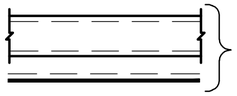
HVAC SYMBOLS

SINGLE LINE DUCTWORK OR EQUIPMENT – NEW

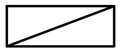
SINGLE LINE DUCTWORK OR EQUIPMENT – EXISTING

DUCTWORK TO BE REMOVED



DUCTWORK WITH ACOUSTIC LINING

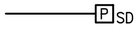
DUCT UNDER POSITIVE PRESSURE
(SUPPLY AIR OR FAN DISCHARGE)



DUCT UNDER NEGATIVE PRESSURE
(RETURN, EXHAUST OR OUTSIDE AIR)

VOLUME DAMPER

FIRE DAMPER AND ACCESS DOOR

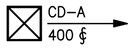


AUTOMATIC SMOKE DAMPER (PNEUMATIC)

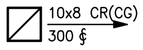
CUBIC FEET PER MINUTE

DIAMETER

SQUARE FEET

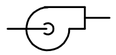


TYPE A CEILING DIFFUSER
400 CFM SUPPLY AIR



10" BY 8" CEILING REGISTER (CEILING GRILLE)
300 CFM RETURN AIR

SEE DUCT DETAILS FOR TYPE OF BRANCH CONNECTION



CENTRIFUGAL FAN

THERMOSTAT

HUMIDISTAT

HEAT DETECTOR

SMOKE DETECTOR

HUMIDIFIER

OUTSIDE AIR SENSOR

CARBON DIOXIDE SENSOR

POINT OF CONNECTION

POINT OF DISCONNECTION

HVAC ABBREVIATIONS

(NOT ALL ABBREV. ARE NECESSARILY USED ON THIS PROJECT)

AC	AIR CONDITIONING
ACU	AIR CONDITIONING UNIT
AD	ACCESS DOOR
AHU	AIR HANDLING UNIT
AL	ALUMINUM
BHP	BRAKE HORSEPOWER
BTU	BRITISH THERMAL UNIT
BTUH	BTU PER HOUR
CC	COOLING COIL
CD	CEILING DIFFUSER
CFM	CUBIC FEET PER MINUTE
CG	CEILING GRILLE
COMPR	COMPRESSOR
COND	CONDENSATE
CP	CONDENSATE PUMP
CR	CEILING REGISTER
CU FT	CUBIC FEET
CU IN	CUBIC INCHES
CWP	CONDENSER WATER PUMP
DIAM	DIAMETER
DN	DOWN
DWG	DRAWING
EA	EACH
EAT	ENTERING AIR TEMPERATURE
EDB	ENTERING DRY BULB TEMPERATURE
ELEV	ELEVATOR
EDH	ELECTRIC DUCT HEATER
EQ	EQUAL
EWB	ENTERING WET BULB
EWT	ENTERING WATER TEMPERATURE
EXH	EXHAUST
EXIST	EXISTING
°F	DEGREES FAHRENHEIT
FD	FIRE DAMPER
FPM	FEET PER MINUTE
FT	FEET
GAL	GALLON
GPM	GALLONS PER MINUTE
GX	GENERAL EXHAUST
H	HUMIDIFIER
HR	HOUR
IN	INCH OR INCHES
KW	KILOWATT
L	LENGTH
LAT	LEAVING AIR TEMPERATURE
LBS	POUNDS
LDB	LEAVING DRY BULB TEMPERATURE
LWB	LEAVING WET BULB TEMPERATURE
LWT	LEAVING WATER TEMPERATURE
MB	MIXING BOX
MBH	THOUSAND BTU PER HOUR
MHP	MOTOR HORSEPOWER
MIN	MINIMUM
MOT	MOTOR
NC	NORMALLY CLOSED
N.O.	NORMALLY OPEN
NO.	NUMBER
NTS	NOT TO SCALE
OA	OUTSIDE AIR
OAI	OUTSIDE AIR INTAKE
PD	PRESSURE DROP
PSI	POUNDS PER SQUARE INCH
RA	RETURN AIR
REFR	REFRIGERANT
RF	RETURN FAN
RM	ROOM
RPM	REVOLUTIONS PER MINUTE
SD	SMOKE DAMPER
SF	SUPPLY FAN
SP	STATIC PRESSURE
SQ.FT.	SQUARE FEET
SS	STAINLESS STEEL
TEMP	TEMPERATURE
TG	TOP GRILLE
TR	TOP REGISTER
TV	TURNING VANES
TYP	TYPICAL
TX	TOILET EXHAUST
V	VOLTS
VAV	VARIABLE AIR VOLUME UNIT
VFD	VARIABLE FREQUENCY DRIVE
W	WIDTH
W/	WITH
W/O	WITHOUT
WB	WET BULB
WG	WATER GAUGE
WMS	WIRE MESH SCREEN
WP	WORKING PRESSURE

GENERAL NOTES

1. GENERAL NOTES, SYMBOL LIST AND DETAILS ARE APPLICABLE TO ALL HVAC/MECHANICAL DRAWINGS.
2. DRAWINGS ARE DIAGRAMMATIC. DETERMINE LOCATIONS OF SYSTEMS AND COMPONENTS IN FIELD. RELOCATE EXISTING WORK THAT INTERFERES WITH WORK OF THIS CONTRACT.
3. WORK IN THIS SECTION IS SPECIFIED IN SECTION 15000.
4. COORDINATE THIS WORK WITH THAT OF OTHER TRADES.
5. DIMENSIONS SHOWN ON PLAN ARE HORIZONTAL. DIMENSIONS SHOWN IN ELEVATION ARE VERTICAL EXCEPT IN WAY OF STRUCTURAL STEEL, DIMENSIONS ARE MEASURED PERPENDICULAR TO FLANGE.
6. NEITHER ACCURACY NOR COMPLETION OF SERVICES AND UTILITY LOCATIONS SHOWN ON DRAWINGS IS GUARANTEED. DETERMINE EXACT LOCATIONS OF EXISTING SERVICES AND UTILITIES IN FIELD, WHETHER OR NOT SHOWN ON DRAWINGS. EXERCISE CAUTION AND IDENTIFY LOCATIONS OF UNMARKED UTILITY LINES AS NECESSARY TO PERFORM WORK OF THIS SECTION.
7. MANUFACTURERS MODEL NUMBERS ARE SPECIFIED SOLELY TO ESTABLISH STANDARDS OF QUALITY FOR PERFORMANCE AND MATERIALS.
8. PRODUCT INSTALLATION SHALL ADHERE TO MANUFACTURERS RECOMMENDATIONS.
9. PROVIDE ACCESS PANELS FOR EQUIPMENT THAT REQUIRES PERIODIC SERVICE.
10. PROVIDE HANGERS, INSERTS, ANCHORS, SUPPLEMENTAL STEEL & SUPPORTS AS REQUIRED TO SUPPORT DUCTWORK, PIPING AND EQUIPMENT FROM STRUCTURE.
11. SCHEDULE WORK OF THIS SECTION TO AVOID INTERFERING WITH EXISTING OPERATIONS IN THE FACILITY.
12. COORDINATE ROOF PENETRATIONS WITH WORK OF OTHER SECTIONS AND WITH FLASHING REQUIREMENTS. MECHANICAL CONTRACTOR TO NOTIFY OWNER PRIOR TO STARTING WORK TO VERIFY COMPLIANCE WITH BOND AND WARRANTY OF EXISTING ROOF.
13. RUN DUCTS AND PIPING CONCEALED, UNLESS OTHERWISE SPECIFIED AND CLEAR OF CEILING INSERTS.
14. INSTALL THERMOSTATS 4'–6" ABOVE FINISHED FLOOR OR AS DIRECTED OTHERWISE BY ARCHITECT.
15. STRUCTURAL WELDING SHALL BE CONTINUOUS 1/4" FILLET UNLESS REQUIRED OTHERWISE.

AIR SYSTEMS

16. AIR SYSTEMS REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATIONS OF AIR DEVICES.
17. INTERNAL AIRFLOW DIMENSIONS ARE SHOWN FOR DUCTS. INCREASE DUCT SIZE AS NECESSARY TO MAINTAIN FREE FLOW AREA INDICATED.
18. USE FLAT TRANSVERSE SEAM FOR DUCTWORK WHERE SPACE AVAILABLE DICTATES.
19. DIFFUSER SIZES SHOWN ARE NECK SIZES. REGISTERS AND GRILLE SIZES ARE NOMINAL.
20. PROVIDE VOLUME DAMPERS OR OTHER APPROVED BALANCING DEVICES AT DUCT BRANCHES AND RUN OUTS, AND AT REGISTER GRILLE AND DIFFUSER NECKS IN SUPPLY, RETURN AND EXHAUST DUCTWORK WHETHER SHOWN OR NOT.
21. DUCTWORK DOWNSTREAM OF ALL VAV AND FAN POWERED VAV BOXES SHALL BE ACOUSTICALLY LINED WITH 1" ACOUSTICAL LINING FOR A MINIMUM OF 15 FEET.
22. PROVIDE 36" CLEARANCE IN FRONT OF ALL ELECTRIC CONTROL PANELS PER N.E.C. AND MFG. REQUIREMENTS.
23. PROVIDE DUCT TRANSITIONS FROM VAV BOX INLET/OUTLET DUCT WORK AT SIZES INDICATED TO VAV BOX INLET/OUTLET UNIT CONNECTIONS.
24. VAV DUCT INLET SIZE SHALL BE AS SCHEDULED OR AS INDICATED ON THE FLOOR PLANS. PROVIDE TRANSITION FROM DUCT SIZE INDICATED ON THE FLOOR PLANS TO SCHEDULED SIZE MINIMUM 2'–0" FROM VAV BOX INLETS.

PIPING SYSTEMS

25. PITCH PIPING 1" IN 20' IN DIRECTION OF FLOW.
26. PROVIDE TRAPS IN CONDENSATE LINES THAT EXTEND OVER 2".

NEW YORK CITY BUILDING DEPARTMENT NOTE

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NO.	DATE	ISSUED FOR
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	04-16-06	CONSTRUCTION SET
	03-14-06	BUILDING MANAGER APPROVAL SET
	02-01-06	BID SET
	01-06-06	BUILDING DEPARTMENT SUBMISSION

date: 12-27-07

drawn by: PB

scale: NTS

title:

HVAC
COVER
SHEET
1 OF 2

number:

H-1.0

BUILDING DEPARTMENT NOTES

ALL WORK SHALL COMPLY WITH THE APPLICABLE SECTIONS OF THE BUILDING CODE, CITY OF NEW YORK, EFFECTIVE DECEMBER 6, 1968 AND ALL AMENDMENTS AND RULES AND REGULATIONS OF THE DEPARTMENT OF BUILDINGS TO DATE.

1. SYSTEMS, MATERIALS AND EQUIPMENT SUBJECT TO CONTROLLED INSPECTION:

   A. MECHANICAL VENTILATION, AIR CONDITIONING, REFRIGERATION AND HEATING.
   B. INSPECTION AND TESTS OF THE REQUIRED VENTILATION SYSTEMS AS PER 27–136, 27–779.
   C. INSPECTION AND TESTS OF THE REQUIRED VENTILATION SYSTEM FIRE DAMPERS AS PER 27–343(D), 27–779.
   D. INSPECTION AND TESTS OF THE REFRIGERATION SYSTEMS AS PER 27–781 AND RS 13–6. OBTAIN EQUIPMENT USE PERMITS.
   E. HEATING EQUIPMENT:

      1) APPLICATION FOR EQUIPMENT USE PERMIT FOR THE HEATING SYSTEM TO BE ACCOMPANIED BY A SIGNED STATEMENT OF AN ARCHITECT OR ENGINEER, RETAINED BY THE CONTRACTOR, INDICATING THAT THE SYSTEM IS IN COMPLIANCE WITH CODE TEMPERATURES, ETC., AS PER 27–187.
      2) BOILERS 27–793.
      3) CHIMNEYS 27–856.
      4) FUEL BURNING EQUIPMENT 27–794.
      5) HIGH PRESSURE STEAM PIPING SYSTEMS:

         a) PER RULES OF THE DEPARTMENT OF BUILDING CH. 20, RULE 20–02 – (1RCNY/20–02).

   F. EMERGENCY GENERATORS 27–794.
   G. NOISE CONTROL TESTS 27–768,769,770.
   H. THE CONTRACTOR SHALL ENGAGE THE SERVICES OF A PROFESSIONAL ENGINEER TO PROVIDE THE REQUIRED CONTROLLED INSPECTIONS.
   I. UPON COMPLETION OF THE VENTILATION SYSTEM:

      1) A TEST SHALL BE CONDUCTED IN THE PRESENCE OF AND UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER OR REGISTERED ARCHITECT QUALIFIED TO CONDUCT SUCH TESTS. FOR SYSTEMS OF OR LESS THAN 5,000 CFM, THE INSPECTION MAY BE BY A PERSON HAVING NOT LESS THAN FIVE YEARS EXPERIENCE SUPERVISING INSTALLATION OF VENTILATING SYSTEMS. THE CONTRACTOR WILL BE REQUIRED TO RETAIN THE SERVICE OF THE PROPER PERSON TO CONDUCT THE TEST. THE TESTS SHALL SHOW COMPLIANCE WITH THE CODE REQUIREMENTS FOR VENTILATION AND THE PROPER FUNCTIONING OF ALL SMOKE DETECTION, FIRE PROTECTION AND OPERATING DEVICES BEFORE THE SYSTEM IS APPROVED.
      2) THE LICENSED PROFESSIONAL ENGINEER OR REGISTERED ARCHITECT WHO CONDUCTS THE TESTS SHALL FILE A CERTIFICATE AS TO WHETHER THE SYSTEM COMPLIES WITH THE APPLICABLE LAWS. THEY SHALL ALSO FILE WITH THIS CERTIFICATION A REPORT OF THE TEST. THE TEST AND REPORT SHALL BE MADE IN A MANNER SATISFACTORY TO THE SUPERINTENDENT.

2. THE FOLLOWING WORK ITEMS, COMPONENTS, MATERIALS, CAPACITIES, ETC. SHALL COMPLY WITH THE REFERENCED CODE SUB–CHAPTER AND/OR REFERENCE STANDARD:

   A. STANDARDS OF HEATING – ARTICLE 5 OF SUB–CHAPTER 12.
   B. HEATING CAPACITY – RS 12–1.
   C. NOISE CONTROL – MULTIPLE DWELLINGS – ARTICLE 9 OF SUB–CHAPTER 12.
   D. NOISE CRITERIA LEVELS AND TEST PROCEDURES FOR SOUND POWER LEVEL (SPL)–RS 12–4 AND RS 12–5.
   E. DUCT CONSTRUCTION, SUPPORT, AIR INTAKES, EXHAUSTS AND RELIEFS – RS 13–1.
   F. SEGREGATION OF AIR SUPPLY FOR CORRIDORS AND MEANS OF EGRESS AND DIFFERENT OCCUPANCY GROUPS–27–777.01 & RS 13–1.
   G. AIR FILTERS, FANS, AIR COOLING AND HEATING EQUIPMENT – RS 13–1.
   H. ELECTRIC WIRING AND EQUIPMENT – RS 13–1.
   I. FIRE DAMPERS AND SMOKE DAMPERS AND SMOKE DETECTORS – RS 13–1
   J. MANUAL AND AUTOMATIC, FIRE AND SMOKE CONTROLS FOR AIR DISTRIBUTION SYSTEMS – RS 13–1.
   K. HEAT EXCHANGER – RS 14–4.
   L. BOILERS – RS 14–5A.
   M. PIPING AND INSULATION – ARTICLE 10 OF SUB–CHAPTER 14.
   N. GAS FIRED EQUIPMENT – ARTICLE 16 OF SUB–CHAPTER 14.
   O. FUEL OIL STORAGE EQUIPMENT – ARTICLE 17 OF SUB–CHAPTER 14, 27–827,828,829,830.

3. MINIMUM TEMPERATURE TO BE MAINTAINED IN OCCUPIED SPACES DURING HEATING SEASON: 70 DEG F. WHEN 5 DEG F OUTSIDE (WITH 15 M.P.H. WIND), OR AS INDICATED ON VENTILATION INDEX AND IN COMPLIANCE WITH TABLE 12–1.

4. THE VENTILATION INDEX FOR ALL AREAS COMPLIES WITH THE MINIMUM CODE REQUIREMENTS PER 27–753 AND 27–754. ALL CALCULATIONS OF THE VENTILATION INDEX ARE MADE WITHOUT TAKING ANY CREDIT FOR EXTERIOR WINDOWS AND/OR OPENINGS IN AIR CONDITIONED AREAS.

5. VENTILATION OF SPECIAL AREAS SHALL COMPLY WITH SUB–CHAPTER 7, "SPECIAL USES AND AND OCCUPANCIES" AND SUB–CHAPTER 8 "PLACES OF ASSEMBLY".

6. ALL TOILET ROOMS TO BE VENTILATED IN ACCORDANCE WITH SECTION 27–759.

7. A STATEMENT SHALL BE FILED BY THE OWNER OR TENANT IN POSSESSION THAT THE VENTILATING SYSTEM WILL BE KEPT IN CONTINUOUS OPERATION AT ALL TIMES DURING THE NORMAL OCCUPANCY OF THE STRUCTURE AS REQUIRED BY CODE 27–779.

8. ALL FIRE DAMPERS SHALL BE ACCEPTED FOR USE BY THE NEW YORK CITY DEPARTMENT OF BUILDINGS SHALL HAVE AN M.E.A. # AND SHALL BE MANUFACTURED AND INSTALLED IN ACCORDANCE WITH UL 555, STANDARD FOR FIRE DAMPERS AND CEILING DAMPERS.

