

MECHANICAL LEGEND AND ABBREVIATIONS

EQUIPMENT ABBREVIATIONS

ACCU	AIR COOLED CONDENSER
AC	AIR CONDITIONING UNIT
CC	COOLING COIL
CF	CEILING FAN
CU	CONDENSING UNIT
ECH	ELECTRIC CABINET HEATER
EF	EXHAUST FAN
EHC	ELECTRIC HEATING COIL
EUH	ELECTRIC UNIT HEATER
F	FILTER
FSD	FIRE AND SMOKE DAMPER
HC	HEATING COIL
HP	HEAT PUMP
P	PUMP
RTU	ROOFTOP UNIT (PACKAGED)
SD	SMOKE DAMPER
SF	SUPPLY FAN
TF	TRANSFER FAN
UH	UNIT HEATER

GENERAL ABBREVIATIONS

DB	DRY BULB
DIA	DIAMETER
DN	DOWN
DX	DIRECT EXPANSION
(E)	EXISTING TO REMAIN
EA	EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
EFF	EFFICIENCY
ELEV	ELEVATOR
EWI	ENTERING WATER TEMPERATURE
*F	DEGREES FAHRENHEIT
FC	FLEXIBLE CONNECTION (DUCT OR PIPE)
FD	FUSIBLE LINK FIRE DAMPER W/ DUCT ACCESS DOOR
FLR	FLOOR
FLA	FULL LOAD AMPS
FPI	FINS PER INCH
FRE	FIRE RATED ENCLOSURE
FT	FEET
GPM	GALLONS PER MINUTE
HP	HORSE POWER
HW	HOT WATER
ID	INSIDE DIMENSION
IN	INCHES
KW	KILOWATT
KWH	KILOWATT HOURS
KX	KITCHEN EXHAUST
LAT	LEAVING AIR TEMPERATURE
LBS	POUNDS
LD	LINEAR DIFFUSER
LWT	LEAVING WATER TEMPERATURE
MAT	MIXED AIR TEMPERATURE
MAX	MAXIMUM
MBH	THOUSAND BTU PER HOUR
MFG	MANUFACTURER
MFS	MAXIMUM FUSE SIZE
MIN	MINIMUM
MOCP	MAXIMUM OVERCURRENT PROTECTION
NC	NORMALLY CLOSED
NFA	NET FREE AREA
NIC	NOT IN THIS CONTRACT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OAI	OUTSIDE AIR INTAKE
OBD	OPPOSED BLADE DAMPER
OD	OUTSIDE DIMENSION
PD	PRESSURE DROP
PSI	POUNDS PER SQUARE INCH (GAUGE)
(R)	EXISTING TO BE RELOCATED
RA	RETURN AIR
RH	RELATIVE HUMIDITY
RPM	REVOLUTIONS PER MINUTE
SA	SUPPLY AIR
SENS	SENSIBLE
SM	SHEET METAL
SP	STATIC PRESSURE
SQFT	SQUARE FEET
TRD	TRANSFER DUCT
TRG	TRANSFER GRILLE
TX	TOILET EXHAUST
TYP	TYPICAL
VFD	VARIABLE FREQUENCY DRIVE
W	WITH
W/O	WITHOUT
WB	WET BULB
WG	WATER GAUGE
WMS	WIRE MESH SCREEN
(X)	EXISTING TO BE DEMOLISHED

DUCTWORK LEGEND

	RECTANGULAR DUCT SIZE (CLEAR INSIDE DIMENSION) FIRST DIMENSION INDICATES VISIBLE SIDE
	ROUND DUCT DIAMETER SIZE (CLEAR INSIDE DIMENSION)
	FLAT-OVAL DUCT SIZE FIRST DIMENSION INDICATES VISIBLE SIDE
	DUCT SPLIT WITH SPLIT SIZE
	RADIUS ELBOW
	ELBOW WITH TURNING VANES
	RECTANGULAR BRANCH TAKEOFF WITH BALANCING DAMPER
	SUPPLY DUCT UP
	SUPPLY DUCT DOWN
	RETURN DUCT UP
	RETURN DUCT DOWN
	EXHAUST DUCT UP
	EXHAUST DUCT DOWN
	BEAM PENETRATION

DUCTWORK LEGEND

	FLEXIBLE CONNECTION
	DUCT END/CAP
	VOLUME DAMPER IN DUCT
	AUTOMATIC CONTROL DAMPER
	FUSIBLE LINK FIRE DAMPER WITH DUCT ACCESS DOOR
	SMOKE DAMPER WITH DUCT ACCESS DOOR
	COMBINATION FIRE AND SMOKE DAMPER WITH DUCT ACCESS DOOR
	BACK DRAFT DAMPER WITH DUCT ACCESS DOOR
	CEILING DIFFUSER WITH AND WITHOUT FLEXIBLE DUCT CONNECTION
	RETURN REGISTER OR GRILLE WITH AND WITHOUT FLEXIBLE DUCT CONNECTION
	EXHAUST REGISTER OR GRILLE WITH AND WITHOUT FLEXIBLE DUCT CONNECTION
	ROUND CEILING DIFFUSER WITH AND WITHOUT FLEXIBLE DUCT CONNECTION
	TRANSFER GRILLES ON BOTH SIDES OF PARTITION OR WALL (SIZE)
	WALL OPENING ABOVE CEILING (SIZE)
	SUPPLY REGISTER WITH AIR OUTLET DEVICE DESIGNATION
	RETURN OR EXHAUST REGISTER OR GRILLE WITH AIR INLET DEVICE DESIGNATION
	LINEAR DIFFUSER
	LINEAR DIFFUSER WITH PLENUM

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EQUIPMENT TAG LEGEND

	EQUIPMENT DESIGNATION		EQUIPMENT TYPE AND NUMBER
	LINEAR DIFFUSER DEVICE DESIGNATION		SIDEWALL REGISTER DEVICE DESIGNATION

GENERAL ABBREVIATIONS

ABV	ABOVE
ACD	AUTOMATIC CONTROL DAMPER
AD	ACCESS DOOR
AL	ACOUSTICAL LINING
ARCH	ARCHITECTURAL
BD	BALANCING DAMPER
BDD	BACK DRAFT DAMPER
BHP	BRAKE HORSE POWER
BTU	BRITISH THERMAL UNIT
BTUH	BRITISH THERMAL UNIT PER HOUR
°C	DEGREES CELSIUS
CD	CEILING DIFFUSER
CFM	CUBIC FEET PER MINUTE
CG	CEILING GRILLE
CO	CLEAN OUT
CR	CEILING REGISTER
CW	CONDENSER WATER

HVAC GENERAL NOTES

- GENERAL NOTES, SYMBOLS LIST AND DETAILS ARE APPLICABLE TO ALL HVAC DRAWINGS.
- DRAWINGS ARE DIAGRAMMATIC. THEREFORE DETERMINE EXACT LOCATIONS OF SYSTEMS AND COMPONENTS IN FIELD.
- COORDINATE WORK OF THIS SECTION WITH THAT OF OTHER SECTIONS.
- SHEETMETAL FITTINGS SHOWN ARE TO BE PROVIDED. NO SUBSTITUTES SHALL BE ALLOWED WITHOUT PRIOR CONSENT FROM ARCHITECT/ENGINEER.
- RUN DUCTS CONCEALED, UNLESS SPECIFIED OTHERWISE, AND CLEAR OF CEILING INSERTS. ALL DUCTWORK SHALL BE INSTALLED AS CLOSE AS POSSIBLE TO WALL AND UNDERSIDE OF BEAMS AND JOISTS.
- ALL WORK SHALL BE COORDINATED WITH ALL TRADES INVOLVED. OFFSETS IN DUCTS (INCLUDING DIVIDED DUCTS) AND TRANSITIONS AROUND OBSTRUCTIONS SHALL BE PROVIDED AT NO ADDITIONAL COST TO THE OWNER.
- VERIFY ALL EQUIPMENT CONNECTIONS WITH MANUFACTURER'S CERTIFIED DRAWINGS. VERIFY AND PROVIDE DUCT TRANSITIONS TO FURNISHED EQUIPMENT. FIELD VERIFY AND COORDINATE ALL DIMENSIONS BEFORE FABRICATION.
- SUPPORT ALL EQUIPMENT AND DUCTWORK FROM BUILDING STRUCTURE TO PROVIDE A VIBRATION FREE INSTALLATION. NOTIFY ARCHITECT AND STRUCTURAL ENGINEER OF ALL WEIGHTS AND METHODS OF SUPPORT.
- PROVIDE VOLUME DAMPERS ON RUN-OUTS TO ALL NEW DIFFUSERS, AS WELL AS BRANCH TAKEOFF, WHETHER SHOWN ON DRAWINGS OR NOT.
- FURNISH AND INSTALL ALL WIRING, CONDUIT, TRANSFORMERS, AND OTHER COMPONENTS REQUIRED FOR OPERATION OF HVAC CONTROLS INCLUDING LINE AND LOW VOLTAGE SYSTEMS.
- ALL CONTROL WIRE AND CONDUIT SHALL COMPLY WITH NEC, HVAC AND ELECTRICAL SPECIFICATIONS.
- REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATIONS OF AIR OUTLETS.
- INTERNAL AIR FLOW DIMENSIONS ARE SHOWN FOR DUCTS.
- ALL MATERIALS AND EQUIPMENT SHALL BE NEW, UNLESS NOTED OTHERWISE.
- THE INSIDE OF ALL UNLINED DUCTWORK VISIBLE THROUGH A GRILLE OR DIFFUSER SHALL BE PAINTED FLAT BLACK.
- FURNISH ELECTRONIC "AS-BUILT" DRAWINGS CONSISTING OF A COMPLETE SET OF PLANS INDICATING IN A NEAT AND ACCURATE MANNER, A COMPLETE RECORD OF ALL CHANGES TO THE ORIGINAL DESIGN OF THE WORK.
- ALL WORK SHALL BE GUARANTEED AGAINST DEFECTS FOR A PERIOD OF ONE YEAR FROM DATE OF FINAL ACCEPTANCE OF THE INSTALLATION AND ANY PORTIONS OF THE WORK WHICH DEVELOP DEFECTS DURING THAT TIME SHALL BE REPLACED OR REPAIRED IN A MANNER SATISFACTORY TO THE OWNER. ALL MANUFACTURER'S WARRANTIES FOR EQUIPMENT EXTENDING BEYOND THE GUARANTEE PERIOD SHALL BE TURNED OVER TO THE OWNER.
- ALL POST INSTALLED ANCHORS MUST BE ICC-ES APPROVED.
- ALL WIRING INCLUDED LOW VOLTAGE WIRING SHALL BE ROUTED IN CONDUIT.

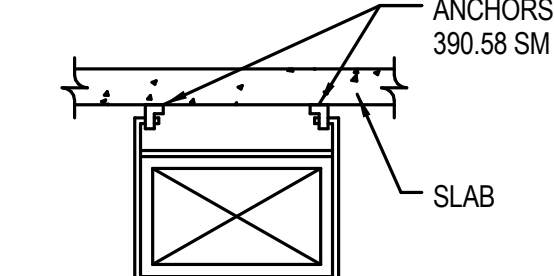
BUILDING DEPARTMENT NOTES

- A SPECIAL INSPECTION AND/OR TEST WILL BE CONDUCTED UNDER DIRECT SUPERVISION OF A LICENSED PROFESSIONAL ENGINEER OR ARCHITECT RETAINED BY THIS CONTRACTOR. THE TEST WILL SHOW COMPLIANCE WITH BUILDING CODE REQUIREMENTS. THE LICENSED PROFESSIONAL ENGINEER OR ARCHITECT SUPERVISING THE INSTALLATION OF SYSTEMS AND CONDUCTING SUCH TESTS WILL FILE A CERTIFICATE AND REPORT OF THE TESTS THAT THE SYSTEM COMPLIES WITH THE APPLICABLE LAWS. THE FOLLOWING MATERIALS AND EQUIPMENT ARE SUBJECT TO CONTROLLED INSPECTION
 - MECHANICAL VENTILATION (M.V.) AIR CONDITIONING (A.C.)
 - INSPECTION AND TESTS OF REQUIRED VENTILATING SYSTEMS PER MC-403.

WORK ITEM OR MATERIAL(S)	SECTION
DUCT CONSTRUCTION	MC-603
ELECTRIC WIRING AND EQUIPMENT	MC-301
AIR COOLING/HEATING EQUIPMENT	MC-302
CONTROLS	MC-405
NOISE CRITERIA LEVELS	MC-926

- A STATEMENT WILL BE FILED (BY THE OWNER OR TENANT IN POSSESSION) THAT THE VENTILATING SYSTEM WILL BE KEPT IN CONTINUOUS OPERATION DURING NORMAL OCCUPANCY OF THE PREMISES.
- THE VENTILATION INDEX FOR ALL AREAS COMPLIES WITH THE MINIMUM CODE REQUIREMENTS MC-403. ALL CALCULATIONS OF VENTILATION INDEX ARE MADE WITHOUT TAKING ANY CREDIT FOR EXTERIOR WINDOWS AND/OR OPENINGS.

- DETAIL OF DUCT SUPPORTS:



ANCHORS BSA
390.58 SM

SLAB

- UNLESS OTHERWISE NOTED, ALL DUCTS SHALL BE CONSTRUCTED OF GALVANIZED STEEL.

- ALL METHODS OF ATTACHMENT TO THE BUILDING STRUCTURE MUST BE SUBMITTED TO THE ARCHITECT AND STRUCTURAL ENGINEER FOR APPROVAL PRIOR TO THEIR USE. ANGLE STEEL SHALL BE SUITABLE TO SUPPORT THE LOAD WHICH IS BEING SUPPORTED.

PROFESSIONAL STATEMENT

TO THE BEST OF MY KNOWLEDGE, BELIEF, AND PROFESSIONAL JUDGMENT, ALL WORK UNDER THIS APPLICATION IS IN COMPLIANCE WITH THE 2014 NEW YORK CITY CONSTRUCTION CODES AND THE 2020 NEW YORK CITY ENERGY CONSERVATION CODE.

MISCELLANEOUS

	TEMPERATURE SENSOR
	TEMPERATURE SENSOR/THERMOSTAT WITH ZONE OR EQUIPMENT DESIGNATION
	DUCT SMOKE DETECTOR SUPPLIED BY ELECTRICAL TRADE, INSTALLED BY MECHANICAL TRADE
	NEW WORK
	EXISTING WORK
	EXISTING WORK TO BE REMOVED
	POINT OF NEW CONNECTION TO EXISTING WORK
	DIAMETER
	UNDERCUT DOOR



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THESE DRAWINGS & SPECIFICATIONS ARE CONFIDENTIAL AND SHALL REMAIN THE SOLE PROPERTY OF SWEETGREEN CORPORATION. THEY SHALL NOT BE REPRODUCED (IN WHOLE OR IN PART), SHARED WITH THIRD PARTIES OR USED IN ANY MANNER ON OTHER PROJECTS OR EXTENSIONS TO THIS PROJECT WITHOUT THE PRIOR WRITTEN CONSENT OF SWEETGREEN CORPORATION. THESE DRAWINGS & SPECIFICATIONS ARE INTENDED TO EXPRESS DESIGN INTENT FOR A PROTOTYPICAL SWEETGREEN STORE WHICH IS SUBJECT TO CHANGE AT ANY TIME AND MAY NOT REFLECT ACTUAL SITE CONDITIONS. NEITHER PARTY SHALL HAVE ANY OBLIGATION OR LIABILITY TO THE OTHER (EXCEPT AS STATED ABOVE) UNTIL A WRITTEN AGREEMENT IS FULLY EXECUTED.

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STAMP:

PROJECT INFORMATION:
23RD + PARK
PROJECT INFORMATION:
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DRAWN BY: Author
CHECKED BY: Checker
PROJECT MANAGER: SG CONSTR. MANAGER:
PROJECT NO: 224134
TEMPLATE VERSION: 04.28.2023

REVISIONS

REV.	DATE	DESCRIPTION
07.11.2024	80% CD SET	
07.25.2024	LL REVIEW SET	
08.02.2024	CLIENT REVIEW	
10.31.2024	ISSUE FOR PERMIT	
02.11.2025	IFC SET	

MECHANICAL LEGENDS AND ABBREVIATIONS

M-001.00
SHEET 1 of 14

SECTION 23 00 00
HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS

23 05 01 - HVAC GENERAL PROVISIONS

- A. THE GENERAL, SUPPLEMENTARY CONDITIONS AND ANY ARCHITECTURAL SPECIFICATIONS ARE A PART OF THE REQUIREMENTS FOR THE WORK UNDER THIS DIVISION OF THE SPECIFICATION.
- B. PROVIDE LABOR AND MATERIALS REQUIRED TO INSTALL, TEST AND PLACE INTO OPERATION THE HEATING, VENTILATING, AND AIR CONDITIONING, AS CALLED FOR IN THE CONTRACT DOCUMENTS, AND ACCORDING TO THE INTERNATIONAL BUILDING CODE AS AMENDED BY THE STATE OF NEW YORK.
- C. PROVIDE LABOR, MATERIALS, AND ACCESSORIES REQUIRED TO PROVIDE COMPLETE OPERATING MECHANICAL SYSTEMS AS DESCRIBED OR WHICH MAY BE REASONABLY IMPLIED AS ESSENTIAL FOR A COMPLETE OPERATING SYSTEM.
- D. DRAWINGS, SPECIFICATIONS, CODES, AND STANDARDS ARE MINIMUM REQUIREMENTS. WHERE REQUIREMENTS DIFFER, APPLY THE MORE STRINGENT.
- E. SHOULD ANY CHANGE IN DRAWINGS OR SPECIFICATIONS BE REQUIRED TO COMPLY WITH GOVERNING REGULATIONS, NOTIFY THE ARCHITECT PRIOR TO SUBMITTING BID.
- F. EXECUTE WORK IN STRICT ACCORDANCE WITH THE BEST PRACTICES OF THE TRADES IN A THOROUGH, SUBSTANTIAL, SKILLFUL AND WELL-EXECUTED MANNER BY COMPETENT WORKERS. PROVIDE A COMPETENT, EXPERIENCED FULL-TIME SUPERINTENDENT WHO IS AUTHORIZED TO MAKE DECISIONS ON BEHALF OF THE CONTRACTOR.
- G. APPLICABLE EQUIPMENT AND MATERIALS TO BE LISTED BY UNDERWRITERS' LABORATORIES AND MANUFACTURED IN ACCORDANCE WITH ASME, ANSIA, OR ANSI STANDARDS, AND AS APPROVED BY AUTHORITIES HAVING JURISDICTION. THE ENERGY USING PRODUCTS SHALL BE IN ACCORDANCE WITH THE INTERNATIONAL ENERGY CONSERVATION CODE AS AMENDED BY THE STATE OF NEW YORK.
- H. SUBMIT SHOP DRAWINGS, MANUFACTURER'S DATA, SAMPLES, AND TEST REPORTS (THREE COPIES MINIMUM), CONTRACTOR SHALL ALLOW FIVE WORKING DAYS MINIMUM REVIEW FROM THE TIME IT IS RECEIVED BY THE ENGINEER.
- I. THE CONTRACT DOCUMENTS SHOW THE GENERAL ARRANGEMENT OF EQUIPMENT, DUCTWORK, PIPING, AND ACCESSORIES. FOLLOW THESE DRAWINGS AS CLOSELY AS THE ACTUAL CONSTRUCTION AND THE WORK OF OTHER TRADES WILL PERMIT. PROVIDE OFFSETS, FITTINGS, AND ACCESSORIES WHICH MAY BE REQUIRED BUT NOT SHOWN ON THE DRAWINGS. INVESTIGATE THE SITE AND REVIEW DRAWINGS OF OTHER TRADES TO DETERMINE CONDITIONS AFFECTING THE WORK AND PROVIDE SUCH WORK AND ACCESSORIES AS MAY BE REQUIRED TO ACCOMMODATE SUCH CONDITIONS.
- J. PROVIDE FIRESTOPPING AROUND ALL PIPES, CONDUITS, DUCTS, ETC. WHICH PASS THROUGH RATED WALLS, PARTITIONS, AND FLOORS IN STRICT ACCORDANCE WITH THE MANUFACTURER'S PUBLISHED APPROVAL LISTING AND RATING.
- K. BEFORE COMMENCING WORK, EXAMINE ADJOINING WORK ON WHICH THIS WORK IS IN ANY WAY DEPENDENT AND REPORT CONDITIONS WHICH PREVENT PERFORMANCE OF THE WORK. BECOME THOROUGHLY FAMILIAR WITH ACTUAL EXISTING CONDITIONS TO WHICH CONNECTIONS MUST BE MADE OR WHICH MUST BE CHANGED OR ALTERED.
- L. DEFINITIONS:
 - 1. "PROVIDE" MEANS TO "FURNISH" AND "INSTALL".
 - 2. "INSTALL" MEANS TO JOIN, UNITE, FASTEN, LINK, ATTACH, SET UP OR OTHERWISE CONNECT TOGETHER BEFORE TESTING AND TURNING OVER TO OWNER, COMPLETE AND READY FOR REGULAR OPERATION.
 - 3. "FURNISH" MEANS TO SUPPLY ALL MATERIALS, LABOR, EQUIPMENT, TESTING APPARATUS, CONTROLS, TESTS, ACCESSORIES, AND ALL OTHER ITEMS CUSTOMARILY REQUIRED FOR THE PROPER AND COMPLETE APPLICATION.
 - 4. "AS DIRECTED" MEANS AS DIRECTED BY THE ARCHITECT OR THE ARCHITECT'S REPRESENTATIVE.
 - 5. "CONCEALED" MEANS EMBEDDED IN MASONRY OR OTHER CONSTRUCTION, INSTALLED BEHIND WALL, FURRING OR WITHIN DOUBLE PARTITIONS, OR INSTALLED WITHIN HUNG CEILING.
 - 6. "SUBMIT" MEANS SUBMIT TO THE ARCHITECT FOR REVIEW.
- M. EVALUATE EXISTING CONDITIONS WHICH MAY AFFECT METHODS OR COST OF PERFORMING THE WORK, BASED ON EXAMINATION OF THE SITE OR OTHER INFORMATION. FAILURE TO EXAMINE THE DRAWINGS, THIS DOCUMENT OR OTHER INFORMATION DOES NOT RELIEVE THE CONTRACTOR OF RESPONSIBILITY FOR SATISFACTORY COMPLETION OF THE WORK.
- N. PROVIDE TWO (2) COPIES OF OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS FOR ALL EQUIPMENT AND MATERIALS FURNISHED UNDER THIS DIVISION UPON TWO (2) WEEKS AFTER COMPLETION OF PROJECT.
- O. MAINTAIN ON A DAILY BASIS AT THE PROJECT SITE A COMPLETE SET OF RECORD DRAWINGS, REFLECTING AN ACCURATE DIMENSIONAL RECORD OF ALL DEVIATIONS BETWEEN WORK SHOWN ON DRAWINGS AND THAT ACTUALLY INSTALLED.
- P. COORDINATE WITH BUILDING MANAGEMENT, THE REQUIREMENTS FOR AFTER-HOURS WORK NEEDED FOR TENANT TIE-INS TO BASE BUILDING SYSTEMS.
- Q. LOCATE ALL EQUIPMENT NEEDING SERVICE IN ACCESSIBLE LOCATIONS AND ON ONE SIDE OF THE UNIT WHEN POSSIBLE. COORDINATE WITH GENERAL CONTRACTORS TO PROVIDE ACCESS PANELS IN INACCESSIBLE CEILING. MINOR DEVIATIONS FROM DRAWINGS CAN BE MADE IN ORDER TO PROVIDE BETTER ACCESSIBILITY.
- R. ALL HVAC SYSTEMS SHALL BE IN ACCORDANCE WITH THE INTERNATIONAL BUILDING CODES AND UNIFORM MECHANICAL CODE AS AMENDED BY THE STATE OF NEW YORK AND REGULATIONS AND CONSTRUCTED IN ACCORDANCE WITH THE BEST GENERAL PRACTICE.
- S. CONTRACTOR SHALL ALLOW FOR TESTING AND REBALANCING OF ALL EXISTING TO BE REUSED EQUIPMENT AS WELL AS NEW.
- T. COORDINATE ALL WORK WITH EXISTING STRUCTURE, PIPING, AND CONDUITS.
- U. OBTAIN AND PAY FOR ALL REQUIRED FEES, PERMITS, AND INSPECTIONS.
- V. OBTAIN WRITTEN PERMISSION OF OWNER BEFORE CUTTING OR PATCHING OF STRUCTURAL SYSTEMS.
- W. GUARANTEE WORK FOR ONE (1) YEAR FROM DATE OF FILING NOTICE OF COMPLETION.
- X. REMOVE ALL ABANDONED MECHANICAL EQUIPMENT AND ASSOCIATED DUCTWORK, PIPING, ETC., UNLESS OTHERWISE SPECIFIED BY OWNER.
- Y. PRESSURE TEST EACH SYSTEM OF PIPING AND DUCTWORK AS SPECIFIED.
- Z. SUBMITTALS AND REVIEWS:
 - 1. SUBMITTALS: PRIOR TO CONSTRUCTION SUBMIT FOR APPROVAL THE FOLLOWING MATERIALS AND EQUIPMENT. SUBMITTAL SHOULD BE SUBMITTED SEPARATELY BY NUMBERED SPECIFICATION SECTION AND SHOULD INCLUDE EQUIPMENT CUT SHEETS, DIMENSIONS, CAPACITIES, WIRING DIAGRAM AND ELECTRICAL LOADS. SPECIAL INSTALLATION DETAILS, ETC.
 - a. ELECTRIC MOTORS FOR HVAC EQUIPMENT
 - b. METERS, GAUGES, AND THERMOMETERS
 - c. GENERAL-DUTY VALVES
 - d. HANGERS AND SUPPORTS
 - e. VIBRATION ISOLATION
 - f. ACCESS DOORS
 - g. SYSTEMS IDENTIFICATION
 - h. TESTING, ADJUSTING, AND BALANCING
 - i. THERMAL INSULATION
 - j. BUILDING CONTROLS
 - k. SEQUENCE OF OPERATIONS
 - l. HYDRONIC PIPING
 - m. PUMPS

- n. REFRIGERANT PIPING
- o. HVAC DUCTS AND CASINGS
- p. DAMPERS
- q. ACOUSTICS
- r. FANS
- s. AIR OUTLETS AND INLETS
- t. OTHER MISCELLANEOUS EQUIPMENT AS SPECIFIED AND OR SCHEDULED ON DRAWINGS.
- 2. ELECTRONIC SUBMITTALS:
 - a. ELECTRONIC SUBMITTALS WHERE ACCEPTABLE TO THE ARCHITECT WILL BE SUBMITTED IN PDF FORMAT THROUGH A PROJECT FILE SHARING WEBSITE.
 - b. IDENTIFY AND INCORPORATE INFORMATION IN EACH ELECTRONIC SUBMITTAL FILE AS FOLLOWS:
 - (1) ASSEMBLE COMPLETE SUBMITTAL PACKAGE INTO A SINGLE INDEXED FILE INCORPORATING SUBMITTAL REQUIREMENTS OF A SINGLE SPECIFICATION SECTION AND TRANSMITTAL FORM WITH LINKS ENABLING NAVIGATION TO EACH ITEM.
 - (2) NAME FILE WITH SUBMITTAL NUMBER OR OTHER UNIQUE IDENTIFIER, INCLUDING REVISION IDENTIFIER.
 - (3) FILE NAME SHALL USE PROJECT IDENTIFIER AND SPECIFICATION SECTION NUMBER FOLLOWED BY A DECIMAL POINT AND THEN A SEQUENTIAL NUMBER (E.G., BV-230923.01). RESUBMITTALS SHALL INCLUDE AN ALPHABETIC SUFFIX AFTER ANOTHER DECIMAL POINT (E.G., BV-230923.01.A).
 - (4) PROVIDE MEANS FOR INSERTION TO PERMANENTLY RECORD CONTRACTOR'S REVIEW AND APPROVAL MARKINGS AND ACTION TAKEN BY ARCHITECT.
 - c. TRANSMITTAL FORM FOR ELECTRONIC SUBMITTALS: USE ELECTRONIC FORM ACCEPTABLE TO ARCHITECT, CONTAINING THE FOLLOWING INFORMATION:
 - (1) PROJECT NAME
 - (2) DATE
 - (3) NAME AND ADDRESS OF ARCHITECT AND ENGINEER
 - (4) NAME OF OWNER
 - (5) NAME OF CONTRACTOR
 - (6) NAME OF FIRM OR ENTITY THAT PREPARED SUBMITTAL
 - (7) NAMES OF SUBCONTRACTOR, MANUFACTURER, AND SUPPLIER
 - (8) CATEGORY AND TYPE OF SUBMITTAL
 - (9) SPECIFICATION SECTION NUMBER AND TITLE
 - (10) DRAWING NUMBER AND DETAIL REFERENCES, AS APPROPRIATE
 - (11) RELATED PHYSICAL SAMPLES SUBMITTED DIRECTLY
 - (12) INDICATION OF FULL OR PARTIAL SUBMITTAL
 - (13) TRANSMITTAL NUMBER (NUMBERED CONSECUTIVELY)
 - (14) SUBMITTAL AND TRANSMITTAL DISTRIBUTION RECORD
 - (15) REMARKS
 - d. METADATA: INCLUDE THE FOLLOWING INFORMATION AS KEYWORDS IN THE ELECTRONIC SUBMITTAL FILE METADATA:
 - (1) PROJECT NAME
 - (2) NUMBER AND TITLE OF APPROPRIATE SPECIFICATION SECTION
 - (3) MANUFACTURER NAME
 - (4) PRODUCT NAME
- 3. PREPARE AND SUBMIT DETAILED SHOP DRAWINGS FOR DUCTWORK, PIPING WORK AND OTHER DISTRIBUTION SERVICES IN MINIMUM 1/4 INCH TO 1 FOOT SCALE. INCLUDING ELEVATIONS AND LOCATIONS AND SIZES OF OPENINGS IN FLOOR DECKS, WALLS AND ROOFS.
- 4. HVAC DESIGN DRAWINGS SHALL NOT BE SUBMITTED AS SHEET METAL SHOP DRAWINGS.
- 5. THE WORK DESCRIBED IN SHOP DRAWING AND PRODUCT DATA SUBMITTALS SHALL BE CAREFULLY CHECKED BY ALL TRADES FOR CLEARANCES (INCLUDING THOSE REQUIRED FOR CODE COMPLIANCE, MAINTENANCE, AND SERVICING), FIELD CONDITIONS, MAINTENANCE OF ARCHITECTURAL CONDITIONS, AND PROPER COORDINATION WITH OTHER TRADES ON THE JOB. EACH SUBMITTED SHOP DRAWING TO INCLUDE A CERTIFICATION THAT RELATED FIELD CONDITIONS AND REQUIREMENTS HAVE BEEN CHECKED BY ALL CONTRACTORS AND SUBCONTRACTORS AND THAT CONFLICTS DO NOT EXIST.
- 6. NO PART OF THE WORK SHALL BE ORDERED, PROCURED, STARTED IN THE SHOP OR IN THE FIELD UNTIL THE SHOP DRAWINGS AND SAMPLES FOR THAT PORTION OF THE WORK HAVE BEEN SUBMITTED, REVIEWED AND RETURNED WITH EITHER "NO EXCEPTIONS NOTED" OR "EXCEPTIONS NOTED" MARKED ON THE SUBMISSION.
- 7. REVIEW OF SUBMITTALS IS FOR GENERAL COMPLIANCE WITH THE DESIGN CONCEPT AND CONTRACT DOCUMENTS. COMMENTS OR ABSENCE OF COMMENTS DOES NOT RELIEVE THE CONTRACTOR FROM COMPLIANCE WITH THE CONTRACT DOCUMENTS. THE CONTRACTOR REMAINS SOLELY RESPONSIBLE FOR DETAILS AND ACCURACY. FOR CONFIRMING AND CORRELATING ALL QUANTITIES AND DIMENSIONS, FOR SELECTING FABRICATION PROCESSES, FOR TECHNIQUES OF CONSTRUCTION, FOR PERFORMING THE WORK IN A SAFE MANNER, AND FOR COORDINATING THE WORK WITH THAT OF OTHER TRADES.
- AA. ALTERNATIVE EQUIPMENT AND MATERIALS
 - 1. CONTRACT DOCUMENTS ARE BASED ON MATERIALS SPECIFIED AND ON EQUIPMENT MANUFACTURERS INDICATED. ACCEPTANCE OF ALTERNATIVE EQUIPMENT MANUFACTURERS DOES NOT RELIEVE CONTRACTOR OF THE RESPONSIBILITY TO PROVIDE EQUIPMENT AND MATERIALS THAT MEET THE QUALITY AND PERFORMANCE AS STATED OR IMPLIED IN THE CONTRACT DOCUMENTS.
 - 2. EQUIPMENT MANUFACTURERS LISTED IN INDIVIDUAL SECTIONS ARE ACCEPTABLE FOR THIS PROJECT, SUBJECT TO REQUIREMENTS OF CONTRACT DOCUMENTS.
 - 3. SUBMIT PROPOSALS TO SUPPLY ALTERNATE MATERIALS OR EQUIPMENT, IN WRITING, WITH SUFFICIENT LEAD TIME FOR REVIEW PRIOR TO THE DATE EQUIPMENT MUST BE ORDERED TO MAINTAIN PROJECT SCHEDULE. REIMBURSE OWNER FOR COSTS ASSOCIATED WITH THE REVIEW OF THE PROPOSED ALTERNATIVE WHETHER ALTERNATIVE IS ACCEPTED OR REJECTED.
 - 4. INCLUDE REVISIONS REQUIRED TO ADAPT ALTERNATIVES IN SUCH PROPOSALS, INCLUDING REVISIONS BY OTHER TRADES. NO INCREASE IN THE CONTRACT PRICE WILL BE CONSIDERED TO ACCOMMODATE THE USE OF ALTERNATIVE EQUIPMENT.
 - 5. WHEREVER QUALITY STANDARDS (SUCH AS SERVICEABILITY, ENERGY EFFICIENCY, LONGEVITY, OR DURABILITY) AND OPERATING RESULTS (SUCH AS NOISE LEVELS, QUANTITY DELIVERED, OR PRESSURE OBTAINED) ARE SPECIFIED OR SCHEDULED, OR WHEN THE MANUFACTURER AND SIZE OF EQUIPMENT, FOR WHICH SUCH OPERATING RESULTS ARE PUBLISHED OR DETERMINABLE, IS SPECIFIED, THE SUBSTITUTION BEING PROPOSED MUST CONFORM SUBSTANTIALLY TO THE QUALITY AND QUANTITIES SPECIFIED OR IMPLIED. THE SUBSTITUTION MUST FIT INTO AVAILABLE SPACE CONDITIONS AND MUST FUNCTION PROPERLY IN COORDINATION WITH THE REST OF THE SYSTEM.
 - 6. PROPOSED CHANGES AND SUBSTITUTIONS OF SYSTEMS, EQUIPMENT, AND MANUFACTURERS SHALL BE SUBMITTED AND INCLUDE THE FOLLOWING INFORMATION WITH THE PROPOSAL:
 - a. A DESCRIPTION OF THE DIFFERENCE BETWEEN THE EXISTING CONTRACT REQUIREMENTS AND THAT PROPOSED, THE COMPARATIVE FEATURES OF EACH, AND THE EFFECT OF THE CHANGE ON THE END RESULT PERFORMANCE. INCLUDE THE IMPACT OF ALL CHANGES ON OTHER CONTRACTORS AND ACKNOWLEDGE THE INCLUSION OF ADDITIONAL COSTS TO OTHER TRADES.
 - b. SCHEMATIC DRAWINGS AND DETAILS TO SUPPLEMENT THE DESCRIPTION.
 - c. A LIST OF THE CONTRACT REQUIREMENTS THAT MUST BE REVISED IF THE CHANGE IS ACCEPTED, INCLUDING ANY SPECIFICATION REVISIONS.

- d. COMPLETE LIST OF MATERIALS AND EQUIPMENT PROPOSED FOR USE IN THE CHANGE.
- e. INCLUDE A DESCRIPTION AND ESTIMATE OF COSTS THE OWNER MAY INCUR IN IMPLEMENTING THE CHANGE, SUCH AS ADDITIONAL SPACE REQUIREMENTS, PERMITS, ARCHITECTURAL AND AESTHETIC IMPACT, DESIGN COSTS, TESTS, PERMITS EVALUATION, OPERATING AND SUPPORT COSTS.
- f. A PROJECTION OF ANY EFFECTS THE PROPOSED CHANGE WOULD HAVE ON COLLATERAL COSTS TO THE OWNER.
- g. A STATEMENT OF THE TIME BY WHICH A CONTRACT MODIFICATION ACCEPTING THE CHANGE MUST BE ISSUED, NOTING ANY EFFECT ON THE CONTRACT COMPLETION TIME OR THE DELIVERY SCHEDULE.
- h. A STATEMENT INDICATING THE REDUCTION TO THE CONTRACT PRICE IF THE OWNER ACCEPTS THE CHANGE. BE RESPONSIBLE FOR APPROPRIATE MODIFICATIONS TO ALL TRADES.
- BB. RECORD DRAWINGS:
 - 1. THE CONTRACTOR SHALL MAINTAIN ON A DAILY BASIS AT THE PROJECT SITE A COMPLETE SET OF RECORD DRAWINGS. THE RECORD DRAWINGS SHALL INITIALLY CONSIST OF A SET OF BOND PAPER PRINTS OR AUTOCAD FILES ELECTRONICALLY UPDATED TO SHOW THE PRECISE LOCATION OF ALL BURED OR CONCEALED WORK AND EQUIPMENT, INCLUDING EMBEDDED PIPING AND VALVES, AND ALL CHANGES AND DEVIATIONS IN THE MECHANICAL WORK FROM THAT SHOWN ON THE CONTRACT DOCUMENTS. THIS REQUIREMENT SHALL NOT BE CONSTRUED AS AUTHORIZATION FOR THE CONTRACTOR TO MAKE CHANGES IN THE LAYOUT OR WORK WITHOUT DEFINITE WRITTEN INSTRUCTIONS FROM THE ARCHITECT OR ENGINEER. THE UPDATED COORDINATION DRAWINGS SHALL BE USED TO PRODUCE THE FINAL RECORD DRAWINGS THAT SHALL BE DELIVERED TO THE OWNER IN AUTOCAD ELECTRONIC FORMAT MEDIA UPON PROJECT COMPLETION.
 - 2. UPON COMPLETION OF THE WORK, THE CONTRACTOR AND SUBCONTRACTORS SHALL CERTIFY ALL RECORD DRAWINGS ON THE FRONT LOWER RIGHT HAND CORNER ADJACENT TO THE ABOVE MARKING WITH A RUBBER STAMP IMPRESSION OR AN AUTOCAD IMAGE.
 - 3. PRIOR TO FINAL ACCEPTANCE OF THE WORK OF THIS DIVISION, THE CONTRACTOR SHALL SUBMIT PROPERLY CERTIFIED RECORD DRAWINGS TO THE ARCHITECT AND ENGINEER FOR REVIEW AND SHALL MAKE CHANGES, CORRECTIONS, OR ADDITIONS AS THE ARCHITECT AND/OR ENGINEER MAY REQUIRE TO THE RECORD DRAWINGS. SUBMITTED RECORD DRAWINGS SHALL BE ON ELECTRONIC MEDIA IN AUTOCAD 2010 OR LATER FORMAT AND ONE SET OF FULL-SIZE PRINTS. AFTER THE ARCHITECT'S AND ENGINEER'S REVIEW, AND ANY REQUIRED CONTRACTOR REVISIONS, THE RECORD DRAWINGS SHALL BE DELIVERED TO THE OWNER ON ELECTRONIC MEDIA IN AUTOCAD 2010 OR LATER FORMAT. THE ARCHITECT AND ENGINEER DO NOT ASSUME ANY RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE RECORD DRAWINGS.

