLY ANCHORED IN LOCATIONS INDICATED; MAINTAIN MANUFACTURER'S RECOMMENDED CLEARANCES. INSTALL CONDENSING UNITS ON CONCRETE BASE. MAINTAIN MANUFACTURER'S RECOMMENDED CLEARANCES FOR SERVICE AND MAINTENANCE. LOOSE COMPONENTS: INSTALL ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES THAT ARE NOT FACTORY MOUNTED. CONNECTIONS INSTALL PIPING ADJACENT TO MACHINE TO ALLOW SERVICE AND MAINTENANCE.

REQUIRED ACCESS TO UNIT. INSTALL FURNISHED FIELD-MOUNTED ACCESSORIES. STARTUP SERVICE START UNIT ACCORDING TO MANUFACTURER'S WRITTEN

CONNECT REFRIGERANT PIPING TO HEAT PUMP UNITS; MAINTAIN

INSTRUCTIONS AND COMPLETE MANUFACTURER'S STARTUP CHECKLIST.

### 9.METAL DUCTS

PRODUCTS

RECTANGULAR DUCTS AND FITTINGS

GENERAL FABRICATION REQUIREMENTS: COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE" BASED ON INDICATED STATIC-PRESSURE CLASS UNLESS OTHERWISE INDICATED.

TRANSVERSE JOINTS: SELECT JOINT TYPES AND FABRICATE ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," FIGURE 1-4, "TRANSVERSE (GIRTH) JOINTS," FOR STATIC-PRESSURE CLASS, APPLICABLE SEALING REQUIREMENTS, MATERIALS INVOLVED, DUCT-SUPPORT INTERVALS, AND OTHER PROVISIONS IN SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE." LONGITUDINAL SEAMS: SELECT SEAM TYPES AND FABRICATE ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," FIGURE 1-5, "LONGITUDINAL SEAMS - RECTANGULAR DUCTS," FOR STATIC-PRESSURE CLASS, APPLICABLE SEALING REQUIREMENTS, MATERIALS INVOLVED, DUCT-SUPPORT INTERVALS, AND OTHER PROVISIONS IN SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE." ELBOWS, TRANSITIONS, OFFSETS, BRANCH CONNECTIONS, AND OTHER DUCT CONSTRUCTION: SELECT TYPES AND FABRICATE ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," CHAPTER 2, "FITTINGS AND OTHER CONSTRUCTION." FOR STATIC-PRESSURE CLASS. APPLICABLE SEALING REQUIREMENTS, MATERIALS INVOLVED, DUCT-SUPPORT INTERVALS. AND OTHER PROVISIONS IN SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE." ROUND DUCTS AND FITTINGS GENERAL FABRICATION REQUIREMENTS: COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE,"

CHAPTER 3, "ROUND, OVAL, AND FLEXIBLE DUCT," BASED ON INDICATED STATIC-PRESSURE CLASS UNLESS OTHERWISE INDICATED. TRANSVERSE JOINTS: SELECT JOINT TYPES AND FABRICATE ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION

STANDARDS - METAL AND FLEXIBLE," FIGURE 3-2, "TRANSVERSE JOINTS - ROUND DUCT," FOR STATIC-PRESSURE CLASS, APPLICABLE SEALING REQUIREMENTS, MATERIALS INVOLVED, DUCT-SUPPORT INTERVALS, AND OTHER PROVISIONS IN SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE." LONGITUDINAL SEAMS: SELECT SEAM TYPES AND FABRICATE ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," FIGURE 3-1, "SEAMS - ROUND DUCT AND FITTINGS," FOR STATIC-PRESSURE CLASS, APPLICABLE SEALING REQUIREMENTS, MATERIALS INVOLVED, DUCT-SUPPORT INTERVALS, AND OTHER PROVISIONS IN SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE." TEES AND LATERALS: SELECT TYPES AND FABRICATE ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," FIGURE 3-4, "90 DEGREE TEES AND LATERALS," AND FIGURE 3-5, "CONICAL TEES," FOR STATIC-PRESSURE CLASS, APPLICABLE SEALING REQUIREMENTS, MATERIALS INVOLVED. DUCT-SUPPORT INTERVALS, AND OTHER PROVISIONS IN SMACNA'S

"HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE." SHEET METAL MATERIALS GENERAL MATERIAL REQUIREMENTS: COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE" FOR ACCEPTABLE MATERIALS, MATERIAL THICKNESSES, AND DUCT CONSTRUCTION METHODS UNLESS OTHERWISE INDICATED. SHEET METAL MATERIALS SHALL BE FREE OF PITTING, SEAM MARKS, ROLLER MARKS, STAINS, DISCOLORATIONS, AND OTHER

IMPERFECTIONS. GALVANIZED SHEET STEEL: COMPLY WITH ASTM A 653/A 653M.