9. COMBINATION FIRE/SMOKE DAMPERS AND SMOKE DAMPERS SHALL BE ACCEPTED FOR USE BY THE NEW YORK CITY DEPARTMENT OF BUILDINGS SHALL HAVE AN M.E.A.#, AND SHALL BE MANUFACTURED AND INSTALLED IN ACCORDANCE WITH UL 555S–1983 STANDARD FOR LEAKAGE RATED DAMPERS FOR USE IN SMOKE CONTROL SYSTEMS.

10. SMOKE DETECTORS, COMBINATION FIRE/SMOKE DAMPERS AND SMOKE DAMPERS SHALL BE INSTALLED AS REQUIRED IN RS 13–1 CHAPTER IV, PARAGRAPH 4–3 AND 4–4 TO CLOSE DAMPERS AND AUTOMATICALLY STOP THE FAN.

11. REFER TO ARCHITECTURAL DRAWINGS FOR REQUIRED FIRE RATED WALL AND SMOKE WALL CONSTRUCTION AND LOCATION.

12. THESE PLANS ARE APPROVED ONLY FOR THE WORK INDICATED ON THE APPLICATION SPECIFICATION SHEET. ALL OTHER MATTERS SHOWN ARE NOT TO BE RELIED UPON OR TO BE CONSIDERED AS EITHER BEING APPROVED OR IN ACCORDANCE WITH APPLICABLE CODES.

13. TO THE BEST OF THE APPLICANT'S KNOWLEDGE, BELIEF AND PROFESSIONAL JUDGEMENT, THESE PLANS ARE IN COMPLIANCE WITH THE ENERGY CONSERVATION CONSTRUCTION CODE OF NEW YORK STATE.

14. TESTS OF SOUND POWER LEVEL OF MECHANICAL EQUIPMENT SHALL BE CONDUCTED AND RESULTS SUBMITTED AS REQUIRED PER 27–770 WHERE WINDOWS OF A DWELLING UNIT ARE WITHIN 100 FEET OF EQUIPMENT OPENING TO OR ON THE EXTERIOR OF THE BUILDING. NOISE CRITERIA LEVEL AND TEST PROCEDURES FOR SOUND POWER LEVEL SHALL COMPLY WITH CODE REFERENCE RS 12–4 AND RS 12–5.

DRAWING INDEX

VENTILATION INDEX

ROOM No.	DESCRIPTION	No. OF PEOPLE	ROOM AREA (SQ.FT.)	ROOM VOLUME (CU.FT.)	VENT INDEX	REQUIRED TOTAL CFM/SQ. FT.			ACTUAL CFM/SQ. FT.		
						SUPPLY	EXHAUST	OUTSIDE AIR	SUPPLY	EXHAUST	OUTSIDE AIR
1	ADMINISTATION	6	520	–	2058	.4	–	.13	5.8	–	1.9
2	IT ROOM	0	166	–	0	1.5	–	.5	9.6	–	3.2
3	KITCHEN	4	395	–	2345	.4	–	.13	2.5	–	.8
4	MEETING 1	6	170	–	673	.9	–	.3	3.2	–	1.1
5	MEETING 2	6	181	–	716	.9	–	.3	8.8	–	2.9
6	MEETING 3	14	327	–	555	.9	–	.3	4.3	–	1.4
7	MODELING	4	303	–	1799	.4	–	.13	5.9	6.6	2.0
8	PLOT 1	0	316	–	0	1.5	–	.5	1.7	–	.6
9	PLOT 2	0	437	–	0	1.5	–	.5	1.8	–	.6
10	PRINCIPLE 1	25	1153	–	1095	.6	–	.2	2.8	–	.9
11	PRINCIPLE 2	25	1026	–	974.7	.6	–	.2	2.2	–	.7
12	PRINCIPLE 3	22	1098	–	1185	.6	–	.2	5.0	–	1.7
13	PRINTER	0	222	–	0	1.5	–	.5	5.4	–	1.8
14	RECEPTION	1	425	–	10094	.4	–	.13	1.6	–	.5
15	SKYLIGHT	4	515	–	3058	.4	–	.13	1.6	–	.5
16	–	–	–	–	–	–	–	–	–	–	–

NOTES:
1. THE AMOUNT OF ACTUAL OUTDOOR AIR SHALL BE AT LEAST 33–1/3 PERCENT OF THE REQUIRED TOTAL.

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NO.	DATE	ISSUED FOR
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	04-16-08	CONSTRUCTION SET
	03-14-08	BUILDING MANAGER APPROVAL SET
	02-01-08	BID SET
	01-08-08	BUILDING DEPARTMENT SUBMISSION

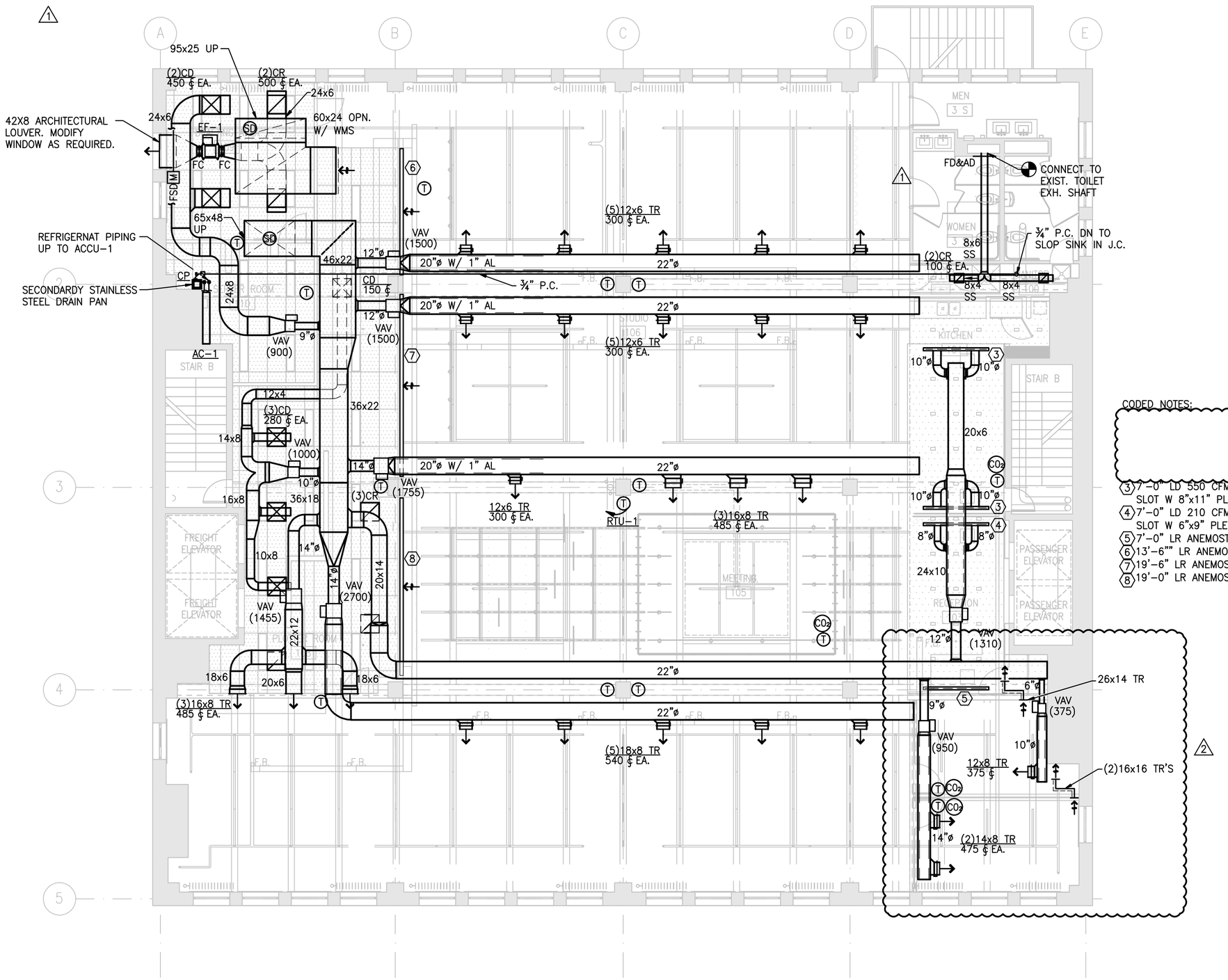
date: 12-27-07

drawn by: PB

scale: NTS

title: HVAC COVER SHEET 2 OF 2

number: H-1.1



CODED NOTES:

3 7'-0" LD 550 CFM ANEMOSTAT SLAD-PS-100, 3 SLOT W 8"x11" PLENUM.
4 7'-0" LD 210 CFM ANEMOSTAT SLAD-PS-75, 2 SLOT W 6"x9" PLENUM.
5 7'-0" LR ANEMOSTAT SLAR-PS-75, 2 SLOT.
6 13'-6"" LR ANEMOSTAT SLAR-PS-150, 3 SLOT.
7 19'-6" LR ANEMOSTAT SLAR-PS-150, 3 SLOT.
8 19'-0" LR ANEMOSTAT SLAR-PS-150, 3 SLOT.

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NO.	DATE	ISSUED FOR
2	05-28-08	BUILDING PERMIT AMENDMENT
1	05-05-08	BUILDING PERMIT AMENDMENT
	04-16-08	CONSTRUCTION SET
	03-14-08	BUILDING MANAGER APPROVAL SET
	02-01-08	BID SET
	01-08-08	BUILDING DEPARTMENT SUBMISSION

date: 12-27-07

drawn by: PB

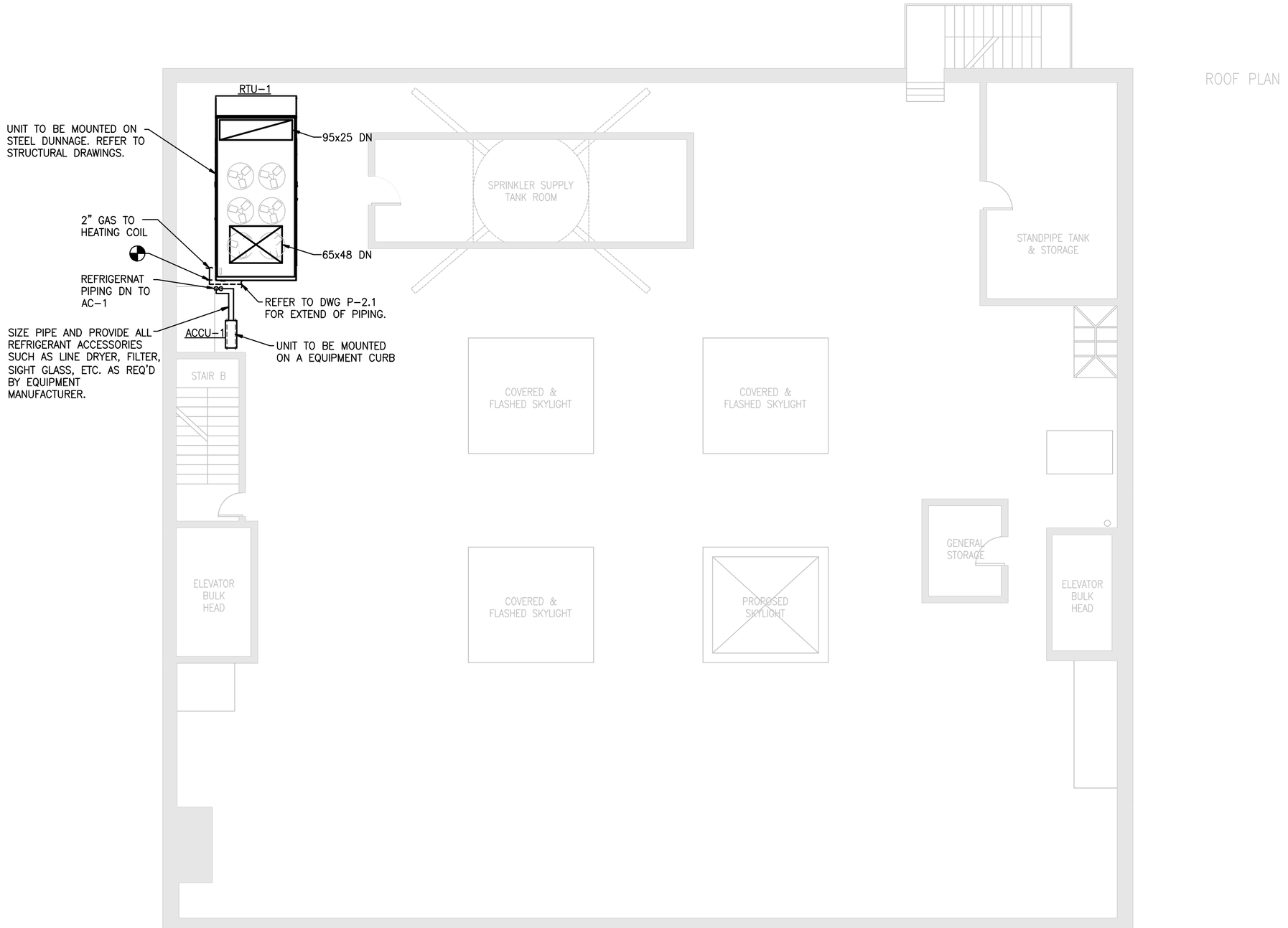
scale: 1/8"=1'-0"

title:

HVAC 12TH FLOOR CONSTRUCTION PLAN

number:

H-2.0



ROOF PLAN

NEW YORK CITY BUILDING DEPARTMENT NOTE

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	01-08-08	BUILDING DEPARTMENT SUBMISSION

date: 12-27-07

drawn by: PB

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

title: HVAC ROOF PLAN

number: H-2.1 (1)

ROOFTOP AIR CONDITIONING UNIT SCHEDULE – AIR COOLED

		SUPPLY FAN DATA						RETURN/ SPILL FAN DATA						DX DATA	COOLING DATA								
																	AIR DATA						
UNIT No.	LOCATION	CFM	EXT. SP (IN. W.G.)	RPM	BHP	MOTOR HP	DRIVE TYPE	CFM	EXT. SP (IN. W.G.)	RPM	BHP	MOTOR HP	DRIVE TYPE	REFRIGERANT	TOTAL (MBH)	SENSIBLE (MBH)	CFM	O.A. CFM	MAX. FPI	No. OF ROWS	EAT °F DB/WB	LAT °F DB/WB	FACE VELOCITY (FPM)
RTU–1	ROOF	15900	2	938	1411	15 X 2	VFD	12720	0.5	938	0.85	2 X 2	VFD	R–410A	463	427	15900	3180	12	6	79/63	54/53	499
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

NOTES:
1. PROVIDE WITH THE FOLLOWING:
   – ECONOMIZER
   – MOTORIZED OUTDOOR AIR DAMPER
   – HOT GAS BYPASS
   – VAV UNIT CONTROLLER

(AAON AS STANDARD)

HEATING DATA					FILTER DATA		EER	UNIT ELECTRICAL DATA					OPERATING WT. (LBS)	MEA No. (NYC ONLY)	MANUF. MODEL #	REMARKS
GAS DATA																
INPUT MBH	INLET PRESS. (WG)	TOTAL MBH	EAT (°F)	LAT (°F)	FILTER TYPE	EFFICIENCY		VOLTS	PHASE	HZ	MCA	UNIT FLA				
745	7	595	50	84.6	PLEAT	95%	10.5	460	3	60	130	125	6410	106–03–E	RN–040–3	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

SPLIT AIR COOLED CONDITIONING UNIT SCHEDULE

			EVAPORATOR COIL CONDITIONS				ELECTRICAL DATA							CONDENSING UNIT						
															COMPRESSOR		ELECTRICAL DATA			
AIR HANDLING UNIT No.	TOTAL COOLING (MBH)	SENSIBLE COOLING (MBH)	CFM	ENT. AIR DB/WB (°F)	LVG. AIR DB/WB (°F)	RPM	VOLTS	PHASE	HZ	AHU FLA	AHU OPER. WEIGHT (LBS)	MEA No. (NYC ONLY)	MANUF. MODEL #	CONDENSING UNIT No.	LRA/RLA (EA.)	CFM	VOLTS	PHASE	HZ	COMPRERSSOR MFS
AC–1	30	22.5	990	80/67	59/58	1380	115	1	60	1.0	62	01–03–E	PK30FL	ACCU–1	73/14	3170	208	1	60	30
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

NOTE:
1. INDOOR UNIT IS EVAPORATOR ONLY – OUTDOOR UNIT IS CONDENSING UNIT (COMPRESSOR AND CONDENSER).
2. MEA No. REQUIRED FOR NEW YORK CITY PROTOTYPE ONLY.
3. PROVIDE CONDENSATE PUMP

(MITSUBISHI AS STANDARD)

COND. WEIGHT (LBS)	MEA No. (NYC ONLY)	MANUF. MODEL #	REMARKS
208	01–03–E	PU30EK	–
–	–	–	–

FAN SCHEDULE

(BASIS OF SELECTION: GREENHECK)

				PERFORMANCE DATA					MOTOR DATA							
												ELECTRICAL DATA				
UNIT No.	LOCATION	SERVICE	FAN TYPE	CFM	TOTAL SP (IN. W.G.)	RPM	BHP	MAX. OV (FPM)	DRIVE TYPE	MHP	STARTER TYPE	VOLTS	PHASE	HZ	MANUF. MODEL #	MANUFACTURER
EF–1	–	EXHAUST	INLINE	1000	1.0	1813	0.37	762	BELT	1/2	HOA	208	3	60	BSQ–100–5	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

NOTES:
1. PROVIDE WITH THE FOLLOWING:
   – BELT GUARD
   – FLANGED INLET AND OUTLET
   – COMPANION FLANGES FOR INLET AND OUTLET
   – SPRING VIBRATION ISOLATORS
   – REINFORCED WHEEL
   – FUSED DISCONNECT AS PART OF HOA STARTER

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NO.	DATE	ISSUED FOR
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	04-16-08	CONSTRUCTION SET
	03-14-08	BUILDING MANAGER APPROVAL SET
	02-01-08	BID SET
	01-08-08	BUILDING DEPARTMENT SUBMISSION

date: 12-27-07
drawn by: PB
scale: NTS
title: HVAC SCHEDULES 1 OF 2
number: H-3.0

DIFFUSER SCHEDULE (BASIS OF SELECTION: ANEMOSTAT)

DESIGNATION	SERVICE	CFM RANGE	MAX NC	TYPE	NECK SIZE (IN.)/SIZE & NO. OF SLOTS	NOMINAL OVERALL DIMENSION WxL (IN.)	MANUF. MODEL	REMARKS
CD	SUPPLY	0–245	20	CEILING	8ø	24x24	PARAGON	–
CD	SUPPLY	246–380	20	CEILING	10ø	24x24	PARAGON	–
CD	SUPPLY	380–550	21	CEILING	12ø	24x24	PARAGON	–
CD	SUPPLY	551–750	23	CEILING	14ø	24x24	PARAGON	–
CR	EXHAUST	0–160	25	CEILING	7ø	12x12	PARAGON	–
CR	EXHAUST	551–750	26	CEILING	14ø	24x24	PARAGON	–
CR	RETURN	–	26	CEILING	14ø	24x24	PARAGON	–
TR	SUPPLY	300	20	–	–	12x6	S2H	–
TR	SUPPLY	320	20	–	–	12x6	S2H	–
TR	SUPPLY	370	20	–	–	12x8	S2H	–
TR	SUPPLY	450	20	–	–	14x8	S2H	–
TR	SUPPLY	565	20	–	–	18x8	S2H	–
TR	SUPPLY	665	20	–	–	20x8	S2H	–

REMARKS:
1. COORDINATE MOUNTING TYPE WITH LATEST ARCHITECTURAL PLANS.
2. COLOR AND FINISH AS SELECTED BY ARCHITECT.
3. PROVIDE EQUALIZING GRID FOR CD'S.
4 ALL DIFFUSERS/REGISTERS LOCATED IN HARD CEILING/SOFFIT SHALL BE SUPPLIED WITH A PULL CORD DAMPER.