23 05 19 - METERS, GAUGES, AND THERMOMETERS

- A. ACCEPTABLE MANUFACTURERS:
 - 1. PRESSURE GAUGES: WEISS, TRERICE, WEKSLER, TAYLOR, ASHCROFT
 - 2. PRESSURE/TEMPERATURE TEST PORTS: PETERSON ENGINEERING, TRERICE, WEKSLER
 - 3. THERMOMETERS: WEISS, TRERICE, WEKSLER, TAYLOR, ASHCROFT
- B. PRESSURE GAUGES:
 - 1. 4 1/2 INCH DIAMETER IN METAL CASE, GLYCERINE FILLED PHOSPHOR BRONZE BOURDON TUBE, ROTARY BRASS MOVEMENT, BRASS SOCKET, AND 1/4 MID-SCALE ACCURACY WITH FRONT RECALIBRATION ADJUSTMENT, BLACK FIGURES ON WHITE BACKGROUND. PROVIDE BRASS NEEDLE OR GATE VALVE AND PULSATION DAMPER.
- C. PRESSURE/TEMPERATURE TEST PORTS:
 - 1. PROVIDE TEST PORTS 1/2 INCH NPT MADE OF BRASS WITH NORDEL CORE. IN ADDITION, SUPPLY THREE (3) KITS CONSISTING OF 1/4 INCH NPT PRESSURE GAUGE, GAUGE ADAPTER WITH AND PROTECTING SHIELD, BI-METAL THERMOMETER RANGE 25 DEGREES F TO 125 DEGREES F WITH 5 INCH STEM AND 1.75 INCH DIAMETER DIAL. BI-METAL THERMOMETER RANGE 20 DEGREES F TO 240 DEGREES F WITH 5 INCH STEM AND 1.75 INCH DIAMETER DIAL. EACH KIT TO BE PROVIDED IN AN IMPACT-RESISTANT CARRYING CASE.
- D. THERMOMETERS:
 - 1. ADJUSTABLE ANGLE DIAL FACE, BI-METAL THERMOMETER, WITH 2 DEGREE F SCALE DIVISION, ACCURATE TO PLUS OR MINUS 1 PERCENT OF SCALE RANGE, TYPE 304 STAINLESS STEEL CASE AND BEZEL, SHATTER-PROOF GLASS WINDOW, SILICONE FILLED.
 - 2. FOR PIPES UP TO 2 INCH DIAMETER, WEISS MODEL SF3VBM, OR EQUAL.
 - 3. FOR PIPES LARGER THAN 2 INCH DIAMETER, WEISS MODEL SF5VBM, OR EQUAL.
 - 4. THERMOMETERS SHALL HAVE THE FOLLOWING INSERTION LENGTHS:
 - a. UP TO 5 INCH PIPE: 2.5 INCHES
 - b. 6 INCH THRU 8 INCH PIPE: 4 INCHES
 - 5. PROVIDE TYPE 304 STAINLESS STEEL WELLS FOR ALL PIPE-MOUNTED THERMOMETERS.
 - 6. PROVIDE EXTENDED WELLS AND STEM LENGTH TO ACCOMMODATE INSULATION THICKNESS FOR INSULATED PIPE APPLICATIONS.
- E. INSTALLATION SCHEDULE:
 - 1. PRESSURE GAUGES:
 - a. PUMPS, INLET AND OUTLET.
 - b. OTHER LOCATIONS AS INDICATED ON DRAWINGS.
 - 2. STEM-TYPE THERMOMETERS:
 - a. OTHER LOCATIONS AS INDICATED ON DRAWINGS.
 - 3. PRESSURE/TEMPERATURE TEST PORTS:
 - a. PUMPS, INLET AND OUTLET
 - b. ALL AUTOMATIC CONTROL VALVES, INLET AND OUTLET
 - c. COOLING AND HEATING COILS, INLET AND OUTLET
 - d. OTHER LOCATIONS AS INDICATED ON DRAWINGS.

23 05 23 - GENERAL-DUTY VALVES

- A. ACCEPTABLE MANUFACTURERS:
 - 1. GATE VALVES:
 - a. BRONZE: GRINNELL, CRANE, CINCINNATI, NIBCO
 - b. CAST IRON: CRANE/JENKINS, CRANE/STOCKHAM, WALWORTH, GRINNELL, MILWAUKEE
 - 2. CHECK VALVES:
 - a. BRONZE: CRANE, HAMMOND, MILWAUKEE, NIBCO, POWEL, STOCKHAM
 - b. GRAY-IRON SWING CHECK: CRANE, HAMMOND, MILWAUKEE, NIBCO, POWELL, STOCKHAM, VICTAULIC
 - c. SPRING-LOADED, LIFT-DISC CHECK VALVES: METRAFLEX 900 SERIES OR EQUAL BY MILWAUKEE, MUELLER STEAM, NIBCO, VAL-MATIC, VICTAULIC
 - 3. GLOBE VALVES: CINCINNATI, CRANE/JENKINS, CRANE/STOCKHAM, HAMMOND WALWORTH, GRINNELL, MILWAUKEE, NIBCO
 - 4. BALL VALVES: APOLLO 70-100200 SERIES, OR EQUAL BY HAMMOND, MILWAUKEE, NIBCO, STOCKHAM
 - 5. AUTOMATIC FLOW CONTROL VALVES: GRISWOLD, FLOW DESIGN
 - 6. BALANCING VALVES: ARMSTRONG TYPE CBV, B&G CIRCUIT SETTER PLUS, TACO ACCU-FLO, TOUR & ANDERSSON STASSTAD, VICTAULIC SERIES 786/787
- B. VALVES AND VALVE CONSTRUCTION SHALL BE SUITABLE FOR THE PRESSURE, TEMPERATURE, AND

- FLUID QUALITY OF THE SERVICE IN WHICH THEY ARE TO BE USED.
- C. MINIMUM TEST PRESSURE FOR ALL VALVES SHALL BE 1.5 TIMES MAXIMUM SYSTEM WORKING PRESSURE UNLESS NOTED OTHERWISE.
- D. BUTTERFLY VALVES SHALL BE SUITABLE FOR DEAD END SERVICE AND CONSTRUCTED OF INDUSTRIAL DESIGN QUALITY.
- E. PROVIDE VALVES OF THE SAME MANUFACTURER FOR THE SAME SERVICE WHERE POSSIBLE.
- F. PROVIDE VALVES WITH MANUFACTURER'S NAME AND PRESSURE RATING CLEARLY AND PERMANENTLY MARKED ON THE OUTSIDE OF BODY
- G. VALVE SEATS SHALL BE RATED TO 240 DEGREES F MINIMUM WITHOUT DETERIORATION.
- H. VALVES SHALL BE FULL PIPE SIZE UNLESS NOTED OTHERWISE.
- I. GATE VALVES:
 - 1. PROVIDE GATE VALVES FOR ISOLATION IN WATER SYSTEMS, AND AS SHOWN ON THE DRAWINGS OR SPECIFIED FOR OTHER SYSTEMS.
 - 2. TWO-INCH AND SMALLER VALVES SHALL BE RISING STEM, SCREWED BONNET, INSIDE SCREW AND WEDGE GATE, BRONZE BODY AND TRIM WITH SCREWED ENDS.
 - 3. GATE VALVES SHALL BE BACKSEATING AND SUITABLE FOR REPACKING UNDER PRESSURE. PACKING SHALL BE ASBESTOS FREE
- J. GLOBE VALVES:
 - 1. PROVIDE GLOBE VALVES FOR THROTTLING IN WATER SYSTEMS, AND AS SHOWN ON THE DRAWINGS OR SPECIFIED FOR OTHER SYSTEMS.
 - 2. TWO-INCH AND SMALLER VALVES SHALL BE INSIDE RISING STEM, SCREWED BONNET WITH SCREWED ENDS.
 - 3. TWO AND ONE-HALF INCH AND LARGER VALVES SHALL BE RISING STEM, OUTSIDE SCREW AND YOKE, BOLTED BONNET AND FLANGED ENDS.
 - 4. GLOBE VALVES SHALL BE SUITABLE FOR REPACKING UNDER PRESSURE. PACKING SHALL BE ASBESTOS FREE.
 - 5. VALVE SEATS SHALL BE NICKEL ALLOY OR STAINLESS STEEL.
- K. CHECK VALVES:
 - 1. SWING TYPE: PROVIDE FOR WATER SERVICES: 2 INCH AND SMALLER WITH SCREWED BONNET, SCREWED END. VALVES SHALL HAVE RENEWABLE BRONZE SEAT AND DISC.
 - 2. SILENT TYPE: PROVIDE ON PUMPS LARGER THAN 2 INCH DISCHARGE. VALVES SHALL HAVE CAST IRON BODY WITH BRONZE OR STAINLESS STEEL TRIM, SPRING LOADED, AND TO BE OF THE CENTER GUIDE TYPE, WITH FLANGED END.
- L. BALL VALVES:
 - 1. PROVIDE BALL VALVES FOR ISOLATION AND AS DRAIN VALVES, IN WATER SYSTEMS UP TO 200 DEGREES F AND PIPE SIZES UP TO 2 INCH AND AS SHOWN ON THE DRAWINGS OR SPECIFIED FOR OTHER SYSTEMS.
 - 2. PROVIDE BALL VALVES OF THE BRONZE TOP-ENTRY BODY TYPE, HAVING A STRAIGHT-THROUGH FULL PORT FLOW PASSAGE. DESIGN TO PERMIT DISASSEMBLY WITHOUT REMOVING BODY FROM LINE. PROVIDE EXTENDED NECK WHERE USED ON INSULATED PIPING.
 - 3. PROVIDE STAINLESS STEEL OR CHROME PLATED BRASS/BRONZE BALL. CONVENTIONAL PORT.
 - 4. CONSTRUCT SEATS AND GLAND PACKING OF GLASS-FILLED TEFLON WITH A THREADED PACKING GLAND FOLLOWER, BLOWOUT-PROOF STEM RATED AT 600 PSIG WOG.
 - 5. PROVIDE STEM EXTENSIONS WHEN VALVES ARE INSTALLED IN INSULATED PIPE WITH VAPOR BARRIER SO VALVE HANDLES CLEAR INSULATION. LEVER HANDLE SHALL BE VINYL COVERED.
 - 6. PROVIDE LEVER FOR QUARTER-TURN OPERATION; LEVER TO INDICATE OPEN OR CLOSED POSITION.
 - 7. WHEN USED AS DRAIN VALVES, PROVIDE WITH HOSE THREAD AND BRASS CAP WITH CHAIN. CAP SHALL BE RATED FOR FULL SYSTEM PRESSURE.
- M. AUTOMATIC FLOW CONTROL VALVES:
 - 1. PROVIDE AUTOMATIC PRESSURE-COMPENSATING FLOW CONTROL VALVES WITH EXTENDED VALVE BODY AND DUAL TEMPERATURE/PRESSURE TEST PORTS. WAFER TYPE BODY IS NOT ACCEPTABLE.
 - 2. AUTOMATIC FLOW VALVE SHALL BE MANUFACTURED IN ONE PIECE AND TO CONSIST OF GROUND JOINT UNION, FLOW CONTROL, AND PRESSURE/TEMPERATURE TEST PORTS.
 - 3. VALVES SHALL BE FACTORY SET TO CONTROL THE FLOW RATE WITHIN 5 PERCENT OF THE SELECTED RATING OVER AN OPERATING PRESSURE DIFFERENTIAL OF AT LEAST 10 TIMES THE MINIMUM REQUIRED FOR FULL FLOW CONDITIONS.
 - 4. THE CONTROL MECHANISM OF THE VALVE SHALL CONSIST OF A SELF-CONTAINED, OPEN-CHAMBER CARTRIDGE ASSEMBLY WITH UNOBSTRUCTED FLOW PASSAGES THAT ELIMINATE ACCUMULATION OF PARTICLES AND DEBRIS. ALL INTERNAL WORKING PARTS SHALL BE TYPE 300 STAINLESS STEEL. NO PLATED MATERIALS ARE ACCEPTABLE.
 - 5. THE STAINLESS STEEL CARTRIDGE ASSEMBLY SHALL CONSIST OF A SPRING-LOADED CUP. THE CUP SHALL BE GUIDED AT TWO POINTS AND SHALL UTILIZE THE FULL AVAILABLE DIFFERENTIAL PRESSURE ACROSS THE VALVE TO ACTUATE THE CUP AND THEREBY REDUCE FRICTION AND HYSTERESIS AND ELIMINATE BINDING. IT SHALL HAVE A THIN ORIFICE PLATE FOR SELF-CLEANING OF THE VARIABLE INLET PORTS OVER THE FULL CONTROL RANGE. CARTRIDGE MUST BE REMOVABLE IN ONE PIECE.
 - 6. CAST IRON VALVE BODIES SHALL BE PROVIDED WITH INLET AND OUTLET PORTS SUITABLE FOR CONNECTION OF INSTRUMENTS FOR VERIFICATION OF FLOW RATES, AND SHALL BE MARKED TO SHOW DIRECTION OF FLOW. VALVE BODIES SHALL BE RATED FOR USE AT NOT LESS THAN 150 PERCENT OF SYSTEM DESIGNED OPERATING PRESSURES.
 - 7. PROVIDE A METAL IDENTIFICATION TAG, WITH CHAIN, FOR EACH INSTALLED VALVE. THE TAG SHALL BE MARKED WITH ZONE IDENTIFICATION, VALVE MODEL NUMBER AND RATED FLOW IN GALLONS PER MINUTE.
 - 8. CORRECT FLOW SHALL BE VERIFIED BY ESTABLISHING THAT THE OPERATING PRESSURE DIFFERENTIAL ACROSS THE VALVE TAPS IS WITHIN THE RANGE INDICATED ON THE SUBMITTAL DATA SHEET FOR THAT MODEL NUMBER.
 - 9. THE PRESSURE MEASURING APPARATUS SHALL BE PORTABLE AND CONSIST OF A PRESSURE GAUGE WITH A 4.5 INCH DIAMETER DIAL, INSTRUCTIONS, HOSES, CONNECTIONS AND A CARRYING CASE. AUTOMATIC FLOW CONTROL VALVES SHALL BE FURNISHED WITH FITTINGS SUITABLE FOR USE WITH THE MEASURING INSTRUMENTS SPECIFIED.
- N. BALANCING VALVES:
 - 1. BALANCING VALVE FOR WATER SERVICE SHALL BE OF THE CALIBRATED BALANCE VALVE TYPE WITH CAPPED PRESSURE/TEMPERATURE PORTS, POSITIVE SHUT-OFF ANGLE GLOBE TYPE, WITH ADJUSTABLE MEMORY STOP AND INDICATOR.
 - 2. VALVES 2 INCH AND SMALLER: BRONZE OR COPPER ALLOY BODY WITH CALIBRATED BALL, GLOBE OR VENTURIALVALVE ARRANGEMENT, INTEGRAL POINTER AND CALIBRATED SCALE TO REGISTER DEGREE OF VALVE OPENING. PROVIDE MEMORY STOP, DRAIN TAPPING, THREADED OR SOLDERED ENDS, WITH OR WITHOUT INTEGRAL UNIONS, PIT OR SHRAEDER TYPE PRESSURE TAPS WITH INTEGRAL CHECK VALVES AND SEALS AND ADJUSTABLE MEMORY STOP. VALVES SHALL BE SUITABLE FOR 200 PSIG WATER WORKING PRESSURE AT 250 DEGREES F.
 - 3. PROVIDE A PRESSURE DIFFERENTIAL METER, HOSES AND CARRYING CASE. THE KIT SHALL INCLUDE A SIX-INCH DIAMETER GAUGE WITH 270 DEGREE ARC READOUT. GAUGE, WITH ACCURACY OF PLUS OR MINUS 1 PERCENT OF FULL SCALE, SHALL BE SUITABLE FOR THE DIFFERENTIAL PRESSURES OF THE VALVES SUPPLIED FOR THIS PROJECT, WITH OVER-RANGE PROTECTION. INCLUDE COLOR-CODED HOSES TEN FEET MINIMUM IN LENGTH WITH BRASS CONNECTORS SUITABLE FOR CONNECTION TO THE LOW- AND HIGH-PRESSURE CONNECTIONS ON THE BALANCE VALVES. PROVIDE INSTRUMENT VALVING SO METER CAN BE VENTED AND DRAINED. PRESSURE AND TEMPERATURE RATING SHALL BE EQUAL TO THAT OF THE VALVES. PROVIDE METER AND ALL ACCESSORIES IN A DURABLE CASE WITH CARRYING HANDLE. THE METER IS APPLIED DIRECTLY ACROSS THE PRESSURE/TEMPERATURE PORTS ON THE CALIBRATED FLOW CONTROL VALVES. PROVIDE A CALIBRATED CONVERSION CALCULATOR TO CONVERT PRESSURE DROP TO FLOW IN GALLONS PER MINUTE. BARTON 247A, MIDWEST 809 OR EQUAL.
 - O. PROVIDE VALVES OF A DESIGN PERMITTING PACKING WHILE OPEN AND UNDER PRESSURE.



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TEMPLATE VERSION: 04.28.2023

REV.	DATE	DESCRIPTION
	07.11.2024	80% CD SET
	07.25.2024	LL REVIEW SET
	08.02.2024	CLIENT REVIEW
	10.31.2024	ISSUE FOR PERMIT
	02.11.2025	IFC SET

**MECHANICAL
SPECIFICATIONS
SHEET #1**

M-002.00
SHEET 2 of 14



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MECHANICAL SPECIFICATIONS SHEET #2

M-003.00
SHEET 3 of 14

- P. PROVIDE 1 INCH DRAIN VALVES WITH THREADED ENDS FOR HOSE CONNECTIONS AT DRAIN POINTS, AT MAIN SHUT-OFF VALVES, LOW POINTS OF PIPING SYSTEMS, BASES OF VERTICAL RISERS, AND AT EQUIPMENT.
- Q. PROVIDE REQUIRED MANUAL OR AUTOMATIC VENT VALVES AT HIGH POINTS OF PIPING SYSTEMS TO FACILITATE VENTING OF AIR AND TO ENSURE QUIET OPERATION. PROVIDE PIPING FROM AIR VENTS TO A DRAIN.
- R. PROVIDE RENEWABLE BRONZE SEAT RINGS AND BRONZE SPINDLES FOR CAST IRON BODY VALVES.
- S. PROVIDE AN ISOLATION VALVE IN THE COMMON SUPPLY LINE AND AN INDIVIDUAL BALANCE VALVE IN THE RETURN LINE FROM EACH HYDRONIC COIL, HEAT EXCHANGER, AND ALL HEAT TRANSFER ELEMENTS.
- T. PROVIDE AN ISOLATION VALVE IN EACH SUPPLY RISER NEAR MAIN AND A BALANCING VALVE IN EACH RETURN RISER NEAR MAINS.
- U. PROVIDE PRESSURE/TEMPERATURE TEST PORT FITTINGS AT EACH SIDE OF GLOBE VALVES.
- V. USE PLASTIC-LINED VALVES WITH WETTED SURFACES MADE OF SAME MATERIAL AS OR COMPATIBLE WITH PIPING AND COMPATIBLE WITH SYSTEM LIQUID.

23.05.29 - HANGERS AND SUPPORTS

- A. ACCEPTABLE MANUFACTURERS:
- PIPE HANGERS: ANVIL, FEE & MASON, ELGEN, TUBE-TURN, F&S, PIPE SHIELDS, B-LINE KINDORF, MICHIGAN HANGER, POWER STRUT, UNISTRUT, OR APPROVED EQUAL. ANVIL FIGURE NUMBERS ARE LISTED BELOW; EQUIVALENT MATERIAL BY SPECIFIED MANUFACTURERS IS ACCEPTABLE.
 - SLEEVES: PIPE SHIELDS, INSUL, RK INDUSTRIES
 - PIPE WRAP TAPE: POLYCEM, NASSUA, 3M
 - FIRESTOP: NELSON, DOW, 3M, HILTI
 - ESCUTCHEON PLATES: BEATON & CORBIN MANUFACTURING
 - MECHANICAL SLEEVE SEAL S: PIPELINE SEAL AND INSULATOR, THUNDERLINE LINKSEAL, CALPCIO PIPE LINK, METRAFLEX METRASEAL
- B. SLEEVES:
- CONSTRUCT SLEEVES FOR PIPES PASSING THROUGH WALLS (OTHER THAN FOUNDATION WALLS), FLOORS, PARTITIONS, HUNG OR FURRED CEILINGS, ETC., OF MINIMUM 18 GAUGE GALVANIZED STEEL, FLANGED ON EACH SIDE OF WALL, PARTITION, HUNG OR FURRED CEILING, ETC.
 - PROVIDE STANDARD WEIGHT GALVANIZED STEEL PIPE SLEEVES WITH WELDED ANCHOR FLANGES AT FOUNDATION WALLS AND REINFORCED CONCRETE OR MASONRY WALLS.
 - PROVIDE 20 GAUGE GALVANIZED SHEET METAL SLEEVES, THE FULL DEPTH OF FLOOR OR WALL, FOR ROUND DUCTWORK PASSING THROUGH MASONRY OR CONCRETE AND/OR STEEL CELLULAR FLOOR CONSTRUCTION. RECTANGULAR DUCTWORK SHALL BE PROVIDED WITH FRAMED OPENINGS THROUGH FLOOR AND WALL CONSTRUCTION.
 - PROVIDE CAST IRON OR FABRICATED "WALL PIPE" EQUIVALENT TO DUCTILE-IRON PRESSURE PIPE, WITH PLAIN ENDS AND INTEGRAL WATERSTOP, UNLESS OTHERWISE INDICATED.
 - STACK SLEEVE FITTINGS: PROVIDE MANUFACTURED, CAST-IRON SLEEVE WITH INTEGRAL CLAMPING FLANGE. INCLUDE CLAMPING RING, BOLTS, AND NUTS FOR MEMBRANE FLASHING AND UNDERDECK CLAMPING RING WITH SETSCREWS.
 - PROVIDE MECHANICAL SLEEVE SEALS AT EXTERIOR WALL AND TANK WALL PENETRATIONS. SEAL SHALL BE OF THE MODULAR SEALING ELEMENT UNIT TYPE, 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.
- C. PENETRATION FIRESTOP:
- FIRE-RATED CONSTRUCTION: MAINTAIN BARRIER AND STRUCTURAL FLOOR FIRE RESISTANCE RATINGS INCLUDING RESISTANCE TO COLD SMOKE AT ALL PENETRATIONS, CONNECTIONS WITH OTHER SURFACES OR TYPES OF CONSTRUCTION, AND SOUND OR VIBRATION ABSORPTION, AND AT OTHER CONSTRUCTION GAPS.
 - SMOKE BARRIER CONSTRUCTION: MAINTAIN BARRIER AND STRUCTURAL FLOOR RESISTANCE TO COLD SMOKE AT ALL PENETRATIONS, CONNECTIONS WITH OTHER SURFACES AND TYPES OF CONSTRUCTION AND AT ALL SEPARATIONS REQUIRED TO PERMIT BUILDING MOVEMENT AND SOUND OR VIBRATION ABSORPTION, AND AT OTHER CONSTRUCTION GAPS.
 - SYSTEMS OR DEVICES LISTED IN THE UL FIRE RESISTANCE DIRECTORY UNDER CATEGORIES XHCR AND XHEZ MAY BE USED, PROVIDING THAT IT CONFORMS TO THE CONSTRUCTION TYPE. PENETRANT TYPE, ANNULAR SPACE REQUIREMENTS AND FIRE RATING INVOLVED IN EACH SEPARATE INSTANCE, AND THAT THE SYSTEM BE SYMMETRICAL FOR WALL APPLICATIONS. SYSTEMS OR DEVICES MUST BE ASBESTOS-FREE. MORTAR SYSTEMS MUST BE WARNOCK HERSEY APPROVED.
 - WITHSTAND THE PASSAGE OF COLD SMOKE EITHER AS AN INHERENT PROPERTY OF THE SYSTEM OR BY THE USE OF A SEPARATE PRODUCT INCLUDED AS A PART OF THE UL SYSTEM OR DEVICE, AND DESIGNED TO PERFORM THIS FUNCTION.
 - ALL FIRESTOPPING PRODUCTS MUST BE FROM A SINGLE MANUFACTURER.
 - THROUGH-PENETRATION SMOKESTOPPING AT SMOKE PARTITIONS: ANY SYSTEM COMPLYING WITH THE REQUIREMENTS FOR THROUGH-PENETRATION FIRESTOPPING IN FIRE-RATED CONSTRUCTION, AS SPECIFIED, IS ACCEPTABLE. PROVIDED THAT THE SYSTEM INCLUDES THE SPECIFIED SMOKE SEAL OR WILL PROVIDE A SMOKE SEAL. THE LENGTH OF TIME OF THE FIRE RESISTANCE MAY BE DISREGARDED IN A NON-FIRE RATED SMOKE BARRIER.
 - SEAL ALL PIPE AND DUCT PENETRATIONS THROUGH FIRE-RATED CONSTRUCTION WITH FACTORY-BUILT DEVICES OR WITH MANUFACTURED FILL, VOID, OR CAVITY MATERIALS "CLASSIFIED" BY UNDERWRITERS LABORATORIES INC. FOR USE AS A THROUGH-PENETRATION FIRESTOP. ALL FIRESTOP DEVICES AND SYSTEMS SHALL BE APPROVED FOR SUCH USE BY THE AUTHORITY HAVING JURISDICTION. THE FIRESAFING SYSTEM USED SHALL MAINTAIN THE FIRE-RESISTANCE RATING OF THE BUILDING COMPONENT THAT IS PENETRATED.
 - ALL MATERIALS SHALL BE NON-HARDENING AND NON-TOXIC. THE FIRESAFING SYSTEM USED SHALL ACCOMMODATE EXPANSION AND CONTRACTION OF THE FLOATING MECHANICAL PIPING SYSTEMS WITHOUT DAMAGING THE FIRESTOP OR REDUCING ITS EFFECTIVENESS AS A SMOKE BARRIER OR WATER SEAL.
- D. HANGERS AND SUPPORTS:
- SUPPORT HORIZONTAL PIPING IN ACCORDANCE WITH THE FOLLOWING SCHEDULE:
- | PIPE SIZE (IN) | MAXIMUM HANGER SPACING (FT) | ROD SIZE (IN) |
|----------------|-----------------------------|---------------|
| 1 AND SMALLER | 6 | 3/8 |
| 1.25 TO 2 | 9 | 3/8 |
| 2.5 TO 3 | 10 | 1/2 |
| 4 TO 5 | 12 | 5/8 |
- DO NOT HANG PIPING FROM OTHER PIPING. SUPPORT OF HANGERS BY MEANS OF VERTICAL EXPANSION BOLTS IS NOT PERMITTED.
 - HANGERS FOR INSULATED PIPING SHALL SUPPORT THE PIPE WITHOUT PIERCING THE INSULATION.
 - USE HANGERS WHICH ARE VERTICALLY ADJUSTABLE 1/2 INCH MINIMUM AFTER PIPING IS ERECTED. INSTALL HANGERS SO THAT 1/2 INCH MINIMUM CLEARANCE IS MAINTAINED BETWEEN FINISHED COVERING OF PIPE AND ADJACENT WORK.

23.05.48 - VIBRATION AND SEISMIC CONTROLS

- A. ACCEPTABLE MANUFACTURERS:
- VIBRATION ISOLATION: MASON INDUSTRIES (MI), VIBRATION MOUNTINGS & CONTROL (VMC), VIBRATION ELIMINATOR (VEC), VIBREX VIBRATION CONTROL SYSTEMS (VVC)
- B. ISOLATE MECHANICAL EQUIPMENT FROM THE BUILDING STRUCTURE BY MEANS OF VIBRATION ISOLATORS AS SPECIFIED OR AS RECOMMENDED BY EQUIPMENT MANUFACTURER. ISOLATOR MODEL NUMBERS REFERRED TO IN THE SPECIFICATION ARE BY MASON INDUSTRIES.
- C. DO NOT MAKE RIGID CONNECTIONS BETWEEN EQUIPMENT AND BUILDING STRUCTURE THAT DEGRADES OR SHORT CIRCUITS THE VIBRATION ISOLATION SYSTEM SPECIFIED HEREIN.
- D. PROVIDE FLEXIBLE CONNECTORS TO ALL OTHER CONNECTIONS TO VIBRATION ISOLATED EQUIPMENT SUCH AS CONDENSATE DRAINS, AND OTHER PIPING AS ALLOWED BY CODES AND/OR LOCAL AUTHORITIES.
- E. LOOP ELECTRICAL CIRCUIT CONNECTIONS TO ISOLATED EQUIPMENT TO ALLOW FREE MOTION. INCLUDE AT LEAST ONE SLACK 90° BEND.
- F. INSTALL ISOLATORS WITH THE ISOLATOR HANGER BOX ATTACHED TO, OR HUNG AS CLOSE AS POSSIBLE TO, THE STRUCTURE. PROVIDE OUTRIGGER SUPPORTS WHERE REQUIRED FOR CLEARANCE TO EQUIPMENT AND TO MAINTAIN MINIMUM CLEARANCE OF EQUIPMENT TO STRUCTURE ABOVE.
- G. SUSPEND ISOLATORS FROM SUBSTANTIAL STRUCTURAL MEMBERS, NOT FROM SLAB UNLESS SPECIFICALLY PERMITTED. ATTACHMENTS TO FIREPROOF STRUCTURAL MEMBERS SHALL BE RE-FIREPROOFED AS REQUIRED.
- H. ALIGN HANGER RODS TO CLEAR THE HANGER BOX. REPLACE BENT RODS.
- I. ISOLATOR AND RESTRAINT SPECIFICATION:

SPRING ELEMENT SEATED ON A STEEL WASHER IN SERIES WITH A DEFLECTED NEOPRENE ELEMENT AS SPECIFIED.

- STEEL RETAINER BOX ENCASED THE SPRING AND NEOPRENE WASHER. ENSURE NO METAL-TO-METAL CONTACT.
 - MINIMUM 1/2 INCH CLEARANCE BETWEEN RETAINER BOX AND SPRING HANGER ROD. PROVIDE NEOPRENE GROMMET.
 - WHERE OPERATING WEIGHT DIFFERS FROM INSTALLED WEIGHT PROVIDE BUILT-IN ADJUSTABLE LIMIT STOPS TO PREVENT EQUIPMENT RISING WHEN WEIGHT IS REMOVED. STOPS SHALL NOT BE IN CONTACT DURING NORMAL OPERATION.
 - MAXIMUM 30 ALLOWABLE ROD MISALIGNMENT FROM CENTERLINE AXIS.
- | TYPE | PC30N | MI |
|---------------|-------|-----|
| TYPE PCSR | | VEC |
| TYPE HXA-PC | | VVC |
| TYPE HRS-A-PR | | VMC |

- J. ISOLATOR SCHEDULE:
- SUSPENDED FANS: 1.0" DEFLECTION, C1 TYPE
 - HEAT PUMPS AND AIR CONDITIONING UNITS: 1.0" DEFLECTION, C1 TYPE

23.05.50 - ACCESS DOORS IN GENERAL CONSTRUCTION

- A. ACCEPTABLE MANUFACTURERS:
- ACCESS DOORS: MILCOR INC., KARP ASSOCIATES, INC., J.L. INDUSTRIES, ACUDOR, WILLIAMS BROTHERS
 - COLOR-CODED IDENTIFICATION BUTTONS: BRADY/SETON, STRANCO
- B. FURNISH ACCESS DOORS OF PROPER SIZE FOR ACCESS TO CONCEALED EQUIPMENT. UNLESS OTHERWISE INDICATED, MINIMUM SIZE TO BE 12 INCHES X 12 INCHES FOR HAND ACCESS; MINIMUM 18 INCHES X 18 INCHES FOR VALVE AND ACTUATOR ACCESS; AND 24 INCH BY 24 INCH FOR EQUIPMENT ACCESS.
- C. PROVIDE ACCESS DOORS FOR MAINTENANCE OR ADJUSTMENT PURPOSES FOR MECHANICAL SYSTEM COMPONENTS, INCLUDING BUT NOT LIMITED TO THE FOLLOWING:
- VALVES
 - DAMPERS
 - CONCEALED EQUIPMENT
 - CONTROLS, SENSORS, AND DEVICES
- D. FURNISH COLOR CODED BUTTONS OR TABS TO INDICATE LOCATION OF VALVES, DAMPERS OR OTHER EQUIPMENT LOCATED ABOVE REMOVABLE TYPE CEILINGS WHERE ACCESS DOORS ARE NOT REQUIRED. PROVIDE COLOR CODED DOTS ON ACCESS DOORS OR CEILING TILES TO INDICATE TYPE OF SERVICE AS FOLLOWS:
- HVAC: BLUE
 - FIRE PROTECTION: RED
 - PLUMBING: SILVER

23.05.53 - SYSTEMS IDENTIFICATION FOR HVAC

- A. IDENTIFY ALL EQUIPMENT WITH IDENTICAL LETTERS AND/OR NUMBERS AS USED ON DRAWINGS. WHERE SPACE IS AVAILABLE USE FULL NAME OF EQUIPMENT. ATTACH NAMEPLATES IN A PERMANENT MANNER IN A LOCATION THAT WILL BE CLEARLY VISIBLE AFTER INSTALLATION IS COMPLETE.
- B. IDENTIFY PIPING SYSTEMS WITH COLOR CODED BANDS, SHARPLY CONTRASTING WITH BACKGROUND. LOCATE BANDS NEAR STRATEGIC POINTS, SUCH AS VALVES, ITEMS OF EQUIPMENT, CHANGES IN DIRECTION, WALL PENETRATIONS, CAPPED STUB OUT FOR FUTURE CONNECTION AND EVERY 40 FEET OF STRAIGHT RUNS. IF NECESSARY, PAINT A STRIP BACKGROUND OF BLACK OR WHITE TO OBTAIN CONTRAST.
- C. MECHANICAL EQUIPMENT SHALL BE IDENTIFIED BY MEANS OF NAMEPLATES PERMANENTLY SCREW FASTENED TO THE EQUIPMENT. NAMEPLATES SHALL BE BLACK SURFACE, WHITE CORE LAMINATED BAKELITE WITH ENGRAVED LETTERS. PLATES SHALL BE A MINIMUM OF 3 INCH LONG BY 1 INCH WIDE WITH WHITE LETTERS 3/8 INCH HIGH.
- D. TERMINAL EQUIPMENT INSTALLED IN CEILING SPACES SUCH AS VARIABLE VOLUME TERMINALS, FAN COIL UNITS, HEAT PUMPS, ETC., SHALL HAVE IDENTIFYING NUMBER STENOILED ON BOTTOM OF UNIT SO THAT IT IS VISIBLE FROM BELOW.
- E. FOR VALVES, SMOKE AND COMBINATION FIRE/SMOKE DAMPERS AND AUTOMATIC CONTROL DAMPERS, USE METAL TAGS 2 INCH MINIMUM DIAMETER, FABRICATED OF 19 GAUGE POLISHED BRASS, STAINLESS STEEL OR ALUMINUM.
- ATTACH TAGS WITH JACK CHAIN "S"-HOOK OR SPLIT RING OF SAME MATERIALS.
 - PROVIDE ENGRAVED/STAMPED TAGS WITH BLACK INK-FILLED 1/4 INCH HIGH LETTERS AND 1/4 INCH HIGH NUMBERS.
 - PROVIDE MINIMUM 5/32 INCH HOLE FOR FASTENER.

23.05.93 - TESTING, ADJUSTING, AND BALANCING

- A. GENERAL PROCEDURE:
- BALANCE TO MAXIMUM MEASURED FLOW DEVIATION FROM SPECIFIED VALUES OF 10% AT TERMINAL DEVICE AND 5% AT EQUIPMENT OR MEAN SOUND LEVEL DEVIATION OF 15 DECIBELS.
 - PERMANENTLY MARK SETTINGS ON VALVES, SPLITTERS, DAMPERS AND OTHER ADJUSTMENT DEVICES.
 - TEST AND BALANCING CONTRACTOR SHALL BE AABC CERTIFIED.
 - TEST AND BALANCE AGENCY SHALL INCLUDE AN EXTENDED WARRANTY OF 90 DAYS. AFTER COMPLETION EACH PHASE OF THE TEST AND BALANCE WORK, DURING WHICH TIME THE ENGINEER MAY REQUEST READJUSTMENT OF THE SYSTEM TO COMPLY WITH COMFORT, SOUND CONDITIONS OR RELATIVE SPACE PRESSURE REQUIREMENTS

- TESTING AND BALANCING AGENCY, AS PART OF ITS CONTRACT, SHALL ACT AS AUTHORIZED INSPECTION AGENCY RESPONSIBLE TO CONSULTING ENGINEER AND OWNER, AND SHALL DURING THE TEST AND BALANCE LIST ALL ITEMS THAT ARE INSTALLED INCORRECTLY, REQUIRE CORRECTION, OR HAVE NOT BEEN INSTALLED IN ACCORDANCE WITH CONTRACT DRAWINGS AND/OR SPECIFICATIONS, PERTAINING TO THE AIR DISTRIBUTION, COOLING AND HEATING SYSTEMS.
- TEST AND BALANCING CONTRACTOR SHALL WORK WITH BUILDING CONTROLS CONTRACTOR AS NEEDED TO OBTAIN TEST DATA AND BALANCE THE SYSTEM.
- ACCEPTANCE:
 - MECHANICAL SYSTEMS SHALL NOT BE CONSIDERED READY FOR FINAL INSPECTION UNTIL BALANCING RESULTS ACCEPTABLE TO THE ARCHITECT ARE OBTAINED.
 - IF IT IS FOUND THAT THE SPECIFIED AIR FLOWS CANNOT BE ACHIEVED ON PORTIONS OF THE SYSTEM, THE ACTUAL CONDITIONS SHALL BE REPORTED TO THE ARCHITECT FOR CONSIDERATION OF CORRECTIVE ACTION BEFORE CONTINUING THE BALANCE PROCEDURE.
 - IF MEASURED FLOW AT FINAL INSPECTION SHOWS DEVIATION OF 10 PERCENT OR MORE OR MEAN SOUND-LEVEL DEVIATION OF 10 DECIBELS OR MORE FROM THE CERTIFIED REPORT LISTINGS FOR MORE THAN 10 PERCENT OF SELECTED AREAS, THE REPORT SHALL BE REJECTED.
 - IF REPORT IS REJECTED, SYSTEMS SHALL BE REBALANCED AND A NEW CERTIFIED REPORT SUBMITTED.

B. BALANCING REPORT AND DRAWINGS:

- SUBMIT A DRAFT COPY OF REPORTS PRIOR TO FINAL ACCEPTANCE OF PROJECT. PROVIDE 4 COPIES OF FINAL REPORT FOR INCLUSION IN OPERATING AND MAINTENANCE MANUALS.
- SUBMIT WITH REPORT: FAN AND PUMP CURVES WITH OPERATING CONDITIONS PLOTTED. SUBMIT GRILLE AND DIFFUSER SHOP DRAWINGS AND DIFFUSION FACTORS.