# **EXECUTION**

DUCT INSTALLATION DRAWING PLANS, SCHEMATICS, AND DIAGRAMS INDICATE GENERAL LOCATION AND ARRANGEMENT OF DUCT SYSTEM. INDICATED DUCT LOCATIONS, CONFIGURATIONS, AND ARRANGEMENTS WERE USED TO SIZE DUCTS AND CALCULATE FRICTION LOSS FOR AIR-HANDLING EQUIPMENT SIZING AND FOR OTHER DESIGN CONSIDERATIONS. INSTALL DUCT SYSTEMS AS INDICATED UNLESS DEVIATIONS TO LAYOUT ARE APPROVED ON SHOP DRAWINGS AND COORDINATION

DRAWINGS. INSTALL DUCTS ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE" UNLESS OTHERWISE INDICATED

INSTALL ROUND DUCTS IN MAXIMUM PRACTICAL LENGTHS. INSTALL DUCTS WITH FEWEST POSSIBLE JOINTS. INSTALL FACTORY- OR SHOP-FABRICATED FITTINGS FOR CHANGES IN DIRECTION, SIZE, AND SHAPE AND FOR BRANCH CONNECTIONS. UNLESS OTHERWISE INDICATED, INSTALL DUCTS VERTICALLY AND HORIZONTALLY, AND PARALLEL AND PERPENDICULAR TO BUILDING

INSTALL DUCTS CLOSE TO WALLS, OVERHEAD CONSTRUCTION, COLUMNS, AND OTHER STRUCTURAL AND PERMANENT ENCLOSURE ELEMENTS OF BUILDING. INSTALL DUCTS WITH A CLEARANCE OF 1 INCH (25 MM), PLUS ALLOWANCE FOR INSULATION THICKNESS.

ROUTE DUCTS TO AVOID PASSING THROUGH TRANSFORMER

VAULTS AND ELECTRICAL EQUIPMENT ROOMS AND ENCLOSURES. WHERE DUCTS PASS THROUGH NON-FIRE-RATED INTERIOR PARTITIONS AND EXTERIOR WALLS AND ARE EXPOSED TO VIEW, COVER THE OPENING BETWEEN THE PARTITION AND DUCT OR DUCT INSULATION WITH SHEET METAL FLANGES OF SAME METAL THICKNESS AS THE DUCT. OVERLAP OPENINGS ON FOUR SIDES BY AT LEAST 1-1/2 INCHES (38 MM).

INSTALLATION OF EXPOSED DUCTWORK PROTECT DUCTS EXPOSED IN FINISHED SPACES FROM BEING DENTED, SCRATCHED, OR DAMAGED. TRIM DUCT SEALANTS FLUSH WITH METAL. CREATE A SMOOTH AND UNIFORM EXPOSED BEAD. DO NOT USE TWO-PART TAPE SEALING

GRIND WELDS TO PROVIDE SMOOTH SURFACE FREE OF BURRS, SHARP EDGES, AND WELD SPLATTER. WHEN WELDING STAINLESS STEEL WITH A NO. 3 OR 4 FINISH, GRIND THE WELDS FLUSH, POLISH THE EXPOSED WELDS, AND TREAT THE WELDS TO REMOVE DISCOLORATION CAUSED BY WELDING. MAINTAIN CONSISTENCY, SYMMETRY, AND UNIFORMITY IN THE ARRANGEMENT AND FABRICATION OF FITTINGS, HANGERS AND SUPPORTS, DUCT ACCESSORIES, AND AIR OUTLETS. REPAIR OR REPLACE DAMAGED SECTIONS AND FINISHED WORK THAT DOES NOT COMPLY WITH THESE REQUIREMENTS.

DUCT SEALING SEAL DUCTS FOR DUCT STATIC-PRESSURE, SEAL CLASSES, AND LEAKAGE CLASSES SPECIFIED IN "DUCT SCHEDULE" ARTICLE ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE."

### 10. FANS

SYSTEM.

PRODUCTS

CEILING CABINET FANS REFER TO DRAWINGS FOR MANUFACTURER AND MODEL.

EXECUTION

CEILING INSTALLATION.

INSTALLATION INSTALL FANS LEVEL AND PLUMB. INSTALL UNITS WITH CLEARANCES FOR SERVICE AND MAINTENANCE. SUSPEND FANS FROM STRUCTURE TO ACCOMMODATE FUTURE

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