VARIABLE VOLUME TERMINAL UNIT SCHEDULE

BOX DESIGNATION	CFM RANGE	INLET SIZE (DIA.)	RADIATED NOISE (NC)	DISCHARGE NOISE (NC)	Δ SP	MANUFACTURER	MODEL	REMARKS
VAV	0–200	5"	20	20	0.20	ANEMOSTAT	EZT	–
VAV	201–400	6"	20	23	0.16	ANEMOSTAT	EZT	–
VAV	401–600	7"	27	22	0.22	ANEMOSTAT	EZT	–
VAV	601–800	8"	22	22	0.25	ANEMOSTAT	EZT	–
VAV	801–1000	9"	26	21	0.25	ANEMOSTAT	EZT	–
VAV	1001–1200	10"	24	24	0.32	ANEMOSTAT	EZT	–
VAV	1201–1800	12"	25	22	0.30	ANEMOSTAT	EZT	–
VAV	1801–2500	14"	25	22	0.28	ANEMOSTAT	EZT	–
VAV	2501–3600	16"	30	26	0.35	ANEMOSTAT	EZT	–

NOTES:
1. BOXES SHALL BE DDC ELECTRONIC.
2. MINIMUM CFM 50%
3. DDC CONTROLS SHALL BE SUPPLIED BY ATC CONTRACTOR, INSTALLED BY BOX MANUFACTURER.
4. BOX MANUFACTURER SHALL PROVIDE CONTROL TRANSFORMER, CROSS FLOW VELOCITY SENSOR AND CONTROL ENCLOSURE.

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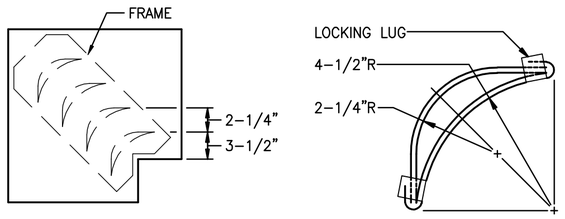
scale: NTS

title: HVAC SCHEDULES 2 OF 2

number: H-3.1



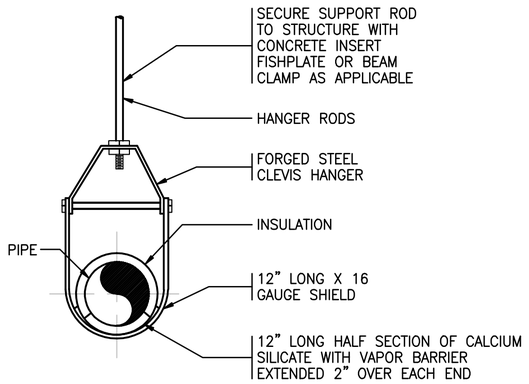
VANED ELBOW

TURNING VANE

NOTES:

1. LOCKING LUGS INTERNAL WITH VANE
2. MAXIMUM UNSUPPORTED VANE LENGTH 48"
3. FRAMES – BOLTED OR RIVETED TO ELBOW
4. VANES AND FRAMES – SAME GAUGE AS ELBOW

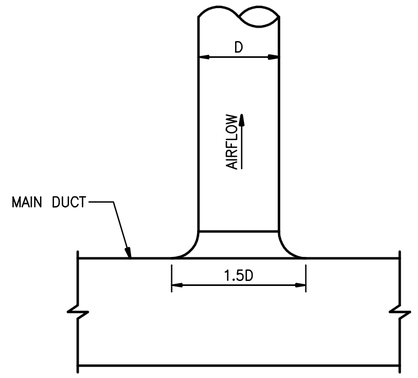
DOUBLE THICKNESS TURNING VANES FOR SQUARE ELBOWS



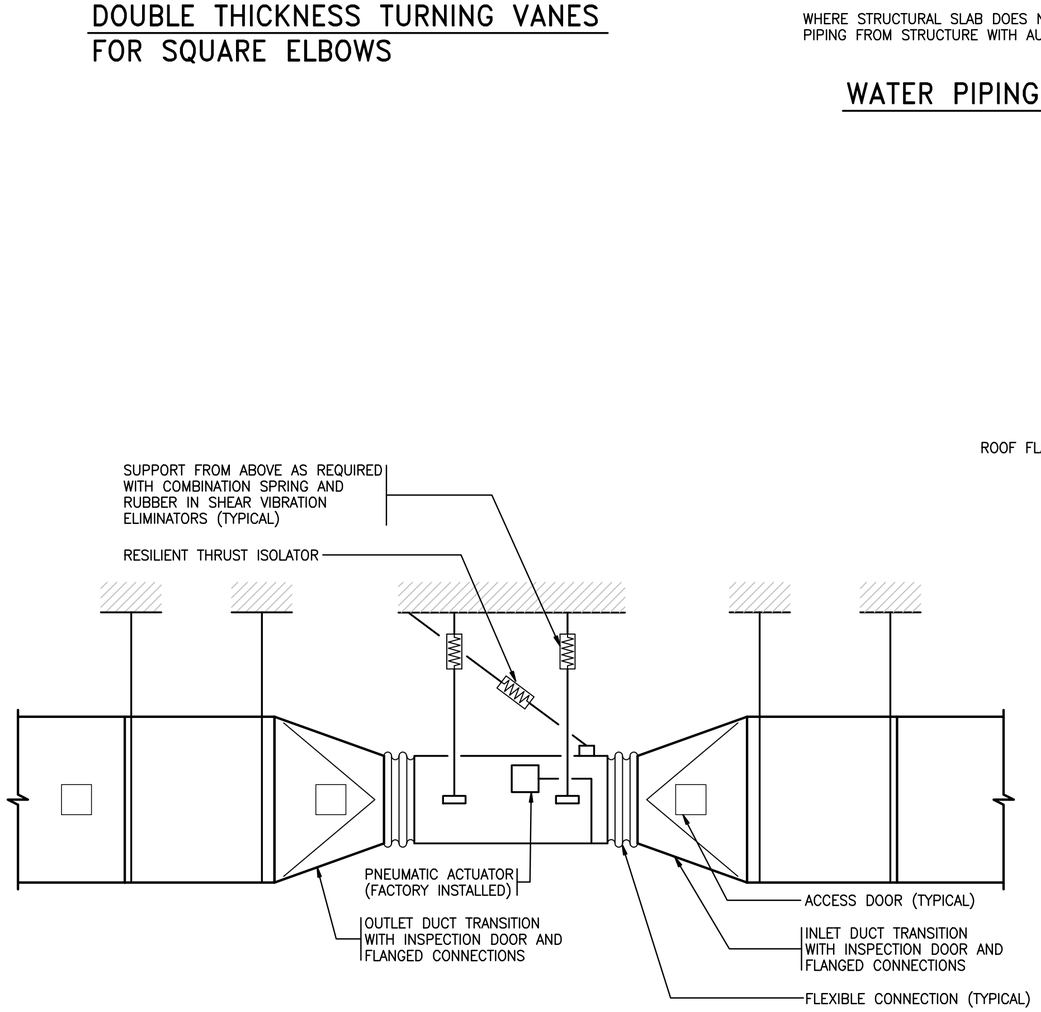
ALL SIZES

WHERE STRUCTURAL SLAB DOES NOT PERMIT INSERTS. SUPPORT PIPING FROM STRUCTURE WITH AUXILIARY STEEL IF REQUIRED.

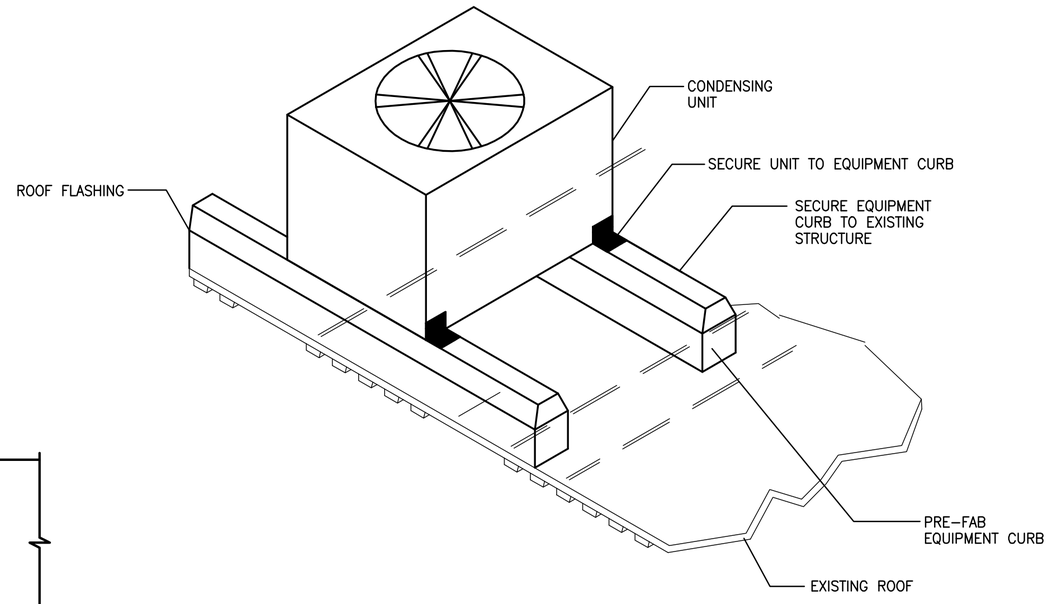
WATER PIPING HANGER DETAIL



CIRCULAR BRANCH CONNECTION TO SINGLE OUTLET



IN–LINE FAN INSTALLATION DETAIL



ROOF TOP EQUIPMENT INSTALLATION

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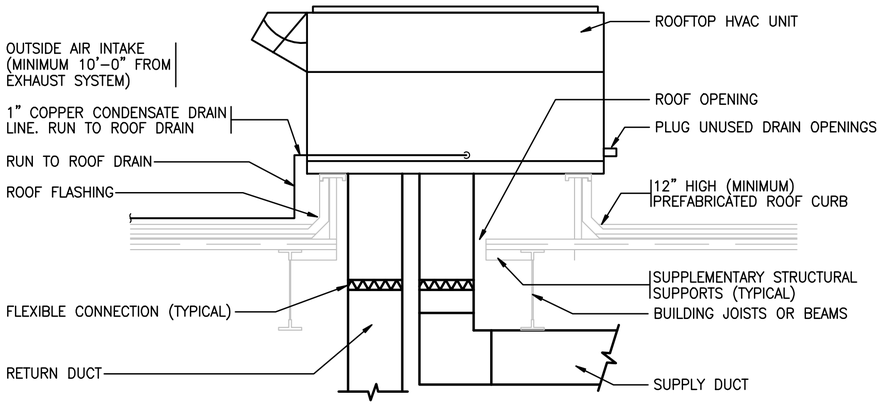
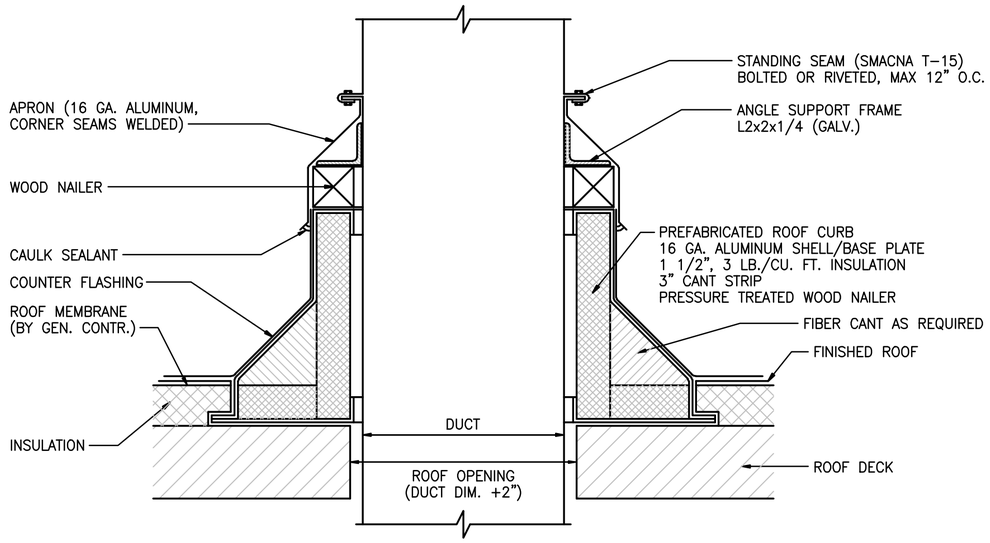


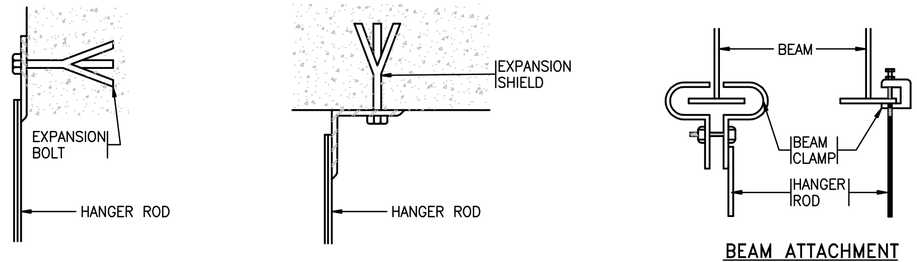
NOTES:

1. CONTRACTOR SHALL FURNISH AND INSTALL ALL ROOF CURBS.
2. CONTRACTOR SHALL PAY FOR ALL ROOF OPENINGS. CONTRACTOR SHALL PERFORM ALL WORK REQUIRED TO PROVIDE ROOF OPENINGS.
3. CONTRACTOR SHALL FURNISH, INSTALL AND/OR PAY FOR ALL SUPPLEMENTARY STRUCTURAL SUPPORTS REQUIRED TO FURNISH AND INSTALLED ROOF MOUNTED EQUIPMENT.
4. CONTRACTOR TO RUN CONDENSATE DRAIN LINE TO NEAREST ROOF DRAIN WITH USE OF PROPER ROOF SUPPORTS, ADEQUATE DRAINAGE.
5. ALL PREFABRICATED ROOF CURBS SHALL BE A MINIMUM OF 12" ABOVE FINISHED ROOF.
6. CONTRACTOR SHALL COORDINATE AND RETAIN THE BUILDING APPROVED ROOF CONTRACTOR TO MAINTAIN INTEGRITY OF ROOF AND WARRANTY.