C. AIR SYSTEM PROCEDURE:

- EXECUTE AIR SYSTEMS BALANCING FOR EACH AIR SYSTEM IN ACCORDANCE WITH AABC SPECIFICATIONS AND AS DESCRIBED HEREIN.
- MAKE TESTS WITH SUPPLY, RETURN AND EXHAUST SYSTEMS OPERATING AND DOORS, WINDOWS, CLOSED, OR IN THEIR NORMAL OPERATION CONDITION.
- TEST AND ADJUST FAN SPEED TO DESIGN REQUIREMENTS.
- TEST AND RECORD MOTOR FULL LOAD AMPS. RECORD EACH INSTALLED MOTOR MANUFACTURER.
- TRANSVERSE MAIN SUPPLY AIR DUCTS, USING A PITOT TUBE AND MANOMETER. CALIBRATE THE MANOMETER TO READ TWO SIGNIFICANT FIGURES IN VELOCITY PRESSURE RANGES. TAKE A MINIMUM 16 READINGS PER TRAVERSE. THE INTENT OF THIS OPERATION IS TO MEASURE BY TRAVERSE THE TOTAL AIR QUALITY SUPPLIED BY THE FAN AND TO VERIFY THE DISTRIBUTION OF AIR TO THE FLOOR AND/OR ZONES. A MAIN DUCT IS DEFINED AS ANY OF THE FOLLOWING:
 - TYPICAL FLOOR DUCT LOOP.
 - A DUCT SERVING FOUR (4) OR MORE OUTLETS.
 - A DUCT SERVING A HYDRONIC OR ELECTRIC COIL.
 - A DUCT EMANATING FROM A FAN DISCHARGE OR PLENUM AND TERMINATING AT ONE OR MORE OUTLETS.
 - MEASURE AND RECORD RA OPENING SIZE AT THE MAIN RA PLENUMS. USING TRAPEZE MEASURE THE TOTAL VOLUME OF RA FROM THAT FLOOR. INSPECT OPERATION OF RETURN AIR DAMPER (RAD) AND ACTUATOR.
- SUBMIT DATA IN SUPPORT OF FAN CAPACITY DELIVERIES BY THE FOLLOWING FOUR METHODS. FOR RETURN, RELIEF AND EXHAUST FANS, METHODS 1 AND 4 ARE SUFFICIENT:
 - BY SUMMATION OF THE AIR QUANTITY READINGS AT INLETS OR OUTLETS.
 - BY DUCT TRAVERSES OF MAIN SUPPLY DUCTS.
 - BY ROTATING VANE TRAVERSE ACROSS THE FILTER OR COIL BANK.
 - BY PLOTTING REVOLUTIONS PER MINUTE AND STATO PRESSURE READINGS ON THE FAN CURVE. AIR DENSITY CORRECTIONS MUST BE INDICATED.
- TEST AND RECORD REQUIRED AND MEASURED SYSTEM STATIC PRESSURES; FILTER DIFFERENTIAL, COIL DIFFERENTIAL AND FAN TOTAL STATIC PRESSURE.
- ADJUST MAIN SUPPLY AND RETURN DUCTS TO PROPER DESIGN FLOW RATES.
- INSPECT AND CONFIRM ALL FAN DAMPERS ARE OPEN, ALL SMOKE DAMPERS AND FIRE/SMOKE DAMPERS ARE IN THEIR CORRECT POSITION, ALL DUCT ACCESS DOORS ARE CLOSED AND FIRE DAMPER FUSIBLE LINKS ARE ACCESSIBLE.
- ADJUST ZONES TO PROPER DESIGN, SUPPLY AND RETURN FLOW RATES.
- TEST AND ADJUST EACH AIR INLET AND AIR OUTLET AND TRANSFER DUCT TO WITHIN 10% OF DESIGN REQUIREMENTS.
- IDENTIFY EACH AIR INLET, AIR OUTLET, TRANSFER DUCT AND TRANSFER WALL OPENING AS TO LOCATION AND AREA ON AS-BUILT DRAWING.
- IDENTIFY AND LIST SIZE, TYPE AND MANUFACTURER OF DIFFUSERS, GRILLES, REGISTERS AND TESTING EQUIPMENT. USE MANUFACTURER'S RATING ON EQUIPMENT TO MAKE REQUIRED CALCULATIONS.
- IN READINGS AND TESTS OF DIFFUSERS, GRILLES AND REGISTERS, REPORT THE REQUIRED FACE AND NECK VELOCITY, TEST FACE AND NECK VELOCITY, AND REQUIRED AIR PRESSURE DROP AND FLOW RATE. TEST AFTER ADJUSTMENTS.
- ADJUST DIFFUSERS, GRILLES, AND REGISTERS TO MINIMIZE DRAFTS, DUMPING, AND TO PREVENT "SHORT CIRCUITING" BETWEEN SUPPLY AND RETURN OUTLETS.
- USE VOLUME CONTROL DEVICES TO REGULATE AIR QUANTITIES ONLY TO EXTENT THAT ADJUSTMENTS DO NOT CREATE OBJECTIONABLE AIR MOTION OR SOUND LEVELS. EFFECT VOLUME CONTROL BY DUCT INTERNAL DEVICES SUCH AS DAMPERS AND SPLITTERS.
- RECORD INSTALLED FAN DRIVE ASSEMBLIES, FAN SHEAVES, MOTOR SHEAVES, BELTS, AND MOTORS.
- CHECK ZONE TEMPERATURE SET POINTS. ENSURE ZONE SENSOR IS OPERATING PROPERLY AND RESPONDS TO CHANGING ROOM TEMPERATURES.

D. HYDRONIC SYSTEMS PROCEDURE:

- PREPARATION OF SYSTEM - PHASE I: THE HYDRONIC SYSTEM SHALL BE PREPARED FOR BALANCING IN THE FOLLOWING MANNER:
 - OPEN VALVES TO FULL POSITION INCLUDING COIL STOP VALVES; CLOSE BYPASS VALVES; AND RETURN LINE BALANCING COCKS.
 - CHECK AIR VENTS AT HIGH POINTS OF WATER SYSTEMS TO ENSURE THAT THEY ARE INSTALLED PROPERLY AND ARE OPERATING FREELY. MAKE CERTAIN AIR IS REMOVED FROM CIRCULATING SYSTEM.
 - SET TEMPERATURE CONTROLS TO CLOSE ALL AUTOMATIC BYPASS VALVES AND PROVIDE FULL FLOW THROUGH HYDRONIC COILS OR HEAT EXCHANGERS.
 - CHECK OPERATION OF AUTOMATIC BYPASS VALVES, 2-WAY, OR 3-WAY VALVES.
 - EXECUTE AIR BALANCE BEFORE WATER BALANCE IS INITIATED.
- TEST AND BALANCE PROCEDURE - PHASE II:
 - CHECK AND RECORD OF WATER TEMPERATURE AT INLET SIDE OF COILS. NOTE RISE OR DROP OF TEMPERATURES FROM SOURCE.
 - POSITION MARK AUTOMATIC VALVES, HAND VALVES AND BALANCING COCKS FOR DESIGN FLOW THROUGH COILS, AC UNITS, CONVECTORS AND ALL OTHER ITEMS IN SYSTEM REQUIRING CIRCULATION OF CHILLED WATER AND HOT WATER.
 - UPON COMPLETION OF FLOW READINGS AND COIL ADJUSTMENTS, MARK SETTINGS AND RECORD DATA.
 - ENSURE BYPASS VALVES ARE TIGHTLY CLOSED.

D. BALANCING DATA:

- AIR HANDLING EQUIPMENT INSTALLATION DATA:
 - MANUFACTURER, MODEL AND SIZE
 - ARRANGEMENT, DISCHARGE AND CLASS
 - MOTOR TYPE, HORSEPOWER, SPEED, VOLTAGE, PHASE, CYCLES AND FULL LOAD AMPERES
 - LOCATION AND FINAL IDENTIFICATION
- AIR HANDLING EQUIPMENT DESIGN DATA:
 - TOTAL AIR FLOW RATE
 - STATIC PRESSURE
 - MOTOR HORSEPOWER, SPEED, VOLTAGE AND AMPERES
 - FAN SPEED AND BRAKE HORSEPOWER
 - HYDRONIC COIL INLET AND OUTLET DRY BULB TEMPERATURES
 - HYDRONIC COIL INLET AND OUTLET FLOW RATES
 - INITIAL FILTER AIR PRESSURE DROP
- AIR HANDLING EQUIPMENT RECORD DATA:
 - TOTAL AIR FLOW RATE
 - STATIC PRESSURE
 - FAN SPEED AND BRAKE HORSEPOWER
 - MOTOR OPERATING AMPERES
 - INLET AND OUTLET, DRY BULB TEMPERATURES
 - FILTER AIR PRESSURE DROP
- DUCT AIR QUANTITIES: MAINS, BRANCHES, OUTSIDE AIR, AND EXHAUSTS (MAXIMUM AND MINIMUM):
 - DUCT SIZES
 - NUMBER OF PRESSURE READINGS
 - SUM OF VELOCITY MEASUREMENTS
 - AVERAGE VELOCITY
 - DUCT RECORDED AIR FLOW RATE
 - DUCT DESIGN AIR FLOW RATES
- AIR INLETS AND OUTLETS:
 - INLET/OUTLET IDENTIFICATION LOCATION AND DESIGNATION
 - MANUFACTURER'S CATALOGUE IDENTIFICATION AND TYPE
 - APPLICATION FACTORS
 - DESIGN AND RECORDED VELOCITIES
 - DESIGN AND RECORDED AIR FLOW RATES
 - DEFLECTOR VANE OR DIFFUSER CONE SETTINGS

23.07.00 - THERMAL INSULATION FOR HVAC

- E. ACCEPTABLE MANUFACTURERS:
- FIBERGLASS: JOHNS MANVILLE; KNAUF; OWENS CORNING
 - ELASTOMERIC: ARMACELL; AEROFLEX
 - MASTICS, ADHESIVES AND SEALERS: DUCTMATE; FOSTER; IC; CHILDERS
 - JACKETS:
 - METAL: CHILDERS; RPR PRODUCTS
 - PVC: CEEL-CO; PIC PLASTICS
 - OTHER: VENTURE TAPE; POLYGUARD; FOSTER VAPOR FAS 62-05
 - PRE-MOLDED FITTINGS, VALVES, STRAINERS AND EQUIPMENT INSULATION: INSUL-THERM INTERNATIONAL; EXTOL OF OHIO, INC.; OR APPROVED EQUAL
 - FIRE BARRIER DUCT WRAP: 3M DUCT WRAP 615+; UNIFRAX FIBREWRAP®; OR APPROVED EQUAL
- F. PIPE INSULATION:
- MATERIALS:
 - GLASS FIBER: ASTM C547; RIGID-MOLDED, NONCOMBUSTIBLE.
 - "K" VALUE: 0.23 AT 75°F.
 - MAXIMUM SERVICE TEMPERATURE: 850°F.
 - VAPOR RETARDER JACKET: WHITE KRAFT PAPER, VINYL COATED, EMBOSSED AND REINFORCED WITH GLASS FIBER YARN AND BONDED TO ALUMINUM FOIL, SECURE WITH SELF-SEALING LONGITUDINAL LAPS AND BUTT STRIPS.
 - ELASTOMERIC FOAM: ASTM C534; FLEXIBLE, CELLULAR ELASTOMERIC, MOLDED OR SHEET.
 - "K" VALUE: 0.27 AT 75°F.
 - MAXIMUM SERVICE TEMPERATURE OF 220°F.
 - FIELD-APPLIED JACKETS:
 - ALUMINUM JACKET (AL): 0.016 INCH THICK SHEET, STIPPLED FINISH, WITH LONGITUDINAL SLIP JOINTS AND 2 INCH LAPS, DIE-SHAPED FITTING COVERS WITH FACTORY-ATTACHED PROTECTIVE LINER.
 - VAPOR BARRIER JACKET (VBJ): FIVE PLY, NON-BITUMINOUS, EMBOSSED, ALUMINUM FOIL/POLYMER LAMINATED FILM WITH PERFORMANCE RATING OF 0.0 AS TESTED IN ACCORDANCE WITH ASTM F1249. VENTURE CLAD PLUS (1579CW) BY VENTURE TAPE, POLYGUARD ZERO-PERM (INDOORS ONLY), FOSTER VAPOR FAS 62-05 OR APPROVED EQUAL.
 - ALL SERVICE JACKET (ASJ): DOUBLE ADHESIVE CLOSURE WITH LONGITUDINAL SEAM. OWENS-CORNING SSL II-ASJ OR APPROVED EQUAL.

- G. PIPE INSULATION SCHEDULE:
- CONDENSER WATER AND CONDENSATE DRAIN PIPING:
 - MATERIAL: GLASS FIBER
 - THICKNESS: 1" INSULATION

H. FITTINGS, VALVES AND FLANGES:

- USE FACTORY PRE-MOLDED FITTINGS OF THE SAME MATERIALS AND THICKNESS AS THE ADJACENT PIPE INSULATION. SUCH FITTINGS SHALL BE APPLIED TO ALL 90°S, 45°S, TEES, FLANGES, AND VALVES.
- WHERE PRE-MOLDED INSULATION FITTINGS ARE NOT MANUFACTURED, INSULATE FITTINGS, FLANGES, STRAINERS AND VALVES WITH INTERED SEGMENTS OF THE SAME DENSITY AS THE ADJOINING PIPE COVERING. VAPORSEAL FOR COLD (BELOW DEW POINT) APPLICATIONS USING VAPOR BARRIER MASTIC WITH OPEN WEAVE GLASS OR POLYESTER MESH LAY IN WHILE

WET. PROVIDE A FINAL COAT OF VAPOR BARRIER MASTIC. OVERLAP GLASS MESH AND OUTER COAT ADJACENT COVERING BY A MINIMUM OF 2 INCHES. VAPOR BARRIER MASTIC SHALL BE IC 501, CHILDERS CP-34 OR FOSTER 30-65. PERMEANCE OF MASTIC SHALL BE 0.03 PERMS OR LESS AT 45 MILS AS TESTED BY ASTM E96. REINFORCING MESH SHALL BE FOSTER MAST A FAB, CHILDERS CHL GLAS #10 OR APPROVED EQUAL.

3. PROVIDE INSULATION FOR THE REMOVABLE COVERS AND FLANGES OF PIPE STRAINERS ON COLD SERVICES WITH BUILT-UP SECTIONS OF GLASS FIBER PIPE COVERING, ARRANGED TO FACILITATE SERVICING OF THE STRAINER. COMPLETE APPLICATIONS WITH VAPORSEALS AS SPECIFIED ABOVE. VAPOR BARRIERS SHALL BE SEALED AND CONTINUOUS THROUGH GUIDES, HANGERS, WALLS, SLEEVES, ETC. ADHESIVES AND COATINGS SHALL BE AS NOTED HEREIN.

I. JACKETING SCHEDULE:

SERVICE LOCATION JACKET TYPE

CONDENSER WATER PIPING: ASJ OR PAINTED FINISH

CONDENSATE: ASJ OR PAINTED FINISH

J. DUCTWORK INSULATION:

1. MATERIALS:

d. FLEXIBLE GLASS FIBER: ASTM C553, FLEXIBLE BLANKET. (1) 'K' VALUE: 0.27 AT 75°F INSTALLED. (2) DENSITY: 0.75 POUNDS PER CUBIC FOOT.

(3) VAPOR BARRIER JACKET: ALUMINUM FOIL REINFORCED WITH FIBER GLASS YARN AND LAMINATED TO FIRE-RESISTANT KRAFT, SECURED WITH UL LISTED PRESSURE SENSITIVE TAPE AND OUTWARD CLINCHED EXPANDED STAPLES AND VAPOR BARRIER MASTIC AS NEEDED. MAXIMUM VAPOR BARRIER PERM RATING SHALL NOT EXCEED 0.02 PERM.

e. RIGID GLASS FIBER: ASTM C612; RIGID BOARD.

(1) 'K' VALUE: 0.23 AT 75°F. (2) DENSITY: 6.0 POUNDS PER CUBIC FOOT. (3) VAPOR BARRIER JACKET: ALUMINUM FOIL REINFORCED WITH FIBER GLASS YARN AND LAMINATED TO FIRE-RESISTANT KRAFT, SECURED WITH UL LISTED PRESSURE SENSITIVE TAPE AND OUTWARD CLINCHED STAPLES AND VAPOR BARRIER MASTIC AS NEEDED.

K. DUCTWORK INSULATION SCHEDULE: (1) EXHAUST DUCTS WITHIN 10 FEET OF EXTERIOR OPENINGS: FLEXIBLE GLASS FIBER, 1.5" INSULATION (2) SUPPLY DUCTS IN CONDITIONED SPACES (COOLING AND HEATING SYSTEMS): FLEXIBLE GLASS FIBER, 1 1/2" INSULATION (MINIMUM R VALUE OF 4.2)

(3) SUPPLY AND RETURN DUCTS IN UNCONDITIONED SPACES: RIGID GLASS FIBER, 2" INSULATION (MINIMUM R VALUE OF 8.0) (4) OUTSIDE AIR INTAKE AND EXHAUST AIR FLENUMS: RIGID GLASS FIBER, 2" INSULATION (MINIMUM R VALUE OF 8.0)

L. WHEREVER EXTERNAL DUCT INSULATION IS SPECIFIED AND INTERNAL ACOUSTIC TREATMENT OF EQUIVALENT INSULATING EFFECT IS ALSO REQUIRED (BY DRAWINGS OR SPECIFICATIONS) FOR THE SAME LOCATION, THE EXTERNAL INSULATION MAY BE OMITTED.

23.09.93 - TEMPERATURE CONTROLS

A. SUPPLY AND INSTALL NECESSARY SOFTWARE, PROGRAMMING, SENSING, CONTROLLING AND CONTROLLED DEVICES, PIPING, WIRING AND COMMISSIONING OF AUTOMATIC CONTROL SYSTEMS, SO AS TO PROVIDE A COMPLETE CONTROL SYSTEM, MEET REQUIREMENTS OF CONTROL SEQUENCES SPECIFIED.

B. GENERAL:

1. ALL HVAC SYSTEM CONTROLS SHALL BE DDC CONTROLS AND PROVIDED FROM THE BUILDING'S BMS CONTROL CONTRACTOR AS APPLICABLE.

2. SAFETY DEVICES SHALL BE HARDWARE INTERLOCKED WITH 'HAND' AND 'AUTOMATIC' POSITIONS IN SERIES WITH MOTOR CONTROLLER HOLDING CIRCUIT.

3. SMOKE CONTROL, FIRE AND LIFE SAFETY SEQUENCES SHALL OVERRIDE OTHER AUTOMATIC CONTROL SEQUENCES INCLUDING HARDWIRED SAFETY DEVICES.

4. RESET SCHEDULES AND SETPOINTS SHOWN IN SEQUENCES ARE FOR INITIAL PROGRAMMING AND START UP, DURING SYSTEM COMMISSIONING THE RESET SCHEDULES AND SETPOINTS SHALL BE FINE-TUNED TO OBTAIN DESIRED COMFORT, ENERGY AND LIFE SAFETY SYSTEM RESULTS.

5. THE OUTPUT OF THE RESET SCHEDULES SHOULD BE LIMITED BETWEEN MAXIMUM AND MINIMUM VALUES. THE INTENT OF THE RESET SCHEDULES INDICATED IS THAT THE RANGE OF THE OUTPUT BE LIMITED BETWEEN THE MINIMUM AND MAXIMUM VALUES INDICATED IN THE RESET SCHEDULES.

6. ALL FUNCTIONS WHICH USE ANALOG POINTS TO SWITCH EQUIPMENT ON AND OFF (E.G., FANS, PUMPS) MUST BE PROGRAMMED WITH DEAD BANDS, AND IF NECESSARY, TIME DELAYS TO PREVENT SHORT CYCLING OF EQUIPMENT.

7. THERMOSTATS SHALL BE PROVIDED WITH REMOTE MONITORING CAPABILITIES, AS APPLICABLE.

8. SPACE TEMPERATURE SENSORS SHALL BE PROVIDED FOR REMOTE THERMOSTAT MOUNTING.

9. ALL THERMOSTATS ARE TO BE PERMANENTLY LABELED WITH THE NAMEPLATE INFORMATION OF THE ASSOCIATED MECHANICAL EQUIPMENT AND IN A LOCATION THAT WILL BE CLEARLY VISIBLE AFTER INSTALLATION IS COMPLETE.

C. WATER SOURCE HEAT PUMPS:

1. THE OUTSIDE AIR DAMPER SHALL BE INTERLOCKED TO THE UNIT OPERATION AND OPEN DURING OCCUPIED OPERATION.

2. THE FAN SHALL RUN CONTINUOUSLY DURING OCCUPIED HOURS.

3. THE MANUFACTURER PROVIDED HEATING CYCLE OR THE COOLING CYCLE SHALL OPERATE TO MAINTAIN SETPOINT OF THE SPACE THERMOSTAT.

4. DURING ECONOMIZER CONDITIONS, THE MANUFACTURER PROVIDED WATERSIDE ECONOMIZER SHALL OPERATE AS THE INITIAL STAGE OF COOLING. UPON AN INCREASE DEMAND FOR COOLING BEYOND THE ECONOMIZER CAPABILITIES, THE DX COOLING CYCLE SHALL BE STAGED ON.

5. UPON THE ACTIVATION OF THE ASSOCIATED DUCT MOUNTED SMOKE DETECTOR, THE UNIT SHALL IMMEDIATELY SHUT DOWN AND THE FIRE ALARM SYSTEM SHALL BE NOTIFIED.

D. GENERAL AND TOILET EXHAUST FANS:

1. START STOP CONTROL: c. FANS SHALL BE INTERLOCKED TO THE AC UNIT THERMOSTAT PROGRAMMABLE SCHEDULE.

2. OCCUPIED OPERATION:

a. THE FAN SHALL BE ON AND THE EXHAUST AIR DAMPER SHALL BE OPEN.

3. UNOCCUPIED:

a. THE FAN SHALL BE OFF, THE EXHAUST AIR DAMPER SHALL BE CLOSED.

4. WARM UP/COOL DOWN:

a. DURING THE WARM UP PERIOD, THE FAN SHALL BE OFF AND THE EXHAUST AIR DAMPER SHALL BE CLOSED. DURING COOL DOWN PERIOD, THE FAN SHALL BE ON AND THE EXHAUST DAMPER AIR SHALL BE OPEN.

E. IT ROOM EXHAUST FANS:

1. START STOP CONTROL: a. FANS SHALL BE INTERLOCKED TO A WALL MOUNTED THERMOSTAT. b. UPON A RISE ABOVE THE SPACE TEMPERATURE SETPOINT (80F ADJ.) THE FAN SHALL RUN AT A PREDETERMINED SPEED.

23.21.13 - HYDRONIC PIPING

A. ACCEPTABLE MANUFACTURERS:

1. STRAINERS:

a. Y-TYPE: MUELLER HAMMOND, MUJESSCO, SPIRAX-SARCO, BAILEY DIV. OF CMB INDUSTRIES, ZURN INDUSTRIES, VICTAULIC COMPANY (ALL GROOVED END STRAINERS)

b. HANDWHEEL OPERATED TYPE: HELLAN FLUID STRAINER, EATON, YALE-TOWNE

1. WELDING FITTINGS: HACKNEY, BONNEY FORGE FOUNDRY, (WELD-O-LETS), WELDBEND

2. FLANGE GASKETS: JOHN CRANE, GARLOCK, MANVILLE, GOODRICH

3. PRE-INSULATED PIPE AND FITTINGS: RICWIL, ROVANCO

4. LEAK DETECTION SYSTEM: TRACETEK TTC-ENC-9TTT1000, OR APPROVED EQUAL

5. DIELECTRIC FITTINGS:

c. UNIONS: WATTS, PERFECTION, CENTRAL PLASTICS, EPCO, ZURN, HART

d. COUPLINGS: CALPICO, LOCHINVAR

e. NIPPLES: PERFECTION, SIOUX CHIEF, VICTAULIC COMPANY

2. LEAK DETECTION SYSTEM: TRACETEK TTC-ENC-9TTT1000, OR APPROVED EQUAL

B. PIPE SERVICES SCHEDULE:

1. ALL PIPING MATERIALS SHALL BE VERIFIED WITH BASE BUILDING STANDARDS AND EXISTING CONDITIONS PRIOR TO FOLLOWING THE BELOW SERVICE SCHEDULE:

a. EQUIPMENT DRAINS AND OVERFLOWS, CONDENSATE DRAINS: STEEL GALVANIZED SCHEDULE 40; COPPER TYPE L HARD

b. CONDENSER WATER: STEEL TYPE BLACK, SCHEDULE 40, 300 CLASS

SCHEDULE OF PIPING FITTINGS FOR HVAC SYSTEMS:

a. CONDENSATE DRAINS: WROUGHT COPPER, SOLDER

b. CONDENSER WATER: WROUGHT COPPER, SILVER SOLDER, COPPER-PHOSPHOROUS ALLOY STANDARD, 350 CLASS

A. STRAINERS

1. PROVIDE SCREWED ENDS UP TO 2-INCH SIZE

2. BODY:

a. OVER 150 POUNDS PER SQUARE INCH: Y-TYPE, DUCTILE OR CAST IRON OR CAST STEEL BODY; STAINLESS STEEL SCREENS; BOLTED, COUPLED OR THREADED SCREEN RETAINER TAPPED FOR A BLOW-OFF VALVE; THREADED OR SOCKET WELD BODY IN SIZES THROUGH 2-INCH AND RATED AT NOT LESS THAN 300 PSI WOG AT 150 DEGREES F; FLANGED, GROOVED END OR BUTT WELD BODY IN SIZES OVER 2-INCH AND RATED AT NOT LESS THAN 300 PSI WOG AT 150 DEGREES F.

3. STRAINER SCREEN SHALL BE TYPE 316 OR 304 STAINLESS STEEL OR MONEL, REINFORCED, WITH FREE AREA NOT LESS THAN 2.5 TIMES INLET AREA.

a. PERFORATIONS:

(1) WATER: (a) UP TO 2-INCH: 1/32 INCHES

4. Y-TYPE:

a. SOLDERED: BRONZE, STRAIGHT THREAD GASKETED CAP, MUELLER 3521/2MM, HAMMOND 3040, OR APPROVED EQUAL

b. SCREWED: (1) STEEL-FACED CAP, STRAIGHT THREAD AND GASKET, MUJESSCO NO. 11M OR APPROVED EQUAL

(2) BRONZE: STRAIGHT THREAD AND GASKETED CAP, MUELLER 351M OR 352M, HAMMOND 3010 OR 3020, OR APPROVED EQUAL

c. FLANGED: BOLTED COVER, MUJESSCO NO. 751 OR NO. 752 OR APPROVED EQUAL

d. GROOVED: COUPLED OVER, VICTAULIC SERIES 732

B. UNIONS

1. STEEL PIPING 2 INCHES AND SMALLER: ASME B16.3 MALLEABLE IRON UNIONS WITH BRASS SEATS, USE UNIONS OF A PRESSURE CLASS EQUAL TO OR HIGHER THAN THAT SPECIFIED FOR THE FITTINGS OF THE RESPECTIVE PIPING SERVICE BUT NOT LESS THAN 250 POUNDS SQUARE INCH, GROUND JOINT.

2. COPPER PIPING: NIBCO NO. 633.

C. DIELECTRIC FITTINGS

1. UNIONS: a. 1.25 INCHES AND SMALLER: EPCO MODEL FX OR APPROVED EQUAL:

(1) 250 POUNDS PER SQUARE INCH WOG (2) PROVIDE STANDARD GASKETS FOR PLUMBING, HIGH TEMPERATURE GASKETS FOR HEATING

(3) FEMALE PIPE THREAD BY SOLDER END CONNECTIONS, NON-ASBESTOS GASKETS, HAVING A MINIMUM PRESSURE RATING OF 250 PSIG AT NOT LESS THAN THE DESIGN OPERATING TEMPERATURE OF THE FLUID BEING CONVEYED

(4) CLEARFLOW DIELECTRIC WATERWAYS

b. 1.5 INCHES AND LARGER: EPCO MODEL X OR APPROVED EQUAL:

(1) BRASS HALF-JUNCTION, ASME B16.1, 175 POUNDS PER SQUARE INCH WOG (2) CLEARFLOW DIELECTRIC WATERWAYS

(3) STEEL WELD NECK BY COPPER SOLDER JOINT END CONNECTIONS, NON-ASBESTOS GASKETS, HAVING A MINIMUM PRESSURE RATING OF 125 PSIG AT NOT LESS THAN THE DESIGN OPERATING TEMPERATURE OF THE FLUID BEING CONVEYED

2. INSULATING FLANGES:

a. DIELECTRIC-FLANGE KITS: PROVIDE 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.

b. PROVIDE SEPARATE COMPANION FLANGES AND STEEL BOLTS AND NUTS, 300 PSIG MINIMUM WORKING PRESSURE WHERE REQUIRED TO SUIT SYSTEM PRESSURES.

c. 2 INCHES AND SMALLER: WALTER VALLETT COMPANY, Y LINE OR APPROVED EQUAL.

3. COUPLINGS: PROVIDE GALVANIZED-STEEL COUPLING WITH INERT AND NON-CORROSIVE, THERMOPLASTIC LINING, THREADED ENDS AND 300-PSIG MINIMUM WORKING PRESSURE AT 225 DEGREES F.

4. NIPPLES: PROVIDE ELECTROPLATED STEEL NIPPLE OR DUCTILE IRON CASING WITH INERT AND NON-CORROSIVE, THERMOPLASTIC LINING, PLAIN, THREADED, OR GROOVED ENDS; AND 300-PSIG MINIMUM WORKING PRESSURE AT 225 DEGREES F. VICTAULIC STYLE 647.

F. LEAK DETECTION SYSTEMS:

1. PROVIDE A COMPLETE ELECTRONIC CABLE SYSTEM THAT DETECTS THE PRESENCE OF WATER AT ALL POINTS ALONG THE CABLES. THE SENSING CABLE SHALL BE CONSTRUCTED SUCH THAT NO METALLIC PARTS ARE EXPOSED TO THE ENVIRONMENT. THE INSTALLATION KIT SHALL INCLUDE ALL SYSTEM COMPONENTS REQUIRED FOR A TYPICAL INSTALLATION.

1. CABLE DRIVER MODULES SHALL BE POWERED BY 12- TO 24-VOLTS AC OR 15- TO 24-VOLTS DC. THE MODULE SHALL HAVE TWO DOUBLE-POLE/DOUBLE-THROW RELAYS WITH 3 AMP RATING FOR LEAK DETECTION AND ONE SINGLE-POLE/SINGLE-THROW RELAY WITH 3 AMP RATING FOR LOSS OF POWER OR A BREAK IN THE SENSOR CABLE.

2. CABLE DRIVER MODULES SHALL BE SUPPLIED INSTALLED IN A HOFFMAN (OR EQUAL), NEMA 1 ENCLOSURE. THE ENCLOSURE SHALL BE SUPPLIED WITH ONE SENSOR CABLE DRIVER MODULE.

G. PIPING INSTALLATION:

1. MAKE PIPING CONNECTIONS TO COILS, HUMIDIFIER DISTRIBUTION MANIFOLDS AND EQUIPMENT WITH OFFSETS PROVIDED WITH SCREWED OR FLANGED UNIONS SO ARRANGED THAT THE EQUIPMENT CAN BE SERVICED OR REMOVED WITHOUT DISMANTLING THE PIPING. DO NOT SCREW UNIONS DIRECTLY TO COIL HEADER OR HUMIDIFIER PIPING CONNECTIONS.

2. INSTALL PIPING CONCEALED ABOVE AS HIGH AS POSSIBLE ABOVE CEILING OR IN WALLS UNLESS OTHERWISE INDICATED.

3. ALL WATER PIPING SHALL BE ARRANGED TO DRAIN TO LOW POINTS AND TO PROVIDE FOR AIR ELIMINATION AT HIGH POINTS.

4. MAINS, RISERS AND BRANCH CONNECTIONS TO SAME SHALL BE ARRANGED TO PERMIT EXPANSION AND CONTRACTION WITHOUT STRAIN BY MEANS OF ELBOW SWINGS AND/OR EXPANSION JOINTS.

5. ALL VALVES, CHECK VALVES, PRESSURE REDUCING VALVES, SHOCK ABSORBERS, TRAP PRIMER VALVES, ETC., SHALL BE EASILY ACCESSIBLE FOR MAINTENANCE AND/OR REMOVAL.

6. ALL CUT AND THREADED PIPE SHALL HAVE THE CUTTING BURRS AND SHARP EDGES REAMED OUT.

7. IN ERECTING PIPE, FRICTION WRENCHES AND RISERS SHALL BE USED EXCLUSIVELY, AND ANY PIPE, CUT, DENTED OR OTHERWISE DAMAGED SHALL BE REPLACED.

8. ALL FERROUS TO NON-FERROUS PIPE CONNECTIONS SHALL BE MADE WITH ACCEPTED DIELECTRIC PIPE OR FLANGE UNION ISOLATING JOINTS TO PREVENT ANY ELECTROLYTIC ACTION BETWEEN DISSIMILAR METALS.

9. ALL COPPER TUBING SHALL BE CUT AND REAMED TO REMOVE ALL BURRS. OUTSIDE AND INSIDE OF THE FITTINGS AND OUTSIDE OF THE TUBING AT EACH END SHALL BE WELL CLEANED WITH STEEL WOOL BEFORE SOLDERING TO REMOVE ALL TRACES OF OXIDATION REGARDLESS OF HOW CLEAN THE SURFACES OF THE PIPE AND FITTINGS MAY APPEAR.

10. PROVIDE UNIONS AT CONNECTIONS TO EACH PIECE OF EQUIPMENT FOR EASY DISMANTLING AND AT SUCH OTHER POINTS TO FACILITATE INSTALLATION. UNIONS SHALL BE OF SAME STRENGTH, AND MANUFACTURE USED IN THE RESPECTIVE PIPING SYSTEMS AND SHALL BE OF THE GROUND JOINT TYPE.

11. NIPPLES: ANY PIECE OF PIPE 8 INCHES IN LENGTH AND LESS SHALL BE CONSIDERED A NIPPLE. ALL NIPPLES WITH UNTHREADED PORTION 1/4" INCH AND LESS SHALL BE EXTRA HEAVY. ALL OTHER NIPPLES TO BE OF WEIGHT CORRESPONDING TO FITTING CONNECTED. ONLY SHOULDER NIPPLES SHALL BE USED, CLOSE NIPPLES WILL NOT BE ACCEPTABLE.

12. SUPPORTS FOR VERTICAL PIPING SHALL BE DOUBLE BOLT RISER CLAMPS (CONSISTENT WITH PIPE MATERIAL, I.E. COPPER FOR COPPER PIPE, ETC.) WITH EACH AND HAVING EQUAL BEARING ON THE BUILDING STRUCTURE. VERTICAL PIPING TO BE SUPPORTED AT EVERY LEVEL.

a. HORIZONTAL PIPING SHALL BE SUPPORTED AS HEREIN SPECIFIED FOR COPPER PIPE.

13. CONDENSATE DRAIN PIPING SHALL BE PITCHED A MINIMUM OF 1/8" PER 12" FROM POINT OF CONNECTION TO TERMINATION POINT.

H. PRESSURE TESTS:

1. LESS THAN 100 POUNDS PER SQUARE INCH OPERATING PRESSURE: a. TEST HYDROSTATICALLY TO 150 POUNDS PER SQUARE INCH.

2. OVER 100 PSI OPERATING PRESSURE: a. TEST HYDROSTATICALLY TO 1 1/2 TIMES OPERATING PRESSURE.

b. NEVER EXCEED ANSI B16.1 TEST PRESSURE BASIS.

c. REVIEW BUILDING WORKING PRESSURE DIAGRAM FOR PRESSURE RATING OF FITNESS AND EQUIPMENT.

23.21.23 - PUMPS

A. ACCEPTABLE MANUFACTURERS:

1. COOLING COIL CONDENSATE PUMPS: LITTLE GIANT VCM-20 SERIES, MARCH, BECKETT CB, HARTELL KTP20

B. COOLING COIL CONDENSATE PUMPS:

1. PROVIDE A FULLY AUTOMATIC CONDENSATE REMOVAL PUMP WITH 1/2 GALLON CAPACITY INTEGRAL LEAKPROOF TANK. PUMP CAPACITY SHALL BE 20 GALLONS PER HOUR WITH A 15 FOOT LIFT.

2. THE PUMP SHALL BE A VERTICAL-TYPE WITH STAINLESS STEEL MOTOR SHAFT, RUST PROOF, HIGH-IMPACT ABS TANK AND MOTOR COVER, 3 DRAIN INLET CONNECTIONS.

3. PROVIDE A REMOVABLE 1/2 INCH BARBED CHECK VALVE.

4. PROVIDE A SAFETY SWITCH AND RELAY RATED AT 5 AMPERES/48 VOLTS TO SHUT DOWN THE ASSOCIATED HVAC UNIT.

5. THE 120 VOLT SINGLE PHASE MOTOR SHALL BE THERMALLY PROTECTED MOTOR AND UL LISTED FOR HARDWARE CONNECTION.

23.31.00 - HVAC DUCTS AND CASINGS

A. ACCEPTABLE MANUFACTURERS:

1. SPIRAL OVAL AND ROUND DUCTS: UNITED MCGILL "UNI-FORM", SEMCO, METCO, DUCTMATE INDUSTRIES "SPIRALMATE" AND "OVALMATE"

2. DUCT CONNECTION SYSTEMS: DUCTMATE INDUSTRIES "DUCTMATE 35" AND "DUCTMATE 45", NEXUS, WARD

3. FLEXIBLE CONNECTIONS: VENTFABRICS "VENTGLAS" AND "VENTLON", DURO DYNE "INSULFAB", ADVANCE ELASTOMERIC SYSTEMS, DUCTMATE INDUSTRIES "PROFLEX"

4. FLEXIBLE DUCTS: AUTOMATIC INDUSTRIES "THERMAFLEX M-KE", UNITED MCGILL, GENFLEX "IL"

5. SPRING FASTENERS: DZUS, SIMMONS "QUICK-LOCK"

6. DUCT SEALANTS: MINNESOTA MINING AND MANUFACTURING, BENJAMIN FOSTER, CHILDERS, MIRACLE ADHESIVE, UNITED MCGILL, HARDCAST, DUCTMATE INDUSTRIES "PROSEAL"

7. SPIN-IN FITTINGS: YOUNG REGULATOR, MODULAR METALS

8. FLEXIBLE DUCT CLAMPS: AEROQUIP IDEAL, TRIDON, YOUNG REGULATOR

9. ACOUSTICAL PANEL PLENUMS: IAC, RINK, VIBRO-ACOUSTICS, UNITED MCGILL

10. ACCESS DOORS, DUCTS: VENTFABRICS, DURO DYNE, RUSKIN. USE "VENTLOK" NO. 140 LATCHES, DUCTMATE INDUSTRIES, HINGED TYPE ONLY

11. ACCESS DOORS, PLENUMS: VENTFABRICS, DURO DYNE, ELGEN

12. DUCT JOINT TAPE: HARDCAST

B. PUBLISHED SPECIFICATIONS STANDARDS, TESTS OR RECOMMENDED METHODS OF TRADE, INDUSTRY OR GOVERNMENTAL ORGANIZATIONS APPLY TO WORK IN THIS SECTION WHERE CITED BELOW:

1. ASHRAE - AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR CONDITIONING ENGINEERS HANDBOOKS (LATEST EDITIONS).

2. SMACNA - SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION, INC. a. HVAC DUCT CONSTRUCTION STANDARDS, METAL AND FLEXIBLE, SECOND EDITION, 2005.

b. FIRE, SMOKE AND RADIATION DAMPER INSTALLATION GUIDE FOR HVAC SYSTEMS, FOURTH EDITION, 2002.

b. HVAC SYSTEMS TESTING ADJUSTING AND BALANCING, 3RD EDITION, 2002

c. SEISMIC RESTRAINT MANUAL, GUIDELINES FOR MECHANICAL SYSTEMS, 1998

d. HVAC AIR DUCT LEAKAGE TEST MANUAL, 1ST EDITION, 1985

C. SUBMITTALS

1. SUBMIT DUCTWORK SHOP FABRICATION AND SHOP CONSTRUCTION STANDARDS PRIOR TO SUBMITTAL OF DUCTWORK SHOP DRAWINGS.

2. DUCTWORK SHOP FABRICATION AND SHOP CONSTRUCTION STANDARDS SHALL INCLUDE ALL APPLICABLE SHOP DETAILS AND PRODUCT DATA. INCLUDE THE FOLLOWING:

a. DUCT REINFORCEMENT TABLES FOR ALL PRESSURE CLASSES, DUCT MATERIALS (GALVANIZED STEEL, ALUMINUM, STAINLESS STEEL, BLACK IRON) AND DUCTWORK SHAPES (RECTANGULAR, ROUND, SPIRAL, FLAT OVAL) TO BE USED ON THIS PROJECT

b. DUCT REINFORCEMENT TABLES SHALL INCLUDE MATERIAL GAUGES, TRANSVERSE JOINT REINFORCEMENT TYPE AND STANDARD SHOP JOINT SPACING

c. TRANSFER DUCT CONSTRUCTION DETAIL

d. ACOUSTICAL LINING, PERFORATED METAL LINER, ADHESIVE, NOSING AND FASTENING CUTS AND DETAILS

e. INSTALLATION DETAILS FOR VOLUME DAMPERS, REMOTE- AND CORD-OPERATED REMOTE VOLUME DAMPERS, CONTROL DAMPERS, FIRE DAMPERS, AND COMBINATION FIRE/SMOKE DAMPERS.

f. DUCT ACCESS DOORS

g. DUCT FITTING CONSTRUCTION DETAILS SUCH AS RECTANGULAR AND RADIUS ELBOWS, TURNING VANES, OFFSETS, BRANCH CONNECTIONS, ETC.

h. DUCT SUPPORT AND ATTACHMENT DETAILS

i. FLANGED DUCT CONNECTION DETAILS FOR ALL SYSTEMS AND EACH MANUFACTURER USED ON PROJECT. MINIMUM DUCT CONSTRUCTION GAUGES SHALL BE AS PER SMACNA DUCT REINFORCEMENT TABLES. DUCT GAUGES MAY NOT BE REDUCED BASED ON ALTERNATIVE JOINTING MANUFACTURER'S RECOMMENDATIONS

j. DUCTWORK SEALANT

k. DIFFUSER DUCTWORK CONNECTION DETAILS

l. DUCT PENETRATING FULL HEIGHT PARTITION DETAILS

m. FLEXIBLE CONNECTION DETAILS

n. DUCT AND PLENUM CONSTRUCTION DETAILS

o. VOC CONTENT OF ANY ADHESIVES OR SEALANTS MUST BE LESS THAN THE CURRENT VOC CONTENT LIMITS OF THE SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD) RULE #168, AND ALL SEALANTS USED AS FILLERS SHALL MEET OR EXCEED THE REQUIREMENTS OF THE BAY AREA AIR QUALITY MANAGEMENT DISTRICT (BAQAQMD) REGULATION 8, RULE 51.