ROOFTOP A.C. UNIT INSTALLATION

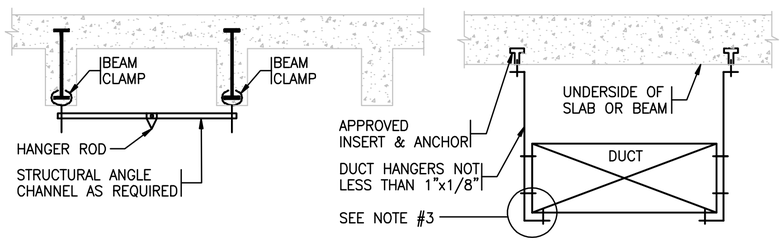


DUCT PENETRATION THROUGH ROOF



CONCRETE ATTACHMENT

BEAM ATTACHMENT

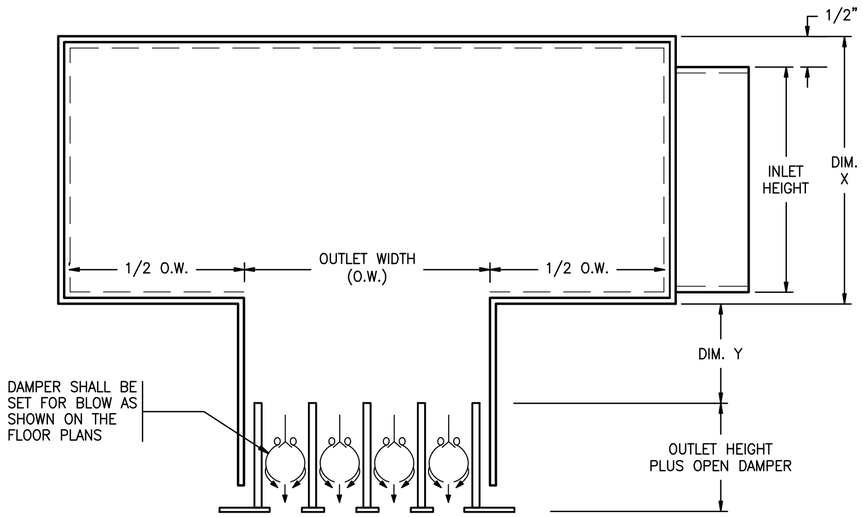


LONGEST DIMENSION OF DUCT	ROUND HANGERS	MAXIMUM SPACING NOTE #4	STRAP HANGERS	TRAPEZE SHELF ANGLES
UP TO 18"	8 GA. WIRE	8'-0"	1"x1/8"	1"x1"x1/8"
19" TO 30"	1/4" ROD	8'-0"	1"x1/8"	1"x1"x1/8"
31" TO 42"	1/4" ROD	8'-0"	1"x1/8"	1-1/2"x1-1/2"x1/8"
43" TO 60"	3/8" ROD	4'-0"	–	1-1/2"x1-1/2"x1/8"
61" TO 84"	3/8" ROD	4'-0"	–	2"x2"x1/8"
85" TO 96"	3/8" ROD	4'-0"	–	2"x2"x3/16"
OVER 97"	3/8" ROD	4'-0"	–	2"x2"x1/4"

NOTES:

1. ALL DUCTWORK TO BE HUNG FROM BUILDING CONSTRUCTION. DO NOT SUPPORT FROM HUNG CEILING.
2. WHEN DUCT AREA EXCEEDS 8 SQ. FT. ANGLE STIFFENERS ARE REQUIRED AROUND CIRCUMFERENCE EVERY 4'-0".
3. FOR DUCTS OVER 48" WIDE, HANGERS SHALL TURN UNDER DUCT AT LEAST 2" AND SHALL BE FASTENED TO THE BOTTOM AS WELL AS TO THE SIDES OF THE DUCT.
4. FOR DUCTS WITH A CROSS SECTIONAL AREA OF 4 SQ. FT. OR LESS, HANGERS SHALL BE NO MORE THAN 8 FT. APART. FOR DUCTS WITH A CROSS SECTIONAL AREA OF MORE THAN 4 SQ. FT. BUT NOT OVER 8 SQ. FT., HANGERS SHALL NOT BE MORE THAN 6 FT. APART. FOR DUCTS WITH A CROSS SECTIONAL AREA MORE THAN 8 SQ. FT., HANGERS SHALL NOT BE MORE THAN 4 FT. APART. THE DISTANCES BETWEEN HANGERS SHALL BE MEASURED LINEARLY ALONG THE DUCT.

DUCT SUPPORT DETAIL



FOR OUTLET WIDTHS UP TO 6"
DIMENSION X=INLET HEIGHT + 1"
DIMENSION Y=1"

FOR OUTLET WIDTHS UP TO 6 1/2" AND UP
DIMENSION X=INLET HEIGHT + 3"
DIMENSION Y=2"

LINEAR DIFFUSER PLENUM DETAIL

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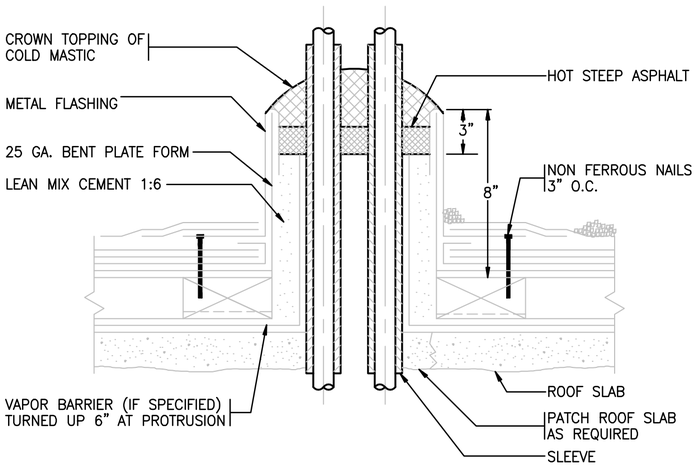
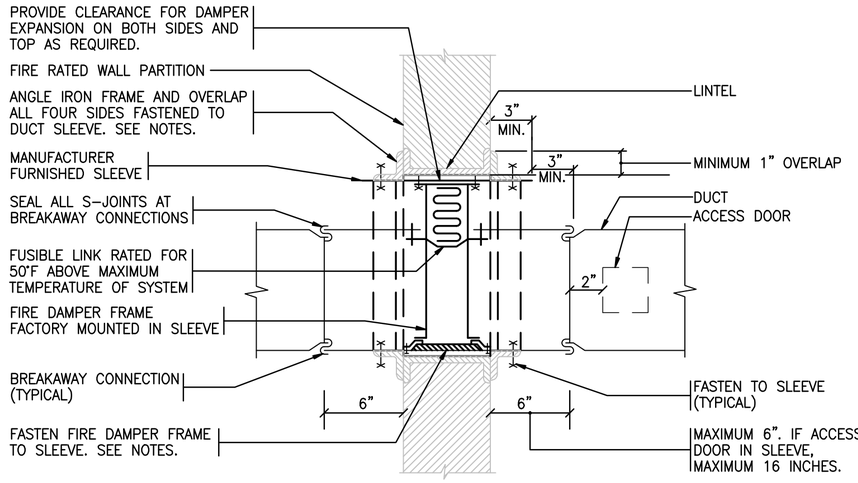


NOTE:

SEE ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR THE ROOF CONSTRUCTION.

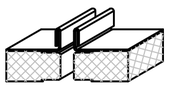
PIPING THROUGH ROOF



GENERAL NOTES:

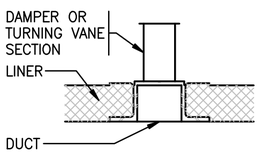
1. DAMPER TO BE U.L. LABELED N.F.P.A. 90A, BSA AND MEA APPROVED.
2. N.F.P.A. APPROVED INSTALLATION DETAILS TO BE PART OF SUBMISSION OF FIRE DAMPER FOR APPROVAL, WHICH SHALL MEET N.F.P.A. STANDARD 90A AND SHALL BE BSA APPROVED.
3. DETAILS SHOWN ARE FOR FIRE DAMPERS IN HORIZONTAL DUCTWORK, FOR DAMPERS IN VERTICAL DUCTWORK, DETAILS SIMILAR EXCEPT DAMPERS ARE TO BE SPRING LOADED.
4. ACCESS DOOR IS SHOWN IN SIDE OF DUCT; IF FUSIBLE LINK IS MORE ACCESSIBLE FROM BOTTOM OF DUCT RELOCATE ACCESS DOOR.
5. U.L. APPROVED BREAKWAY SLIP JOINT CONNECTION SHALL BE USED.
6. THIS DETAIL IS A GUIDE ONLY. INSTALL FIRE DAMPER IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND UL LISTING.
7. RETAINING ANGLES MUST OVERLAP THE FIRE WALL 1" MIN. AND COVER CORNERS OF OPENINGS.

BRANCH OR MAIN DUCT WITH TYPE "B" FIRE DAMPER – DETAIL



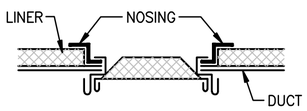
NOTE:
OF LINER AT TRAVERSE JOINTS (ALL JOINTS) ENTERING, BUTTING AND TRAILING EDGES TO BE COVERED BY NOSING.

TRAVERSE JOINT DETAIL



NOTE:
HATCH SECTION INSTALLED WITH NOSING TO CONCEAL LINER EDGES

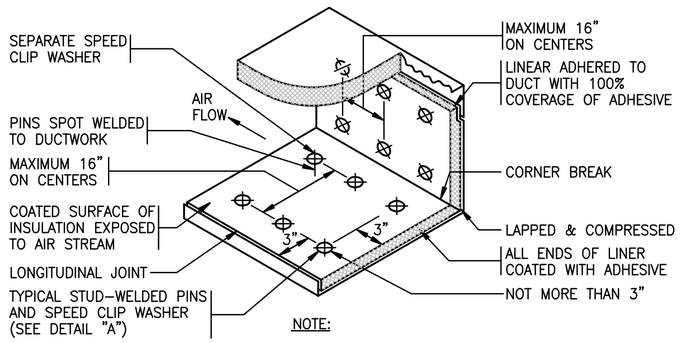
DETAIL AT DAMPERS AND TURNING VANES



ACCESS DOOR DETAIL

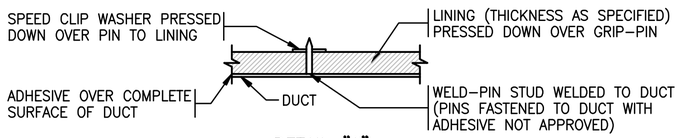
GENERAL NOTES:

1. NOSING ATTACHED TO DUCT BY RIVETS, SCREWS OR WELDS.
2. NOSING: 24 GA. UP TO 48"; OVER 48" – SAME GA. AS DUCT.

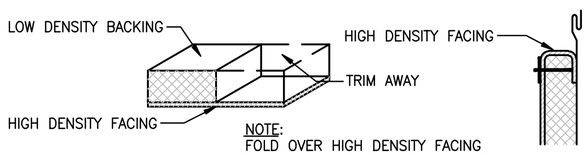


NOTE:

1. NOT LESS THAN TWO PINS ON EACH FACE OF DUCT.



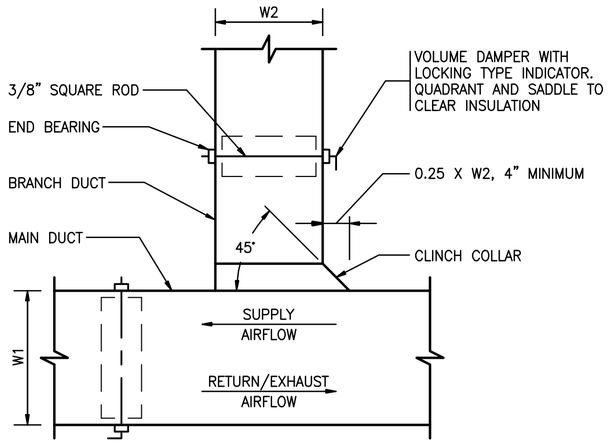
DETAIL "A"



NOTE:
FOLD OVER HIGH DENSITY FACING ON ALL LONGITUDINAL JOINTS AND SECURE WITH MECHANICAL FASTENERS

LONGITUDINAL JOINT DETAIL

SOUND LINING INSTALLATION AND NOSING DETAIL



NOTES:

1. FURNISH THIS TYPE CONNECTION WHEN SINGLE LINE DUCTWORK IS INDICATED AS THIS . FOR LOW PRESSURE BRANCHES WITH LESS THAN 700 CFM AND MEDIUM PRESSURE BRANCHES WITH LESS THAN 1,000 CFM.
2. NOT TO BE USED AS A SUBSTITUTE FOR AN ELBOW.

RECTANGULAR DUCT ANGULAR TAP WITH VOLUME DAMPER

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date: 12-27-07

drawn by: PB

scale: NTS

title: HVAC DETAILS 3 OF 3

number: H-4.2

1. GENERAL

A. THE "GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION," AIA DOCUMENT A201, LATEST EDITION, AND THESE SPECIFICATIONS AS APPLICABLE ARE PART OF THIS CONTRACT.

B. ALL APPLICABLE CODES, LAWS AND REGULATIONS GOVERNING OR RELATING TO ANY PORTION OF THIS WORK ARE HEREBY INCORPORATED INTO AND MADE A PART OF THESE SPECIFICATIONS, AND THEIR PROVISIONS SHALL BE CARRIED OUT BY THE CONTRACTOR WHO SHALL INFORM THE OWNER, PRIOR TO SUBMITTING A PROPOSAL, OF ANY WORK OR MATERIALS WHICH VIOLATE ANY OF THE ABOVE LAWS AND REGULATIONS. ANY WORK DONE BY THE CONTRACTOR CAUSING SUCH VIOLATION SHALL BE CORRECTED BY THE CONTRACTOR.

C. INVESTIGATE EACH SPACE THROUGH WITH EQUIPMENT MUST BE MOVED. WHERE NECESSARY, EQUIPMENT SHALL BE SHIPPED FROM MANUFACTURER IN SECTIONS OF SIZE SUITABLE FOR MOVING THROUGH AVAILABLE RESTRICTIVE SPACES. ASCERTAIN FROM BUILDING OWNER AT WHAT TIMES OF DAY EQUIPMENT MAY BE MOVED THROUGH ALL AREAS.

D. DUCTWORK AND PIPING IS SHOWN DIAGRAMMATICALLY AND DOES NOT SHOW ALL OFFSETS, DROPS AND RISES OF RUNS. THE CONTRACTOR SHALL ALLOW IN HIS PRICE FOR ROUTING OF DUCTWORK AND PIPING TO AVOID OBSTRUCTIONS. EXACT LOCATIONS ARE SUBJECT TO APPROVAL OF ARCHITECT. COORDINATION WITH THE EXISTING SERVICES, INCLUDING THOSE OF OTHER TRADES IS REQUIRED.

E. SUPPORT ALL DUCTWORK AND PIPING FROM BUILDING STRUCTURE AND/OR FRAMING IN AN APPROVED MANNER. WHERE OVERHEAD CONSTRUCTION DOES NOT PERMIT FASTENING OR SUPPORTS FOR EQUIPMENT, FURNISH ADDITIONAL FRAMING. INSERTS SHALL BE STEEL, SLOTTED TYPE AND FACTORY PAINTED. SINGLE ROD SHALL BE SIMILAR TO GRINNELL FIG. 281. MULTI-ROD SHALL BE SIMILAR TO FEE & MASON SERIES 9000 WITH END CAPS AND CLOSURE STRIPS. MAXIMUM LOADING INCLUDING PIPES, DUCTWORK CONTENTS AND COVERING SHALL NOT EXCEED 75% OF RATED INSERT CAPABILITY. WHEN SUPPORTING FROM BUILDING USE BEAM CLAMPS IN APPROVED MANNER.

F. INSTALL WORK SO AS TO BE READILY ACCESSIBLE FOR OPERATION, MAINTENANCE AND REPAIR. MINOR DEVIATIONS FROM DRAWINGS MAY BE MADE TO ACCOMPLISH THIS, BUT CHANGES WHICH INVOLVE EXTRA COST SHALL NOT BE MADE WITHOUT APPROVAL.

G. REMOVAL AND RELOCATION OF CERTAIN EXISTING WORK WILL BE NECESSARY FOR THE PERFORMANCE OF THE GENERAL WORK. ALL EXISTING CONDITIONS CANNOT BE COMPLETELY DETAILED ON THE DRAWINGS. THE CONTRACTOR SHALL SURVEY THE SITE AND INCLUDE ALL CHANGES IN MAKING UP THE WORK PROPOSAL.

H. PLAN INSTALLATION OF NEW WORK AND CONNECTIONS TO EXISTING WORK TO INSURE MINIMUM INTERFERENCE WITH REGULAR OPERATION OF EXISTING FACILITIES. ALL SYSTEM SHUTDOWNS AFFECTING OTHER AREAS SHALL BE COORDINATED WITH BUILDING OWNER. INSTALL ISOLATION VALVES AT POINT OF CONNECTION TO THE EXISTING PIPING. PROVIDE TEMPORARY DUCT CAPS AND/OR CONNECTIONS TO MINIMIZE SHUTDOWN TIME.

I. CONNECT NEW WORK TO EXISTING WORK IN NEAT AND APPROVED MANNER. RESTORE EXISTING WORK DISTURBED WHILE INSTALLING NEW WORK TO ACCEPTABLE CONDITION AS DETERMINED BY ARCHITECT.

J. DISCONNECT, REMOVE AND/OR RELOCATE EXISTING MATERIAL, EQUIPMENT AND OTHER WORK AS NOTED OR REQUIRED FOR PROPER INSTALLATION OF NEW SYSTEM.

K. THE CONTRACTOR SHALL KEEP ALL EQUIPMENT AND MATERIALS, AND ALL PARTS OF THE BUILDING, EXTERIOR SPACES AND ADJACENT STREETS, SIDEWALKS AND PAVEMENTS, FREE FROM MATERIAL AND DEBRIS RESULTING FROM THE EXECUTION OF THIS WORK. EXCESS MATERIALS WILL NOT BE PERMITTED TO ACCUMULATE EITHER ON THE INTERIOR OR THE EXTERIOR.

L. SEAL OPENINGS AROUND DUCTS AND PIPING THROUGH PARTITIONS, WALLS AND FLOORS (NOT IN SHAFTS) WITH MINERAL WOOL OR OTHER NONCOMBUSTIBLE MATERIAL.

M. PROVIDE ALL NECESSARY FLASHING AND COUNTERFLASHING TO MAINTAIN THE WATERPROOFING INTEGRITY OF THIS BUILDING AS REQUIRED BY THE INSTALLATION OR REMOVAL OF PIPES, DUCTS, LOUVERS, CONDUIT, AND EQUIPMENT. PROVIDE EQUIPMENT CURBS AND DUNNAGE STEEL AS REQUIRED.

N. ALL PRESENT MATERIAL, EQUIPMENT AND CONSTRUCTION DEBRIS TO BE REMOVED UNDER THIS CONTRACT SHALL BECOME THE PROPERTY OF THE CONTRACTOR WITH THE EXCEPTION OF SPECIFIC EQUIPMENT AND APPARATUS REQUESTED BY THE BUILDING REPRESENTATIVE, ARCHITECT OR AS NOTED TO BE RELOCATED ON THE DRAWINGS SHALL BE PROPERLY DISPOSED OF BY THIS CONTRACTOR.

O. MATERIALS AND WORKMANSHIP, UNLESS OTHERWISE NOTED, SHALL BE IN ACCORDANCE WITH BUILDING STANDARDS.

P. THE WORK IN THE BUILDING SHALL BE DONE WHEN AND AS DIRECTED, AND IN A MANNER SATISFACTORY TO THE OWNER. THE WORK SHALL BE PERFORMED SO AS TO CAUSE THE LEAST POSSIBLE INCONVENIENCE AND DISTURBANCE TO THE PRESENT OCCUPANTS.

Q. THE CONTRACTOR'S PROPOSAL FOR ALL WORK SHALL BE PREDICATED ON THE PERFORMANCE OF THE WORK DURING REGULAR WORKING HOURS. WHEN SO DIRECTED, HOWEVER, THE CONTRACTOR SHALL INSTALL WORK IN OVERTIME AND THE ADDITIONAL COST TO BE CHARGED THEREFORE SHALL BE ONLY THE "PREMIUM" PORTION OF THE WAGES PAID.

R. UNLESS OTHERWISE SPECIFICALLY SPECIFIED, INCLUDE ALL CUTTING AND PATCHING OF EXISTING FLOORS, WALLS, PARTITIONS AND OTHER MATERIALS IN THE EXISTING BUILDING. THE CONTRACTOR SHALL RESTORE THESE AREAS TO ORIGINAL CONDITION.

S. REMOVABLE ACCESS TILE AND/OR ACCESS DOOR ARE REQUIRED IN HUNG CEILINGS, SHAFTS AND WALLS FOR ALL VOLUME AND FIRE DAMPERS, AUTOMATIC DAMPERS AND ALL OTHER MECHANICAL EQUIPMENT AND DEVICES. HVAC CONTRACTOR TO FURNISH ACCESS LOCATION REQUIREMENTS TO GENERAL CONTRACTOR. ACCESS TILE IDENTIFICATION: PROVIDE BUTTONS, TABS, AND MARKERS TO IDENTIFY LOCATION OF CONCEALED VALVES, DAMPERS AND EQUIPMENT.

T. ALL EQUIPMENT SHALL HAVE AN MEA AND/OR BSA NUMBER. THIS INFORMATION MUST BE INCLUDED IN THE SUBMITTAL PACKAGE.

U. ALL MATERIAL AND EQUIPMENT TO BE NEW UNLESS OTHERWISE NOTED AND SHALL BE IN ACCORDANCE WITH BUILDING STANDARDS.

V. SUBMISSION OF A PROPOSAL SHALL BE CONSTRUED AS EVIDENCE THAT A CAREFUL EXAMINATION OF THE PORTIONS OF THE EXISTING BUILDING, EQUIPMENT, ETC., WHICH AFFECT THIS WORK, AND THE ACCESS TO SUCH SPACES, HAS BEEN MADE AND THAT THE CONTRACTOR IS FAMILIAR WITH EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT THE EXECUTION OF THE WORK. LATER CLAIMS SHALL NOT BE MADE FOR LABOR, EQUIPMENT OR MATERIALS REQUIRED BECAUSE OF DIFFICULTIES ENCOUNTERED WHICH COULD HAVE BEEN FORESEEN DURING SUCH AN EXAMINATION. THE ON-SITE INSPECTION SHALL VERIFY EXISTING DUCTWORK, PIPING (SIZES, CLEARANCES, ETC) AND CONDITIONS.

W. INSURANCE: IN ACCORDANCE WITH BUILDING REQUIREMENTS AND SHALL INCLUDE A HOLD HARMLESS CLAUSE FOR OWNER AND ENGINEER.

X. THE FINAL ACCEPTANCE WILL BE MADE AFTER THE CONTRACTOR HAS ADJUSTED HIS EQUIPMENT, BALANCED THE VARIOUS SYSTEMS, DEMONSTRATED THAT IT FULFILLS THE REQUIREMENTS OF THE DRAWINGS AND SPECIFICATIONS AND HAS FURNISHED ALL THE REQUIRED CERTIFICATES OF INSPECTION AND APPROVAL.

Y. SPECIFICATIONS ARE OF SIMPLIFIED FORM AND INCLUDE INCOMPLETE SENTENCES. WORDS OR PHRASES SUCH AS "THE CONTRACTOR SHALL," "SHALL BE," "FURNISH," "PROVIDE," "A," "THE," AND "ALL" HAVE BEEN OMITTED FOR BREVITY.

Z. DEFINITIONS:

1) "PROVIDE": TO SUPPLY, INSTALL AND CONNECT UP COMPLETE AND READY FOR SAFE AND REGULAR OPERATION THE PARTICULAR WORK REFERRED TO UNLESS SPECIFICALLY OTHERWISE NOTED.

2) "INSTALL": TO ERECT, MOUNT AND CONNECT COMPLETE WITH RELATED ACCESSORIES.

3) "FURNISH" OR "SUPPLY": TO PURCHASE, PROCURE, ACQUIRE AND DELIVER COMPLETE WITH RELATED ACCESSORIES.

4) "WORK": LABOR, MATERIALS, EQUIPMENT, APPARATUS, CONTROLS, ACCESSORIES AND OTHER ITEMS REQUIRED FOR PROPER AND COMPLETE INSTALLATION.

5) "CONCEALED": EMBEDDED IN MASONRY OR OTHER CONSTRUCTION, INSTALLED IN FURRED SPACES, WITHIN DOUBLE PARTITIONS OR HUNG CEILINGS, IN TRENCHES, IN CRAWL SPACES, OR IN ENCLOSURES.

6) "EXPOSED": NOT INSTALLED UNDERGROUND OR "CONCEALED" AS DEFINED ABOVE.

7) "SIMILAR" OR "EQUAL": EQUAL IN MATERIALS, WEIGHT, SIZE, DESIGN AND EFFICIENCY OF SPECIFIED PRODUCT.

2. SCOPE OF WORK

A. THE WORK UNDER CONTRACT INCLUDES ALL LABOR, MATERIALS AND APPLIANCES NECESSARY FOR THE FURNISHING, INSTALLING AND TESTING, COMPLETE AND READY FOR SAFE OPERATION OF THE SYSTEMS. WORK SHALL BE INSTALLED IN A NEAT, WORKMANLIKE MANNER.

B. THE CONTRACTOR SHALL GIVE NECESSARY NOTICE, FILE DRAWINGS AND SPECIFICATIONS WITH THE DEPARTMENT HAVING JURISDICTION, OBTAIN PERMITS OR LICENSES NECESSARY TO CARRY OUT THIS WORK AND PAY ALL FEES THEREFORE. THE CONTRACTOR SHALL ARRANGE FOR INSPECTION AND TESTS OF ANY OR ALL PARTS OF THE WORK IF SO REQUIRED BY AUTHORITIES AND PAY ALL CHARGES FOR SAME. THE CONTRACTOR SHALL PAY ALL COSTS FOR, AND FURNISH TO THE OWNER BEFORE FINAL BILLING, ALL CERTIFICATES NECESSARY AS EVIDENCE THAT THE WORK INSTALLED CONFORMS WITH ALL REGULATIONS WHERE THEY APPLY TO THIS WORK.

C. THE CONTRACTOR SHALL FURNISH A WRITTEN GUARANTEE TO REPLACE OR REPAIR PROMPTLY AND ASSUME RESPONSIBILITY FOR ALL EXPENSES INCURRED FOR ANY WORKMANSHIP AND EQUIPMENT IN WHICH DEFECTS DEVELOP WITHIN ONE YEAR FROM THE DATE OF FINAL CERTIFICATE FOR PAYMENT AND/OR FROM DATE OR ACTUAL USE OF EQUIPMENT OR OCCUPANCY OF SPACES, BY OWNER, INCLUDED UNDER THE VARIOUS PARTS OF THE WORK, WHICHEVER DATE IS EARLIER. THIS WORK SHALL BE DONE AS DIRECTED BY THE OWNER. THIS GUARANTEE SHALL ALSO PROVIDE THAT WHERE DEFECTS OCCUR, THE CONTRACTOR WILL ASSUME RESPONSIBILITY FOR ALL EXPENSES INCURRED IN REPAIRING AND REPLACING WORK OF OTHER TRADES AFFECTED BY DEFECTS, REPAIRS OR REPLACEMENTS IN

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EQUIPMENT SUPPLIED BY THE CONTRACTOR.

D. CONTROLLED INSPECTION BY A LICENSED PROFESSIONAL ENGINEER TO BE HIRED BY THIS CONTRACTOR.

E. PRIOR TO THE INSTALLATION OF ANY WORK AND PROCUREMENT OF EQUIPMENT PROVIDE COMPLETE SET OF COORDINATED SHOP DRAWINGS OF ALL NEW AND EXISTING EQUIPMENT, DUCTWORK, PIPING AND CONTROL SYSTEMS INDICATING CAPACITY DIMENSIONS AND SEQUENCE OF OPERATION FOR WRITTEN APPROVAL BY THE ARCHITECT AND ENGINEER.

3. SHOP DRAWINGS

A. INDICATE ON EACH SUBMISSION: PROJECT NAME AND LOCATION, ARCHITECT AND ENGINEER, ITEM IDENTIFICATION AND APPROVAL STAMP OF PRIME CONTRACTOR.

B. SUBMISSIONS:

1) SUBMISSIONS 11 IN. X 17 IN. OR SMALLER: IF THE SUBMISSION IS A CATALOG CUT, THEN THE CONTRACTOR SHALL SUBMIT ONE ORIGINAL AND TWO COPIES. OTHERWISE, HE SHALL SUBMIT THREE COPIES. THE ARCHITECT WILL FORWARD THE ORIGINAL AND ONE COPY (TWO COPIES WHEN NO ORIGINAL IS RECEIVED) TO THE ENGINEER. ALL CATALOG CUTS SHALL BE COMPLETE.

2) SUBMISSIONS LARGER THAN 11 IN. X 17 IN.: SUBMIT TWO PRINTS AND ONE PAPER SEPIA TO THE ARCHITECT. THE ARCHITECT WILL FORWARD ONE PRINT AND THE PAPER SEPIA TO THE ENGINEER.

C. SUBMIT SHOP DRAWINGS FOR THE FOLLOWING:

1) DUCTWORK LAYOUT AND SHEET METAL DESIGNS.

2) AIR OUTLETS.

3) AIR BALANCE REPORT.

4) AC UNITS AND FANS.

5) OPERATING SEQUENCES.

6) VIBRATION ISOLATION.

7) ELECTRIC DAMPER MOTORS.

8) AUTOMATIC CONTROL SYSTEMS AND DEVICES.

9) VAV BOXES.

4. AS-BUILTS AND EQUIPMENT OPERATION INSTRUCTIONS

A. ON COMPLETION AND ACCEPTANCE OF WORK, THIS CONTRACTOR SHALL FURNISH WRITTEN INSTRUCTIONS, EQUIPMENT MANUALS AND DEMONSTRATE TO THE OWNER THE PROPER OPERATION AND MAINTENANCE OF ALL EQUIPMENT AND APPARATUS FURNISHED UNDER THIS CONTRACT.

B. THESE INSTRUCTIONS SHALL BE TYPED ON 8-1/2 IN. X 11 IN. PAPER AND BOUND IN THREE-RING BINDERS WITH CLEAR ACETATE COVERS. THE CONTRACTOR SHALL GIVE THREE COPIES OF THE INSTRUCTIONS TO THE OWNER AND ONE COPY TO THE ENGINEER.

C. THE INSTRUCTION BOOKLET SHALL BE ORGANIZED IN SECTIONS, WITH ONE SECTION PER SYSTEM. THE COVER OF THE INSTRUCTION BOOKLET SHALL BEAR THE NAME, ADDRESS AND PHONE NUMBER OF THE PROJECT, ARCHITECT, ENGINEER, MECHANICAL CONTRACTOR AND SUBCONTRACTORS.

D. REPRODUCIBLE "AS-BUILT" DRAWINGS INDICATING AS INSTALLED CONDITIONS SHALL BE PROVIDED TO THE ARCHITECT AFTER COMPLETION OF THE INSTALLATION.

5. SHEET METAL WORK

A. EXCEPT AS OTHERWISE SHOWN OR NOTED, ALL DUCTWORK AND OTHER SHEET METAL WORK SHALL BE GALVANIZED SHEET STEEL AND SHALL BE INSTALLED IN ACCORDANCE WITH THE LATEST EDITION OF SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION, INC. DUCT CONSTRUCTION STANDARDS, PRESSURE CLASSIFICATION 2 IN. W.G.

B. VOLUME DAMPERS: GALVANIZED STEEL, PER SMACNA "LOW VELOCITY MANUAL," EXCEPT PROVIDE BEARING AT ONE END OF DAMPER ROD AND QUADRANT, WITH LEVER AND LOCKSCREW AT OTHER END. FOR INSULATED DUCTS, QUADRANTS MOUNTED ON COLLAR TO CLEAR INSULATION. INSTALL WITH LEVERS ACCESSIBLE.

C. ACCESS DOORS: INSULATED OR UNINSULATED, SAME AS DUCT.

1) PROVIDE MINIMUM 20 IN. X 14 IN. ON MAIN DUCTS, AND 12 IN. X 6 IN. ON BRANCH DUCTS, UNLESS OTHERWISE APPROVED, AT FIRE DAMPERS, AND AT ALL DUCT ACCESSORIES SUCH AS HUMIDIFIERS, DUCT SMOKE DETECTORS, AUTO DAMPERS, AND LOUVERS.

2) ALL ACCESS DOORS TO BE HINGED, WITH LATCH SIMILAR TO VENTLOCK NO. 100.

D. FLEXIBLE CONNECTIONS: NEOPRENE-COATED GLASS FABRIC, 30 OZ PER SQ YD WITH SEWED AND CEMENTED SEAMS, SIMILAR TO VENT FABRICS. PROVIDE WITH METAL COLLARS. ALLOW MINIMUM MOVEMENT OF 1 IN.

E. TURNING VANES: GALVANIZED STEEL SMALL DOUBLE-THICKNESS VANES WITH 2 IN. INSIDE RADIUS.

F. FIRE DAMPERS: UL LISTED, GALVANIZED STEEL CONSTRUCTION, MULTIBLADED TYPE, SPRING LOADED, EQUIPPED WITH FUSIBLE LINK, CONFORMING TO NFPA STANDARD 90A AND APPROVED BY NEW YORK CITY BOARD OF STANDARDS AND APPEALS FOR NYC CAL-100-65-5M. SIMILAR TO AIR BALANCE MODEL 319-P, RATED AS REQUIRED. SEE INSTALLATION ON DRAWING.

G. ALL DUCT DIMENSIONS INDICATED ON PLANS ARE INSIDE CLEAR DIMENSIONS.

H. AUTOMATIC DAMPERS: COMPLETE WITH LINKAGE AND ELECTRIC OPERATOR. OPPOSED BLADE DAMPER OR GALVANIZED STEEL MIN. 4 IN., MAX. 8 IN. WIDE WITH COMPRESSIBLE EDGE SEALS TO PREVENT LEAKAGE. FACTORY-ASSEMBLE STEEL LINKAGE AND SHAFT WITH NYLON OR OIL-IMPREGNATED BRONZE BEARINGS. MOTOR WITH SUFFICIENT POWER TO LIMIT LEAKAGE TO 10 CFM PER SQ FT. LINKAGE TO WITHSTAND LOAD EQUAL TO TWICE MAXIMUM OPERATING FORCE WITHOUT DEFLECTION. DAMPER MOUNTED IN WELDED STEEL CHANNEL FRAME.

I. EXTERIOR LOUVERS: 4 IN. WIDE STATIONARY LOUVER, EXTRUDED ALUMINUM, 0.081 IN. WALL THICKNESS, 6063T5 ALLOY BLADES AND FRAME WITH STAINLESS STEEL OR ALUMINUM FASTENERS. LOUVER TO INCORPORATE STRUCTURAL SUPPORT TO WITHSTAND WIND LOAD OF 20 LBS PER SQ FT. PROVIDE REMOVABLE 3/4 IN. X 3/4 IN. ALUMINUM BIRDSCREEN IN AN ALUMINUM FRAME. AIR PERFORMANCE AND WATER PENETRATION LESS THAN OR EQUAL TO RUSKIN MODEL ELF-375.

J. ALUMINUM DUCTWORK: ALL OUTSIDE AIR, EXHAUST, AND RELIEF DUCTWORK WITHIN 5 FT OF LOUVERS SHALL BE ALUMINUM WITH SEAMS SEALED WATERTIGHT WITH ALCOA ALUMINASTIC TYPE C SEAM SEALER OR SOLDER. PITCH DUCTWORK TOWARDS LOUVER.

K. WIRE MESH SCREEN (WMS): NO. 16 USSG, 3/4 SQUARE MESH, IN 1 IN. WIDE GALVANIZED STEEL ENCLOSING FRAME. FLANGED DUCT OPENING TO RECEIVE FRAME.

L. COMBINATION FIRE AND SMOKE DAMPERS: UL LISTED, GALVANIZED STEEL CONSTRUCTION MULTI-BLADED TYPE. EQUIPPED WITH FUSIBLE LINK CONFORMING TO NFPA STANDARD 90A. SIMILAR TO RUSKIN MODEL FSD 60.