3. PRODUCT DATA INCLUDING MANUFACTURER'S INSTALLATION INSTRUCTIONS, APPLICATION, MATERIALS OF CONSTRUCTION, GAUGES, DESCRIPTIVE LITERATURE, AND MAINTENANCE DATA FOR:

a. DUCTWORK AND FITTINGS

b. PLENUMS

c. FASTENERS AND SEALANTS

d. ACCESS DOORS

4. SHOP DRAWINGS:

a. 1/4 INCH SCALE DIMENSIONED DUCT LAYOUT DRAWINGS OF ALL MECHANICAL ROOMS, RISER ELEVATIONS, AND FLOOR PLANS, GIVING COMPLETE DIMENSIONS FOR LOCATION, ELEVATION, AND CLEARANCE, SHOWING WORK OF OTHER SECTIONS AND DIVISIONS WHEREVER NECESSARY TO SHOW COORDINATION

b. ACCESS DOOR DETAILS

c. FLEXIBLE CONNECTION DETAILS

d. DUCT AND PLENUM CONSTRUCTION DETAILS

e. PROVIDE A SEPARATE SET OF DIMENSIONED DRAWINGS OR A PARTIAL SET AT ENLARGED SCALE SHOWING ALL PENETRATIONS REQUIRED FOR DUCTWORK THROUGH STRUCTURAL MEMBERS, FLOOR AND ROOF SLABS, CONCRETE WALLS AND PRECAST WALLS

f. DUCT MATERIALS, REINFORCEMENT AND CONSTRUCTION SCHEDULES

g. DUCT SUPPORT AND ATTACHMENT DETAILS

5. ALL SHEET METAL SHOP DRAWINGS SHALL BE DRAWN IN DOUBLE LINE INDICATING ACTUAL DIMENSIONS OF DUCTWORK, FITTINGS AND EQUIPMENT. SHOP DRAWINGS SUBMITTED WITH DUCTWORK DRAWN IN SINGLE LINE SHALL BE RETURNED WITHOUT REVIEW.

6. SHEET METAL SHOP DRAWING SHALL INDICATE, AS A MINIMUM, THE FOLLOWING DATA:

- OUTLETS (+1" W.G.).
 - b. OUTSIDE AIR SUPPLY SYSTEMS (+1" W.G.).
 - c. FLEXIBLE DUCTS (+1" W.G.).
 - d. RELIEF, RETURN AND EXHAUST SYSTEMS (-2" W.G.).
- A. MATERIALS:
1. SHEET METAL:
 - a. STEEL SHEETS:
 - (1) COLD ROLLED STEEL SHEETS, LOCK FORMING QUALITY.
 - (2) MEETING ASTM A653 AND A-653M.
 - (3) BLACK OR GALVANIZED AS SPECIFIED.
 - (4) GALVANIZING: 0.9 OUNCES PER SQUARE FOOT BOTH SIDES.
 - b. STAINLESS STEEL SHEETS:
 - (1) ANSI TYPE 316 AS SPECIFIED.
 - (2) CONCEALED: FINISH NO. 2B OR NO. 3.
 - (3) EXPOSED: FINISH NO. 4.
 2. MISCELLANEOUS PRODUCTS:
 - a. DUCT SEALANTS:
 - (1) SEALING COMPOUND: SHALL BE FLEXIBLE WATER BASED ADHESIVE FOR USE IN ALL PRESSURES. SEALANT SHALL BE UV-RESISTANT, CONFORM TO ASTM E84, BE UL 723 LISTED AND MEET NFPA REQUIREMENTS FOR CLASS 1 DUCTWORK.
 - (2) GASKETS:
 - (a) CONTINUOUS, REINFORCED, INERT SELF-CONFORMING TYPE.
 - (b) 1/2" INCH THICK.
 - (c) WIDTH: TO MATCH ANGLE CONNECTION.
 - (d) DUCTMATE INDUSTRIES MODEL 440, OR EQUAL.
 - b. HARD-SETTING JOINT TAPE:
 - (1) TWO-PART TAPE:
 - (a) MINERAL IMPREGNATED WOVEN FIBER TAPE.
 - (b) IMPREGNATED WITH ACTIVATOR/ADHESIVE OF POLYVINYL ACETATE TYPE.
 - (2) UL LISTED:
 - (a) FLAME SPREAD: 10.
 - (b) SMOKE DEVELOPED: 0.
 - (3) SIMILAR TO HARDCAST.
 - c. SPRING FASTENERS: SELF-EJECTING OVAL HEAD STUD AND RECEPTACLE WITH SCREWDRIVER SLOT.
 - d. SLIDE-ON TRANSVERSE JOINT CONNECTORS:
 - (1) PREFABRICATED SLIDE-ON TRANSVERSE DUCT CONNECTORS AND COMPONENTS SHALL BE ACCEPTED. DUCTS CONSTRUCTED USING PREFABRICATED SYSTEMS SHALL REFER TO THE MANUFACTURER GUIDELINES FOR SHEET GAUGE, INTERMEDIATE REINFORCEMENT SIZE AND SPACING, AND PROPER JOINT REINFORCEMENT. DUCTMATE INDUSTRIES, WARD, NEXUS, OR APPROVED EQUAL.
 - (2) FORMED-ON FLANGES SHALL BE CONSTRUCTED AS T-25 AB FLANGES, OF WHICH THE CONSTRUCTION GUIDELINES ARE GIVEN IN FIGURE 1-4 OF THE 1995 SMACNA HVAC DUCT CONSTRUCTION STANDARDS, METAL AND FLEXIBLE, SECOND EDITION, NO OTHER CONSTRUCTION STANDARDS PERTAINING TO FORMED-ON FLANGES SHALL BE ACCEPTED.
 - (3) FORMED-ON FLANGES SHALL INCLUDE THE USE OF CORNERS, BOLTS, CLEAT AND GASKET.
 - (4) ALL COMPONENTS SHALL BE METAL UNLESS OTHER MATERIALS ARE REQUIRED BY CODE OR SPECIFIED.
 3. FLEXIBLE CONNECTIONS:
 - a. FLEXIBLE CONNECTIONS SHALL BE USED WHERE DUCTWORK CONNECTS TO ROTATING, VIBRATING OR NOISE PRODUCING MACHINERY. CONNECTORS SHALL BE ATTACHED IN SUCH A MANNER TO PROVIDE AN AIRTIGHT AND WATERPROOF SEAL.
 - b. WITH METAL EDGES AT EACH END:
 - (1) NO. 24 USSG GALVANIZED STEEL.
 - c. 2 INCH SLACK IN FABRIC.
 - d. INSTALL TO ALLOW MINIMUM MOVEMENT OF 1 INCH.
 - e. LENGTH OF FABRIC CONNECTIONS:
 - (1) MINIMUM: 4 INCHES.
 - (2) MAXIMUM: 10 INCHES.
 - f. MATERIALS:
 - (1) INDOOR INSTALLATIONS SHALL BE A UL LISTED, FIRE RETARDANT NEOPRENE OR VINYL COATED WOVEN FIBERGLASS FABRIC, MINIMUM DENSITY 30 OUNCES PER SQUARE YARD AND RATED TO 200°F.
 - (2) OUTDOOR INSTALLATIONS SHALL BE A UL LISTED ULTRA VIOLET LIGHT RESISTANT HYPALON COATED WOVEN FIBERGLASS FABRIC, MINIMUM DENSITY 24 OUNCES PER SQUARE YARD AND RATED TO 250°F.
 - (3) FLAME SPREAD RATING: 25 MAXIMUM, SMOKE DEVELOPED RATING: 50 MAXIMUM
 - (4) INSULATED CONNECTIONS:
 - (a) TWO LAYERS OF FABRIC WITH 1/8 INCH THICK FIBERGLASS, 1.5 POUND DENSITY.
 - (b) PERFORMANCE AS PREVIOUSLY SPECIFIED IN 3-F-(2).
 - (5) PROVIDE WIRE EMBEDDED UNCOATED GLASS FABRIC WITH SEWN SEAMS FOR AIR TEMPERATURE OVER 150°F.
 4. TURNING VANES:
 - a. GALVANIZED STEEL DUCTWORK: GALVANIZED STEEL OR PAINTED BLACK STEEL, EXCEPT AS NOTED.
 - b. OTHER DUCTWORK: SAME MATERIAL AS DUCTWORK.
 - c. CONSTRUCTION SHALL MEET OR EXCEED SMACNA "HVAC DUCT CONSTRUCTION STANDARDS".
 - (1) USE OF SINGLE WALL VANES WITH 1/4 INCH TRAILING EDGE SHALL BE LIMITED TO MAXIMUM AIR VELOCITY OF 2,000 FEET PER MINUTE AND A MAXIMUM DUCT DIMENSION OF 18 INCHES.
 - (2) DOUBLE WALL VANES SHALL BE USED IN DUCTS WHERE AIR VELOCITY EXCEEDS 2,000 FEET PER MINUTE, OR ANY DUCT WITH A DIMENSION OVER 18 INCHES.
 - (3) VANE LENGTH: PROVIDE SEPARATE EQUAL SIZE SECTIONS FOR VANE LENGTH GREATER THAN THOSE PREVIOUSLY INDICATED IN PARAGRAPH 1.03; REFERENCED STANDARDS.
 - (4) VANE RUNNERS: SMACNA TYPE 1 OR 2 ACCEPTABLE.
 - (5) TAB SPACING SHALL BE AS SPECIFIED IN FIGURE 2-3 OF THE SMACNA MANUAL, HVAC DUCT CONSTRUCTION STANDARDS, METAL AND FLEXIBLE, 3RD EDITION, 2005. RAIL SYSTEMS WITH NON-STANDARD TAB SPACING SHALL NOT BE ACCEPTED.
 5. SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS:
 - a. GENERAL FABRICATION REQUIREMENTS: COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE", BASED ON INDICATED STATIC -PRESSURE CLASS - BUT NO LESS THAN 2" - UNLESS OTHERWISE INDICATED.

- b. TRANSVERSE JOINTS: SELECT JOINT TYPES AND FABRICATE ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE", FIGURE FOR "RECTANGULAR DUCT/TRANSVERSE 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".
 - c. LONGITUDINAL SEAMS: SELECT SEAM TYPES AND FABRICATE ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE", FIGURE FOR "ROUND DUCT LONGITUDINAL SEAMS" 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".
 - d. MATERIALS OF CONSTRUCTION:
 - GALVANIZED STEEL: SUPPLY AND RETURN, GENERAL AND TOILET EXHAUST DUCTS.
 - TYPE 316 STAINLESS STEEL: VAPOR HOODS, SHOWER, DISHWASHER, EXHAUST DUCTS.
 - ALUMINUM: VAPOR HOODS, SHOWER, AND DISHWASHER EXHAUST DUCTS.
 - KITCHEN EXHAUST DUCTWORK
6. ROUND DUCT TAKE-OFF FITTINGS:
 - e. FACTORY-FABRICATED SPIN-IN FITTING.
 - f. DIE-FORMED GALVANIZED STEEL.
 - g. PRESSURE RATINGS:
 - (1) STANDARD CONSTRUCTION - UP TO 1/2 INCH STATIC PRESSURE.
 - h. BALANCING DAMPER:
 - (1) LOCKING REGULATOR.
 7. ROUND AND OVAL DUCTWORK:

GENERAL:

 - a. FACTORY-FABRICATED SPIRAL LOCKSEAM DUCT, EXCEPT AS OTHERWISE INDICATED.
 - b. FACTORY-FABRICATED LONGITUDINAL SEAM ACCEPTABLE FOR DUCTS LARGER THAN STANDARD FACTORY SIZES.
 - c. FACTORY-FABRICATED FITTINGS:
 - (1) SAME MANUFACTURER AS DUCT AND AS DETAILED.
 - (2) SAME MATERIAL AND CONSTRUCTION AS DUCT IN WHICH INSTALLED.
 - (3) TEES: VAV BOX CONNECTION TO DUCT LOOP:
 - (a) CONICAL SADDLE TAP OR CONICAL TEE FITTING.
 - (b) CENTER-LINE TAKE-OFF, UNLESS OTHERWISE INDICATED.
 - (c) CONTINUOUSLY WELDED SEAMS.
 - (4) ELBOWS:
 - (a) STANDING SEAMS.
 - (b) MITERED ELBOWS WITH CONTINUOUSLY WELDED SEAMS:
 - (i) 2 GORES - LESS THAN 35°
 - (ii) 3 GORES - 36°F THROUGH 71°
 - (iii) 5 GORES - OVER 71°
 - (c) ADJUSTABLE ELBOWS ALLOWED DOWNSTREAM OF VARIABLE VOLUME BOXES, RETURN/EXHAUST FANS AND FAN COIL UNITS PROVIDED EACH JOINT IS SEALED.
 - (5) ALSO ACCEPTABLE:
 - (a) DIE-STAMPED RADIUS ELBOWS FOR DUCTS 8 INCHES OR SMALLER.
 - (b) MITERED ELBOWS AS SPECIFIED ABOVE FOR DUCTS LARGER THAN 8 INCHES.
 - d. NOT ACCEPTABLE:
 - (1) CORRUGATED OR FLEXIBLE METAL DUCT.
 - (2) PLEATED ELBOWS.
 - (3) ACOUSTIFLEX.
8. SINGLE-WALL DUCTS:
 - a. MATERIALS OF CONSTRUCTION:
 - (1) GALVANIZED STEEL: SUPPLY AND RETURN, GENERAL AND TOILET EXHAUST DUCTS.
 - b. METAL GAUGES:
 - (1) COMPLY WITH SMACNA STANDARDS.
 - (2) COMPLY WITH NFPA 90A WHEN DUCTS TRANSVERSE THROUGH SMOKE ZONES.
 - c. SIMILAR TO UNITED MCGILL "UNI-FORM".
9. FLEXIBLE DUCTS:
 1. GENERAL:
 - a. USE ONLY WHERE INDICATED
 - b. UL 181, CLASS 1 AIR DUCT
 - c. LABELED FOR COMPLIANCE WITH UMC
 - d. WITH POLYMERIC LINER
 - e. DO NOT USE ON EXHAUST SYSTEMS
 2. STATIC PRESSURE CLASS UP TO 1 INCH W.G.:
 - a. INSULATED FLEXIBLE DUCT:
 - (1) MAXIMUM WORKING PRESSURE 1.0 INCHES W.G.
 - (2) NOMINAL 1 INCH INSULATION WITH VAPOR BARRIER.
 - (3) MAXIMUM THERMAL CONDUCTIVITY 0.27 BTU/HSQ. FT. *IN AT 75°F.
 - (4) SIMILAR TO THERMAFLEX M.K.E.
 - b. USE DOWNSTREAM OF VAV BOXES OR AT DISTRIBUTION DEVICES IN A CONSTANT VOLUME SYSTEM.
 - c. MAXIMUM LENGTH 6 FEET.
 3. FACTORY INSTALLED COLLAR.
 4. FLEXIBLE DUCTWORK CLAMPS:
 - a. STRAPS APPROVED FOR USE WITH FLEXIBLE DUCTWORK.
 - b. STAINLESS STEEL STRAP.
 - c. ADJUSTABLE SCREW TYPE.
 - d. SIMILAR TO IDEAL.
- H. ACCESS DOORS:
 1. IN ACCORDANCE WITH SMACNA - DUCT CONSTRUCTION STANDARDS, METAL AND FLEXIBLE, 3RD EDITION, 2005, EXCEPT AS NOTED.
 2. IN DUCTWORK:
 - a. INSULATED OR NON-INSULATED, SAME AS DUCT.

- b. HINGED, EXCEPT WHERE SLIDING OR REMOVABLE TYPE REQUIRED. LATCH, EQUAL TO VENTLOK NO. 100.
 - c. SIZE:
 - (1) 20 INCHES X 14 INCHES.
 - (2) DUCTS LESS THAN 16 INCHES: ONE DIMENSION 20 INCHES; OTHER DIMENSION 2 INCHES LESS THAN DUCT WIDTH.
 - (3) LARGER SIZES WHERE REQUIRED FOR ACCESS.
 - d. PROVIDE IN FOLLOWING LOCATIONS:
 - (1) COILS IN DUCTS: ENTERING AND LEAVING SIDE.
 - (2) AUTOMATIC DAMPERS: LINKAGE SIDE.
 - (3) BALANCING DAMPERS AND BACKDRAFT DAMPERS
 - (4) FIRE DAMPERS, SMOKE DAMPERS AND COMBINATION FIRE SMOKE DAMPERS.
 - (5) DUCT-MOUNTED SMOKE DETECTORS, SPRINKLER HEADS, HEAT DETECTORS.
 - (6) INLET AND OUTLET SIDES OF EACH IN-LINE CENTRIFUGAL AND AXIAL FAN.
 - (7) ALL CONTROLS, SENSING, PROCESSING, TRANSMITTING AND ACTUATING DEVICES
 - d. MAKE COMPLETELY ACCESSIBLE. PROVIDE PERMANENT LABEL ON ALL ACCESS DOORS IDENTIFYING THE CONCEALED COMPONENTS AS SPECIFIED ABOVE.
- I. DUCTWORK INSTALLATION:
1. GENERAL:
 - a. DUCT DIMENSIONS INDICATED ARE NET, INSIDE, CLEAR, DIMENSIONS:
 - (1) FOR INTERNALLY LINED DUCTS, ADD LINING THICKNESS TO DETERMINE METAL DUCT FOR DIMENSIONS.
 - b. AT EXPOSED DUCT PENETRATIONS OF WALLS, FLOORS AND CEILINGS, PROVIDE SHEET METAL ANGLE TYPE ESCUTCHEONS.
 - c. TRANSITIONS:
 - (1) PITCH SIDES OF DUCT IN "DIVERGING" OR "CONVERGING" AIRFLOW MAXIMUM OF 15 INCLUDING ANGLE.
 - d. DUCT OPENINGS:
 - (1) PROVIDE OPENINGS WHERE REQUIRED TO ACCOMMODATE THERMOMETERS, SMOKE DETECTORS, CONTROLLERS, ETC.
 - (a) INSERT THROUGH AIRTIGHT RUBBER GROMMETS.
 - (2) AT FIRE DAMPERS ALLOW ADEQUATE LENGTH OF DUCT TO INSTALL ACCESS DOOR.
 - e. FLEXIBLE DUCT CONNECTIONS:
 - (1) INSTALL AT:
 - (a) AT CONNECTIONS TO FANS, SOUND ATTENUATORS, FAN COILS, HEAT PUMPS, AIR CONDITIONING UNITS AND ALL AIR HANDLING EQUIPMENT AS INDICATED ON DRAWINGS.
 - f. VOLUME DAMPERS:
 - (1) INSTALL DAMPERS WHERE SPECIFIED.
 - (2) INSTALL DAMPER IN BRANCH DUCT FOR EVERY DIFFUSER AT ACCESSIBLE LOCATION MOST REMOTE FROM DIFFUSER.
 - (3) INSTALL CABLE OPERATED VOLUME DAMPERS FOR ALL INACCESSIBLE LOCATIONS.
 2. RECTANGULAR DUCT JOINTS:
 - a. STANDING SEAMS, EXCEPT WHERE FLUSH DRIVE SLIP SEAM CALLED FOR.
 - b. USE FLUSH, DRIVE-SLIP, FOR:
 - (1) EXPOSED DUCTS.
 - (2) WHERE REQUIRED FOR CLEARANCE.
 - c. "DUCTMATE" SYSTEM JOINTS, MAY BE USED IN LIEU OF STANDING SEAMS. PLASTIC CLIPS ARE NOT ALLOWED.
 3. JOINT SEALING:
 - a. SEAL ALL TRANSVERSE, LONGITUDINAL AND SPIRAL JOINTS OF ALL SHEET METAL DUCTS BY ONE OF FOLLOWING METHODS:
 - (1) SIX OUNCE CANVAS STRIP, SIX INCHES WIDE.
 - (a) ADHERE WITH LAGGING ADHESIVE. HARDCAST TWO PART II DUCT SEALING SYSTEM: DT-5400 TAPE WITH RTA-50 SEALANT. DUCT TAPE NOT ALLOWED.
 - a. SEAL PUNCHED HOLES AND CORNER CRACKS. DUCT TAPE NOT ALLOWED.
 - b. AFTER INSTALLATION AND TESTING RESEAL JOINTS FOUND TO BE LEAKING.
 1. ROUND AND OVAL DUCTWORK:
 - a. JOINTS BETWEEN DUCTS:
 - (1) MADE WITH BEADED SLEEVE JOINTS.
 - (2) DUCT SEALER APPLIED TO MALE END.
 - (3) MECHANICALLY FASTENED WITH SHEET METAL SCREWS OR POP RIVETS.
 - (4) OVER JOINT AND SCREW OR RIVET HEADS, APPLY COATING OF DUCT SEALER.
 - (5) SEAL AND TAPE AS SPECIFIED FOR RECTANGULAR DUCTWORK.
 - b. JOINTS, DUCT AND FITTING:
 - (1) SLIP PROJECTING COLLAR OF FITTINGS INTO DUCT WITH A MINIMUM INSERTION LENGTH OF 2 INCHES.
 - (2) APPLY DUCT SEALER. SEAL AND TAPE AS SPECIFIED FOR RECTANGULAR DUCTWORK.
 - c. JUNCTIONS BETWEEN DUCTS:
 - (1) BRANCH TAKE-OFF: 45 DEGREES OR
 - (2) BRANCH TAKE-OFF: CONICAL 90 DEGREES
 - d. HORIZONTAL SUPPORTS SHALL BE ONE-PIECE CLAMP BAND STRAP, MINIMUM ONE STRAP PER SECTION. SUPPORT FITTINGS AS REQUIRED BY SMACNA.
 - e. VERTICAL SUPPORTS SHALL BE ONE OF THE FOLLOWING:
 - (1) CLAMP BANDS WITH EXTENDED ENDS SUPPORTED AT EACH FLOOR.
 - (2) CLAMP BANDS WITH KNEE BRACING.
 - f. USE ANGLE IRON BRACES FOR DUCT REINFORCING. REFER TO THE SMACNA HVAC DUCT CONSTRUCTION STANDARDS, METAL AND FLEXIBLE, 3RD EDITION, 2005, FIGURE NUMBERS 1-9 THROUGH 1-12.
 5. FLEXIBLE DUCT:
 - a. PROVIDE CONTINUOUS, SINGLE PICES.
 - b. MAXIMUM LENGTH:
 - (1) ABOVE 1 INCH WATER GAUGE STATIC PRESSURE: 12 INCHES OR AS SPECIFIED.
 - (2) UNDER 1 INCH WATER GAUGE STATIC PRESSURE: 6 FEET.
 - (3) LOCAL CODES OR UNION RULES TAKE PRECEDENCE AND MAY REDUCE THE MAXIMUM LENGTHS SPECIFIED.

- c. END CONNECTIONS:
 - (1) CONNECT TO DUCT COLLARS, TERMINAL UNIT CONNECTIONS AND ROUND AIR OUTLETS PER MANUFACTURER'S INSTRUCTIONS.
 - (2) SECURE WITH STRAP CLAMPS SPECIFIED ABOVE.
 - a. INSTALLATION:
 - (1) SUPPORT PER SMACNA.
 - (2) FLEXIBLE DUCT IS NOT ALLOWED IN LENGTHS GREATER THAN THAT SPECIFIED. BENDS, TWISTS OR SAGGING OF FLEXIBLE DUCT IS NOT ACCEPTABLE.
 - (3) MINIMUM INSIDE BENDING RADIUS SHALL BE A MINIMUM OF TWO DUCT DIAMETERS. IF MINIMUM RADIUS CANNOT BE MAINTAINED, PROVIDE SHEET METAL PLENUM OVER AIR OUTLET AND CONNECT FLEXIBLE DUCT TO SIDE OF PLENUM. PAINT INTERIOR FLAT BACK.
 - (4) MAXIMUM - ONE 90 DEGREE TURN.
 - (5) INSTALL AS STRAIGHT AS POSSIBLE.
 - (6) FLEXIBLE DUCT IS ONLY ALLOWED ABOVE LAY-IN TYPE ACCESSIBLE CEILING ONLY.
- 23.33.13 - DAMPERS
- A. ACCEPTABLE MANUFACTURERS:
 1. STATIC AND DYNAMIC FIRE DAMPERS: RUSKIN DBD2 STYLE B, DBD2 STYLE B, OR APPROVED EQUAL BY AIR BALANCE, AWW, POTTORFF, GREENHECK.
 2. COMBINATION FIRE/SMOKE DAMPERS: RUSKIN FSD60, FSD60-3 (3 HOUR), FSD 37, FSDR25 (ROUND) OR APPROVED EQUAL BY AIR BALANCE OR POTTORFF.
 3. ACTUATORS: BELIMO FSNF120, FSNF24, HONEYWELL ML4115, ML8115, OR EQUAL.
 4. REMOTELY ADJUSTABLE OPERATORS WITH BALANCING DAMPERS:
 - a. REMOTE ADJUSTABLE OPERATOR SHALL BE YOUNG REGULATOR MODEL NUMBER 270-896 WITH 'C' BRACKET.
 - b. RECTANGULAR BALANCING DAMPER SHALL BE YOUNG REGULATOR MODEL NUMBER 830ACC FOR EXTERNAL CONTROL OR MODEL NUMBER 830ACC-2 FOR INTERNALLY CONTROLLED APPLICATIONS.
 - c. ROUND BALANCING DAMPER SHALL BE YOUNG REGULATOR MODEL NUMBER 5020CC FOR EXTERNAL CONTROL OR MODEL NUMBER 5020CC-2 FOR INTERNALLY CONTROLLED APPLICATIONS
 - B. FIRE DAMPERS:
 1. PROVIDE STATIC AND DYNAMIC FIRE DAMPERS IN DUCTS PENETRATING FIRE RATED WALLS, FLOORS, AND CEILINGS AS REQUIRED BY NFPA, LOCAL CODES AND AUTHORITIES REGARDLESS IF SHOWN OR NOT SHOWN ON THE DRAWINGS. DAMPERS SHALL BE FACTORY MARKED FOR STATIC OR DYNAMIC USE.
 2. PROVIDE CONVENIENTLY LOCATED ACCESS DOORS, OR SIMPLE SIZE FOR RESETTING THE DAMPERS. DUCT MOUNTED GRILLES, REGISTERS OR DIFFUSERS CAN BE USED FOR ACCESS AS LONG AS SUCH ACCESS IS READILY AVAILABLE AS DETERMINED BY THE ARCHITECT.
 3. INTEGRAL SLEEVE FRAME SHALL BE MINIMUM 20 GAUGE ROLL FORMED, GALVANIZED STEEL. COMPLY WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS AND SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION (SMACNA) DETAILS.
 4. DAMPERS SHALL BE SPRING-LOADED WITH SHUTTER STORED OUT OF THE AIRSTREAM TO PROVIDE MINIMUM 95 PERCENT FREE AREA.
 5. DYNAMIC RATED FIRE DAMPERS SHALL BE LABELED IN ACCORDANCE WITH UL 555. STATIC FIRE DAMPERS SHALL BE LABELED IN ACCORD WITH UL 555.
 6. DAMPERS SHALL BE ACTUATED BY UL-APPROVED FUSIBLE LINK. UPON OPERATION OF THE LINK, THE DAMPERS SHALL CLOSE AUTOMATICALLY AND REMAIN TIGHTLY CLOSED. FUSIBLE LINKS SHALL OPERATE APPROXIMATELY 50 DEGREES F ABOVE THE MAXIMUM TEMPERATURE. THE DUCT SYSTEM WILL ENCOUNTER UNDER NORMAL OPERATION, BUT NOT LESS THAN 165 DEGREES F.
 7. DAMPERS SHALL BE OF TYPES ACCEPTABLE TO THE LOCAL AUTHORITIES, OWNER AND ARCHITECT.
 - C. COMBINATION FIRE/SMOKE DAMPERS:
 1. PROVIDE DAMPERS OF SIZE AND LOCATION AS INDICATED ON THE DRAWINGS AND AS SPECIFIED.
 2. EACH DAMPER SHALL BE CLASSIFIED BY UNDERWRITERS LABORATORIES AS A LEAKAGE RATED DAMPER FOR USE IN SMOKE CONTROL SYSTEMS UNDER THE LATEST VERSION OF UL555S, AND BEAR A UL LABEL ATTESTING TO SAME. THE DAMPER LEAKAGE RATING UNDER UL555S SHALL BE LEAKAGE CLASS 1 (4 CUBIC FEET PER MINUTE PER SQUARE FOOT AT 1 INCH WATER GAUGE).
 3. IN ADDITION TO THE LEAKAGE RATINGS ALREADY SPECIFIED HEREIN, THE DAMPERS AND THEIR ACTUATORS SHALL BE QUALIFIED UNDER UL555S TO AN ELEVATED TEMPERATURE OF 250°F, 350°F, OR 450°F DEPENDING UPON THE ACTUATOR. APPROPRIATE LISTED ELECTRONIC ACTUATORS SHALL BE INSTALLED BY THE DAMPER MANUFACTURER AT TIME OF DAMPER FABRICATION.
 4. EACH DAMPER SHALL BE EQUIPPED WITH INDICATION POSITION SWITCHES CONSISTING OF TWO-POSITION INDICATOR SWITCHES LINKED DIRECTLY TO THE DAMPER BLADE TO PROVIDE THE CAPABILITY OF REMOTELY INDICATING DAMPER BLADE POSITION.
 5. HEAT-ACTUATED TEMPERATURE RELEASE DEVICE:
 - a. CONTROL CLOSE AND LOCK DAMPER DURING TEST, SMOKE DETECTION, POWER FAILURE, OR FIRE CONDITIONS THROUGH ACTUATOR CLOSURE SPRING. AT NO TIME SHALL ACTUATOR DISENGAGE FROM DAMPER BLADES.
 - b. ALLOW DAMPER TO BE AUTOMATICALLY AND REMOTELY RESETTABLE AFTER TEST, SMOKE DETECTION, OR POWER FAILURE CONDITIONS. AFTER EXPOSURE TO HIGH TEMPERATURE OR FIRE, INSPECT DAMPER BEFORE RESET TO ENSURE PROPER OPERATION.
 - c. CONTROLLED CLOSURE AND LOCKING OF DAMPER SHALL OCCUR IN 5 TO 15 SECONDS TO ALLOW DUCT PRESSURE TO EQUALIZE. INSTANTANEOUS CLOSURE IS NOT ACCEPTABLE.
 - d. ELECTRIC FUSE LINK (EFL) WITH ELECTRIC ACTUATORS.
 - e. RELEASE TEMPERATURES: 165 DEGREES F.
 6. COMBINATION FIRE/SMOKE DAMPER ACTUATORS SHALL BE POWERED BY A 24 VOLT AC SIGNAL FROM DIVISION 26.
 - D. ACTUATORS:
 1. ACTUATOR MOTOR SHALL BE SILENT MICROPROCESSOR-CONTROLLED PROVIDING ELECTRONIC CUT-OFF.
 2. MOTOR SHALL BE DIRECT-COUPLED AND INCAPABLE OF BURNING OUT IF STALLED BEFORE FULL ROTATION IS REACHED.
 3. HOUSING, GEARS AND TOOTHED COLD-WELD CLAMP SHALL BE STEEL.
 4. OPERATION TIME: 5 TO 15 SECONDS AT 32 TO 350 DEGREES F.
 - E. ACCESSORIES FOR DAMPERS:
 1. INTERLOCK SWITCH: ELECTRICALLY AND MECHANICALLY LOCK DAMPER IN CLOSED POSITION WHEN DUCT TEMPERATURES EXCEED 165 DEGREES F AND STILL ALLOW APPROPRIATE AUTHORITY TO OVERRIDE INTERLOCK SWITCH AND OPERATE DAMPER AS MAY BE REQUIRED FOR SMOKE MANAGEMENT FUNCTIONS. ALLOW DAMPER TO REMAIN OPERABLE WHILE TEMPERATURE IS BELOW 350 DEGREES F. SWITCH SHALL COMPLY WITH NFPA 92A AND BE UL CLASSIFIED.
 2. INTERFACE WITH SMOKE DETECTORS, BUILDING FIRE ALARM SYSTEMS OR REMOTE INDICATING AND CONTROL STATIONS.
 3. HIGH-LIMIT TEMPERATURE SENSOR:
 - a. RETURNS DAMPER TO FIRE PROTECTION MODE WHEN TEMPERATURES REACH OPERATIONAL LIMIT OF DAMPER AND ACTUATOR ASSEMBLY OF 350 DEGREES F.
 - b. CONFORMS TO NFPA 92A.
 - c. REPLACES CONTROLLED CLOSURE DEVICES ON STANDARD DAMPERS.
 4. BLADE POSITION INDICATOR SWITCHES: TWO POSITION-INDICATOR SWITCHES LINKED DIRECTLY TO DAMPER BLADE TO REMOTELY INDICATE DAMPER BLADE POSITION.



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**MECHANICAL
 SPECIFICATIONS
 SHEET #4**

M-005.00
 SHEET 5 of 14

- 5. PICTURE FRAME MOUNTING ANGLES:
 - a. ONE-PIECE, ROLL FORMED RETAINING ANGLES, 1.5 BY 1.5 INCHES. REQUIRES FACTORY SLEEVE.
 - b. FACTORY-MATCHED AND -SHIPPED ON INDIVIDUAL DAMPER WITH FACTORY-PREPUNCHED SCREW HOLES.
- 6. STEEL MULLIONS: FOR DAMPERS IN OVERSIZED MASONRY WALL OPENINGS.
- 7. PROVIDE BREAKAWAY CONNECTION: DRIVENUTE, DUCTMATE OR EQUAL.

F. BALANCING DAMPERS - SINGLE BLADE:

- 1. PROVIDE VOLUME DAMPERS AS SPECIFIED AND/OR SHOWN ON THE DRAWINGS FOR PROPER BALANCING AND DISTRIBUTION OF AIR, IN THE VARIOUS BRANCHES OF THE DUCTWORK FOR USE IN TESTING AND BALANCING THE SYSTEM. DAMPERS SHALL BE INSTALLED SEPARATE AND INDEPENDENT FROM THE DAMPER SPECIFIED TO BE SET BEHIND SUPPLY, RETURN AND EXHAUST AIR GRILLES. PROVIDE SINGLE BLADE DAMPERS IN DUCTS 24 INCHES IN WIDTH OR LESS, OR 12 INCHES IN HEIGHT OR LESS. PROVIDE MULTIPLE BLADE DAMPERS FOR ALL OTHER DUCT SIZES. COORDINATE WITH THE AIR BALANCING CONTRACTOR AND PROVIDE ADDITIONAL DAMPERS REQUIRED FOR PROPER AIR BALANCE.
- G. REMOTE CABLE CONTROLS FOR BALANCING DAMPERS:
 - 1. MANUFACTURER SHALL SUPPLY ALL NECESSARY HARDWARE FOR SIMPLE INSTALLATION OF REMOTE CABLE CONTROLS SYSTEM INCLUDING THE BOWDEN ALUMINUM ANGLE BRACKET AND THE BOWDEN CONTROL HUB TO ACCOMMODATE THE CABLE CONTROL SYSTEM MOUNTED ON THE DAMPER.
 - 2. CABLE CONTROL SYSTEM SHALL CONSIST OF BOWDEN CABLE 0.054 INCH STAINLESS STEEL CONTROL WIRE ENCAPSULATED IN 3/16 INCH FLEXIBLE GALVANIZED SPIRAL WIRE SHEATH TO INSURE POSITIVE OPERATION FOR UP TO 50 FEET (CAN BE REDUCED IF THERE ARE MULTIPLE TURNS OR BENDS).
 - 3. CONTROL KIT SHALL BE DESIGNED FOR USE WITH INTERNALLY OR EXTERNALLY CONTROLLED ROUND OR RECTANGULAR DAMPERS AND SHALL CONSIST OF 14 GAUGE STEEL RACK AND PINION GEAR DRIVE TO CONVERT ROTARY MOTION TO PUSH-PULL MOTION. CONTROL SHAFT SHALL BE D-STYLE FLATTENED WITH 265 DEGREE ROTATION PROVIDING GRADUATIONS FOR POSITIVE LOCKING CONTROL AND LINEAR TRAVEL.
 - 4. CONTROL MOUNTING OPTIONS INCLUDE CEILING FRAMEWORK, BEHIND GRILLES, ON OR INSIDE PLENUM SLOT DIFFUSERS AND OTHER VARIOUS TYPES OF DIFFUSERS OR THROUGH CEILING VIA 1 INCH DIAMETER INCONSPICUOUS ACCESS PORT. TWISTING TYPE CABLES ARE NOT ACCEPTABLE.
 - 5. MANUAL QUADRANT SHALL BE COMMERCIAL QUALITY, LOCKING TYPE FOR 3/4-INCH SQUARE SHAFT. PROVIDE EXTENDED BASE FOR EXTERNALLY INSULATED DUCTWORK.

23 33 19 - ACOUSTICS

A. GENERAL:

- 1. NOISE LEVELS, GENERATED BY EQUIPMENT AND DUCTWORK, SHALL BE ATTENUATED TO PERMIT ATTAINMENT OF SOUND PRESSURE LEVELS IN ALL 8 OCTAVE BANDS IN OCCUPIED SPACES THAT CONFORM TO THE FOLLOWING NOISE CRITERIA (NC) CURVES:
 - a. ALL SPACES: NC 25-30
- B. ACCEPTABLE MANUFACTURERS:
 - 1. SOUND LININGS: CERTANTEED TOUGHGUARD, SCHULLER, OWENS-CORNING FIBERGLAS
- C. DUCT LINING:
 - 1. FIBER GLASS DUCT LINER DOWNSTREAM OF TERMINAL UNITS AND FAN COILS SHALL BE FINISHED WITH A NEOPRENE COATED FACING, STENOILED NFPA 90.
 - 2. 1.5 IN. W.G. PRESSURE DUCT LINER SHALL BE FINISHED WITH PERFORATED 24_GAUGE GALVANIZED SHEET METAL, 28% MINIMUM OPEN AREA OR FOIL FACING.
 - 3. THICKNESS:
 - a. IN DUCTWORK: MINIMUM 1_INCH, 1 1/2 POUNDS PER CUBIC FOOT DENSITY MATTE-FACED UNLESS OTHERWISE NOTED ON DRAWINGS OR SPECIFICATIONS.
 - b. LINEAR DIFFUSER SUPPLY PLENUMS: MINIMUM 3/4_INCH, 1 1/2 POUND DENSITY.
 - 4. FLAMESPREAD SHALL BE MAXIMUM 25 FUEL CONTRIBUTED AND SMOKE DEVELOPED SHALL BE MAXIMUM 50.
 - 5. WHERE DUCT LINER IS APPLIED, INSULATION IS NOT REQUIRED.
 - 6. MINIMUM SOUND-ABSORPTION COEFFICIENTS (ASTM C423 MOUNTING TYPE A) FOR SOUND-ABSORBING DUCT LINING MATERIAL WHEN TESTED WHILE MOUNTED PER ASTM E795:
 - a. 1/2" THICKNESS: 0.45 NRC
 - b. 1" THICKNESS: 0.70 NRC
 - c. 1.5" THICKNESS: 0.85 NRC
 - d. 2" THICKNESS: 0.95 NRC
 - 7. DYNAMIC LOSS COEFFICIENT: MAXIMUM 1.2
 - 8. K FACTOR: MAXIMUM 0.23 BTUINCH-HOUR - DEGREE FAHRENHEIT - SQUARE FOOT, R VALUE MINIMUM: 4.2 AT 1" THICKNESS.
- D. INSTALLATION OF SOUND-LININGS:
 - 1. ADHERE WITH 6_INCH WIDE STRIPS OF ADHESIVE AT 12_INCH CENTERS AT ALL JOINTS IN LINING.
 - 2. IN ADDITION, SECURE WITH WELD PINS AND 2_INCH DIAMETER WASHERS ON MAXIMUM 16_INCH CENTERS AND IN COMPLIANCE WITH SMACNA STANDARDS.
 - 3. COAT ALL EDGES WITH SEALER.
 - 4. PROVIDE CONTINUOUS SHEETMETAL EDGE PROTECTION NOSINGS AT ENTERING EDGES OF LINED DUCT SECTIONS AND ALL JOINTS.
 - 5. DIMENSIONS OF LINED DUCTWORK ARE CLEAR INSIDE DIMENSIONS AFTER LINING HAS BEEN INSTALLED.
 - 6. EXTENT OF DUCTWORK SOUND-LININGS:
 - a. EXHAUST SYSTEMS: ALL DUCTWORK UPSTREAM AND DOWNSTREAM OF FAN SYSTEM.
 - b. DUCTWORK DOWNSTREAM OF HEAT PUMPS, AC UNITS OR FAN-POWERED TERMINAL UNITS: MINIMUM TEN (10) FEET. BRANCH TAKEOFFS TO DIFFUSERS ARE NOT ALLOWED WITHIN FIVE (5) FEET FROM DISCHARGE OUTLET.
 - 7. ALL TRANSFER DUCTS.
 - 8. ALL LINEAR DIFFUSER SUPPLY PLENUMS.