M. ROUND DUCTWORK SHALL BE SPIRAL SEAM CONSTRUCTION ONLY. GAUGES SHALL BE IN ACCORDANCE WITH SMACNA DUCT CONSTRUCTION STANDARD AND FITTINGS IN ACCORDANCE WITH SMACNA DUCT CONSTRUCTION STANDARD, EXCEPT AS NOTED.

1) JOINTS: INTERIOR SLIP COUPLING BEADED AT CENTER, FASTENED TO DUCT WITH SCREWS AND WITH SEALING COMPOUND APPLIED CONTINUOUSLY AROUND JOINT BEFORE ASSEMBLING AND AFTER FASTENING. WRAP JOINTS WITH 3 INCH WIDE DUCT TAPE.

6. AIR OUTLETS

A. GENERAL:

1) MARGIN TYPES, COLORS, FINISH AND METHODS OF ATTACHMENT FOR ALL DIFFUSERS, GRILLES AND REGISTERS SHALL BE COORDINATED WITH ARCHITECTURAL CEILING AND WALL DETAILS AND SPECIFICATIONS.

2) FRAME TYPE SUITABLE FOR MOUNTING IN CEILING OR WALL CONSTRUCTION AS INDICATED ON ARCHITECTURAL PLANS.

3) EXACT LOCATION OF ALL AIR OUTLETS AS PER ARCHITECTURAL PLANS.

4) SUITABLE FOR OPERATION AT 20% EXCESS AND 20% LESS THAN NOTED CAPACITY FOR CONSTANT VOLUME SYSTEMS AND AT 20% EXCESS AND 60% LESS THAN NOTED CAPACITY FOR VARIABLE VOLUME SYSTEMS. MANUFACTURER RESPONSIBLE FOR EXAMINING APPLICATION OF EACH OUTLET AND GUARANTEE THAT EACH WILL PROVIDE REQUIRED NC LEVELS AND COMFORT SPACE CONDITIONS WITHOUT DRAFTS THROUGHOUT OPERATING RANGE.

5) ALL REGISTERS AND DIFFUSERS SHALL BE PROVIDED WITH OPPOSED BLADE VOLUME DAMPERS. DAMPER OPERATING LEVERS SHALL BE ACCESSIBLE AT THE FACE OF AIR OUTLETS.

B. LINEAR DIFFUSERS: EXTRUDED ALUMINUM CONSTRUCTION, NATURAL ANODIZE FINISH, REMOVABLE CORE, AIR DEFLECTION VANE AND CABLE DAMPER IN EACH BRANCH TAP WITH 3 FT CABLE TO DIFFUSER FACE. SIMILAR TO ANEMOSTAT TYPE SLAD-75. CABLE DAMPER SIMILAR TO ANEMOSTAT MODEL OBASL.

C. SQUARE DIFFUSERS: DIFFUSERS SHALL BE STEEL CONSTRUCTION PAINTED WHITE SIMILAR TO ANEMOSTAT DDC SUITABLE FOR THE TYPE OF CEILING.

D. REGISTERS AND GRILLES:

1) RETURN AND EXHAUST REGISTERS: STEEL CONSTRUCTION WITH VOLUME DAMPER. SIMILAR TO TITUS 23-RL5.

2) SUPPLY REGISTERS: ALUMINUM CONSTRUCTION ADJUSTABLE DOUBLE DEFLECTION ALUMINUM AIRFOIL LOUVERS, WITH VOLUME DAMPER. SIMILAR TO ANEMOSTAT X3HOD. PROVIDE AIR EQUALIZING DEFLECTOR WHERE REGISTER COLLAR DUCT IS LESS THAN 2 FT LONG.

3) TRANSFER GRILLES: STEEL CONSTRUCTION WITHOUT VOLUME DAMPER. SIMILAR TO TITUS 23-RL.

7. NOISE CONTROL

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A. ALL ROOM NC LEVELS SHALL BE 35 OR LESS.

B. PROVIDE SOUNDLINING FOR THE FOLLOWING DUCTWORK:

1) ALL DUCTWORK WITHIN MECHANICAL ROOMS AND NOT LESS THAN 20 FT ON EACH SIDE OF ALL FANS AND AC UNITS.

2) AIR TRANSFER DUCTS.

3) DOWNSTREAM OF ALL VARIABLE AIR VOLUME AND CONSTANT VOLUME BOXES FOR A MINIMUM OF 10 FT.

4) ALL MIXED AIR PLENUMS, EXCEPT WHERE MOISTURE CARRYOVER FROM OUTDOOR AIR LOUVER WILL OCCUR.

5) ALSO WHERE NOTED ON A DRAWING.

C. SOUNDLINING IN DUCTWORK: FIBROUS GLASS, MINIMUM 3 LB DENSITY, 1 IN. THICKNESS, MAXIMUM 0.25 K FACTOR AT 75 DEG F MEAN TEMPERATURE WITH ACRYLIC COATED FINISH FACTORY APPLIED EDGE COATING AND STENCILED IN ACCORDANCE WITH NFPA 90. FLAMESPREAD SHALL BE A MAXIMUM OF 25. LINING SHALL NOT SUPPORT MICROBIAL GROWTH AND SHALL BE TESTED IN ACCORDANCE WITH ASTM C 1071 AND ASTM G21/G22. SIMILAR TO MANVILLE PERMACOTE LINA COUSTIC.

D. ALL SOUNDLINING, ADHESIVES, FACES AND ACCESSORIES TO BE APPLIED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS, EXCEPT AS OTHERWISE NOTED.

8. TESTING AND BALANCING

A. AIR BALANCING SHALL BE ACCOMPLISHED BY ADJUSTMENT OF FANS AND BRANCH DAMPERS FOR MAJOR ADJUSTMENTS. ADJUSTMENT OF TERMINAL DAMPERS AND DEVICES SHALL BE FOR TRIM OR MINOR ADJUSTMENT ONLY. THIS SHALL BE DONE TO PERMIT THE LEAST NOISE GENERATION IN THE TERMINAL AREAS AND UTILIZE MINIMUM FAN ENERGY.

B. WATER BALANCING SHALL BE ACCOMPLISHED BY ADJUSTMENT OF BALANCING VALVES AT PUMPS FOR PROPER FLOW. ADJUST FLOW THROUGH BOILERS, CHILLERS, HEAT EXCHANGERS AND COILS AS REQUIRED.

C. UPON COMPLETION OF THE INSTALLATION, THE CONTRACTOR SHALL REBALANCE ANY EXISTING PORTIONS OF AIR DISTRIBUTION SYSTEM AND WATER DISTRIBUTION SYSTEM AFFECTED BY THE RENOVATION AND ALSO BALANCE ALL NEW WORK.

D. THE CONTRACTOR SHALL PROVIDE ALL LABOR, PRESSURE GAUGES, FLOW METERS, SHEAVES, AND BELTS REQUIRED TO BALANCE SYSTEMS.

E. BALANCING REPORT SHALL BE PROVIDED ON AABC–TYPE FORMS.

F. FANS, AIR HANDLING UNITS, PUMPS, CHILLERS, HEAT EXCHANGERS AND COILS SHALL BE BALANCED TO WITHIN +5% OF THEIR DESIGN CAPACITIES. ALL OTHER AIR AND WATER QUANTITIES SHALL BE BALANCED TO WITHIN +10% OF THE DESIGN QUANTITIES.

G. BALANCING AND TESTING SHALL BE PERFORMED AND SUPERVISED BY ONE OF THE FOLLOWING INDEPENDENT FIRMS SPECIALIZING IN TESTING AND BALANCING:

1) INDEPENDENT TESTING AND BALANCING

2) MERENDINO ASSOCIATES

3) THERMAL THINKERS

H. THE PERFORMANCE AND CAPACITY OF ALL SYSTEMS AND EQUIPMENT TO BE DEMONSTRATED BY THE CONTRACTOR.

9. INSULATION – GENERAL REQUIREMENTS

A. ALL INSULATION MATERIALS, INCLUDING JACKETS, FACING, ADHESIVE, COATINGS, AND ACCESSORIES ARE TO BE FIRE HAZARD RATED AND LISTED BY UNDERWRITERS LABORATORIES, INC. USING STEINER TUNNEL TEST METHOD FOR FIRE HAZARD CLASSIFICATION OF BUILDING MATERIALS, STANDARD UL 723 (ASTM E–84), (ASA A2.5–1963). FLAMESPREAD: MAXIMUM 25. FUEL CONTRIBUTED AND SMOKE DEVELOPED: MAXIMUM 50. FLAMEPROOFING TREATMENTS SUBJECT TO DETERIORATION FROM MOISTURE OR HUMIDITY ARE NOT ACCEPTABLE.

B. DEFINITIONS:

1) EXPOSED: INDOOR DUCTS, PIPING OR EQUIPMENT LOCATED IN MECHANICAL EQUIPMENT ROOMS AND IN AREAS WHICH WILL BE VISIBLE WITHOUT REMOVING CEILINGS OR OPENING ACCESS PANELS.

2) CONCEALED: INDOOR DUCTS, PIPING OR EQUIPMENT WHICH IS NOT EXPOSED.

3) OUTDOOR: DUCTS, PIPING OR EQUIPMENT WHICH IS EXPOSED TO THE WEATHER.

10. DUCTWORK INSULATION

A. INSULATE ALL DUCTWORK IN ACCORDANCE WITH INSULATION SCHEDULE EXCEPT AS OTHERWISE NOTED.

INSULATION SCHEDULE ? DUCTWORK

SERVICE	LOCATION	THICKNESS	MATERIAL	FINISH
SUPPLY/RETURN	CONCEALED	1"	D–1	VAPORSEAL
INTAKE	ALL	2"	D–3	VAPORSEAL
SUPPLY/RETURN	EXPOSED	1"	D–2	VAPORSEAL

B. REINSULATE ALL DUCTWORK AND PIPING WHICH IS EXISTING AND DAMAGED DURING CONSTRUCTION OR SHOWN OR REQUIRED TO BE RELOCATED. INSULATE WITH SAME MATERIAL AND THICKNESS.

C. NON–INSULATED DUCTWORK:

1) WHERE SOUNDLINING IS OF MINIMUM THICKNESS SPECIFIED FOR INSULATION.

2) AIR CONDITIONING SUPPLY AIR DUCTWORK EXPOSED ON GROUND FLOOR, MEZZANINE LEVEL AND CONCOURSE LEVEL, SALES AREA ONLY.

3) AIR CONDITIONING RETURN AIR DUCTWORK EXPOSED IN AIR CONDITIONED SPACES AND INSTALLED IN HUNG CEILINGS WHERE SPACE IMMEDIATELY ABOVE AND BELOW ARE BOTH AIR CONDITIONED.

D. MATERIAL:

1) TYPE D–1: MINIMUM 1–LB DENSITY FIBERGLASS BLANKET, MAXIMUM 0.28 K–FACTOR AT 75 DEG F MEAN TEMPERATURE WITH FACTORY–APPLIED FOIL–SKRIM–KRAFT FACING SIMILAR TO MANVILLE MICROLITE.

2) TYPE D–2: 3 LB. FIBERGLASS BOARD. THE MAXIMUM K FACTOR SHALL BE 0.23 AT 75 DEG F MEAN TEMPERATURE WITH A MINIMUM DENSITY OF 3 LB. THE INSULATION SHALL BE PROVIDED WITH A FACTORY–APPLIED ALL PURPOSE OR ALL SERVICE FACING. THE INSULATION SHALL BE EQUAL TO MANVILLE TYPE 814 SPIN–GLAS AP.

3) TYPE D–3: MINIMUM 6 LB FIBERGLASS BOARD. MAXIMUM 0.22 K–FACTOR AT 75 DEG F MEAN TEMPERATURE WITH FACTORY APPLIED ALL PURPOSE OR ALL SERVICE FACING. SIMILAR TO MANVILLE 817 SPIN–GLAS AP.

E. INSTALLATION:

1) FIBERGLASS BLANKET: 2 IN. LAP STRIPS AT ALL SEAMS. SECURE BOTTOM OF ALL DUCTS OVER 24 IN. WIDE WITH MIN. 2 ROWS OF WELD PINS 12 IN. ON CENTER. SECURE ALL SEAMS WITH FOIL VAPOR BARRIER TAPE AND VAPORSEAL ADHESIVE.

2) FIBERGLASS BOARD: SEAL JOINTS AND BREAKS IN FACING WITH 3 IN. WIDE TAPE TO MATCH FACING AND ADHERE WITH VAPOR SEAL ADHESIVE. APPLY 5 IN. WIDE TAPE AT CORNERS, WELD PINS ON TOP, SIDES AND BOTTOM.

11. PIPING INSULATION

A. INSULATE ALL PIPING IN ACCORDANCE WITH INSULATION SCHEDULE EXCEPT AS OTHERWISE NOTED.

INSULATION SCHEDULE – PIPING

SERVICE	SIZE	THICKNESS	MATERIAL	FINISH
REFRIGERANT LIQUID & SUCTION LINES	ALL	1/2"	P–6	VAPORSEAL

B. PIPING, VALVES AND FITTINGS TO BE INSULATED:

1) LOW TEMPERATURE PIPING SYSTEMS – 40 TO 100 DEG F INCLUDING:

a. CONDENSATE DRAIN PIPING.

C. MATERIAL:

1) TYPE P–6: MINIMUM 6 LB MOLDED FOAMED PLASTIC. MAXIMUM 0.27 K–FACTOR AT 75 DEG F MEAN TEMPERATURE. MAXIMUM 0.17 PERMEANCE. SIMILAR TO ARMSTRONG ARMAFLEX II.

D. OUTDOOR PIPING:

1) FOR ALL PIPING, FITTINGS AND VALVES LOCATED OUTDOORS, INCREASE SCHEDULED INSULATION THICKNESS BY A MINIMUM OF 1 IN. AND PROVIDE F–4 FINISH. PROVIDE VAPORSEAL ON ALL OUTDOOR PIPES, VALVES AND FITTINGS SUBJECT TO CONDENSATION.

E. INSTALLATION:

1) BEFORE APPLYING INSULATION ALL PRESSURE AND LEAK TESTS SHALL BE COMPLETED AND APPROVED.

2) ALL INSULATION SHALL BE BUTTED FIRMLY TOGETHER. PROVIDE 2 IN. LAMP STRIPS AT ALL SEAMS SECURED WITH ADHESIVE. USE VAPOR BARRIER TAPE AND VAPORSEAL ADHESIVE WHERE REQUIRED. STAPLES NOT PERMITTED. REFRIGERANT PIPING INSULATION SHALL HAVE MITERED FITTINGS.

3) ALL INSULATION AND VAPOR BARRIERS SHALL BE CONTINUOUS PASSING THROUGH SLEEVES, HANGERS, ETC., OR OTHER OPENINGS.

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PROVIDE SADDLES OR SHIELDS FOR PROTECTION.

4) INSULATION FOR STRAINERS OR OTHER FITTINGS OR ACCESSORIES REQUIRING SERVICING OR INSPECTION SHALL HAVE INSULATION REMOVABLE AND REPLACEABLE WITHOUT DAMAGE.

12. EQUIPMENT INSULATION

A. STEAM SYSTEMS: CONDENSATE PUMPS AND TANKS, FLASH TANKS, STEAM GENERATOR AND ALL OTHER EQUIPMENT AS RECOMMENDED BY THE MANUFACTURER.

1) TYPE D–3 INSULATION 2 IN. THICK WITHOUT FOIL SCRIM SCORED TO FIT EQUIPMENT. INSTALLATION SHALL ALLOW FOR REMOVAL AND REINSTALLATION WITHOUT DAMAGE TO INSULATION. PROVIDE COAT OF TYPE F–6 INSULATING CEMENT COVERED WITH TYPE F–2 FINISH.

13. VIBRATION ISOLATION

A. GENERAL:

1) PROVIDE ISOLATION FOR EQUIPMENT, PIPING AND DUCTWORK.

2) INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

3) PROVIDE LEVELING DEVICES AND APPROVED RESILIENT RESTRAINING DEVICES AS REQUIRED TO LIMIT EQUIPMENT AND PIPING MOTION IN EXCESS OF 1/4 IN.

4) ACCEPTABLE MANUFACTURERS:

a. MASON INDUSTRIES, INC.

b. VIBRATION ELIMINATOR CO.

c. KORFUND DYNAMICS CORP.

B. CEILING–HUNG FANS AND EQUIPMENT:

1) PROVIDE SPRING HANGER ROD ISOLATORS. STEEL COMPRESSION SPRING AND NEOPRENE SOUND PAD WITHIN A STEEL RETAINER BOX. SIMILAR TO MASON TYPE PCHS.

2) 1 IN. MINIMUM STATIC DEFLECTION. 1/2 IN. MINIMUM RESERVE DEFLECTION. FACTORY–PRELOADED TO 75% OF RATED LOAD.

3) PROVIDE SUPPLEMENTAL STEEL AS REQUIRED WHERE EQUIPMENT OR STRUCTURE CANNOT SUPPORT POINT LOADS.

C. FLOOR MOUNTED EQUIPMENT HAVING INTERNAL ISOLATION:

1) PROVIDE 5/16 IN.–THICK NEOPRENE ACOUSTICAL BASE PADS OF RIBBED OR WAFFLE CONSTRUCTION. SIMILAR TO MASON TYPE W.

2) 50 PSI MAXIMUM LOADING. PROVIDE STEEL BEARING PLATE TO DISTRIBUTE LOAD WHERE REQUIRED.

14. PIPING – GENERAL REQUIREMENTS

A. COMPLETE WITH: PIPE, FITTINGS, VALVES, STRAINERS, MOTORIZED VALVE OPERATORS, STRAINERS, HANGERS, SUPPORTS, GUIDE, SLEEVES, AND ACCESSORIES.

B. ALL ITEMS SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH THE LATEST EDITIONS OF THE FOLLOWING CODES AND STANDARDS:

1) AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME).

2) AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM).

3) AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI).

4) MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTING INDUSTRY (MSS).

C. ALL PRESSURIZED PIPING TO BE TESTED HYDROSTATICALLY TO 150 PSI OR 150% OF OPERATING PRESSURE, WHICHEVER IS GREATER, BUT NEVER EXCEED TEST PRESSURE ANSI B16.1 BASIS. TEST DURATION TO BE 2 HOURS WITH NO PRESSURE CHANGE CORRECTED FOR TEMPERATURE CHANGE. REPAIR OR REPLACE LEAKS OR DEFECTS WITHOUT ADDITIONAL COST.

D. PROVIDE DIELECTRIC FITTINGS WHERE DISSIMILAR METALS ARE TO BE JOINED.

E. PIPE SUPPORTS:

1) PROVIDE ADEQUATE SUPPORT FOR PIPE AND CONTENTS TO PREVENT SAGGING, VIBRATION, OR SWAYING AND ALLOW FOR EXPANSION AND CONTRACTION. PROVIDE SUPPLEMENTAL STEEL AS REQUIRED WHERE STRUCTURE CANNOT SUPPORT POINT LOADS.

2) HORIZONTAL PIPING TO BE SUPPORTED BY FORGED STEEL ADJUSTABLE CLEVIS TYPE HANGER. MAXIMUM SPACING AS FOLLOWS:

a. STEEL 1 IN. AND SMALLER: 7 FT.

b. STEEL 1–1/4 IN. AND LARGER: 10 FT.

c. COPPER 3 IN. AND SMALLER: 7 FT.

d. ADDITIONAL SUPPORTS AT CHANGES IN DIRECTION, RUNOUTS, AND CONCENTRATED LOADS DUE TO VALVES, ETC.

3) VERTICAL PIPING:

a. BASE ELBOW SUPPORT WITH BEARING PLATE ON STRUCTURAL SUPPORT.

b. GUIDES AT EVERY SECOND FLOOR (SPACING NOT TO EXCEED 25 FT).

c. TOP SUPPORT HANGER OR SADDLE IN HORIZONTAL CONNECTION WITH PROVISIONS FOR EXPANSION.

d. INTERMEDIATE STEEL RISER CLAMP SUPPORT BOLTED AND WELDED TO PIPE BEARING ON STRUCTURAL STEEL OR BEARING PLATE AT FLOOR.

15. CONDENSATE DRAIN PIPING

A. PIPE: ASTM B88, HARD DRAWN COPPER TUBING TYPE "L".

B. FITTINGS: SOLDERED JOINT FITTINGS, 95/5 SOLDER.

C. PITCH, EXCEPT AS NOTED:

1) 1 IN. IN 4 FT PREFERRED.

2) 1 IN. IN 8 FT MINIMUM.

D. SWING CHECK VALVES: AT CONDENSATE PUMP DISCHARGE. 300 LB WOG, BRONZE BODY SOLDER ENDS, REGRIND BRONZE DISC TO BE USED WITH COPPER TUBING. JENKINS FIG. 1222.

16. MOTORS:

A. MOTORS (UNDER HVAC WORK): IN ACCORDANCE WITH NEMA, IEEE AND ANSI C50 STANDARDS:

1) STANDARD EFFICIENCY UNLESS OTHERWISE NOTED.

2) 1.15 SERVICE FACTOR.

3) SQUIRREL CAGE INDUCTION, OPEN DRIPPROOF TYPE, 1750 RPM, NEMA TYPE B INSULATION CLASS, CONTINUOUS DUTY, EXCEPT AS NOTED.

17. MOTOR CONTROLLERS

A. PROVIDED BY HVAC CONTRACTOR AND INSTALLED AND WIRED BY ELECTRICAL CONTRACTOR.

B. NEMA ENCLOSURE, WEATHERPROOF WHERE MOUNTED OUTDOORS.

C. WITH OVERLOAD PROTECTION. COORDINATE ALL MOTOR CONTROLLER TYPES AND SIZES WITH MOTOR TYPES AND SIZES.

D. 1/3 HP AND SMALLER: PROVIDE MANUAL STARTER EXCEPT USE MAGNETIC TYPE WHERE AUTOMATICALLY CONTROLLED.

1) MANUAL TYPE: 2–POLE TOGGLE SWITCH WITH OVERLOAD PROTECTION AND PILOT LIGHT.

E. 1/2 HP AND LARGER: PROVIDE MAGNETIC STARTER:

1) COMBINATION UNFUSED DISCONNECT SWITCH AND MAGNETIC STARTER EXCEPT AS NOTED.

2) OVERLOAD PROTECTION IN EACH PHASE LEG WITH RESET IN ENCLOSURE.

3) HOA SELECTOR SWITCH FOR AUTOMATICALLY OPERATED MOTORS. SAFETY CONTROLS COMMON TO BOTH CONTROLS.

4) RED, GREEN AND AMBER PILOT LIGHTS.

5) SWITCHES: HORSE–POWER–RATED, EXTERNAL PADLOCKING TYPE.

6) HOLDING COILS: 10 WATT, 120 VOLT.

7) CONTACTS: MAIN LINE AND MINIMUM (2) – NORMALLY OPEN, (2) – NORMALLY CLOSED 10 AMP AUXILIARIES, IN ADDITION TO CONTACTS REQUIRED FOR CONTROLS SPECIFIED.

8) CONTROL TRANSFORMER: FOR MOTORS OVER 120 VOLTS, TO STEP DOWN CONTROL VOLTAGE TO 120 VOLTS; OF THE REQUIRED CAPACITY WITH FUSE AND GROUND CONNECTION ON VOLTAGE SIDE.

9) FUSES: SIMILAR TO BUSSMAN.

10) RELAYS: TO SUPPLEMENT AUXILIARY CONTACTS IN CONTROLLER. MINIMUM 10 WATT COIL AND TWO 10 AMP CONTACTS.

11) TERMINALS: SUITABLE FOR CONDUCTORS NOTED AND AS APPROVED.

F. ACCEPTABLE MANUFACTURERS:

1) CUTLER–HAMMER.

2) SQUARE D.

3) ALLEN BRADLEY.

18. SMOKE DETECTORS

A. THE ELECTRICAL CONTRACTOR SHALL SUPPLY DUCT MOUNTED

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IONIZATION–TYPE SMOKE DETECTORS AND PROVIDE ALL WIRING.

B. THIS CONTRACTOR SHALL INSTALL THE SMOKE DETECTOR IN THE DUCT AS SHOWN ON THE PLANS. THE CONTRACTOR SHALL NOT INSTALL A SMOKE DETECTOR IN A LOCATION WHERE ITS OPERATING RANGE (TYPICALLY 32–100 DEG F) WILL BE EXCEEDED.

C. THE SUPPLY FAN AND ALL ASSOCIATED EQUIPMENT SHALL STOP AND ALL DAMPERS SHALL RETURN TO THEIR "NORMAL" POSITIONS IF PRODUCTS OF COMBUSTION ARE DETECTED. RESET FOR THE SMOKE DETECTOR SHALL BE AT THE FIRE ALARM PANEL (OR FIRE COMMAND STATION).

D. THIS CONTRACTOR SHALL ASSIST THE ELECTRICAL CONTRACTOR IN TESTING THE DUCT–MOUNTED SMOKE DETECTION SYSTEM.

19. EQUIPMENT

A. FANS:

1) GENERAL (APPLIES TO ALL FAN TYPES EXCEPT AS NOTED):

a. PROVIDE CENTRIFUGAL TYPE, NON–OVERLOADING DESIGN EXCEPT AS NOTED WITH MINIMUM CAPACITIES AS NOTED AND WITH CERTIFIED RATINGS BY AMCA. WHEEL SHALL BE FACTORY BALANCED STATICALLY AND DYNAMICALLY. BRAKE HORSEPOWER RATINGS SHALL NOT BE MORE THAN 5 PERCENT ABOVE WHAT IS NOTED ON DRAWINGS. DRIVES SHALL BE MATCHED, MULTIPLE V–BELT DRIVE UNLESS OTHERWISE NOTED WITH MINIMUM CAPACITY OF 1.4 TIMES RATED MOTOR HP. PULLEYS SHALL BE CAST IRON.

b. MOTOR PULLEY SHALL BE VARIABLE PITCH DIAMETER EXCEPT FANS WITH VARIABLE INLET VANES. SUPPLY AND INSTALL ONE FIXED PITCH PULLEY CHARGE AS REQUIRED PER FAN TO BALANCE SYSTEMS. COMPANION SHEAVES SHALL MAINTAIN BELTS PARALLEL. BELT GUARDS SHALL BE IN COMPLIANCE WITH OSHA REGULATIONS AND WITH TACHOMETER OPENING FOR FAN SPEED MEASUREMENTS. MANUFACTURER SHALL PROVIDE REPLACEMENT FIXED PITCHED SHEAVES WHERE NEEDED TO BALANCE SYSTEM.

c. PROVIDE REMOVABLE FLANGED SCREENS AT INLETS OR OUTLETS WHERE NO CONNECTING DUCTWORK IS INDICATED.

d. BEARINGS BALL ROLLER OR TAPER. PROVIDE PRESSURE TYPE LUBRICATING FITTINGS WITH PRESSURE RELIEF FITTINGS EXTENDED TO ACCESSIBLE LOCATIONS. MINIMUM L–10 LIFE RATING; 50,000 HOURS PER AFBMA STANDARD B–10 OR 250,00 HOURS AVERAGE (B–50) LIFE AT MAXIMUM CATALOG RATING.

2) IN–LINE CENTRIFUGAL FANS (ILCF): SHALL HAVE FULL WELDED HOUSING WITH CAM TYPE LEVER ACCESS DOOR, ADJUSTABLE MOTOR BASE, INLET AND OUTLET FLANGES AND BEARINGS OUT OF THE AIR STREAM. SIMILAR TO BARRY BLOWER TUBULAR 8000.

B. AIR HANDLING UNITS:

1) FACTORY FABRICATED VERTICAL DRAW THROUGH AIR HANDLING UNITS SHIPPED IN SIZES SUITABLE FOR MOVING THROUGH AVAILABLE RESTRICTIVE SPACES.

20. AUTOMATIC CONTROLS ? GENERAL REQUIREMENTS

A. WORK INCLUDED

1) FURNISH A COMPLETE DISTRIBUTED AUTOMATIC TEMPERATURE CONTROL (ATC) SYSTEM IN ACCORDANCE WITH THIS SPECIFICATION SECTION. THIS INCLUDES ALL CONTROLLERS AND ALL INPUT/OUTPUT DEVICES. ITEMS OF WORK INCLUDED ARE AS FOLLOWS:

a. PROVIDE A SUBMITTAL THAT MEETS THE REQUIREMENTS BELOW FOR APPROVAL.

b. PROVIDE POWER FOR PANELS AND CONTROL DEVICES FROM A SOURCE DESIGNATED BY THE ELECTRICAL CONTRACTOR.

c. COORDINATE INSTALLATION SCHEDULE WITH THE MECHANICAL CONTRACTOR AND GENERAL CONTRACTOR.

d. FURNISH, MOUNT, AND WIRE ALL ASSOCIATED PANELS AND DEVICES FOR THE SYSTEM TO BE COMPLETELY OPERATIONAL REGARDLESS OF FUNCTION OR VOLTAGE, UNLESS OTHERWISE STATED.

e. PROVIDE ENGINEERING AND TECHNICIAN LABOR TO PROGRAM AND COMMISSION SOFTWARE FOR EACH SYSTEM AND OPERATOR INTERFACE. SUBMIT COMMISSIONING REPORTS FOR APPROVAL.

B. SUBMITTALS

1) PRODUCT DATA: INCLUDE MANUFACTURER'S TECHNICAL LITERATURE FOR EACH CONTROL DEVICE INDICATED, LABELED WITH SETTING OR ADJUSTABLE RANGE OF CONTROL. INDICATE DIMENSIONS, CAPACITIES, PERFORMANCE CHARACTERISTICS, ELECTRICAL CHARACTERISTICS, FINISHES FOR MATERIALS, AND INSTALLATION AND STARTUP INSTRUCTIONS FOR EACH TYPE OF PRODUCT INDICATED.

2) SHOP DRAWINGS: DETAIL EQUIPMENT ASSEMBLIES AND INDICATE DIMENSIONS, WEIGHTS, LOADS, REQUIRED CLEARANCES, METHOD OF FIELD ASSEMBLY, COMPONENTS, AND LOCATION AND SIZE OF EACH FIELD CONNECTION.

a. SCHEMATIC FLOW DIAGRAMS SHOWING FANS, PUMPS, COILS, DAMPERS, AND CONTROL DEVICES.

b. WIRING DIAGRAMS: POWER, SIGNAL, AND CONTROL WIRING.

c. DETAILS OF CONTROL PANEL FACES, INCLUDING CONTROLS, INSTRUMENTS, AND LABELING.

a. SCHEDULE OF VALVES INCLUDING LEAKAGE AND FLOW CHARACTERISTICS.

3) FIELD QUALITY–CONTROL TEST REPORTS.

4) OPERATION AND MAINTENANCE DATA.

C. QUALITY ASSURANCE

1) INSTALLER QUALIFICATIONS: A QUALIFIED INSTALLER WHO IS AN AUTHORIZED REPRESENTATIVE OF THE AUTOMATIC CONTROL SYSTEM MANUFACTURER FOR BOTH INSTALLATION AND MAINTENANCE OF UNITS REQUIRED FOR THIS PROJECT.

2) COMPLY WITH ALL CURRENT GOVERNING CODES, ORDINANCES, AND REGULATIONS INCLUDING UL, NFPA, THE LOCAL BUILDING CODE, NEC, ETC.

3) MATERIALS AND EQUIPMENT SHALL BE THE CATALOGUED PRODUCTS OF MANUFACTURERS REGULARLY ENGAGED IN PRODUCTION AND INSTALLATION OF AUTOMATIC TEMPERATURE CONTROL SYSTEMS AND SHALL BE MANUFACTURER'S LATEST STANDARD DESIGN THAT COMPLIES WITH THE SPECIFICATION REQUIREMENTS.

4) ALL SYSTEM COMPONENTS SHALL BE FAULT–TOLERANT, SUCH THAT THEY HAVE SATISFACTORY OPERATION WITHOUT DAMAGE AT 110% AND 85% OF RATED VOLTAGE AND AT PLUS OR MINUS 3 HERTZ VARIATION IN LINE FREQUENCY, STATIC, TRANSIENT, AND SHORT–CIRCUIT PROTECTION ON ALL INPUTS AND OUTPUTS, PROTECTION FOR COMMUNICATION LINES AGAINST INCORRECT WIRING, STATIC TRANSIENTS, AND INDUCED MAGNETIC INTERFERENCE, NETWORK–CONNECTED DEVICES TO BE AC COUPLED OR EQUIVALENT SO THAT ANY SINGLE DEVICE FAILURE WILL NOT DISRUPT OR HALT NETWORK COMMUNICATION, AND ALL REAL TIME CLOCKS AND DATA FILE RAM TO BE BATTERY–BACKED FOR A MINIMUM 100 HOURS AND INCLUDE LOCAL AND REMOTE SYSTEM LOW BATTERY INDICATION.

5) THE ATC CONTRACTOR SHALL HAVE A MINIMUM OF TEN (10) YEARS OF EXPERIENCE IN THE INSTALLATION AND MAINTENANCE OF ATC SYSTEMS SIMILAR IN SIZE AND COMPLEXITY TO THIS PROJECT, BE CERTIFIED–TO–INSTALL, AND BE A DIRECT REPRESENTATIVE OF AN APPROVED CONTROL SYSTEM MANUFACTURER,

6) THE PROJECT MANAGER RESPONSIBLE FOR DIRECT SUPERVISION OF THE DESIGN, INSTALLATION, START–UP AND COMMISSIONING OF THE ATC AS WELL AS ATTENDING OF PROJECT MEETINGS WHENEVER DIRECTED BY THE OWNER, CONSTRUCTION MANAGER, AND/OR MECHANICAL CONTRACTOR. IT SHALL NOT BE ACCEPTABLE TO CHANGE THE PROJECT MANAGER AFTER THE PROJECT HAS BEGUN AND BEFORE FINAL COMPLETION. IF THE ATC MANUFACTURER WISHES TO CHANGE THE PROJECT MANAGER, THE CONSTRUCTION MANAGER AND/OR OWNER?S REPRESENTATIVE MUST BE NOTIFIED IMMEDIATELY AND BOTH THE NEW PROJECT MANAGER AND THE PREVIOUS PROJECT MANAGER SHALL SPEND 3 CONSECUTIVE BUSINESS DAYS TOGETHER ON–SITE PERFORMING A PROJECT MANAGEMENT SWITCHOVER. EXCEPTIONS MAY BE ALLOWED FOR SMALL PROJECTS AS DETERMINED BY THE CONSTRUCTION MANAGER AND/OR OWNER?S REPRESENTATIVE.

21. PRODUCTS

A. MANUFACTURERS

1) MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:

a. AUTOMATED LOGIC CORPORATION

b. TEC SYSTEM – HONEYWELL.

c. SIEMENS BUILDING TECHNOLOGIES, INC.

B. CONTROL PANELS

1) LOCAL CONTROL PANELS: UNITIZED CABINET WITH SUITABLE BRACKETS, APPROPRIATE NEMA RATED METAL ENCLOSURE, FLUSH MOUNTED AND EXPOSED ADJUSTMENTS FOR DEVICES. PROVIDE SCHEMATIC DISPLAYS ON THE INSIDE OF THE PANEL DOOR SHOWING SYSTEM BEING CONTROLLED. PROVIDE COMMON KEYING FOR ALL PANELS.