23 34 00 - FANS

A. ACCEPTABLE MANUFACTURERS:

- 1. CENTRIFUGAL FANS: TWIN CITY, CHICAGO, HOWDEN, LOREN COOK, GREENHECK
- 2. CABINET FANS: PENN, PANASONIC, GREENHECK
- B. GENERAL - ALL FANS:
 - 1. PROVIDE FANS THAT ARE QUIET OPERATING AND NON-OVERLOADING THE ENTIRE RANGE OF OPERATION.
 - 2. STATICALLY AND DYNAMICALLY BALANCE FAN WHEELS/IMPELLERS AT THE FACTORY AND CERTIFY BALANCE.
 - 3. PROVIDE PRECISION SELF-ALIGNING BEARINGS DESIGNED TO PREVENT LEAKAGE OF OIL OR GREASE. PROVIDE CUPS, OIL CHAMBERS, ZERK OR ALEMITE LUBRICATION FITTINGS IN ACCESSIBLE LOCATIONS FOR EASE OF LUBRICATION.
 - 4. PROVIDE COPPER LUBRICATION LEADS, FOR LUBRICATION OF INTERNAL MOTORS AND BEARINGS, EXTENDING TO A CAPPED TERMINATION POINT EXTERNAL TO THE FAN CASING OR AIR HANDLING UNIT.
 - 5. EXTEND WIRE LEADS ON FANS DRIVEN BY DIRECT MOTOR DRIVE FROM THE MOTOR JUNCTION BOX IN AIR TIGHT RIGID WALLED CONDUIT, TO A JUNCTION BOX MOUNTED EXTERNAL TO THE FAN CASING.

- 6. ON FANS DRIVEN BY BELT DRIVE PROVIDE STANDARD "V-GROOVE" TYPE BELTS AND SHEAVES SUITABLE FOR THE SERVICE INTENDED. FAN SHEAVES ARE NON-ADJUSTABLE TYPE WITH REMOVABLE MACHINED BUSHINGS. PROVIDE ADJUSTABLE PITCH TYPE WITH REMOVABLE MACHINED BUSHINGS. PROVIDE ADJUSTABLE PITCH TYPE MOTOR SHEAVES WITH DOUBLE LOCKING FEATURE, TO 10% ABOVE AND BELOW THE RATED FAN SPEED. DYNAMICALLY BALANCE SHEAVES WITH OVER THREE GROOVES. PROVIDE AT LEAST TWO BELTS AND SHEAVES EACH CAPABLE OF CARRYING THE ENTIRE LOAD WITH ONE BELT BROKEN.
- 7. PROVIDE PERFORMED EXPANDED METAL OR SHEET METAL BELT GUARDS, WITH GROMMETED TACHOMETER PORTS AT THE FAN AND MOTOR SHAFTS, FOR ALL EXPOSED SHEAVES AND BELTS. BELT GUARD SHALL COMPLY WITH OSHA REQUIREMENTS AND BE EASILY REMOVABLE.
- 8. CONSTRUCT WHEELS/IMPELLERS EXPOSED TO NORMAL ATMOSPHERES OF CAST ALUMINUM OR HOT DIP GALVANIZED STEEL AND FINISHED WITH TWO LAYERS OF FACTORY APPLIED NON-SCALING PAINT.
- 9. ELECTRICALLY GROUND ALL FANS AND DRIVES TO PREVENT ACCUMULATION OF STATIC CHARGE. INDICATE GROUNDING METHOD IN FAN SUBMITTALS.
- 10. PROVIDED THREADED DRAIN PLUGS AT FAN HOUSING LOW POINTS.
- 11. FAN WHEELS/IMPELLERS AND HOUSINGS SHALL BE RELIEVED OF RESIDUAL STRESSES PRODUCED IN THE FORMING PROCESS.
- 12. PROVIDE HOUSINGS WITH INTEGRAL INLET AND DISCHARGE FLANGES, COMPLETE WITH BOLT HOLES FOR FLEXIBLE OR HARD DUCT CONNECTIONS. SHOP FABRICATE ANY COMPANION FLANGES REQUIRED FOR CONNECTIONS TO SOUND ATTENUATORS. COMPANION FLANGES SHALL BE ROLLED ANGLES MATCHED TO BOTH FAN HOUSING AND SOUND ATTENUATORS.

C. CENTRIFUGAL FANS:

- 1. PROVIDE BACKWARD INCLINED (BI), BACKWARD CURVED (BC), AIRFOIL (AF), FORWARD CURVED (FC) FAN WHEELS, AND SINGLE WIDTH SINGLE INLET (SWSI), OR DOUBLE WIDTH DOUBLE INLET (DWDI), AS SPECIFIED OR INDICATED ON THE DRAWINGS, ENCLOSED IN A SCROLL SHAPED FAN HOUSING.
- 2. WELD OR SECURELY RIVET FAN BLADES TO THE HUB PLATE AND RIM.
- 3. FAN HOUSINGS ARE TO BE HEAVY GAUGE CONSTRUCTION, CONTINUOUSLY WELDED INSIDE AND OUTSIDE. HOUSINGS SHALL BE SUITABLY BRACED TO PREVENT VIBRATION OR PULSATION. FAN HOUSINGS SHALL HAVE SPUN, AERODYNAMICALLY DESIGNED SPUN INLET CONES OR INLET VENTURIS FOR SMOOTH AIR ENTRY INTO THE WHEELS. ALL FAN WHEELS SHALL HAVE TAPERED SPUN WHEEL CONES OR SHROUDS PROVIDING STABLE FLOW AND HIGH RIGIDITY. HOUSING WITH LOCK SEAM CONSTRUCTION OR PARTIAL WELD SHALL NOT BE ACCEPTABLE UNLESS FOR SMALLER FAN SIZES (12 INCH WHEEL DIAMETERS OR LESS) WHERE IT IS STANDARD CONSTRUCTION FOR MODELS LISTED ON DRAWINGS.

D. CABINET FANS:

- 1. PROVIDE SCROLL TYPE CENTRIFUGAL FANS, FACTORY INSTALLED WITHIN A CABINET ENCLOSURE, AND COMPLY WITH THE REQUIREMENTS OF SCROLL TYPE CENTRIFUGAL FANS.
- 2. INTERNALLY ISOLATE FAN AND MOTOR ASSEMBLIES FROM THE CABINET.
- 3. PROVIDE GASKETED ACCESS DOORS AND PANELS FOR INSPECTION AND ROUTINE MAINTENANCE OF THE INTERNAL COMPONENTS.
- 4. PROVIDE SOLID STATE VARIABLE SPEED CONTROLLERS FOR SMALL CEILING MOUNTED DRIVEN EXHAUST AND TRANSFER FANS.

E. HOUSINGS:

- 1. HOUSINGS SHALL BE HEAVY GAUGE ALUMINUM WITH RIGID INTERNAL SUPPORT STRUCTURE.
- 2. DRIVE FRAME ASSEMBLY SHALL BE OF HEAVY GAUGE STEEL AND MOUNTED ON VIBRATION ISOLATORS.

F. MOTORS:

- 1. MOTOR SHALL BE OPEN DRIPPROOF, AC INDUCTION MOTOR WITH DISCONNECT SWITCH.
- 2. MOTOR SHALL BE ELECTRONICALLY COMMUTATED TYPE (ECM) WITH MANUAL, DIAL TYPE POTENTIOMETER MOUNTED AT THE MOTOR TO CONTROL FAN MOTOR SPEED.
- 3. PROVIDE DISCONNECT SWITCH FOR POSITIVE SHUTOFF.

3 37 00 - AIR OUTLETS AND INLETS

A. ACCEPTABLE MANUFACTURERS:

- 1. AIR INLETS AND OUTLETS: TITUS, KRUEGER, E.H. PRICE, AIR FACTORS, AIR CONCEPTS.
- 2. ACCESSORIES: DAMPERS, EQUALIZING GRIDS, TURNING VANES, EXTRACTORS, PLENUMS, HARDWARE AND FRAMES SHALL BE PROVIDED BY THE SAME MANUFACTURERS AS THE AIR INLETS AND AIR OUTLETS PROVIDED.

B. GENERAL:

- 1. REFER TO ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR REFLECTED CEILING PLANS, ELEVATIONS, WALL AND CEILING TYPES AND CONSTRUCTION. AIR OUTLETS AND INLETS IN FIRE RATED CEILINGS OR WALLS MUST BE ALL STEEL CONSTRUCTION. COORDINATE FRAME AND BORDER TYPES TO ACCOMMODATE THE WALL OR CEILING SPECIFIED OR SHOWN ON THE ARCHITECTURAL DRAWINGS.
- 2. ALL DAMPERS PROVIDED SHALL BE OPERABLE FROM THE FACE OF THE AIR INLET OR AIR OUTLET.
- 3. OUTLET TYPES:
 - a. SQUARE CEILING DIFFUSER, PLAQUE FACE:
 - (1) PROVIDE ARCHITECTURAL SQUARE PANEL CEILING DIFFUSERS, ALL-STEEL CONSTRUCTION WITH AG-75 OPPOSED BLADE VOLUME DAMPER.
 - (2) DIFFUSER SHALL HAVE AN 22-GAUGE STEEL FACE PANEL THAT CAPTURES A SECONDARY 22-GAUGE PANEL. THE FACE PANEL SHALL BE REMOVABLE BY MEANS OF FOUR HANGER BRACKETS. THE EXPOSED SURFACE OF THE FACE PANEL SHALL BE SMOOTH, FLAT, AND FREE OF VISIBLE FASTENERS.
 - (3) THE BACKPAN SHALL BE ONE PIECE PRECISION DIE-STAMPED AND SHALL INCLUDE AN INTEGRALLY DRAWN INLET. THE DIFFUSER BACKPAN SHALL BE CONSTRUCTED OF 22-GAUGE STEEL.
 - (4) SIZES INDICATED ON THE DRAWINGS ARE NECK SIZES.
 - (5) BAKED WHITE ENAMEL FINISH.
 - (6) TYPE CD-B: 24-INCH BY 24-INCH FACE SIZE. TITUS MODEL OMNI OR APPROVED EQUAL.
 - (7) TYPE CD-A: 12-INCH BY 12-INCH FACE SIZE. TITUS MODEL OMNI OR APPROVED EQUAL.

c. DOUBLE DEFLECTION SUPPLY REGISTER:

- (1) ALL ALUMINUM REGISTER WITH REAR VERTICAL AND FRONT HORIZONTAL ADJUSTABLE AIR FOIL TYPE BLADES.
- (2) PROVIDE MODEL AG-35-AA ALUMINUM OPPOSED BLADE VOLUME CONTROL DAMPER, MODEL AG-45 EXTRACTOR, AND TYPE PF MOUNTING FRAME.
- (3) FRAMES SHALL BE 1.25 INCHES WIDE BY 0.05 INCH THICK ALUMINUM, INTERLOCKED AT THE CORNERS AND MECHANICALLY STAKED TO FORM A RIGID FRAME WITH FLUSH JOINTS AND COUNTERSUNK SCREW HOLES.
- (4) ALUMINUM BLADES SHALL BE SPACED ON 0.75 INCH CENTERS AND EXTEND COMPLETELY THROUGH THE SIDE FRAME ON EACH SIDE. BLADES SHALL BE INDIVIDUALLY ADJUSTABLE WITHOUT LOOSENING OR RATTLING AND SHALL BE SECURELY HELD IN PLACE WITH PERMANENTLY SPRING TENSIONED WIRE.
- (5) BAKED WHITE ENAMEL FINISH.
- (6) TYPE SG-A: TITUS MODEL 300RL OR APPROVED EQUAL.

a. COMBINATION PLENUM AND LINEAR SLOT:

- (1) CONTINUOUS LINEAR SLOT DIFFUSERS SHALL FULLY INTEGRATE WITH THE CEILING SYSTEM AND BE CONSTRUCTED OF 1/8-INCH MINIMUM EXTRUDED ALUMINUM WITH CONTINUOUS BAY VOLUME AND DEFLECTION CONTROL DAMPER FOR EACH SLOT. PROVIDE CONTINUOUS 26_GAUGE STEEL PLENUMS WITH 1/2-INCH ACOUSTICAL LINING SIZED AS PER MANUFACTURER'S RECOMMENDATION ABOVE DIFFUSERS WITH SUPPLY AIR CONNECTIONS AS INDICATED ON DRAWINGS.
- (2) THE SLOT DIFFUSERS SHALL HAVE PATTERN CONTROLLERS SUPPORTED WITH SPACER CHANNELS IN 48_INCH (NOMINAL) INCREMENTS THE ENTIRE LENGTH OF THE SLOT. THE PATTERN CONTROLLERS SHALL ALLOW INFINITE ADJUSTMENTS TO THE AIR STREAM AT 24_INCH INTERVALS RELATIVE TO THE DIRECTION OF THE AIR STREAM AS WELL AS EXTENDING OR REDUCING THE AIR THROW AS MAY BE REQUIRED TO SATISFY JOB CONDITIONS AND TO PROVIDE DRAFT-FREE AIR DISTRIBUTION. THE SLOT DIFFUSER SHALL MAINTAIN AIR FLOW ACROSS THE CEILING AND SHALL NOT "DUMP" EVEN WHEN AIRFLOW IS REDUCED TO 10% OF DESIGN AIR QUANTITIES. FIXED OR BLADE TYPE PATTERN CONTROLLERS ARE NOT ACCEPTABLE.
- (3) TYPE LD-A: TITUS MODEL FL20 OR APPROVED EQUAL.
- c. OVAL DUCT MOUNTED DOUBLE DEFLECTION SUPPLY REGISTER:
 - (1) PROVIDE STEEL BORDER REGISTER WITH REAR VERTICAL AND FRONT HORIZONTAL ADJUSTABLE AIR FOIL TYPE SOLID ALUMINUM BLADES.
 - (2) PROVIDE FACTORY ADJUSTABLE AIR-SCOPP DAMPER EXTRACTOR.
 - (3) FRAMES SHALL BE 1.25 INCHES WIDE, 20 GAUGE STEEL WITH FULL PENETRATION RESISTANCE WELDS AND A STEEL REINFORCEMENT GASKET AT EACH CORNER. GRIND WELDS SMOOTH AND COUNTERSINK ALL SCREW HOLES.
 - (4) ALUMINUM BLADES SHALL BE SPACED ON 0.75 INCH CENTERS AND EXTEND COMPLETELY THROUGH THE SIDE FRAME ON EACH SIDE. BLADES SHALL BE INDIVIDUALLY ADJUSTABLE WITHOUT LOOSENING OR RATTLING AND SHALL BE SECURELY HELD IN PLACE WITH PERMANENTLY SPRING TENSIONED WIRE.
 - (5) BAKED WHITE ENAMEL FINISH.
 - (6) TYPE SG-A: TITUS MODEL S300FL OR APPROVED EQUAL.

4. INLET TYPES:

- a. SQUARE CEILING DIFFUSER, LOUVER FACE:
 - (1) PROVIDE LOUVER FACE SUPPLY DIFFUSERS, ALL-STEEL CONSTRUCTION WITH AG-95 STEEL OPPOSED BLADE VOLUME CONTROL DAMPER AND ADJUSTABLE DISCHARGE PATTERN CONTROL VANES.
 - (2) DIFFUSER SHALL CONSIST OF AN OUTER FRAME ASSEMBLY WITH A SQUARE, RECTANGULAR OR ROUND INLET (USING A TRANSITION DUCT FITTING).
 - (3) PROVIDE ADJUSTABLE SINGLE ADJUSTABLE PATTERN VANES FOR FULL VERTICAL AND HORIZONTAL PROJECTIONS.
 - (4) SIZES INDICATED ON THE DRAWINGS ARE NECK SIZES.
 - (5) AIR PATTERN AS INDICATED ON THE DRAWINGS.
 - (6) BAKED WHITE ENAMEL FINISH.
 - (7) TYPE RG-A: 24-INCH BY 24-INCH FACE SIZE. TITUS MODEL 350RL OR APPROVED EQUAL.
 - (8) TYPE EG-A: 12-INCH BY 12-INCH FACE SIZE. TITUS MODEL 350RL OR APPROVED EQUAL.
 - (9) TYPE EG-B: 24-INCH BY 24-INCH FACE SIZE. TITUS MODEL 350FL OR APPROVED EQUAL.

c. SINGLE DEFLECTION RETURN REGISTER:

- (1) ALL ALUMINUM REGISTER WITH FRONT HORIZONTAL ADJUSTABLE AIR FOIL TYPE BLADES.
- (2) PROVIDE MODEL AG-35-AA ALUMINUM OPPOSED BLADE VOLUME CONTROL DAMPER, MODEL AG-45 EXTRACTOR, AND TYPE PF MOUNTING FRAME.
- (3) FRAMES SHALL BE 1.25 INCHES WIDE BY 0.05 INCH THICK ALUMINUM, INTERLOCKED AT THE CORNERS AND MECHANICALLY STAKED TO FORM A RIGID FRAME WITH FLUSH JOINTS AND COUNTERSUNK SCREW HOLES.
- (4) ALUMINUM BLADES SHALL BE SPACED ON 0.75 INCH CENTERS AND EXTEND COMPLETELY THROUGH THE SIDE FRAME ON EACH SIDE. BLADES SHALL BE INDIVIDUALLY ADJUSTABLE WITHOUT LOOSENING OR RATTLING AND SHALL BE SECURELY HELD IN PLACE WITH PERMANENTLY SPRING TENSIONED WIRE.
- (5) BAKED WHITE ENAMEL FINISH.
- (6) TYPE RG-B: TITUS MODEL 350RL OR APPROVED EQUAL.

23 81 46 - WATER COOLED HEAT PUMP

A. ACCEPTABLE MANUFACTURERS:

- 1. HORIZONTAL: BOSCH, ABOVE AIR, CLIMATE MASTER, TRANE
- B. PROVIDE SELF-CONTAINED, PACKAGED, FACTORY ASSEMBLED, PRE-WIRED UNIT CONSISTING OF CABINET, BLOWER/MOTOR ASSEMBLY, WATER TO REFRIGERANT HEAT EXCHANGER, CONTROLS, AIR FILTER, HERMETIC COMPRESSORS, REFRIGERANT TO AIR COIL, REFRIGERANT REVERSING VALVE, AND THERMOSTAT.

- 1. UNIT SHALL HAVE MINIMUM COP OF 4.3 AND EER OF 12.1 WHEN RATED IN ACCORD WITH ARI 320-86.
- 2. CABINET: HEAVY GAUGE GALVANIZED STEEL WITH BAKED ACRYLIC PAINT FINISH EASILY REMOVED AND SECURED ACCESS DOORS, ONE INCH GLASS FIBER INSULATION ON CASING SURFACES. NO EXPOSED EDGES OR UNSEALED INSULATION SEAMS.
- 3. WATER TO REFRIGERANT: FINNED COPPER WATER TUBES IN A STEEL HEAT EXCHANGER REFRIGERANT SHELL BOTH RATED FOR 450 PSIG.
- 4. BLOWER/MOTOR ASSEMBLY: CENTRIFUGAL TYPE DIDW FORWARD CURVED BLADES MOUNTED ON A STEEL SHAFT WITH OUTBOARD AND CENTER BEARINGS ADJUSTABLE VARIABLE PITCH DRIVE, FULLY ISOLATED HINGE MOUNTED 1800 RPM MOTOR. FAN DISCHARGE SHALL BE FIELD SELECTABLE FOR SIDE OR END CONNECTION.
- 5. AIR TO REFRIGERANT COIL: STAGGERED COPPER TUBE ALUMINUM FIN COIL ASSEMBLY WITH GALVANIZED DRAIN PAN, DRAIN CONNECTION, REFRIGERANT PIPING CONNECTIONS. SEPARATE COILS AND CIRCUIT FOR EACH COMPRESSOR.
- 6. REVERSING VALVE: FACTORY INSTALLED REFRIGERANT REVERSING VALVE, PILOT OPERATED SLIDING PISTON TYPE.
- 7. COMPRESSOR: HERMETIC, EXTERNAL AND INTERNAL VIBRATION ISOLATION INDIVIDUALLY CIRCUITED.
- 8. AIR FILTER: 2_INCH DISPOSABLE FIBERGLASS MEDIA, SLIDE-OUT SIDE FRAME.

C. CONTROLS:

- 1. MOUNT CONTROLS IN ACCESSIBLE AREA OF UNIT CASING.
- 2. SAFETY: HIGH PRESSURE AND LOW TEMPERATURE CUTOUTS WITH LOCKOUT RELAY TO PREVENT COMPRESSOR SHORT CYCLING.
- 3. ANTI-CYCLE TIMER: COMPRESSORS TO BE PROVIDED WITH ANTI-CYCLE TIMERS TO PREVENT RAPID RESTARTING OF COMPRESSOR.
- 4. MOTOR CONTROL: BLOWER AND COMPRESSORS CONTROLLED BY SEPARATE CONTACTORS. PROVIDE BUILT-IN OVERLOAD PROTECTION AND NON-FUSED DISCONNECTS.
- 5. HEAT PUMPS SHALL BE PROVIDED WITH TERMINAL POINTS TO PERMIT CONNECTION TO BUILDING FIRE ALARM SYSTEM FOR COMPRESSOR ONLY AUTOMATIC SHUTDOWN.
- 6. PROVIDE CONTACTS IN UNIT CONTROL PANEL FOR REMOTE START-STOP OF UNITS FROM BUILDING MANAGEMENT SYSTEM. UNIT CONTROL PANEL SHALL CONTAIN NECESSARY RELAYS, TIMERS, TRANSFORMERS, FUSES AND TERMINALS FOR INTERCONNECTING WIRING BETWEEN THERMOSTAT, UNIT AND BMS.
- 7. A SPACE SENSOR SUITABLE FOR CONTROL OF ALL STAGES OF UNIT OPERATION WILL BE PROVIDED BY BUILDING CONTROLS CONTRACTOR.

- a. THERMOSTAT FOR UNITS TO BE LOW VOLTAGE, REMOTE MOUNTED WITH MANUAL CHANGE OVER, HILO FAN SWITCH.

- 8. PROVIDE A STAND-ALONE MICROPROCESSOR-BASED WALL THERMOSTAT WITH TIME SCHEDULE, FAN ON/OFF, HEAT/COOL SELECTION CAPABILITIES.

END OF SECTION



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MECHANICAL SPECIFICATIONS SHEET #5

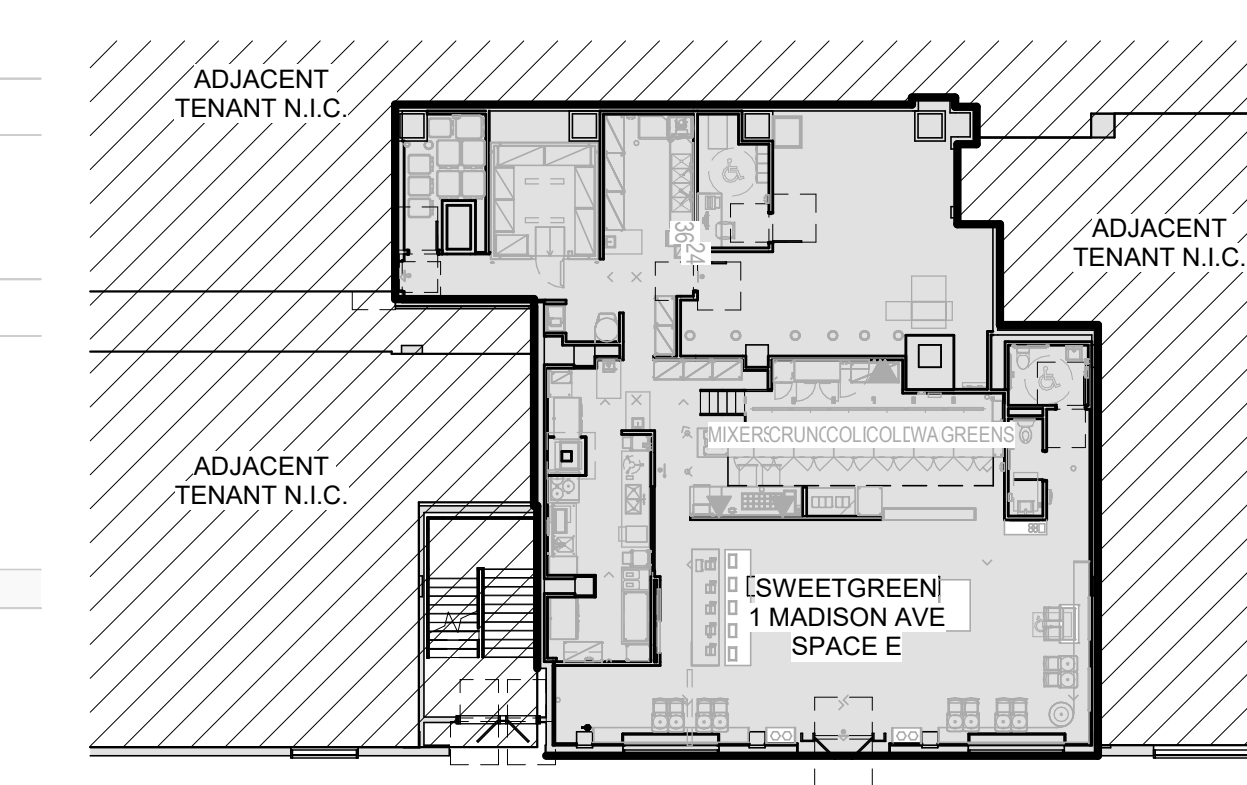
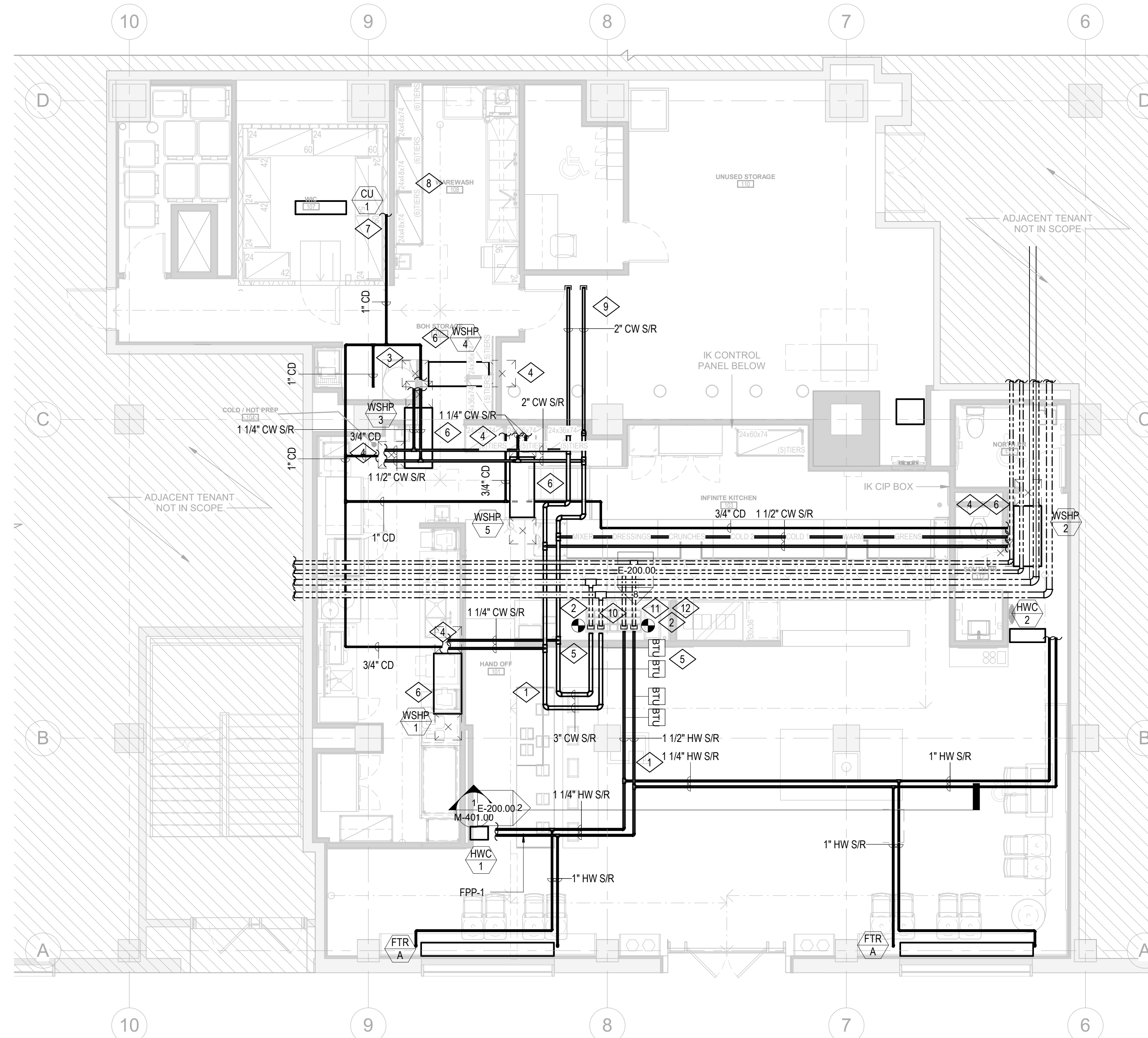
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GENERAL NOTES

- COORDINATE ALL SCOPE OF WORK, SYSTEM SHUT DOWNS, AND SCHEDULING WITH ALL TRADES AND LANDLORD PRIOR TO CONSTRUCTION.
- COORDINATE ALL SCOPE AND CONSTRUCTION REQUIREMENTS WITH BUILDING RULES AND REGULATIONS.
- ALL CONDENSATE DRAIN PIPING IS TO BE PITCHED A MINIMUM OF 1/8" PER 1' FROM CONNECTION POINT TO TERMINATION LOCATION.
- NO DUCTWORK OR PIPING SHALL BE RUN WITHIN EQUIPMENT REQUIRED ACCESS SPACE. ACCESS SHOWN WITHIN FLOOR PLAN IF FOR REFERENCE ONLY, COORDINATE WITH EQUIPMENT MANUFACTURER FOR SPECIFIC ACCESS REQUIREMENTS.
- PROVIDE BACKFLOW CHECK VALVES ON CONDENSATE PIPING FOR EACH CONNECTION TO MAIN CONDENSATE PIPE. REFER TO MECHANICAL DETAILS AND SPECIFICATIONS FOR ADDITIONAL PIPING SCOPE.
- COORDINATE WITH LANDLORD AND SCANNED DECK LOCATIONS FOR ALL EQUIPMENT, DUCTWORK, PIPING, AND ACCESSORY HANGER LOCATIONS PRIOR TO ATTACHMENT.
- MECHANICAL AND GENERAL CONTRACTOR ARE RESPONSIBLE FOR ALL TEMPORARY HEATING OR COOLING REQUIREMENTS.

MECHANICAL KEYNOTES

- ROUTE CONDENSER WATER AND HOT WATER PIPING TO AVOID CONFLICTS WITH EXISTING VALVES, CLEANOUTS, AND ACCESS POINTS REQUIRED FOR BASE BUILDING SERVICES. COORDINATE ALL ROUTING AND ELEVATIONS WITH EQUIPMENT CLEARANCE AND CONNECTION REQUIREMENTS.
- CONNECT NEW CONDENSER WATER AND HOT WATER SUPPLY AND RETURN PIPING TO EXISTING VALVED AND CAPPED CONNECTIONS. COORDINATE EXACT LOCATION OF EXISTING CONDENSER WATER VALVED AND CAPPED CONNECTIONS IN FIELD.
- CONDENSATE DRAIN PIPING DOWN TO JANITORS SINK. ROUTE VERTICAL PIPING ALONG SINK REAR WALL TO NOT CAUSE CONFLICT WITH SINK OPERATION.
- PROVIDE EXTERNAL CONDENSATE PUMP AND STAINLESS STEEL DRAIN PAN WITH LEAK DETECTION. LEAK DETECTION TO BE WIRED TO UNIT SHUTDOWN. COORDINATE WITH ELECTRICAL AND CONTROLS CONTRACTOR.
- LOCATE NEW UNIT VALVE TRIM AT ACCESSIBLE ELEVATIONS FROM FINISHED CEILING HEIGHT. VALVE TRIM TO BE LOCATED A MAXIMUM OF 3'-0" ABOVE FINISHED CEILING.
- UNIT TO BE INDIVIDUALLY HUNG AND NOT PROVIDED WITH A SERVICE PLATFORM. NEW UNIT TO BE INSTALLED AT AN ACCESSIBLE ELEVATION FROM FINISHED CEILING HEIGHT. UNIT TO BE LOCATED A MAXIMUM OF 3'-0" ABOVE FINISHED CEILING. ALL HANGER ATTACHMENTS TO SLAB ARE TO BE COORDINATED WITH STRUCTURAL SCAN AND BE ATTACHED IN AN APPROVED LOCATION. COORDINATE WITH STRUCTURAL ENGINEER, AND LANDLORD PRIOR TO ATTACHMENT. COORDINATE ALL PIPE ROUTING MODIFICATIONS WITH HANGING REQUIREMENTS.
- PROVIDE 1" CONDENSATE DRAIN PIPING FROM WALK-IN COOLER TO NEAREST FLOOR DRAIN. PIPING TO BE PITCHED 1/8" PER 1'. ROUTE PIPING TO NOT CAUSE CONFLICTS WITH EQUIPMENT OR PERSONNEL OPERATIONS.
- PROVIDE REFRIGERANT PIPING TO WALK-IN COOLER PER MANUFACTURER REQUIREMENTS. INSULATE ALL REFRIGERANT PIPING.
- PROVIDE CAPPED CONDENSER WATER CONNECTIONS IN STORAGE SPACE FOR FUTURE USE. PROVIDE FULL VALVE TRIM. ACCESS TO EXISTING BASE BUILDING LZCWS&R AND LZHS&R VALVES SHALL BE MAINTAINED AND NOT OBSTRUCTED BY NEW MEP/FP SERVICES.
- MECHANICAL CONTRACTOR TO PROVIDE INITIAL PRESSURE READINGS AT BASE BUILDING PIPING CONNECTION POINTS FOR ENGINEERS REVIEW. COORDINATE SYSTEM OPERATION SCHEDULE WITH BUILDING PRIOR TO TESTING.
- MECHANICAL CONTRACTOR TO MAINTAIN BASE BUILDING CHEMICAL TREATMENT VENDOR TO PROVIDE FLUSHING, CLEANING, TREATMENT, THROUGH ALL NEW PIPING SYSTEMS PRIOR TO THE OPENING OF BASE BUILDING VALVED CONNECTIONS.



1 MECHANICAL PIPING PLAN
3/16" = 1'-0"

2 KEY MAP/IZONING
1" = 20'-0"



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MECHANICAL PIPING PLAN

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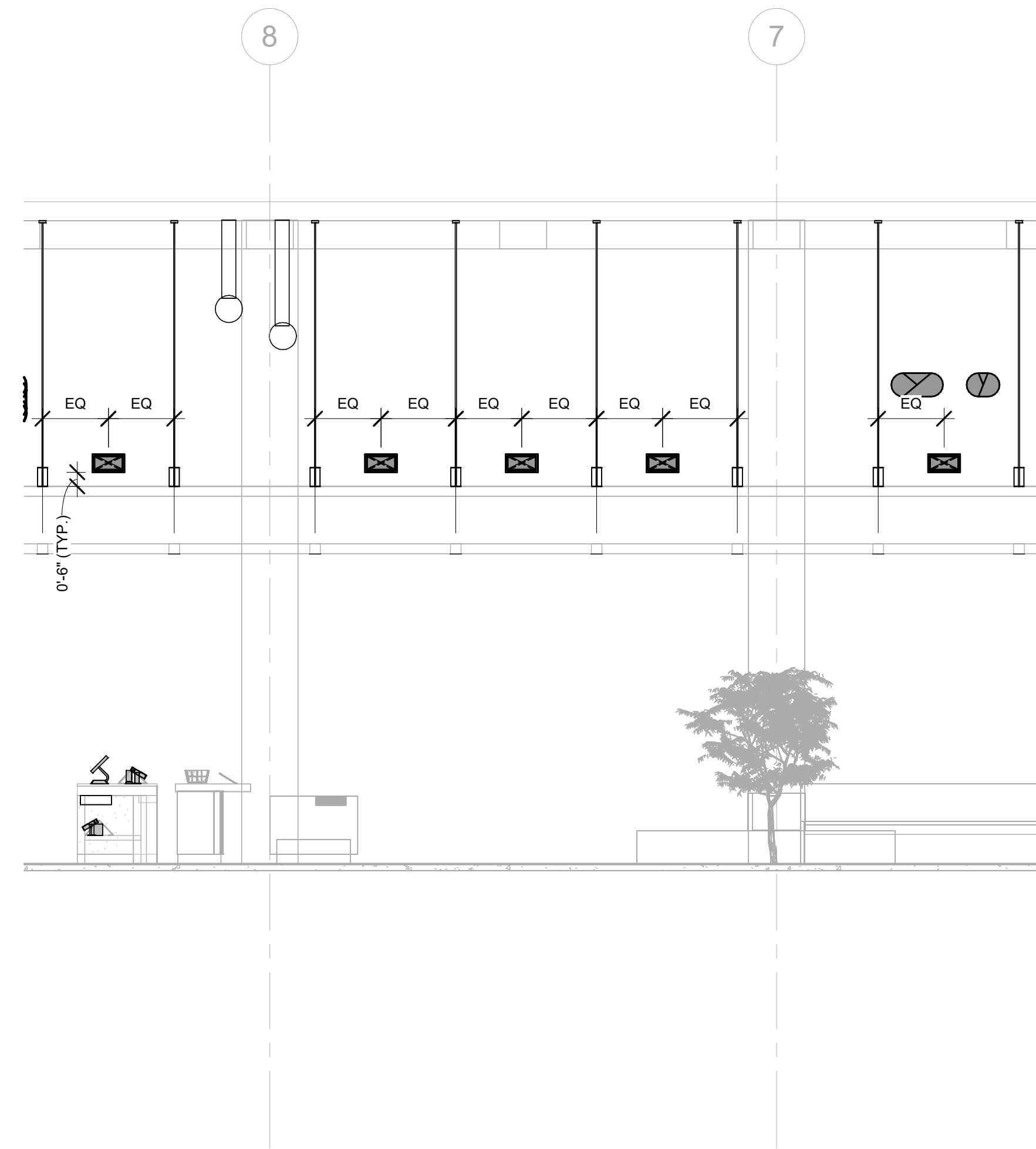
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HVAC ELEVATION

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① M+M -SEC- SERVE LINE DIFFUSER
1/4" = 1'-0"

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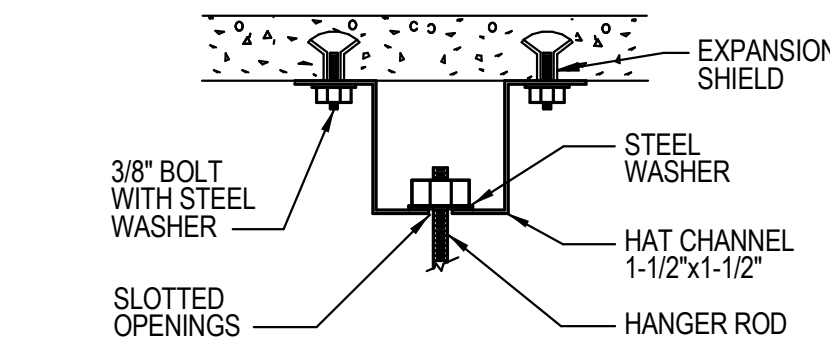
PROJECT INFORMATION:
23RD + PARK
PROJECT INFORMATION:
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SPACE E
NEW YORK, NY 10010**

DRAWN BY: Author
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PROJECT MANAGER:
SG DESIGN MANAGER:
SG CONSTR. MANAGER:
PROJECT NO: 224134
TEMPLATE VERSION: 04.28.2023

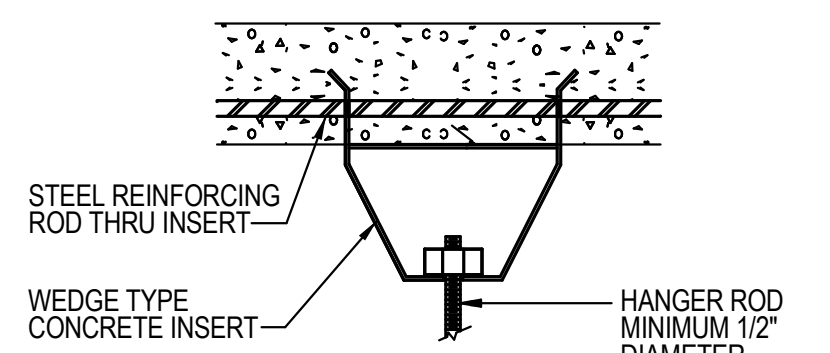
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02.11.2025 IFC SET

**MECHANICAL
DETAILS SHEET #1**

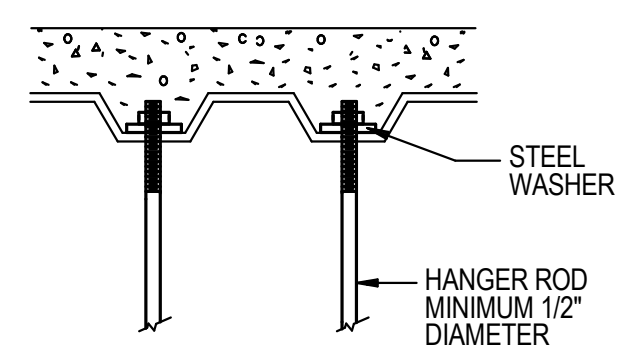
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SHEET 10 of 14



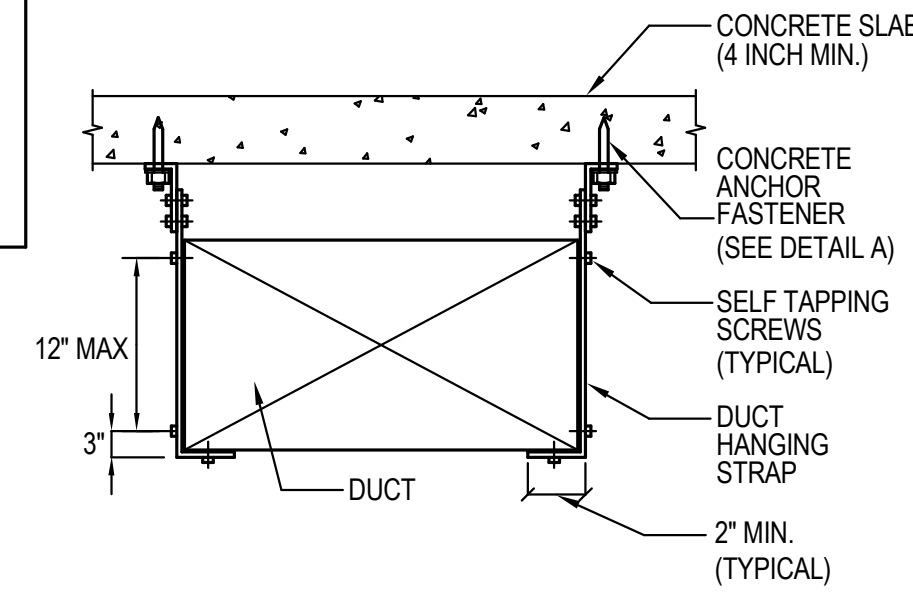
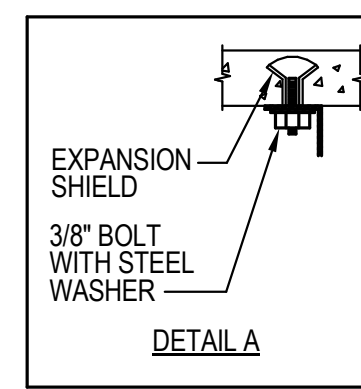
DETAIL 'A'
FOR EXISTING CONCRETE SLABS



DETAIL 'B'
FOR NEW CONCRETE SLABS

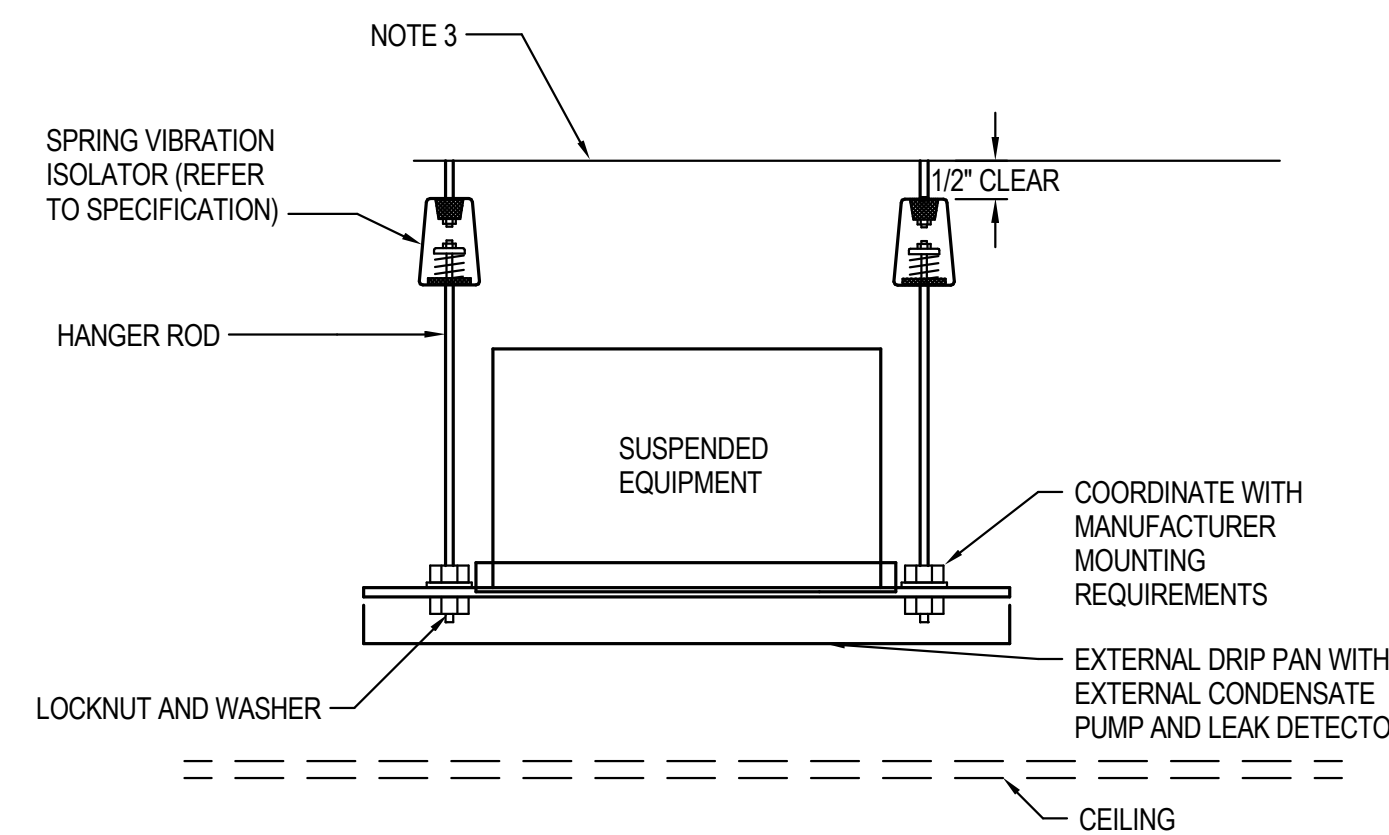


DETAIL 'C'
FOR NEW METAL DECK SLABS



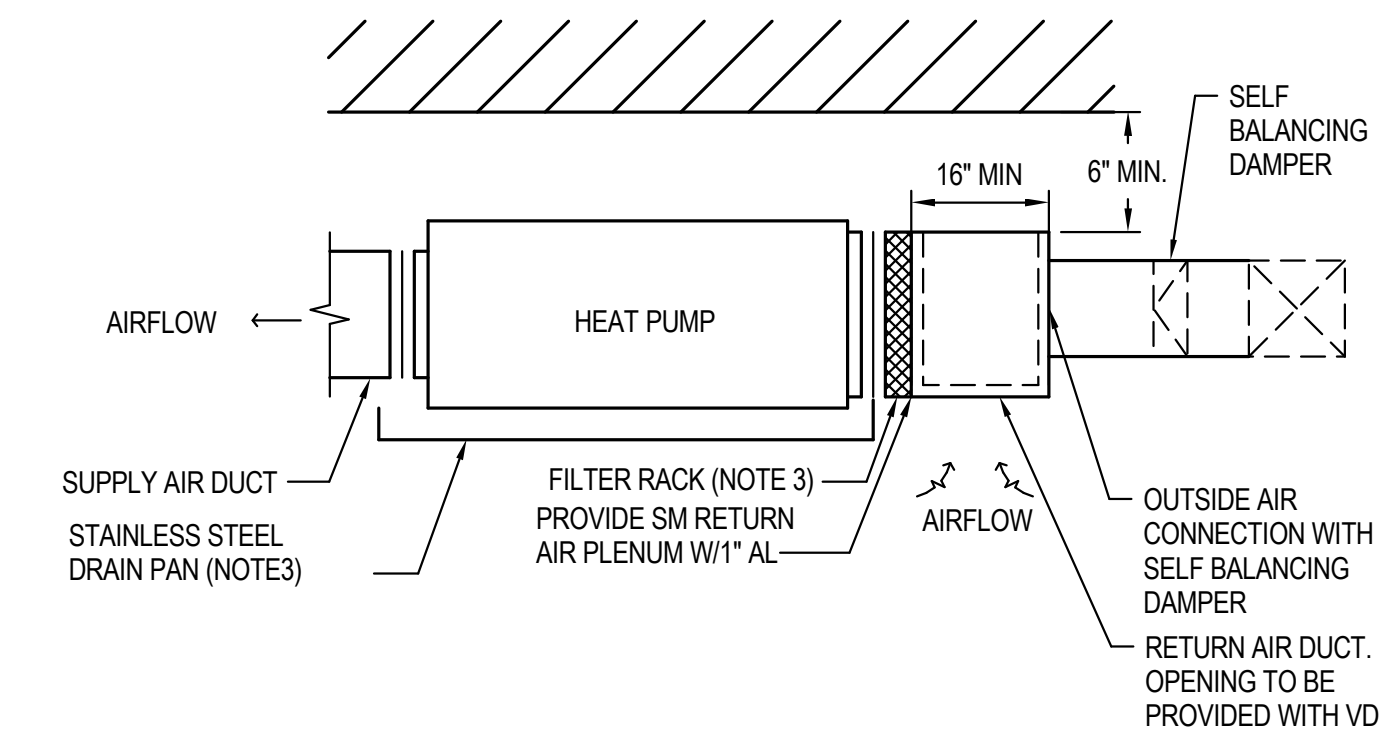
NOTES FOR DUCT HANGING DETAILS:

- DUCT SHALL BE SUSPENDED WITH GALVANIZED BAND IRON STRAPS SECURELY FASTENED TO THE BOTTOM AND SIDE OF THE DUCT. STRAPS TO BE SIZED IN ACCORDANCE WITH THE SMACNA TABLE 4-1 OR ACCORDING TO LOCAL CODES, WHICHEVER IS MORE STRINGENT.
- | CROSS SECTIONAL AREA (SQ.FT.) | MAX. HANGER SPACING (FT.) |
|-------------------------------|---------------------------|
| UP TO 4 | 8 |
| OVER 4 NOT TO EXCEED 10 | 6 |
| OVER 10 | 4 |
- DUCTS WIDER THAN 60 INCHES TO BE SUPPORTED BY TRAPEZE ANGLES IN ACCORDANCE WITH SMACNA TABLE 4-3.



NOTES:

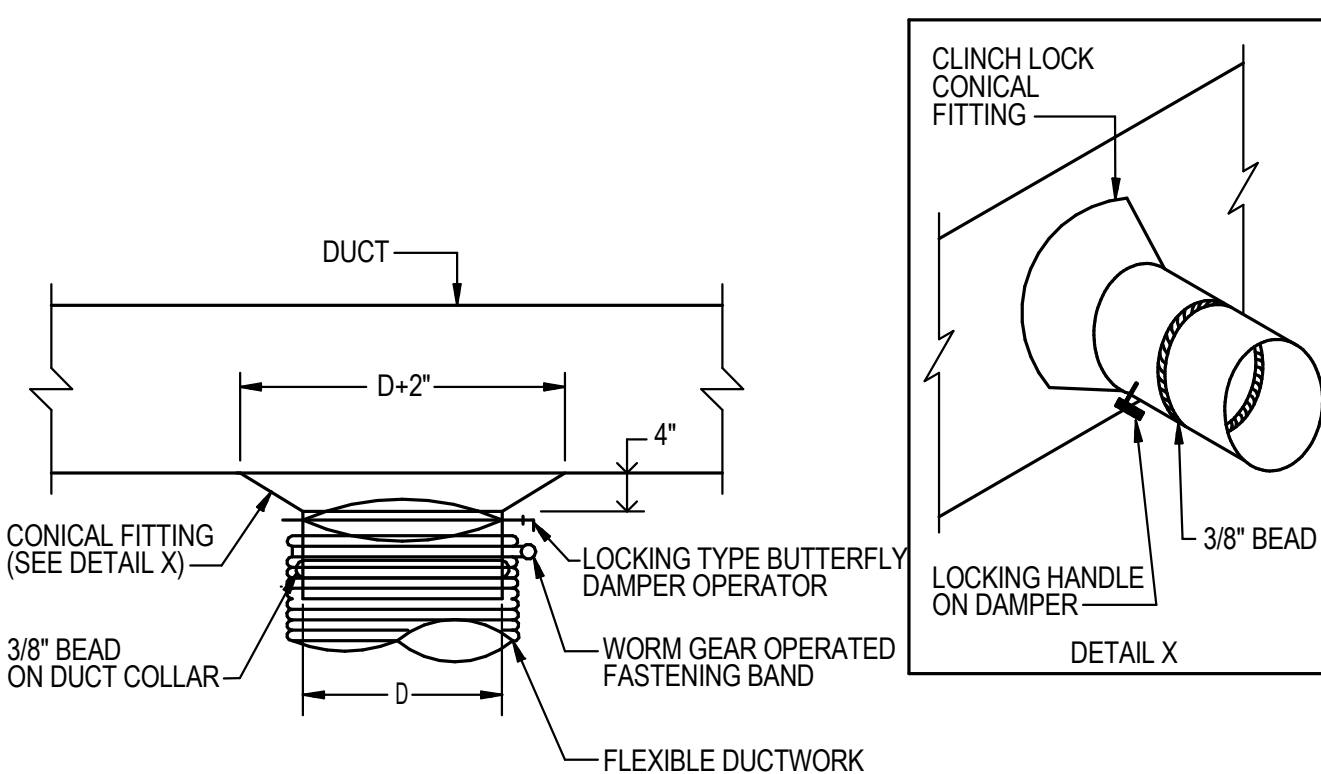
- HANGER SPACING ALONG LENGTH OF UNIT TO BE AS FOLLOWS: MINIMUM - 2 HANGERS MAXIMUM SPACING
- COORDINATE ALL ROD THICKNESSES, ATTACHMENTS, AND ANGLE SUPPORT SIZING WITH APPROVED EQUIPMENT SPECIFICATIONS AND MANUFACTURER RECOMMENDATIONS.
- ATTACH TO STRUCTURE ABOVE.
- MECHANICAL SUBCONTRACTOR TO STAINLESS STEEL EXTERNAL DRAIN PAN, EXTERNAL CONDENSATE PUMP, AND LEAK DETECTOR.



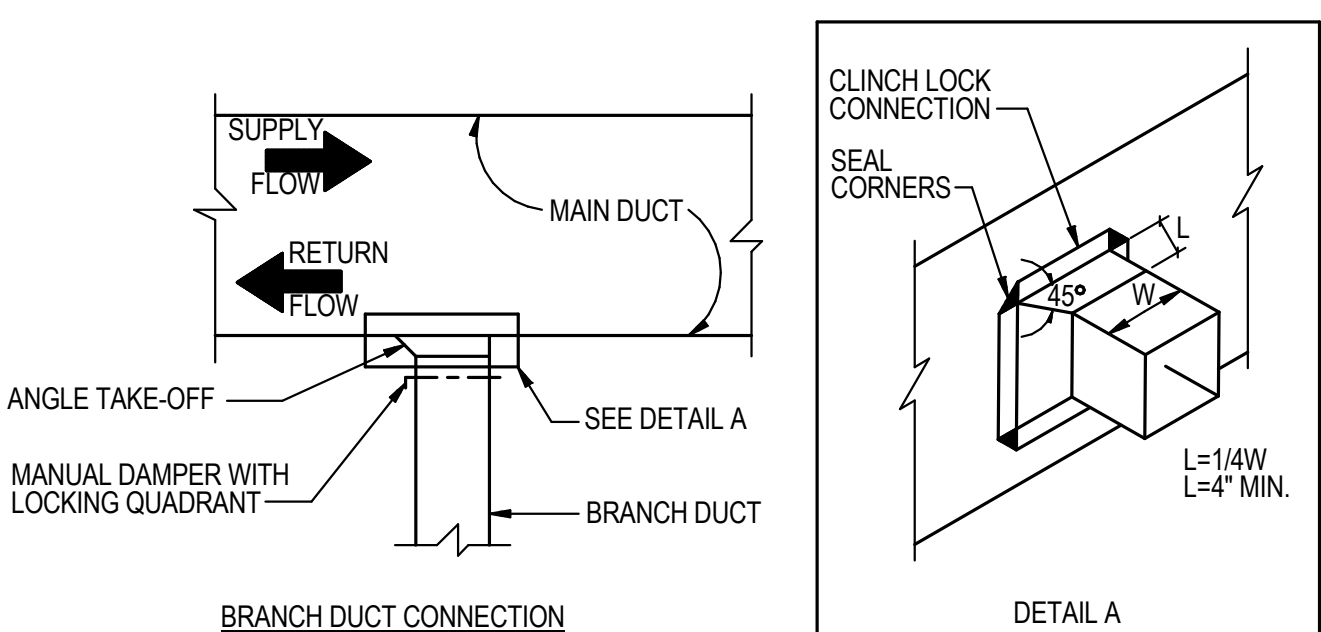
NOTES:

- PROVIDE FLEXIBLE CONNECTIONS AT UNIT SUPPLY AND RETURN.
- FILTER RACKS AND RETURN BOOTS TO BE FABRICATED BY THE MECHANICAL CONTRACTOR. PROVIDE MINIMUM MERV-13 FILTERS.
- COORDINATE DRAIN PAN APPLICATION AND REQUIREMENTS WITH EQUIPMENT ACCESS AND FACTORY PROVIDED INTERNAL ACCESSORIES. AS APPLICABLE, PROVIDE STAINLESS STEEL DRAIN PAN WITH LEAK DETECTION AND EXTERNAL CONDENSATE PUMP FOR ALL UNITS.

1 STRUCTURE ATTACHMENTS
SCALE: NTS

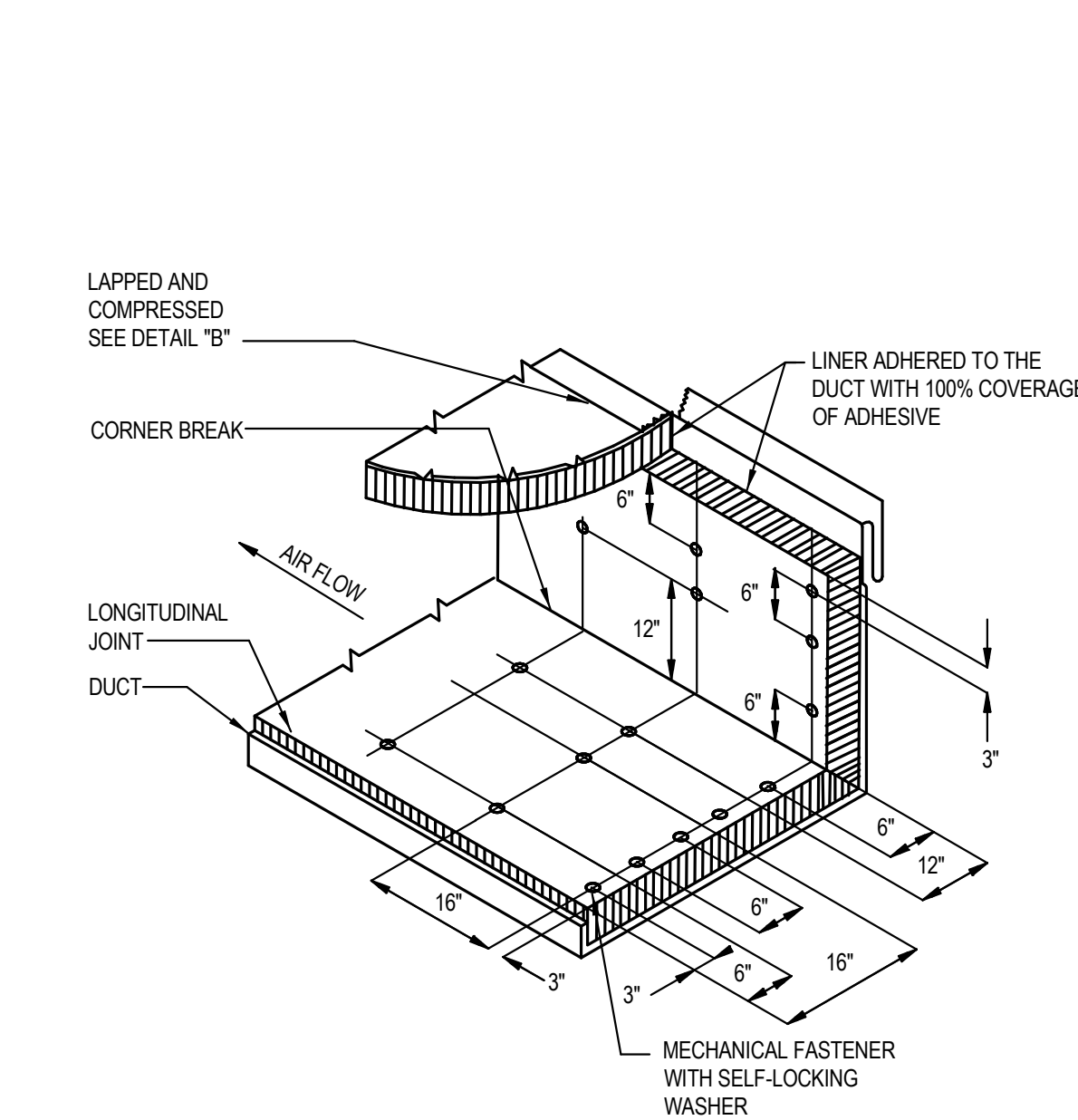


FLEXIBLE DUCT CONNECTION TO MAIN DUCTS



5 LOW PRESSURE BRANCH DUCT CONNECTIONS
SCALE: NTS

2 DUCT HANGING DETAIL FOR EXISTING SLAB
SCALE: NTS

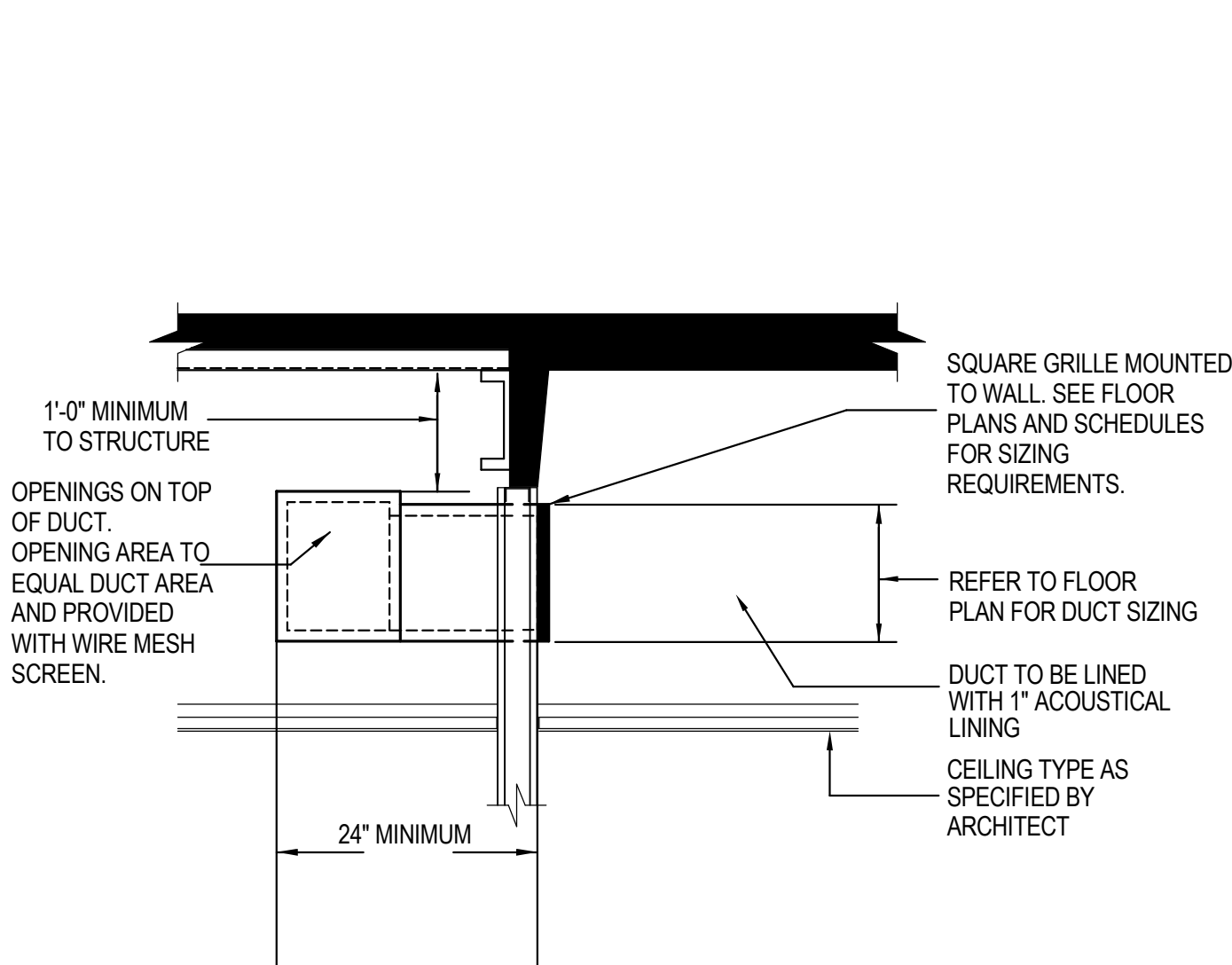


NOTES:

- MECHANICAL FASTENERS ARE TO BE SPOT WELDED TO DUCTWORK.
- PROVIDE SHEET METAL NOSING AS DESCRIBED IN SPECIFICATIONS.

6 ACOUSTICAL DUCT LINING DETAIL
SCALE: NTS

3 EQUIPMENT HANGING DETAIL
SCALE: NTS

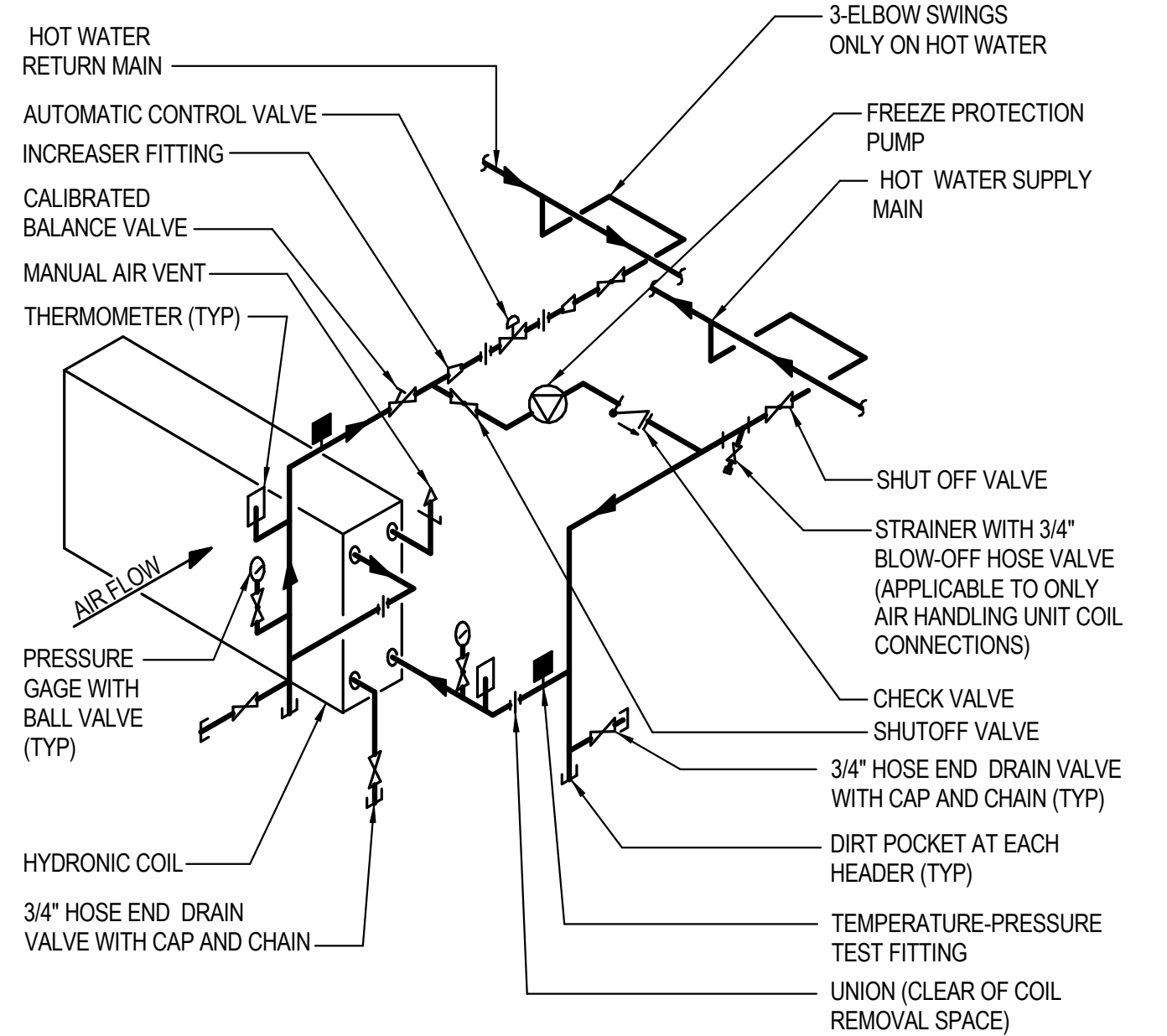


NOTES FOR TRANSFER AIR DUCT ASSEMBLY:

- FOR TRANSFER DUCTS NOT CONNECTED TO CEILING OUTLETS PROVIDE AN UPTURN 90 DEGREE ELBOW AT EACH OPEN END OF THE DUCT. ELBOW TERMINATION ELEVATIONS SHALL BE COORDINATED WITH ALL OBSTRUCTIONS TO PROVIDE EQUIVALENT OPEN FREE AREA OF TRANSFER DUCT OPENING
- ALL TRANSFER OPENINGS ABOVE CONCEALED CEILINGS ARE TO BE PROVIDED WITH WIRE MESH SCREENS.

7 TRANSFER AIR DUCT ASSEMBLIES
SCALE: NTS

4 WATER SOURCE HEAT PUMP HANGING DETAIL
SCALE: NTS



NOTES:

- ALL BRANCH PIPING, SUPPLY, RETURN AND VERTICAL HEADERS TO BE FULL SIZE BOTTOM CONNECTION FROM MAIN (REFER TO DRAWINGS FOR PIPE SIZE).
- ALL HORIZONTAL CONNECTIONS TO COIL FROM VERTICAL HEADERS TO BE SIZE OF COIL CONNECTION OUTLET/INLET, U.O.N.

8 HOT WATER COIL PIPING (2-WAY CONTROL VALVE)
SCALE: NTS

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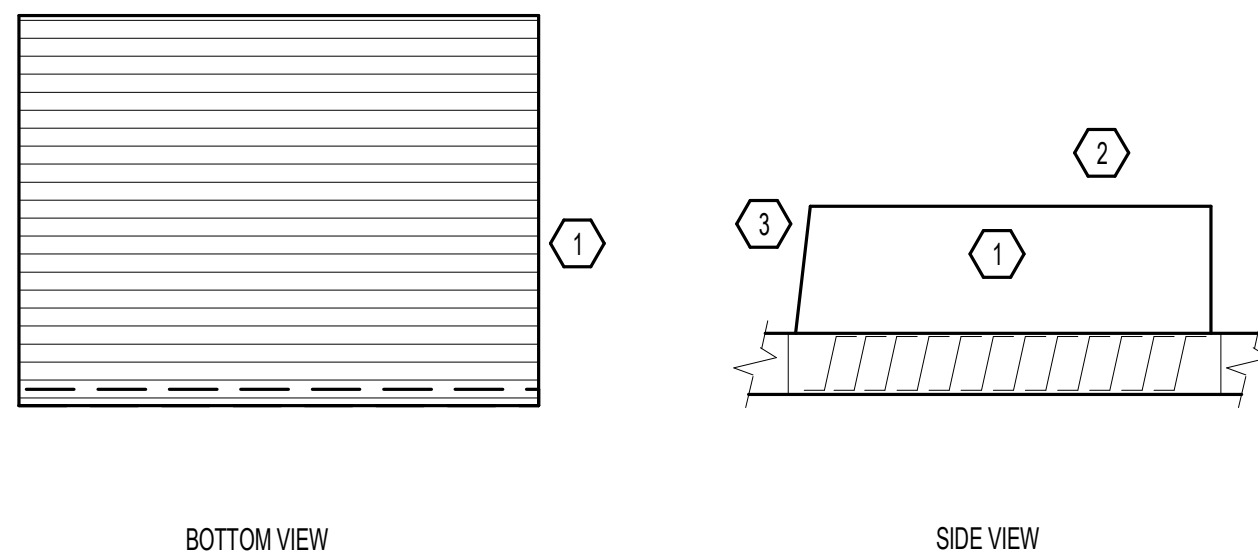
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**MECHANICAL
DETAILS SHEET #2**

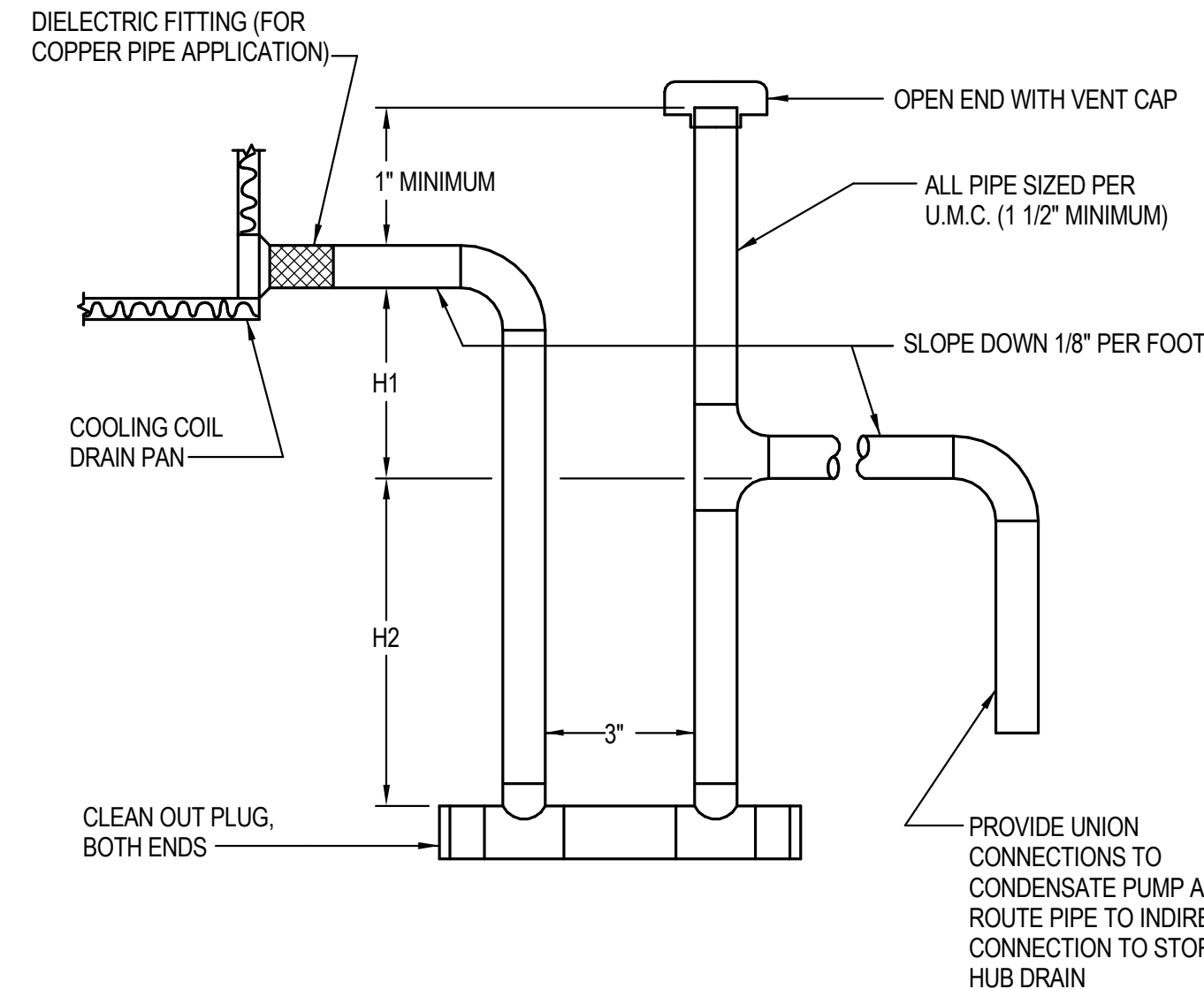
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SHEET 11 of 14



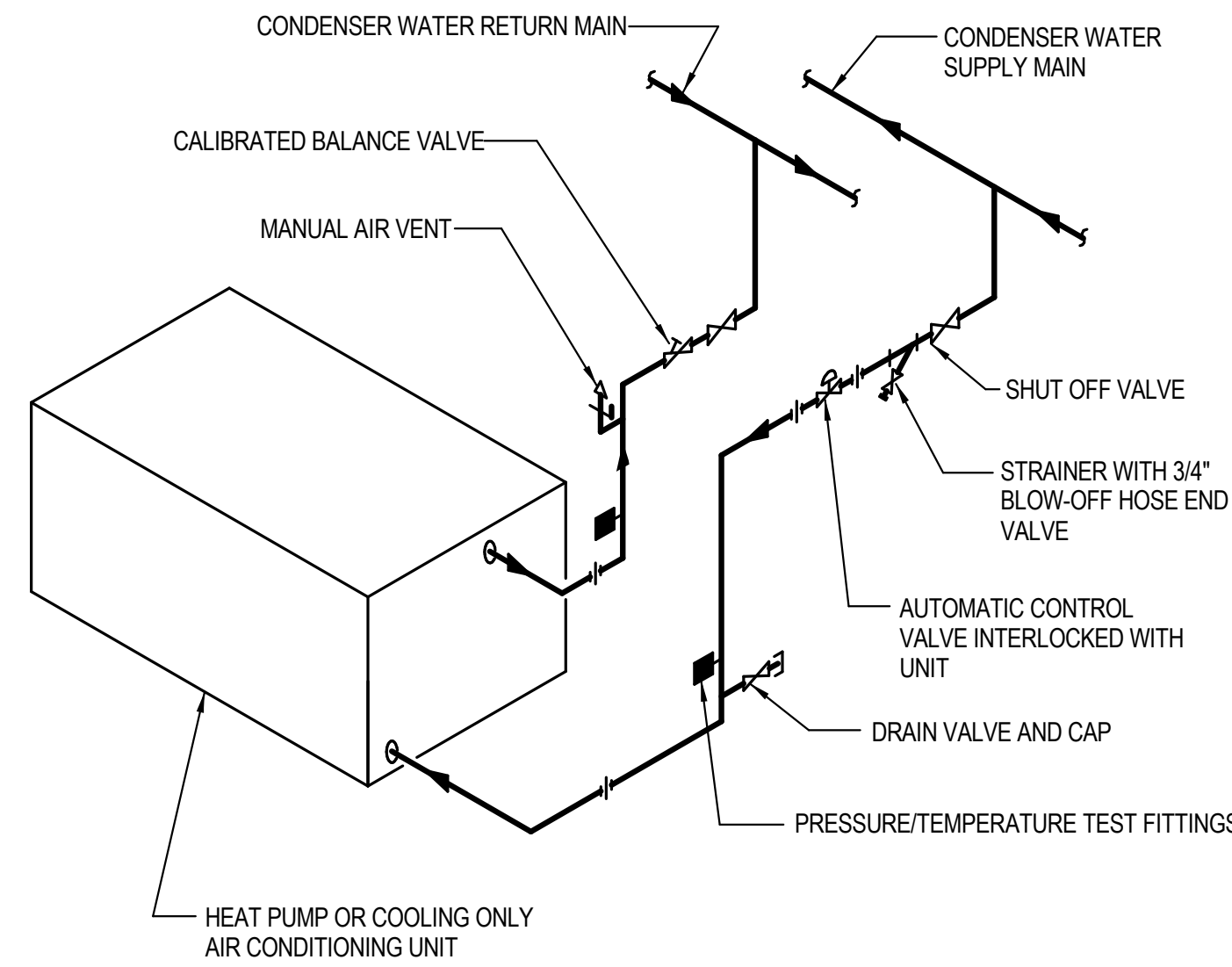
- 1 SHEETMETAL PLENUM TO BE SIZED FOR FREE AREA REQUIREMENT. REFER TO DRAWINGS.
- 2 COORDINATE LOUVER CONNECTION REQUIREMENTS WITH EXISTING LOUVER.
- 3 SHEETMETAL PLENUM TO PITCHED TOWARDS EXTERIOR. MAKE ALL SEAMS WATERTIGHT.

1 LOUVER PLENUM DETAIL
SCALE: NTS

COIL TYPE	H1 (HEIGHT)	H2 (HEIGHT)
BLOW-THROUGH (LOCATED ON DISCHARGE SIDE OF FAN)	1" MINIMUM	POSITIVE STATIC PRESSURE AT DRAIN PAN IN INCHES TIMES 2 (2" MINIMUM)
DRAW-THROUGH (LOCATED ON SUCTION SIDE OF FAN)	NEGATIVE STATIC PRESSURE AT DRAIN PAN IN INCHES PLUS 1"	NEGATIVE STATIC PRESSURE AT DRAIN PAN IN INCHES PLUS 1"

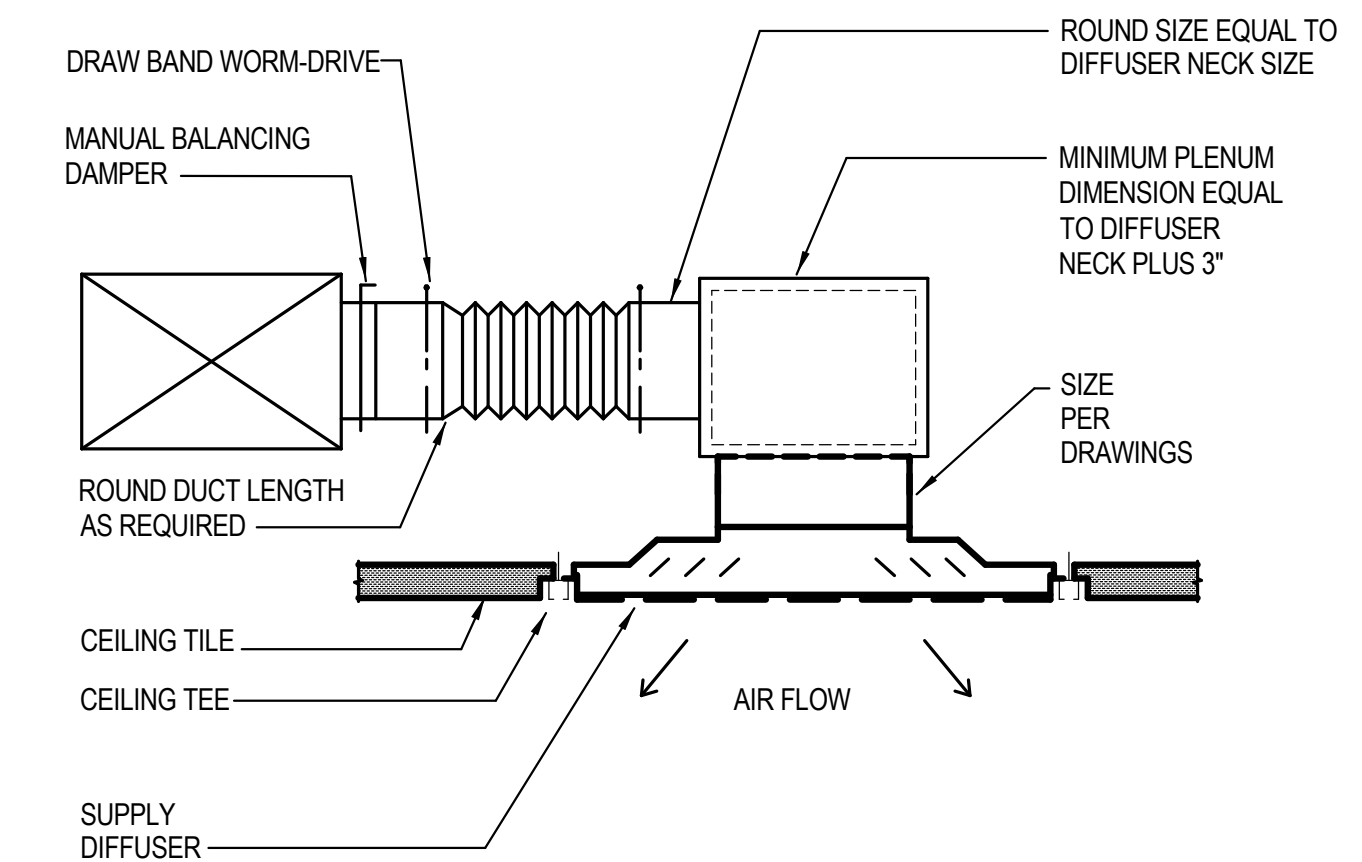


2 COOLING COIL CONDENSATE TRAP
SCALE: NTS

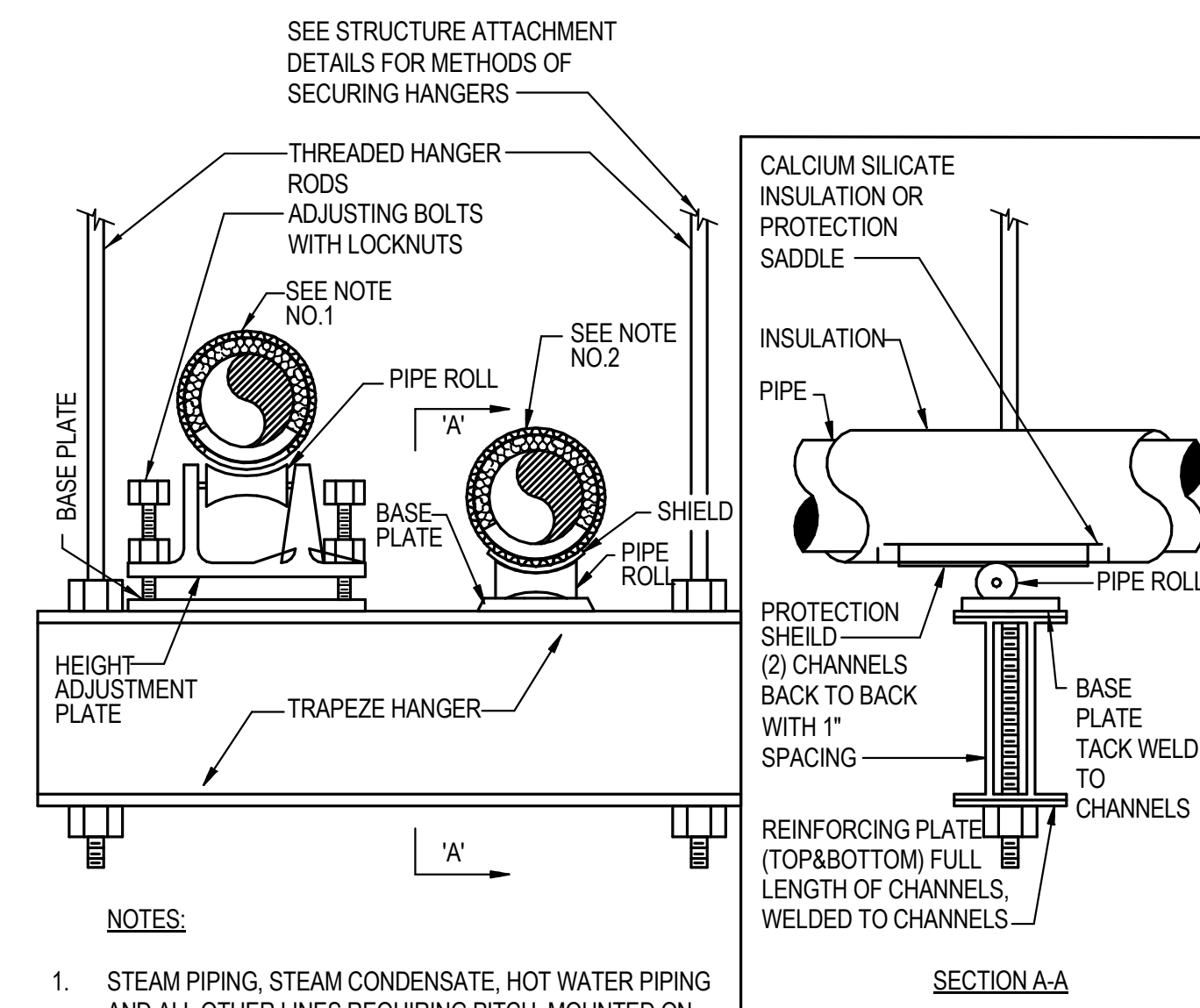


- NOTES:
1. REFER TO DRAWINGS FOR PIPE SIZES.
 2. ALL PIPING TO BE CLEAR OF SERVICE AND ACCESS CLEARANCE.
 3. OMIT ON/OFF AUTOMATIC VALVE ONLY IF VALVE IS PROVIDED INTERNAL TO THE UNIT.

3 WATER-COOLED HEAT PUMP PIPING CONNECTIONS
SCALE: NTS

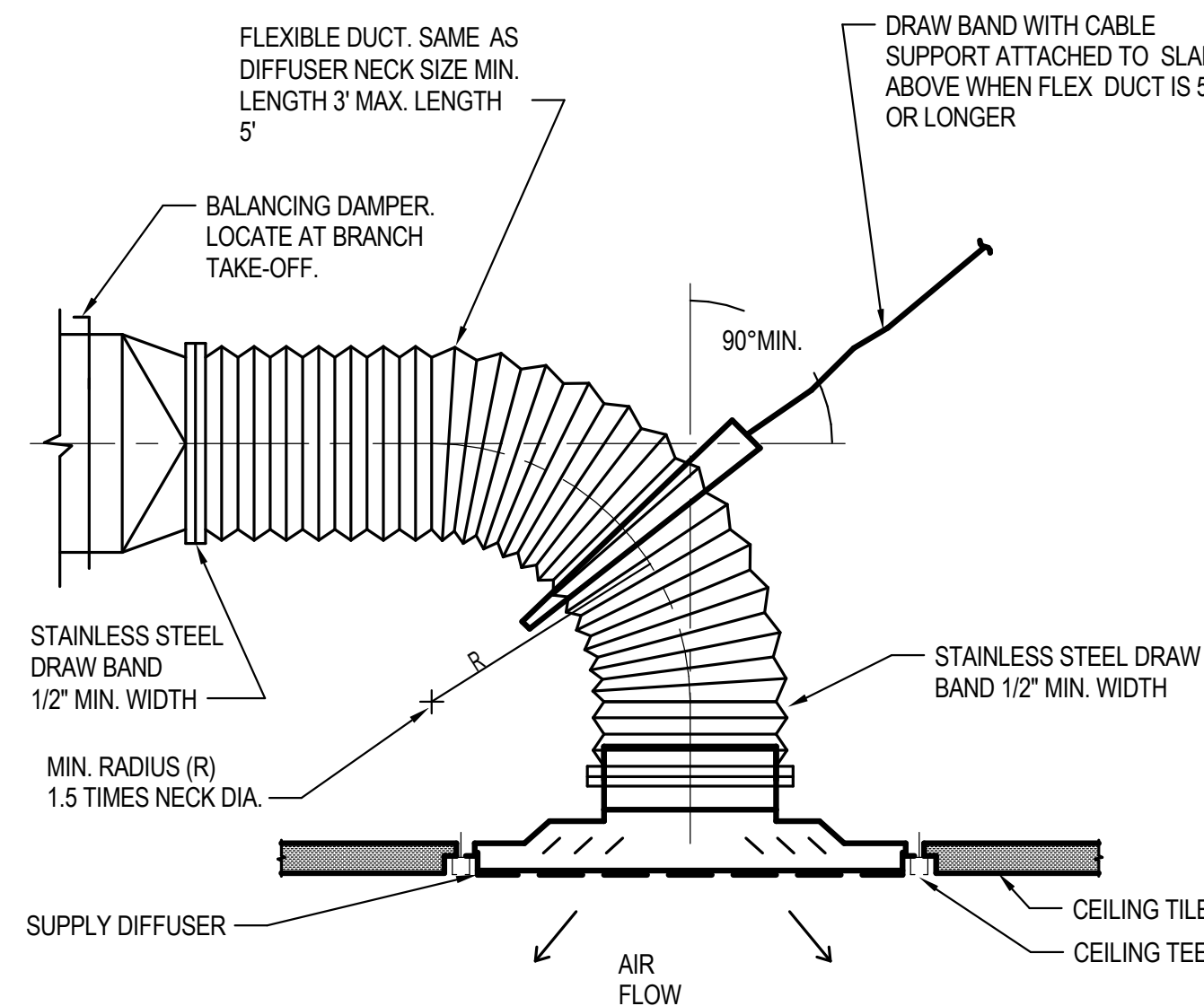


4 ALTERNATE DIFFUSER CONNECTION DETAIL
SCALE: NTS

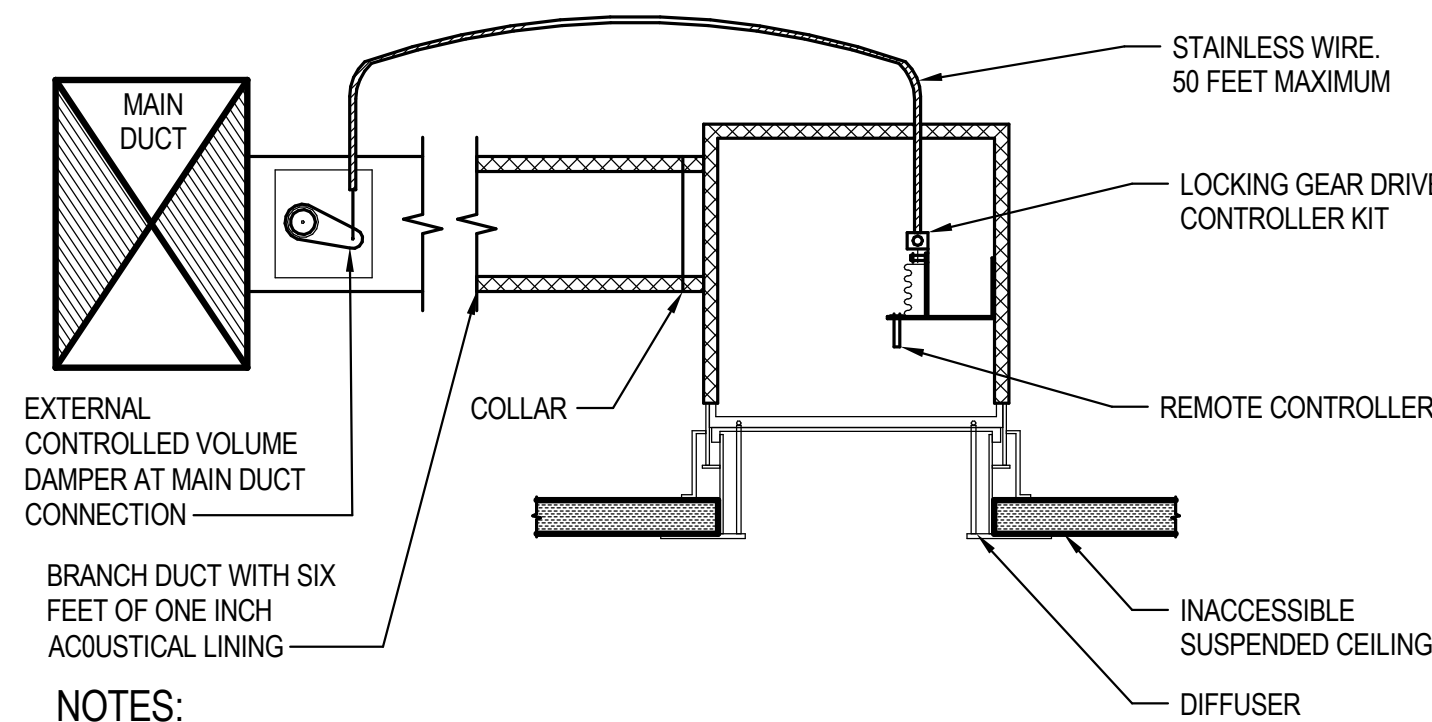


- NOTES:
1. STEAM PIPING, STEAM CONDENSATE, HOT WATER PIPING AND ALL OTHER LINES REQUIRING PITCH, MOUNTED ON ADJUSTABLE PIPE ROLL STANDS, PROTECTION SADDLES TACK WELDED TO PIPE FILLED WITH INSULATION ON ALL PIPES 6" DIA. AND OVER 12" LONG SECTION OF CALCIUM SILICATE WITH SHIELD ON ALL OTHER
 2. PIPES CHILLED AND INSULATED CONDENSER WATER PIPING MOUNTED ON PIPE ROLL AND PLATE. 12" LONG SECTION OF CALCIUM SILICATE WITH PROTECTION SHIELD BETWEEN INSULATION AND ROLL. ADD VAPOR BARRIER ON CHILLED WATER PIPING EXTENDED 2' OVER EACH END OF SHIELD.

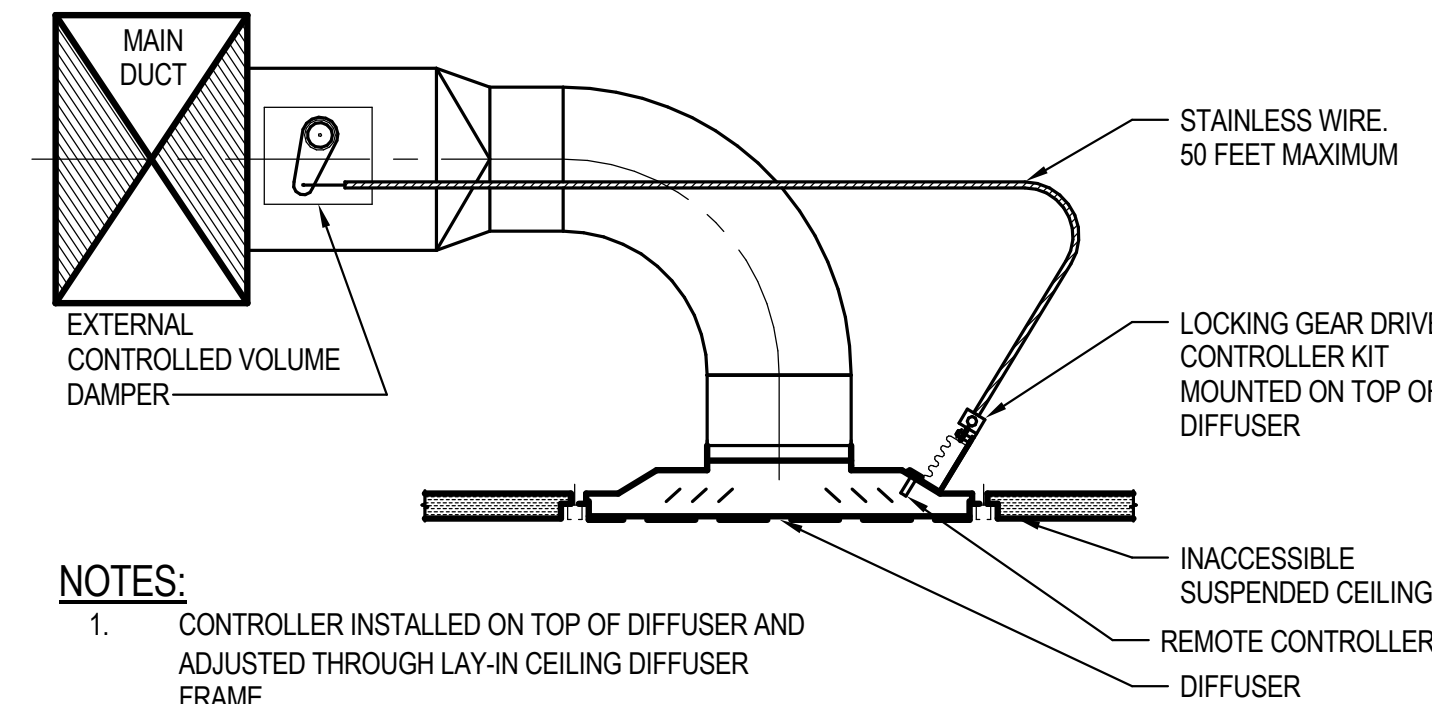
5 TRAPEZE PIPE HANGER (MULTIPLE PIPES)
SCALE: NTS



6 SUPPLY DIFFUSER CONNECTION DETAIL
SCALE: NTS

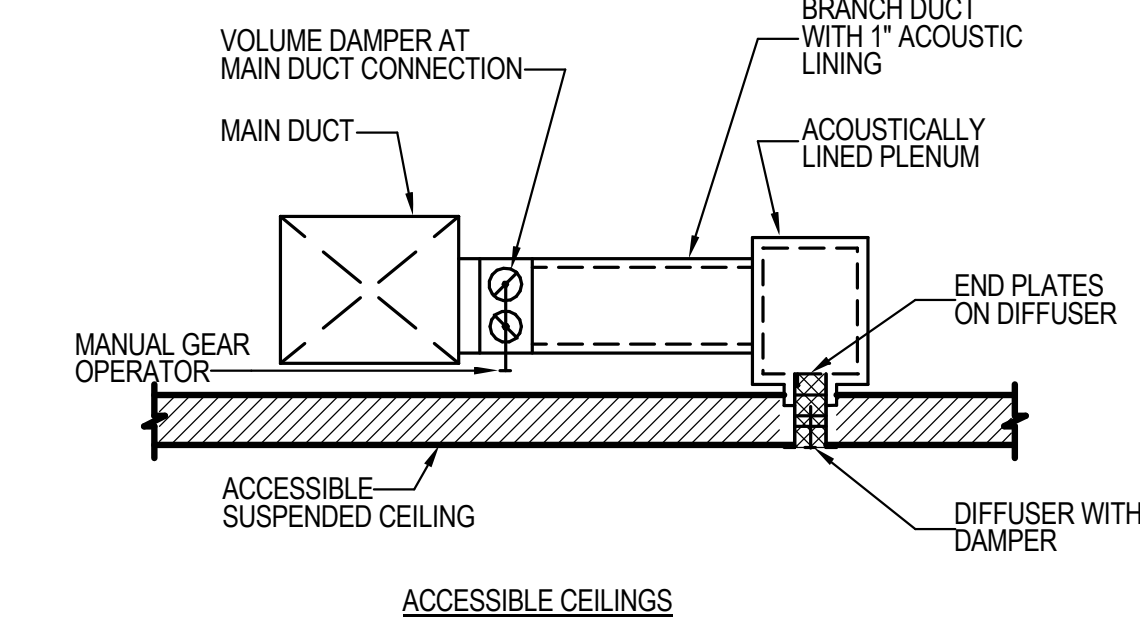
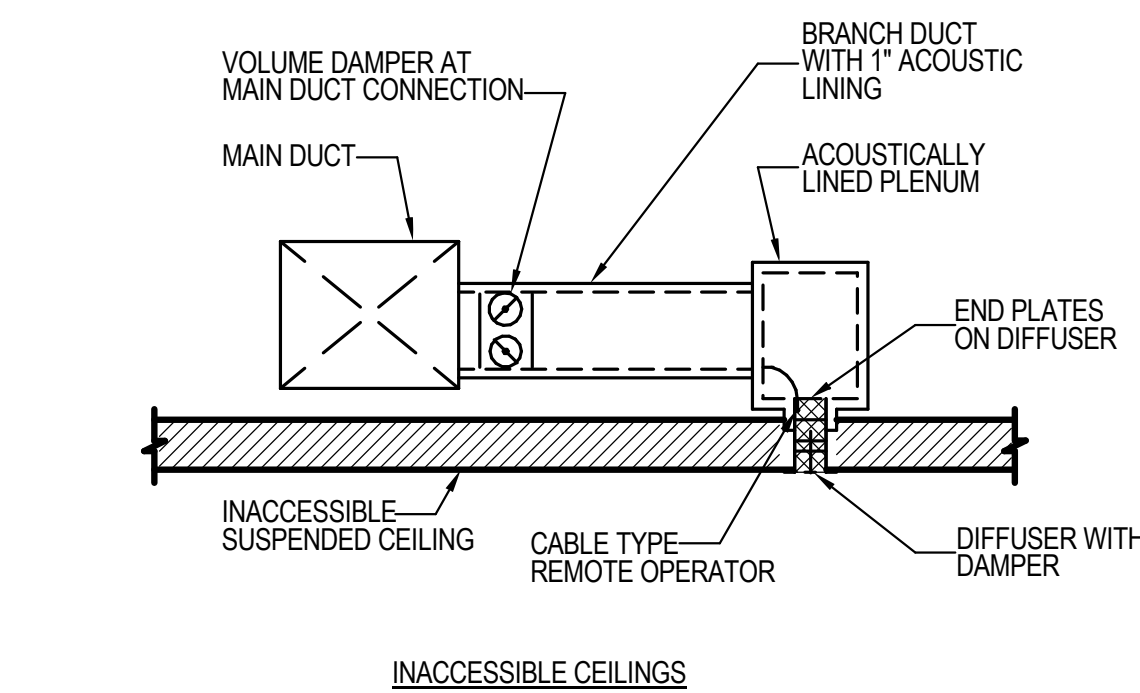


- NOTES:
1. CONTROLLER INSTALLED INSIDE PLENUM AND ADJUSTED THROUGH THE DIFFUSER FRAME.



- NOTES:
1. CONTROLLER INSTALLED ON TOP OF DIFFUSER AND ADJUSTED THROUGH LAY-IN CEILING DIFFUSER FRAME.

7 REMOTE CABLE DAMPER CONTROLLER
SCALE: NTS



8 LINEAR AIR OUTLET CONNECTION
SCALE: NTS



sweetgreen

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**MECHANICAL
SCHEDULES**

M-701.00
SHEET 12 of 14

AIR OUTLETS AND INLETS

DESIGNATION	MANUF. MODEL NUMBER	FACE SIZE (IN)	AIR FLOW (CFM)	NECK SIZE (IN)	NC LEVEL	MANUFACTURER
CD-A	OMNI	12"x12"	0-150	8	12	TITUS
CD-B	OMNI-AA	24"x24"	0-525	12	20	TITUS
LD-A	FL-20HT	2" SLOT /4' LENGTH	0-225	8	-	TITUS
LR-A	FL-20	2" SLOT	-	-	-	TITUS
SG-A	300RL	12"x6"	0-250	-	20	TITUS
SG-B	S300FL	12"x8"	0-320	-	20	TITUS
RG-A	350RL	24"x24"	-	-	-	TITUS
RB-B	350RL	SEE DRAWINGS	-	-	-	TITUS
EG-A	350RL	12"x12"	0-150	8	12	TITUS
EG-B	350FL	24"x24"	0-1000	18"x18"	-	TITUS

NOTES:
1. CONFIRM BORDER, TRIM AND FINISH DETAILS WITH ARCHITECTURAL DRAWINGS.
2. ALL EXHAUST/RETURN INLETS SHALL BE PROVIDED WITH OPPOSED BLADE DAMPER (OBD).
3. ALL NON-DUCTED RETURN INLETS AND SLOTS ARE TO BE PROVIDED WITH LIGHT SHIELDS.
4. ALL SUPPLY AND EXHAUST AIR OUTLETS SHALL BE PROVIDED WITH A VOLUME DAMPER. OUTLETS LOCATED ABOVE INACCESSIBLE CEILINGS SHALL BE PROVIDED WITH CABLE OPERATED DAMPERS. COORDINATE WITH SHEET METAL CONTRACTOR.
5. FOR ALL OUTLETS INDICATED WITH BLANKOFFS, PROVIDE NEXT LARGER NECK SIZE. REFER TO FLOOR PLAN.
6. COORDINATE WITH MANUFACTURER RECOMMENDED NECK SIZING FOR THE SPECIFIC AIRFLOW QUANTITY OF EACH AIR OUTLET. NC LEVELS SHALL NOT EXCEED THE INDICATED VALUES.
7. COORDINATE APPROVED AIR OUTLET SUBMITTAL AND CONNECTIONS REQUIREMENTS WITH SHEET METAL CONTRACTOR.
8. ALL SG-A AND SG-B TYPE SUPPLY GRILLES ARE TO BE DOUBLE DEFLECTION AND PRE-ADJUSTED FOR 22.5 DEGREE DEFLECTION.

HOT WATER HEATING COIL

DESIGNATION	LOCATION / SERVICE	MANUFACTURER	CFM	FACE VELOCITY (FPM)	CAPACITY (MBH)	WATER PRESS. (PSIG)	EWI ("F)	LWT ("F)	EAT ("F)	LAT ("F)	PD (IN. WG.)	GPM	SIZE PER COIL SECTION W x H (INCHES)	DRY WEIGHT (LBS)	NOTES
HWC-1	PERIMETER	GREENHECK	1,500	480	84	150	112	132	0	70	0.1	8.4	20X18	-	SEE NOTES
HWC-2	WSHP-2	GREENHECK	2,000	480	69	150	112	132	70	102	0.1	6.8	32X20	-	SEE NOTES

NOTES:
1. COILS TO BE AHRI 410 CERTIFIED.
2. COORDINATE HOT WATER CONDITIONS WITH BUILDING PRIOR TO RELEASE.
3. COORDINATE COIL SIZING WITH EXISTING SHEET METAL PRIOR TO RELEASE.
4. CONTRACTOR TO PROVIDE HOT WATER CONTROL VALVE AND WALL MOUNTED THERMOSTAT. REFER TO MECHANICAL DETAILS FOR ADDITIONAL VALVE TRIM REQUIREMENTS.
5. CONTRACTOR TO VERIFY HOT WATER WORKING PRESSURE WITH BUILDING.

FREEZE PROTECTION PUMPS (BASIS OF DESIGN BELL AND GOSSETT)

DESIGNATION	LOCATION/SERVICE	MANUF. MODEL NUMBER	TYPE	GPM	HEAD (FT H2O)	MINIMUM EFFICIENCY (PERCENT)	CASING PRESSURE (PSIG)	RPM	MOTOR HP	VOLTAGE/ PHASE	EMERG. POWER (Y/N)	VFD (Y/N)	OPER. WEIGHT (LBS)	NOTES
FPP-1	DINING 100/HWC-1	B&G - ECM	INLINE	8.4	20	-	150	900	1/4	120/1	N	N	-	-

NOTES:

FANS

DESIGNATION	SERVICE	MANUF. MODEL NUMBER	TYPE	CFM	EXTERNAL STATIC PRESSURE (IN. WG.)	RPM	BHP	MOTOR			OPERATING WEIGHT (LBS)	MANUFACTURER
								HP	VOLTAGE/ PHASE	MOTOR TYPE		
TXF-1	TOILET EXHAUST	SQ-80-VG	INLINE	200	0.50	1550	0.05	1/6	208/1	ECM	60	GREENHECK
KXF-1	KITCHEN EXHAUST	QEI-9	INLINE	750	1.50	2010	0.39	3/4	208/1	ECM	236	GREENHECK
OAF-1	OUTDOOR AIR	SQ-140HP-VG	INLINE	1500	1.00	1691	0.55	1	208/1	ECM	150	GREENHECK
EXF-1	TRANSFER AIR	SQ-120-VG	INLINE	900	0.50	1157	0.14	1/2	208/1	ECM	100	GREENHECK
GXF-1	TRASH EXHAUST	CSP-A700-VG	INLINE	550	0.75	1365	0.20	1/3	208/1	ECM	60	GREENHECK

NOTES:
1. PROVIDE EXTERNAL DISCONNECT RATED FOR OUTDOOR USE. COORDINATE WITH ELECTRICAL CONTRACTOR.
2. REFER TO MECHANICAL SPECIFICATIONS FOR VIBRATION ISOLATION AND CONTROL REQUIREMENTS. COORDINATE WITH MANUFACTURER RECOMMENDED MOUNTING REQUIREMENTS.
3. ALL FANS ARE TO BE PROVIDED WITH INTERNAL BACKDRAFT DAMPER.
4. COORDINATE APPROVED FAN SUBMITTAL WITH SHEET METAL CONTRACTOR PRIOR TO FABRICATION.
5. MANUFACTURER TO PROVIDE ROOF CURB. COORDINATE CURB DIMENSIONS WITH ROOF OPENING AND FAN REQUIREMENTS. REFER TO MECHANICAL DETAILS AND FLOOR PLANS.
6. COORDINATE ALL ROOF FLASHING REQUIREMENTS WITH BUILDING. REFER TO MECHANICAL DETAILS.
7. FAN TO BE PROVIDED WITH MOTOR SPEED DIAL FOR BALANCING.
8. FAN ENCLOSURE AND ACCESSORIES ARE TO BE RATED FOR OUTDOOR USE.
9. FAN TO BE TIED INTO AC UNIT PROGRAMMABLE SCHEDULE OR TIME CLOCK IF REQUIRED. PROVIDE ALL REQUIRED CONTACTS AND INTERLOCKS.
10. FAN KXF-1 TO BE PROVIDED WITH EXTERNAL DRIP PAN.
11. KXF-1 TO BE OF ALL STEEL CONSTRUCTION.

CONDENSING UNIT SCHEDULE

DESIGNATION	DESCRIPTION	PAIRED WITH	NUMBER OF COMPRESSORS	REFRIGERANT	WEIGHT (LB)	ELECTRICAL DATA				SUPPLIER	INSTALLER	MODEL	MANUFACTURER	REMARKS
						VOLTAGE/ PHASE	UNIT MCA	UNIT FLA						
CU-1	WALK-IN COOLER REMOTE CONDENSING UNIT	NA	1	R448A	260	208/1	25	16.3	KES	KES	BY KES	BY KES	FURNISHED WITH THE WALK-IN COOLER	

FIN TUBE RADIATOR

DESIGNATION	MANUF. MODEL NUMBER	FIN SIZE (INCHES)	FIN PER FOOT	HW AVERAGE ("F)	MIN HTG CAP (BTU/LF)	NUMBER OF ROWS	TUBE SIZE (INCHES)	FIN MATERIAL	TUBE MATERIAL	ENCLOSURE HEIGHT DEPTH (INCHES)	ENCLOSURE STYLE	NOTES
FTR-A	VULCAN - VC35	3-1/4"x3-1/4"	50	122	480	2	1.00	COPPER	COPPER	-	JV4-ARPM	-

NOTES:
1. ENCLOSURE AND FINISH TYPE SHALL BE APPROVED BY THE ARCHITECT.

WATER SOURCE HEAT PUMPS

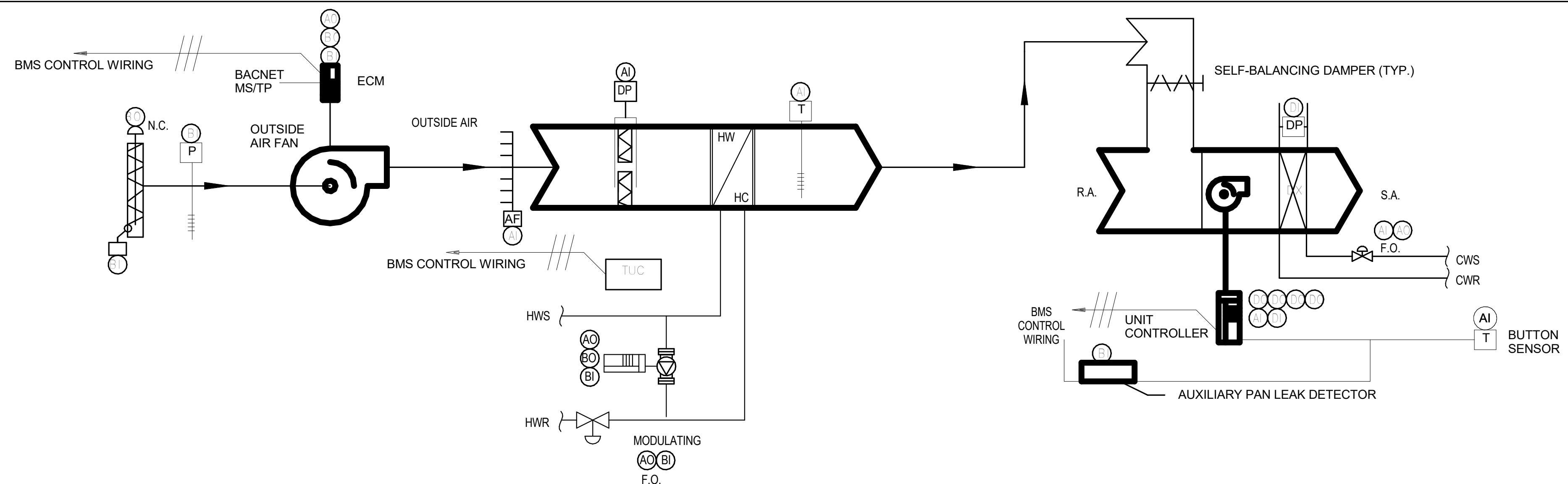
DESIGNATION	MANUF. MODEL NUMBER	MIN OA CFM	FAN			GPM	P.D. (IN H2O)	WORKING PRESSURE (PSIG)	COOLING DATA						ELECTRICAL DATA			EER	REFRIGERANT	OPER. WEIGHT (LBS)	NOTES		
			AIRFLOW (CFM)	ESP (IN. WG.)	MOTOR (HP)				CAPACITY		EAT		LAT		MCA	MOCP							
									TOTAL (MBH)	SENSIBLE (MBH)	DB ("F)	WB ("F)	DB ("F)	WB ("F)			EWI ("F)					LWT ("F)	VOLTAGE/ PHASE
WSHP-1	BOSCH - CL060	350	1600	0.92	1	9.5	4.9	150	56.9	40.5	80.0	67.0	56.8	55.6	87	102	460/3	14.4	20	14.30	R-454B	318	SEE NOTES
WSHP-2	BOSCH - CL070	350	2000	0.9	1	10.9	6.2	150	65.1	48.3	80.0	67.0	58.0	56.6	87	102	460/3	15.2	20	14.30	R-454B	365	SEE NOTES
WSHP-3	BOSCH - CL070	300	2000	0.9	1	10.9	6.2	150	65.1	48.3	80.0	67.0	58.0	56.6	87	102	460/3	15.2	20	14.30	R-454B	365	SEE NOTES
WSHP-4	BOSCH - CL048	250	1400	0.82	3/4	7.4	5.1	150	46.2	33.9	80.0	67.0	57.8	56.4	87	102	460/3	11.2	15	14.20	R-454B	274	SEE NOTES
WSHP-5	BOSCH - CL042	250	1200	0.78	3/4	6.6	6.9	150	40.4	29.9	80.0	67.0	57.2	56.2	87	102	460/3	10.5	15	14.70	R-454B	231	SEE NOTES

NOTES:
1. PROVIDE SINGLE POINT POWER CONNECTIONS. COORDINATE WITH ELECTRICAL CONTRACTOR.
2. PROVIDE EXTERNAL CONDENSATE PUMP AND STAINLESS STEEL DRAIN PAN WITH LEAK DETECTION. LEAK DETECTION TO BE WIRED TO SHUT DOWN AC UNIT AND INITIATE AN ALARM AT BMS.
3. PROVIDE MERV 13 FILTER BOX WITH OUTSIDE AIR AND RETURN AIR CONNECTIONS. FILTERBOX PLENUM IS TO BE PROVIDED WITH VOLUME DAMPERS ON BOTH THE RETURN AIR AND OUTSIDE AIR OPENINGS.
4. BALANCE UNIT TO INDICATED SUPPLY, RETURN AND OUTDOOR AIRFLOW RATES.
5. PROVIDE WALL MOUNTED PROGRAMMABLE THERMOSTAT AND REMOTE MOUNTED "BUTTON TYPE" SPACE TEMPERATURE SENSORS. THERMOSTAT TO BE WIRED TO WALL MOUNTED TEMPERATURE SENSOR. COORDINATE WITH BMS CONTRACTOR. COORDINATE LOCATIONS WITH ARCHITECT PRIOR TO INSTALLATION.
6. REFER TO MECHANICAL SPECIFICATIONS FOR VIBRATION ISOLATION AND CONTROL REQUIREMENTS.
7. PROVIDE WATERSIDE ECONOMIZER WITH FREE COOLING COIL AND VALVE PACKAGE.
8. PROVIDE FACTORY PACKAGE CONTROLS AND BACNET INTEGRATION CARD.
9. ALL UNITS ARE TO BE PROVIDED WITH:
A. R-454B GREEN REFRIGERANT
B. ECM MOTOR
C. HOT GAS BYPASS
D. EXTRA QUIET SOUND PACKAGE
E. LOW WATER TEMPERATURE PACKAGE
F. STAINLESS STEEL DRAIN PAN
G. UNIT MOUNTED VFD

SELF BALANCING DAMPERS

DESIGNATION	MANUF. MODEL NUMBER	QUANTITY	SIZE	MANUFACTURER
SBD	CAR	PER DRAWING	PER DRAWING	EFLOW

NOTES:
1. COORDINATE APPROVED SUBMITTAL WITH SHEET METAL CONTRACTOR PRIOR TO FABRICATION.
2. DAMPERS TO BE FACTORY CALIBRATED FOR ASSOCIATED AIRFLOW RATES.
3. ALL DAMPERS TO BE UL CLASSIFIED AND BI-DIRECTIONAL



ALL BMS CONTROLS ARE TO BE INSTALLED AND PROGRAMMED BY THE BASE BUILDING CONTROL VENDOR.

OUTSIDE AIR FAN WITH HEATING COIL

SYSTEM OFF:
THE FAN AND ELECTRIC HEATING COIL ARE DE-ENERGIZED.

SYSTEM START:
WHEN THE SYSTEM IS CALLED TO START EITHER LOCALLY AT THE VFD OR VIA THE BMS, MOTORIZED ISOLATION DAMPER SHALL BE COMMANDED OPEN. UPON THE DAMPER END SWITCH CONFIRMING THE MOTORIZED DAMPERS ARE PROVED OPEN, THE FAN SHALL BE RELEASED FOR OPERATION AND SHALL GRADUALLY RAMP UP TO THE VFD SPEED SETPOINT. THE HOT WATER PREHEATING COIL CONTROL VALVE SHALL BE RELEASED FOR OPERATION.

SYSTEM RUN:
THE FAN VFD SHALL MODULATE THE FAN SPEED TO MAINTAIN CONSTANT AIRFLOW VOLUME OF THE FAN. THE STATIC PRESSURE SETPOINT SHALL BE DETERMINED DURING BALANCING.

THE TEMPERATURE SENSOR DOWNSTREAM OF THE HEATING COILS SHALL MAINTAIN 55F (ADJ) SUPPLY AIR TEMPERATURE OFF OF THE COIL. UPON A DROP IN SUPPLY AIR TEMPERATURE BELOW 55F (ADJ), THE CONTROLLER SHALL MODULATE THE HOT WATER CONTROL VALVE TO MAINTAIN SUPPLY AIR TEMPERATURE SETPOINT.

PROVIDE THE FOLLOWING POINTS TO THE BUILDING BMS:
AI - FILTER DP PRESSURE
AI - STATIC PRESSURE SENSOR (2/3 DOWNSTREAM)
AI - AIRFLOW SUPPLY AIRFLOW
BO - FAN ENABLE/DISABLE
BI - VFD FAULT
AO - VFD SPEED (Hz)
AO - MODULATING VALVE COMMAND
BI - MODULATING VALVE FEEDBACK
AI - SUPPLY AIR TEMPERATURE
BI - LOW STATIC PRESSURE SWITCH
BI - MOTORIZED DAMPER OPEN/CLOSE
BO - MOTORIZED DAMPER END SWITCH

- ALARMS:
- IF THE SUPPLY FAN VFD ENTERS FAULT MODE, ALARM SHALL BE ANNUNCIATED OVER THE BMS.
 - IF THE SUPPLY AIR TEMPERATURE DOWNSTREAM OF THE HOT WATER HEATING COIL DROPS BELOW 50F, ALARM SHALL BE ANNUNCIATED OVER THE BMS. THE FAN SHALL CONTINUE TO OPERATE. IF THE SUPPLY AIR TEMPERATURE DROPS BELOW 45F, THE SUPPLY FAN SHALL COMMANDED OFF.
 - IF A FAULT IS DETECTED AT THE HOT WATER PREHEAT VALVE, ALARM SHALL BE ANNUNCIATED AT THE BMS.
 - IF HIGH STATIC IS DETECTED, ALARM SHALL BE ANNUNCIATED AT THE BMS.

HEAT PUMP UNIT

- SYSTEM OVERVIEW
 - EACH HEAT PUMP UNIT WILL BE DIRECTLY CONTROLLED BY ITS OWN DEDICATED DDC UNITARY CONTROLLER.
 - DCC UNITARY CONTROLLER WILL BE CONNECTED TO A WALL MOUNTED ELECTRONIC ZONE TEMPERATURE SENSOR.
 - THE TEMPERATURE SETPOINT OF EACH ZONE TEMPERATURE SENSOR SHALL BE ADJUSTABLE AT THE CENTRAL BMS.

- SYSTEM OFF
 - IN THE SYSTEM "OFF" MODE THE SUPPLY FAN AND THE DX CYCLE OF THE AC UNIT ARE OFF.

- SYSTEM START:
 - THE SYSTEM SHALL BE ACTIVATED VIA THE BMS OR MANUALLY AT THE UNIT. WHEN THE UNIT IS CALLED TO START, THE UNIT CONTROLLER SHALL RELEASE THE ECM FANS AND ASSOCIATED CONDENSER FOR OPERATION AND OPEN THE CONDENSER WATER CONTROL VALVE.

- UNIT FAN OPERATION
 - WHEN THE ZONE IS IN OCCUPIED MODE, THE FAN SHALL RUN CONTINUOUSLY.
 - DURING THE UNOCCUPIED MODE, COOL DOWN, AND WARM UP, AS DETERMINED BY BMS TIME SCHEDULE, THE UNIT FAN CYCLES WITH DEMAND AND THE TEMPERATURE IS CONTROLLED BY THE UNOCCUPIED SPACE TEMPERATURE HEATING AND COOLING SETPOINTS.

- HEATING OPERATION (AS APPLICABLE TO UNITS WITH HEATING COILS)
 - THE CONTROLLER COMPARES THE HEATING SETPOINT WITH THE SPACE TEMPERATURE AND DETERMINES A NEED-HEATING CONTROL SIGNAL TO MODULATE THE HOT WATER HEATING CONTROL TO MAINTAIN SPACE TEMPERATURE SETPOINT. DURING HEATING OPERATION, THE UNIT'S COOLING CYCLE SHALL BE LOCKED OUT.

- COOLING OPERATION
 - THE CONTROLLER COMPARES THE COOLING SETPOINT WITH THE SPACE TEMPERATURE AND DETERMINES A NEED-COOLING SIGNAL.
 - THE CONTROLLER WILL ENABLE THE COMPRESSOR AND REVERSING VALVE (ACCORDING TO HEAT PUMP UNIT MANUFACTURER'S INSTRUCTION FOR COOLING CYCLE) TO MAINTAIN THE ROOM SET POINT.

- SET BACK CONTROLS
 - DURING UNOCCUPIED OR SETBACK OPERATIONS, ESTABLISHED BY THE BMS SCHEDULE, THE OUTSIDE AIR FAN SHALL BE OFF AND THE UNITS HEATING AND COOLING CYCLE SHALL BE RELEASED TO MAINTAIN A MAXIMUM SPACE TEMPERATURE OF 80F AND MINIMUM SPACE TEMPERATURE OF 65F

- FREE COOLING (WATERSIDE ECONOMIZER) OPERATION
 - DURING ECONOMIZER CONDITIONS THE CONTROLLER SHALL MODULATE THE INTERNAL WATERSIDE ECONOMIZER 3-WAY CONTROL VALVE ACCORDING TO THE HEAT PUMP MANUFACTURER'S INSTRUCTIONS FOR WATERSIDE ECONOMIZER OPERATION TO MAINTAIN THE ROOM SET POINT.

- PRE-HEATING OPERATION
 - THE BMS DDC CONTROLLER COMPARES THE OUTSIDE AIR TEMPERATURE WITH THE SUPPLY AIR TEMPERATURE SETPOINT AND DETERMINES A NEED-PREHEATING CONTROL SIGNAL. IF THE OUTSIDE AIR TEMPERATURE IS LESS THAN THE SUPPLY AIR TEMPERATURE SETPOINT, THE PRE-HEAT VALVE MODULATES TO MAINTAIN THE SUPPLY AIR TEMPERATURE SETPOINT.
 - MECHANICAL COOLING TO BE LOCKED OUT DURING PRE-HEATING MODE.

- FREEZE PROTECTION PUMP OPERATION
 - THE FREEZE PROTECTION PUMP SHALL BE ENERGIZED WHEN THE LOW TEMPERATURE DETECTION SWITCH IS ACTIVATED. THE PUMP SHALL CONTINUE TO OPERATE UNTIL THE LOW TEMPERATURE DETECTION SWITCH IS RESET. THE OUTSIDE ISOLATION DAMPER ON FLOOR SHALL CLOSE AND THE HOT WATER CONTROL VALVE SHALL BE COMMANDED 100% OPEN.
 - SYSTEM SAFETIES: UPON ACTIVATION OF THE LOW OR HIGH STATIC SENSOR ON THE DISCHARGE AND INLET OF THE SUPPLY FAN AND/OR THE LOW TEMPERATURE DETECTION SWITCH, THE UNIT SHALL ENTER FAULT MODE AND REVERT TO "SYSTEM OFF" MODE. ALARM SHALL BE ANNUNCIATED AT THE BMS WORKSTATION.
 - AN ALARM SHALL BE SENT TO THE BMS WORKSTATION WHEN THE FILTER DIFFERENTIAL PRESSURE EXCEEDS 1" W.C. (ADJUSTABLE)

11. MONITORING - THE FOLLOWING CONDITIONS SHALL BE MONITORED AND DISPLAYED AT EMS OPERATOR WORKSTATION/GRAPHICAL USER INTERFACE:

- SUPPLY AIR TEMPERATURE.
- ROOM TEMPERATURE.
- CURRENT MODE (HEATING/COOLING/FAN).
- SUPPLY AIR TEMPERATURE ATTAINED LAST TIME UNIT WAS IN HEATING.
- SUPPLY AIR TEMPERATURE ATTAINED LAST TIME UNIT WAS IN COOLING.
- CURRENT COMMAND STATUS OF FAN, COMPRESSOR, REVERSING VALVE AND AUX HEAT.
- RUN TIME METERS ON FAN, COMPRESSOR, REVERSING VALVE AND AUX HEAT.
- FAN STATUS THRU CURRENT SWITCH.
- CONTROL VALVE POSITIONS

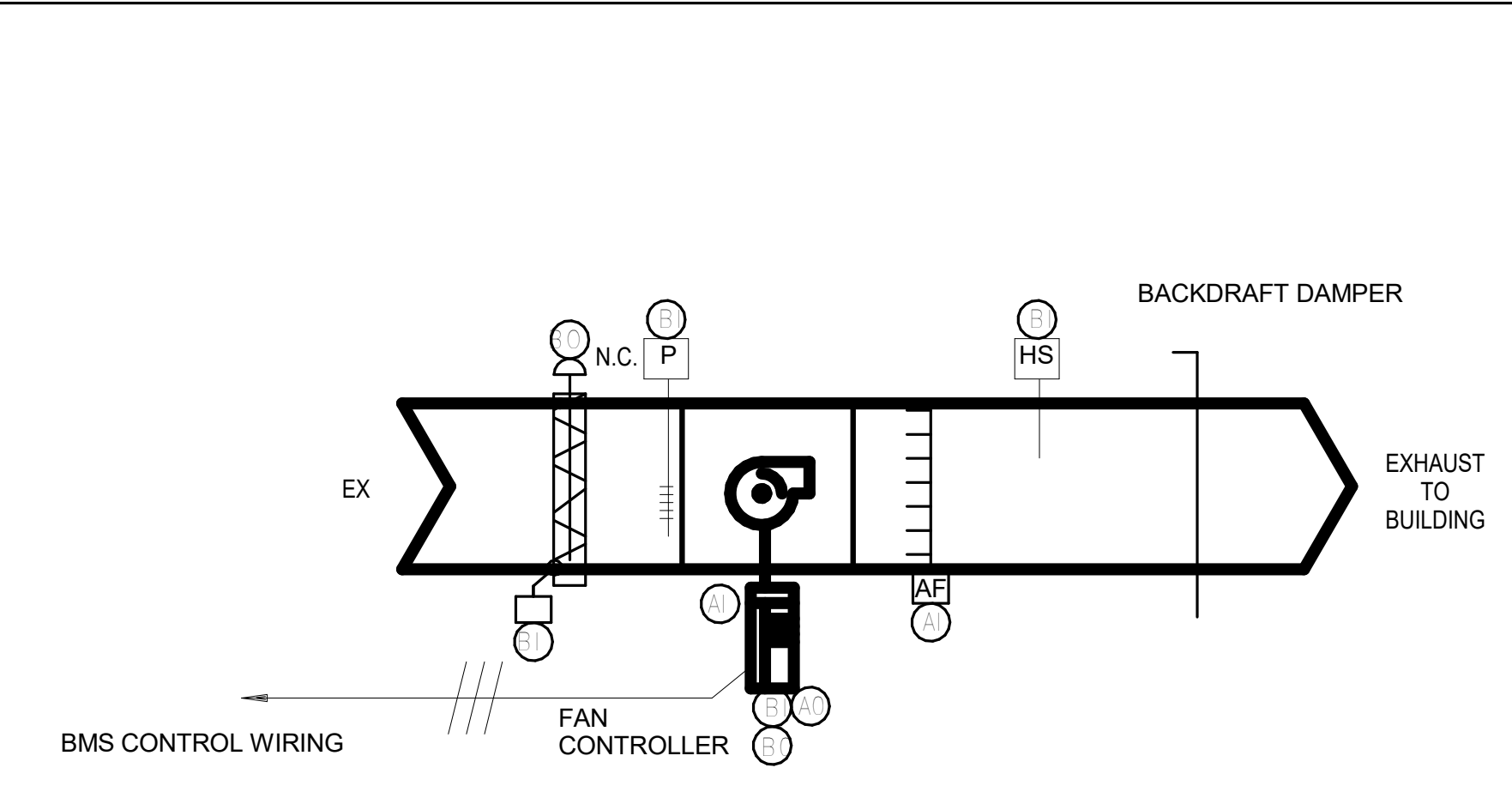
- SYSTEM STOP:
 - THE SYSTEM SHALL BE STOPPED AND REVERT TO SYSTEM "OFF" MODE IF COMMANDED OFF VIA THE BMS, LOCAL CONTROLLER.

- SYSTEM SAFETIES AND ALARMS
 - IF THE AUXILIARY PAN LEAK DETECTOR IS ACTIVATED, ALARM SHALL BE ANNUNCIATED AT THE TENANT BMS WORKSTATION AND BASE BUILDING BMS. THE UNIT SHALL REMAIN OPERATIONAL.
 - A DIFFERENTIAL PRESSURE SWITCH SHALL BE INSTALLED ACROSS THE SUPPLY AND RETURN PIPING TO THE DX COIL. COMPRESSOR OPERATION SHALL BE LOCKED OUT UNTIL PROOF OF FLOW HAS BEEN ESTABLISHED.

14. OVERRIDES: PROVIDE THE FOLLOWING OVERRIDES:

- CONTROL VALVE POSITION BY BUILDING
- SETBACK CONTROL OVERRIDE BY BUILDING

PROVIDE THE FOLLOWING POINTS TO THE BUILDING BMS:
AI - SPACE TEMPERATURE
AI - FAN KWH
DI - UNIT STATUS
DI - LEAK ALARM
DI - PROOF OF FLOW VIA DP SWITCH
DO - FAN ENABLE/DISABLE
DO - COOLING ENABLE/DISABLE
DO - HEATING ENABLE/DISABLE
DO - REVERSING VALVE
DO - CONTROL VALVES
DI - FREEZE PROTECTION PUMP STATUS



PROVIDE THE FOLLOWING POINTS TO THE BUILDING BMS:

- AI - FAN KWH
- BI - LOW STATIC PRESSURE SWITCH
- BI - FAN FAULT
- AO - FAN SPEED
- BO - FAN ENABLE/DISABLE
- BI - MOTORIZED DAMPER OPEN/CLOSE
- BO - MOTORIZED DAMPER END SWITCH
- BI - HIGH STATIC SWITCH

ALL BMS CONTROLS ARE TO BE INSTALLED AND PROGRAMMED BY THE BASE BUILDING CONTROL VENDOR.

GENERAL: EQUIPMENT ROOM AC UNIT

SYSTEM OFF:

IN THE SYSTEM "OFF" MODE THE FAN IS DE-ENERGIZED.

SYSTEM START:

- THE SYSTEM SHALL BE STARTED VIA THE BMS OR MANUALLY AT THE FAN DISCONNECT. WHEN THE FAN IS CALLED TO START, THE FAN CONTROLLER SHALL RELEASE THE ECM FAN FOR OPERATION.

SYSTEM RUN:

THE FAN SPEED SHALL MODULATE TO MAINTAIN AN EXHAUST AIR DISCHARGE EQUAL TO 80 PERCENT (ADJUSTABLE) OF THE SUPPLY AIR DISCHARGE MEASURE BY ASSOCIATED OAF-2-1 AIRFLOW MONITORING STATION.

THE MOTORIZED DAMPER SHALL TRACK INVERSELY PROPORTIONAL TO THE MOTORIZED DAMPER ASSOCIATED WITH OAF-2-1.

SYSTEM STOP:

- THE SYSTEM SHALL BE STOPPED AND REVERT TO SYSTEM "OFF" MODE IF COMMANDED OFF VIA THE BMS, LOCAL CONTROLLER.

WATER SOURCE HEAT PUMPS, OUTDOOR AIR FAN, AND HOT WATER HEATING COIL (OAF-1, HWC-1, ASSOCIATED WSHP UNITS)

EXHAUST FAN (GXF-1)



sweetgreen
3102 W. 36TH STREET
LOS ANGELES, CALIFORNIA 90018

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PROJECT NO: 224134
TEMPLATE VERSION: 04.28.2023

REV.	DATE	DESCRIPTION
	07.11.2024	80% CD SET
	07.25.2024	LL REVIEW SET
	08.02.2024	CLIENT REVIEW
	10.31.2024	ISSUE FOR PERMIT
	02.11.2025	IFC SET

**MECHANICAL
CONTROLS SHEET #1**

M-801.00
SHEET 13 of 14

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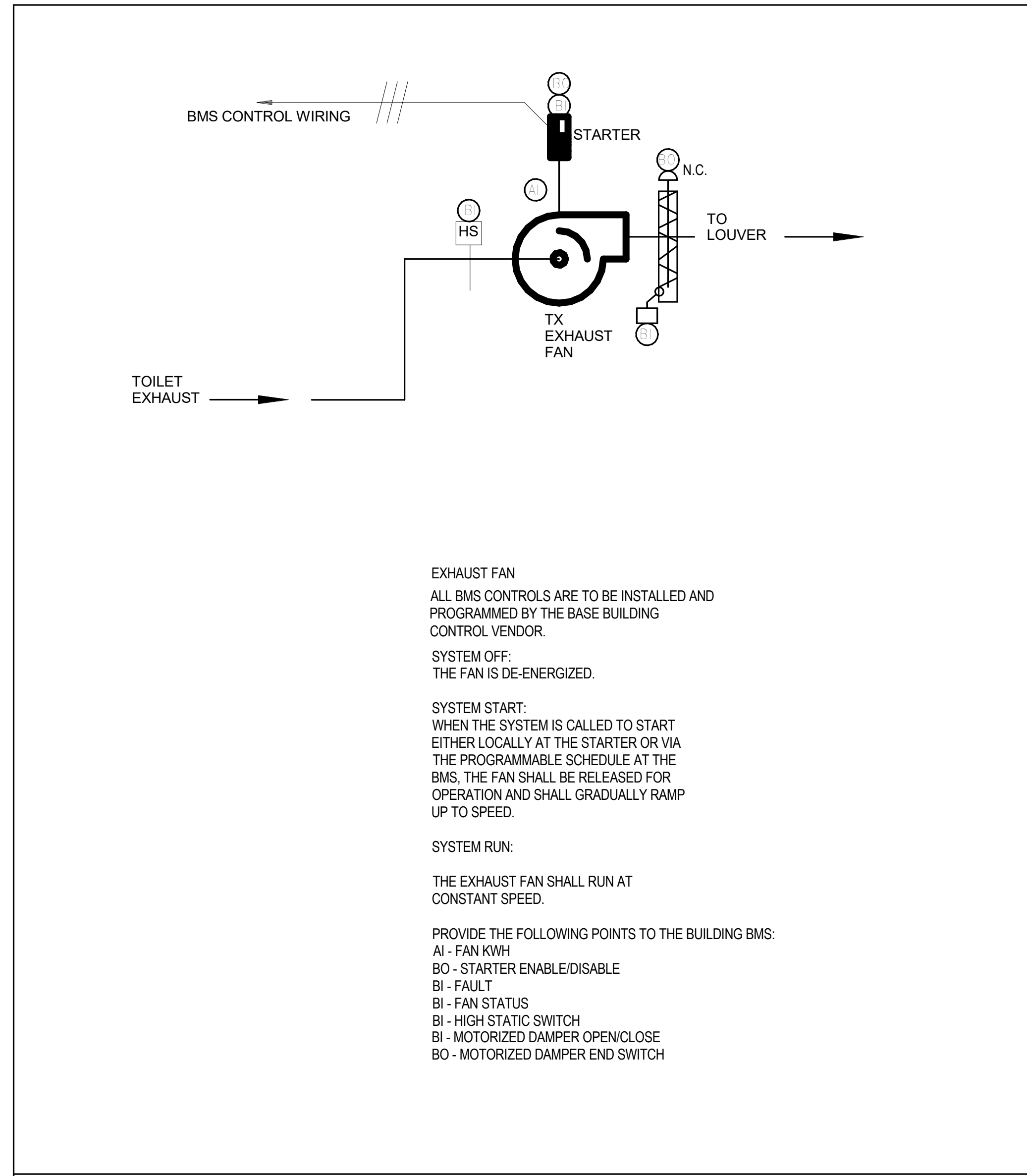
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REVISIONS

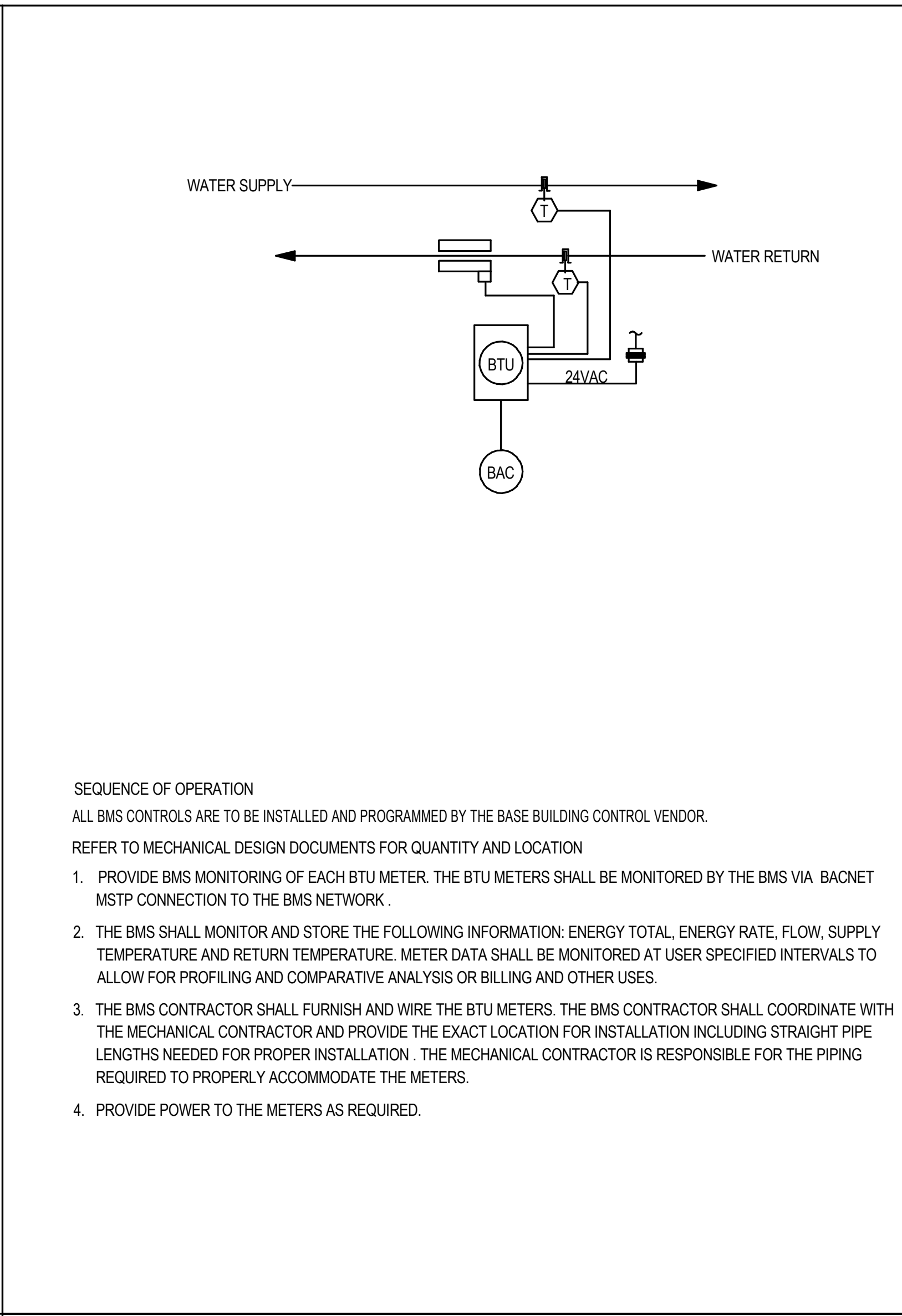
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08.02.2024	CLIENT REVIEW	
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02.11.2025	IFC SET	

**MECHANICAL
CONTROLS SHEET #2**

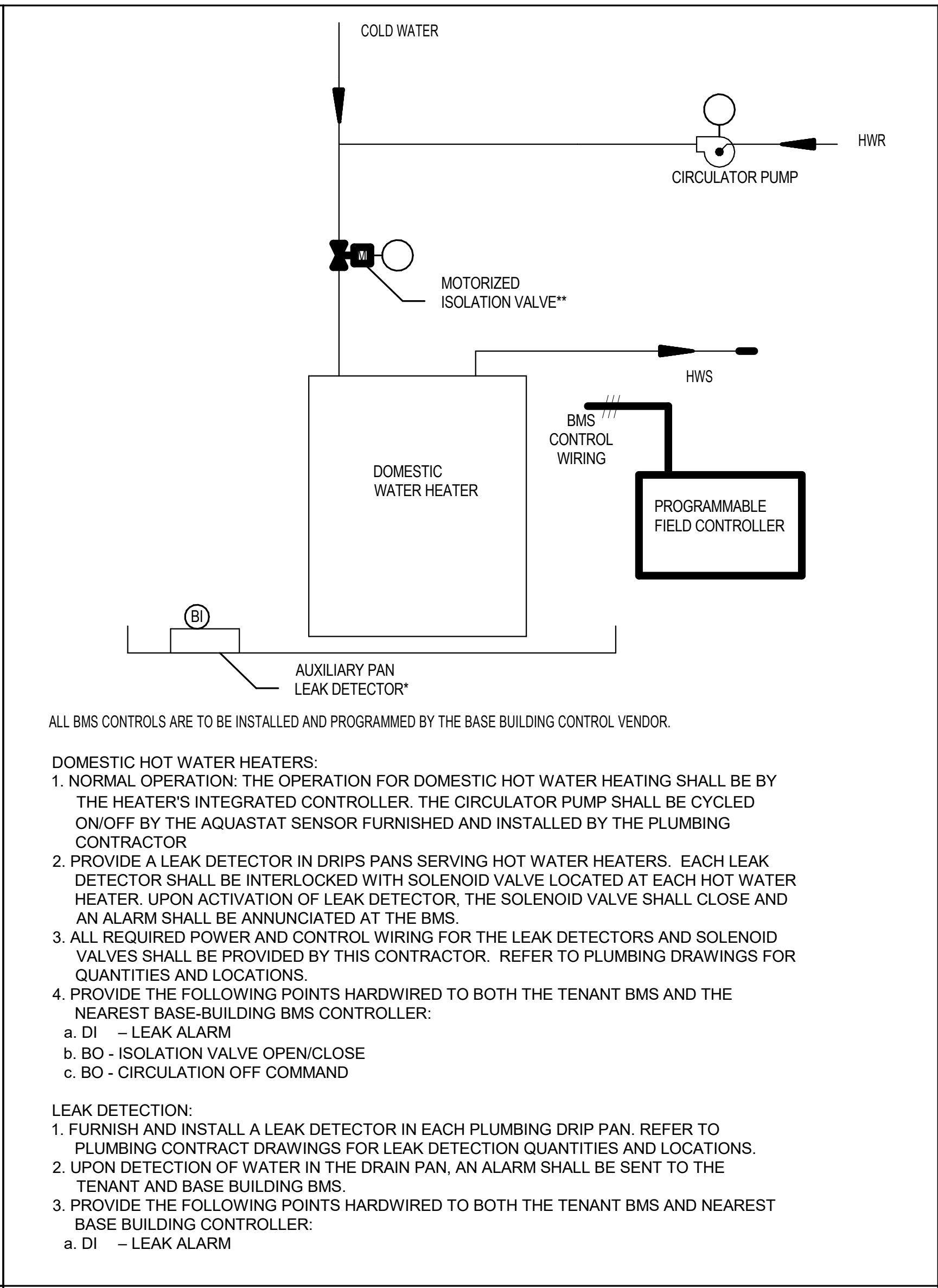
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SHEET 14 of 14



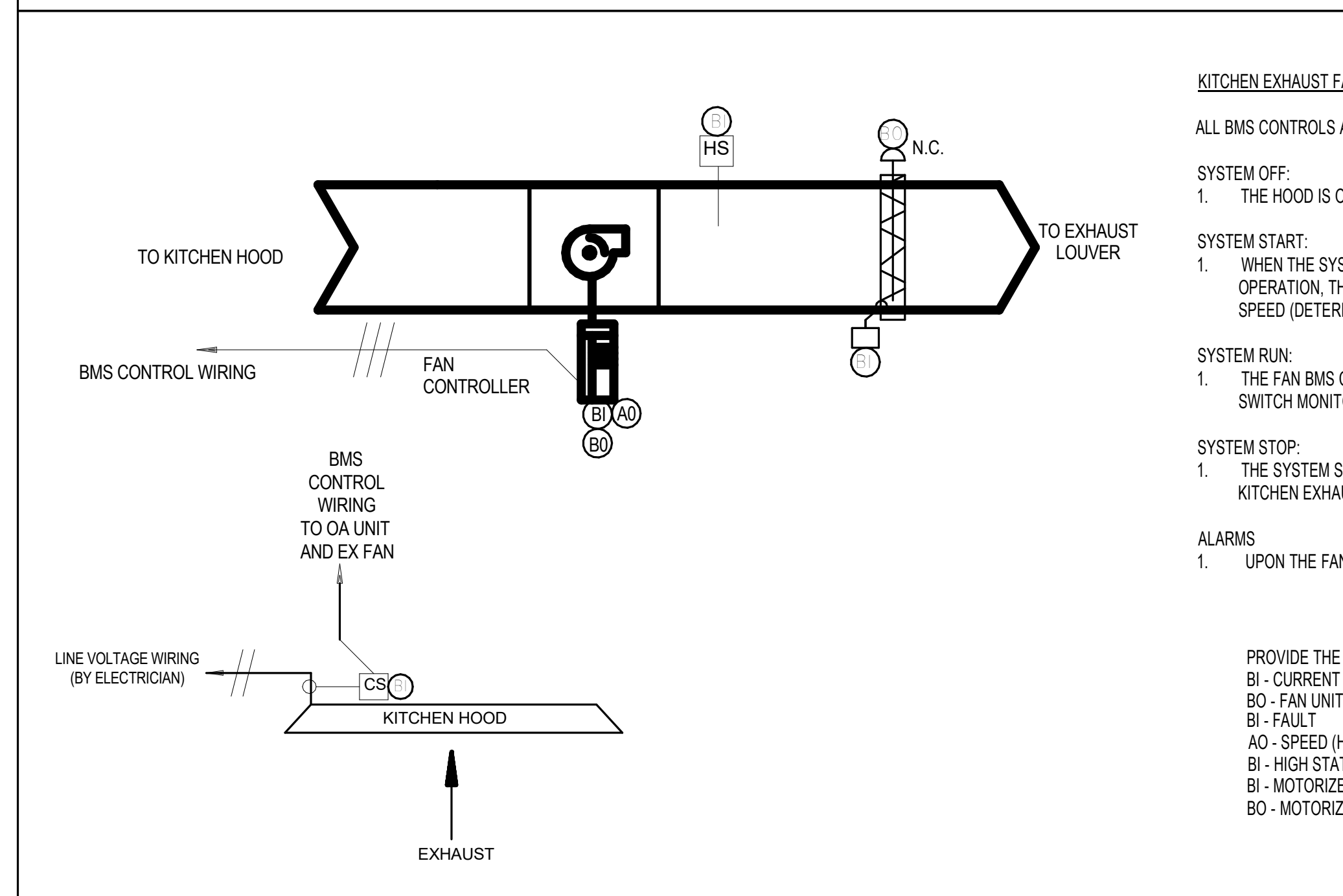
TOILET EXHAUST FAN (TXF-1)



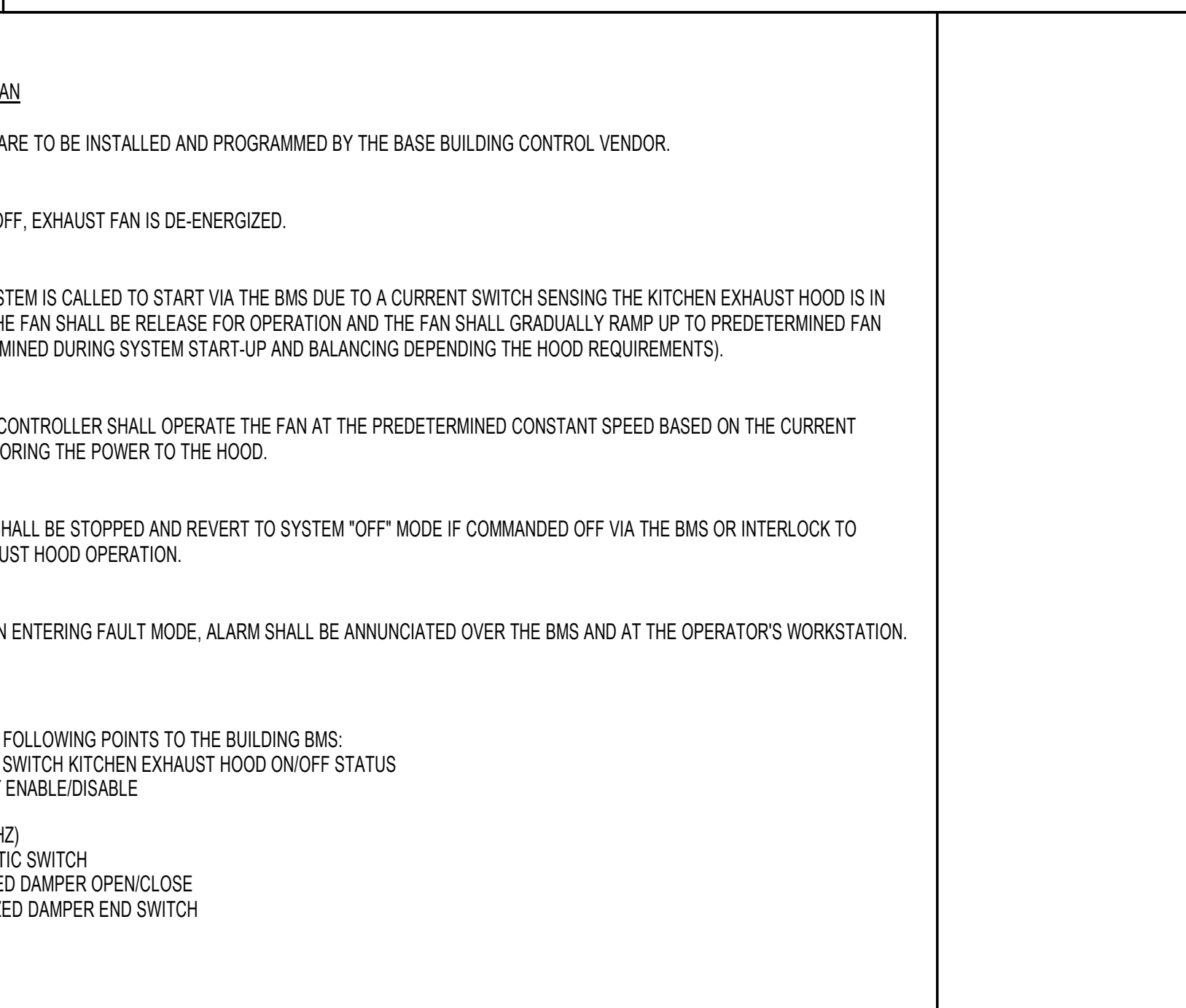
BTU METER MONITORING



DOMESTIC HOT WATER HEATER (EWH-1)



KITCHEN EXHAUST BOOSTER FAN CONTROLS (KXF-1)



TYPICAL HEAT TRACE MONITORING