2) ALARM PANELS: INDICATING LIGHT FOR EACH ALARM POINT, SINGLE HORN, ACKNOWLEDGE SWITCH, AND TEST SWITCH, MOUNTED IN HINGED–COVER ENCLOSURE.

a. ALARM CONDITION: INDICATING LIGHT FLASHES AND HORN SOUNDS.

b. ACKNOWLEDGE SWITCH: HORN IS SILENT AND INDICATING LIGHT IS STEADY.

c. SECOND ALARM: HORN SOUNDS AND INDICATING LIGHT IS STEADY.

d. ALARM CONDITION CLEARED: SYSTEM IS RESET AND INDICATING LIGHT IS EXTINGUISHED.

a. CONTACTS IN ALARM PANEL ALLOW REMOTE MONITORING BY INDEPENDENT ALARM COMPANY.

a. PROVIDE ONE (1) PANEL FOR CARBON DIOXIDE LEVEL ALARMS. THE

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PANEL SHALL BE LOCATED IN IT CLOSET.

A. PRIMARY CONTROL PANEL HARDWARE

1) PROVIDE ALL NECESSARY HARDWARE FOR A COMPLETELY INDEPENDENT CONTROLLER, AND INSTALL ALL HARDWARE IN A PRIMARY CONTROL PANEL.

1) SUPPORT OF ANY COMBINATION OF PRIMARY CONTROL PANELS AND OPERATOR WORKSTATIONS DIRECTLY CONNECTED TO THE PRIMARY NETWORK. A MAXIMUM OF 50 DEVICES SHALL BE SUPPORTED ON A SINGLE PRIMARY NETWORK.

1) EACH PRIMARY CONTROL PANEL SHALL, AT A MINIMUM, BE 32 BIT, STAND ALONE, MULTI TASKING, MULTI USER, REAL TIME DIGITAL CONTROL MICROPROCESSOR MODULE, APPROPRIATE FOR NETWORK FUNCTION, 72MB MEMORY MODULE, SIZED FOR 10,000 DATA SAMPLES, PORTABLE COMPUTER AND PRINTER CONNECTION PORTS, LOCAL DIGITAL INPUT/OUTPUT STATUS, GRADUATED INTENSITY LED?S FOR ANALOG OUTPUT, INPUT/OUTPUT POINT MODULES AS REQUIRED INCLUDING 10 % SPARE CAPACITY.

1) THE PANEL SHALL INCLUDE MONITORING OF THE STATUS OF ALL HAND OFF AUTO SWITCHES. THE STATUS OF THE HAND OFF AUTO SWITCH SHALL BE AVAILABLE AS A BMS DATA POINT.

1) RELAY LOGIC IS NOT ACCEPTABLE.

1) PROVIDE ONE (1) PRIMARY CONTROL PANEL FOR THE ROOFTOP AIR HANDLING UNIT.

C. SECONDARY CONTROL PANEL HARDWARE

1) EACH SECONDARY CONTROL PANEL SHALL OPERATE AS A STAND–ALONE CONTROLLER CAPABLE OF PERFORMING ITS USER SELECTABLE CONTROL ROUTINES INDEPENDENTLY OF ANY OTHER CONTROLLER IN THE SYSTEM.

2) EACH SECONDARY CONTROL PANEL SHALL, AT A MINIMUM, BE A MICROPROCESSOR–BASED, MULTI–TASKING, STAND–ALONE, REAL–TIME DIGITAL CONTROL MICROPROCESSOR MODULE, LOCAL DIGITAL INPUT/OUTPUT STATUS, AND A PORTABLE COMPUTER CONNECTION PORT, NON–VOLATILE EEPROM, EPROM, AND PROM, OR A MINIMUM OF 72–HOUR BATTERY BACKUP SHALL BE PROVIDED. RELAY LOGIC IS NOT ACCEPTABLE.

3) EACH SECONDARY CONTROL PANEL SHALL CONTINUOUSLY PERFORM SELF–DIAGNOSTICS ON ALL HARDWARE AND SECONDARY NETWORK COMMUNICATIONS. THE SECONDARY CONTROL PANEL SHALL PROVIDE BOTH LOCAL AND REMOTE ANNUNCIATION OF ANY DETECTED COMPONENT FAILURES, LOW BATTERY CONDITIONS, OR REPEATED FAILURE TO ESTABLISH COMMUNICATION TO THE SYSTEM.

4) CONTROLLERS SHALL INCLUDE ALL POINT INPUTS AND OUTPUTS NECESSARY TO PERFORM THE SPECIFIED CONTROL SEQUENCES. AS A MINIMUM, 50% OF THE POINT OUTPUTS SHALL BE OF THE UNIVERSAL TYPE; THAT IS, THE OUTPUTS MAY BE UTILIZED EITHER AS MODULATING OR TWO–STATE, ALLOWING FOR ADDITIONAL SYSTEM FLEXIBILITY. IN LIEU OF UNIVERSAL OUTPUTS, PROVIDE A MINIMUM OF 50% SPARE OUTPUTS OF EACH TYPE VIA ADDITIONAL POINT TERMINATION BOARDS OR CONTROLLERS. ANALOG OUTPUTS SHALL BE INDUSTRY STANDARD SIGNALS SUCH AS 24 VAC FLOATING CONTROL, ALLOWING FOR INTERFACE TO A VARIETY OF MODULATING ACTUATORS. TERMINAL EQUIPMENT CONTROLLERS UTILIZING PROPRIETARY CONTROL SIGNALS AND ACTUATORS SHALL NOT BE ACCEPTABLE.

5) PROVIDE A SECONDARY CONTROL PANEL FOR EACH VAV BOXIN THE IT CLOSET FOR THE SPACE CARBON DIOXIDE MONITORING. THE CONTROL PANEL SHALL BE PROVIDED WITH AN LED/LCD DISPLAY ON THE PANEL FACE AND A LOCAL ALARM PANEL.

D. SENSORS

1) ALL ELECTRONIC SENSORS SHALL BE VIBRATION AND CORROSION RESISTANT FOR WALL, IMMERSION, OR DUCT MOUNTING AS REQUIRED.

2) TEMPERATURE SENSORS USED IN WATER SENSING APPLICATIONS SHALL BE 1K OHM PLATINUM RESISTANCE TEMPERATURE DETECTORS. PLATINUM RTDS MUST BE INSTALLED WITH A TRANSMITTER IF THE CONTROLLER CANNOT ACCEPT A DIRECT PLATINUM RTD INPUT. TEMPERATURE SENSORS USED IN DUCT OR SPACE SENSING APPLICATIONS SHALL BE THERMISTORS. TEMPERATURE SENSORS SHALL HAVE THE FOLLOWING CHARACTERISTICS.

a. ACCURACY: PLUS OR MINUS 0.7°F.

b. WIRE: TWISTED, SHIELDED–PAIR CABLE

c. INSERTION ELEMENTS IN DUCTS: SINGLE POINT, 18? (46CM) LONG; USE WHERE NOT AFFECTED BY TEMPERATURE STRATIFICATION OR WHERE DUCTS ARE SMALLER THAN 9SQ FT. (1SQ M).

d. AVERAGING ELEMENTS IN DUCTS: 36? (91CM) LONG, FLEXIBLE; USE WHERE PRONE TO TEMPERATURE STRATIFICATION OR WHERE DUCTS ARE LARGER THAN 9SQ FT (1SQ M); LENGTH AS REQUIRED.

a. OUTSIDE–AIR SENSORS: OUTDOOR ASPIRATED AIR MODULE FOR MONITORING OUTSIDE TEMPERATURE AND HUMIDITY. THE ENCLOSURE SHALL BE A NEMA 3R PAINTED WHITE TO REDUCE RADIATION EFFECTS. THE ENCLOSURE SHALL HAVE A FAN FOR POWER VENTILATION. PROVIDE A 2% HUMIDITY TRANSMITTER AND A 1000–OHM PLATINUM 375 TEMPERATURE TRANSMITTER. WATERTIGHT INLET FITTING, SHIELDED FROM DIRECT SUNLIGHT.

a. SPACE SENSORS:

(1) SET–POINT ADJUSTMENT: EXPOSED

(1) SET–POINT INDICATION: EXPOSED

(1) THERMOMETER: EXPOSED

(1) OCCUPANCY OVERRIDE WITH AN ADJUSTABLE TIME PERIOD FROM 1/2 TO 3 HOURS.

3) STATIC–PRESSURE TRANSMITTER: NONDIRECTIONAL SENSOR WITH SUITABLE RANGE FOR EXPECTED INPUT, AND TEMPERATURE COMPENSATED.

a. ACCURACY: 1% OF FULL SCALE WITH REPEATABILITY OF 0.1%.

b. OUTPUT: 4 ? 20MA.

c. BUILDING STATIC–PRESSURE RANGE: 0–0.25? WG (0–62 PA).

d. DUCT STATIC–PRESSURE RANGE: 0–5? WG (0–1243 PA).

e. PROVIDE A SETRA M264 OR PRE–APPROVED EQUAL.

E. AIR DIFFERENTIAL PRESSURE SWITCHES: DIAPHRAGM TYPE AIR DIFFERENTIAL PRESSURE SWITCHES WITH DIE–CAST ALUMINUM HOUSING, ADJUSTABLE SETPOINT, MINIMUM 5 AMP SWITCH RATING AT 120VAC, SPDT SWITCHES, AND THE SWITCH PRESSURE RANGE SHALL BE SUITED FOR THE APPLICATION. PROVIDE DWYER OR EQUAL.

F. CARBON–DIOXIDE SENSOR AND TRANSMITTER: SINGLE DETECTORS, USING SOLID–STATE INFRARED SENSORS, SUITABLE OVER A TEMPERATURE RANGE OF 23 TO 130°F, CALIBRATED FOR 0 TO 2%, WITH CONTINUOUS OR AVERAGED READING, 4 TO 20 MA OUTPUT, AND WALL MOUNTED.

A. OUTSIDE AIR MONITOR

1) THE MONITOR/CONTROLLER SHALL BE CAPABLE OF DIRECT MEASUREMENT OF AIRFLOW THROUGH AN OUTSIDE AIR INLET AND PRODUCE DUAL OUTPUTS; ONE REPRESENTING THE MEASURED AIRFLOW, AND THE OTHER TO CONTROL THE INLET DAMPER.

1) THE MONITOR SHALL CONTAIN AN INTEGRAL MULTI–LINE LIQUID CRYSTAL DISPLAY FOR USE DURING THE CONFIGURATION AND CALIBRATION PROCESSES, AND TO DISPLAY TWO MEASURED PROCESSES (VOLUME, VELOCITY, TEMPERATURE) DURING NORMAL OPERATION. ALL CONFIGURATION, OUTPUT SCALING, CALIBRATION, AND CONTROLLER TUNING WILL BE PERFORMED DIGITALLY IN THE ON–BOARD MICROPROCESSOR VIA INPUT PUSHBUTTONS.

1) THE MONITOR/CONTROLLER SHALL MEASURE INLET AIRFLOW WITH AN ACCURACY OF ±5% OF READING OVER A RANGE OF 150–600 FPM OR 250–1000 FPM AND NOT HAVE ITS READING AFFECTED BY THE PRESENCE OF DIRECTIONAL OR GUSTING WIND. MEASURED AIRFLOW SHALL BE DENSITY CORRECTED FOR AMBIENT TEMPERATURE VARIANCES, AND ATMOSPHERIC PRESSURE DUE TO SITE ALTITUDE.

1) THE MONITOR/CONTROLLER SHALL INTERFACE WITH EXISTING BUILDING MANAGEMENT SYSTEMS, ACCEPTING INPUTS FOR FAN SYSTEM START, ECONOMIZER MODE OPERATION, AND AN EXTERNAL CONTROLLER SETPOINT, AND PROVIDE FLOW DEVIATION ALARM OUTPUTS.

1) THE SENSORS SHALL BE CONSTRUCTED OF MATERIALS THAT RESIST CORROSION DUE TO THE PRESENCE OF SALT OR CHEMICALS IN THE AIR; ALL NON–PAINTED SURFACES SHALL BE CONSTRUCTED OF STAINLESS STEEL. THE ELECTRONICS ENCLOSURE SHALL BE NEMA 1 [NEMA 4; NEMA 4 WITH ENCLOSURE HEATER AND INSULATION].

1) THE MONITOR/CONTROLLER SHALL BE THE VOLU–FLO/OAM AS MANUFACTURED BY AIR MONITOR OR PRE–APPROVED EQUAL.

22. EXECUTION

A. INSTALLATION

1) INSTALL EQUIPMENT LEVEL AND PLUMB.

2) VERIFY LOCATION OF THERMOSTATS, HUMIDISTATS, AND OTHER EXPOSED CONTROL SENSORS WITH PLANS AND ROOM DETAILS BEFORE INSTALLATION. LOCATE ALL 60 INCHES ABOVE THE FLOOR OR AS OTHERWISE REQUIRED BY ADA.

3) INSTALL AVERAGING ELEMENTS IN DUCTS AND PLENUMS IN CROSSING OR ZIGZAG PATTERN.

4) INSTALL GUARDS ON THERMOSTATS IN THE FOLLOWING LOCATIONS:

a. ENTRANCES.

b. PUBLIC AREAS.

c. WHERE INDICATED.

5) INSTALL DAMPER MOTORS ON OUTSIDE OF DUCT IN WARM AREAS, NOT IN LOCATIONS EXPOSED TO OUTDOOR TEMPERATURES.

B. ELECTRICAL WIRING AND CONNECTION INSTALLATION

1) INSTALL, CONNECT AND WIRE THE ITEMS INCLUDED UNDER THIS SECTION. THIS WORK INCLUDES PROVIDING REQUIRED CONDUIT, WIRE, FITTINGS AND RELATED WIRING ACCESSORIES.

2) ALL EXPOSED WIRING AND WIRING IN MECHANICAL EQUIPMENT ROOMS

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SHALL BE INSTALLED IN CONDUIT.

3) PLENUM RATED CABLE SHALL BE ACCEPTABLE IN HUNG CEILINGS, WALLS, AND RAISED FLOORS.

4) ALL WIRING LOCATED OUTSIDE SHALL BE INSTALLED IN RIGID CONDUIT, SEAL TITE, OR EMT WITH COMPRESSION FITTINGS.

5) CONCEAL CABLE, EXCEPT IN MECHANICAL ROOMS AND AREAS WHERE OTHER CONDUIT AND PIPING ARE EXPOSED.

6) INSTALL CABLE IN RACEWAY.

7) BUNDLE AND HARNESS MULTICONDUCTOR INSTRUMENT CABLE IN PLACE OF SINGLE CABLES WHERE SEVERAL CABLES FOLLOW A COMMON PATH.

8) FASTEN FLEXIBLE CONDUCTORS, BRIDGING CABINETS AND DOORS, ALONG HINGE SIDE; PROTECT AGAINST ABRASION. TIE AND SUPPORT CONDUCTORS.

9) NUMBER-CODE OR COLOR-CODE CONDUCTORS FOR FUTURE IDENTIFICATION AND SERVICE OF CONTROL SYSTEM, EXCEPT LOCAL INDIVIDUAL ROOM CONTROL CABLES.

10) WIRES AND CABLES SHALL BE AS FOLLOWS:

a. SINGLE CONDUCTOR (120VAC): TYPE THWN 12AWG STRANDED COPPER WITH 600V INSULATION

1) PRIMARY AND SECONDARY COMMUNICATIONS NETWORK CABLING

a. CABLE SHALL BE OF TYPE RECOMMEND BY THE DDC SYSTEM MANUFACTURER AND 20AWG AT A MINIMUM.

a. CABLE SHALL BE SHIELDED.

11) ROOM SENSOR CABLING

a. CABLE SHALL CONSIST OF COPPER CONDUCTORS NOT LESS THAN NO. 24 AWG.

12) CABLES FOR 120VAC WIRING AND LOW LEVEL SIGNAL WIRING (I.E., 4 ? 20MA ANALOG) SHALL ALWAYS BE RUN IN SEPARATE RACEWAYS.

C. CONNECTIONS

1) INSTALL PIPING ADJACENT TO MACHINE TO ALLOW SERVICE AND MAINTENANCE.

2) CONNECT MANUAL-RESET LIMIT CONTROLS INDEPENDENT OF MANUAL-CONTROL SWITCH POSITIONS. AUTOMATIC DUCT HEATER RESETS MAY BE CONNECTED IN INTERLOCK CIRCUIT OF POWER CONTROLLERS.

3) CONNECT HAND-OFF-AUTO SELECTOR SWITCHES TO OVERRIDE AUTOMATIC INTERLOCK CONTROLS WHEN SWITCH IS IN HAND POSITION.

4) GROUND EQUIPMENT.

D. FIELD QUALITY CONTROL

1) OPERATIONAL TEST: AFTER ELECTRICAL CIRCUITRY HAS BEEN ENERGIZED, START UNITS TO CONFIRM PROPER UNIT OPERATION. REMOVE MALFUNCTIONING UNITS, REPLACE WITH NEW UNITS, AND RETEST.

2) TEST AND ADJUST CONTROLS AND SAFETIES. REPLACE DAMAGED AND MALFUNCTIONING CONTROLS AND EQUIPMENT, AND RETEST.

3) REPLACE DAMAGED OR MALFUNCTIONING CONTROLS AND EQUIPMENT.

4) ADJUST, CALIBRATE, AND FINE TUNE CIRCUITS AND EQUIPMENT TO ACHIEVE SEQUENCE OF OPERATION SPECIFIED.

E. TRAINING

1) THE ATC CONTRACTOR SHALL PROVIDE COMPETENT INSTRUCTORS TO GIVE FULL INSTRUCTION TO DESIGNATED PERSONNEL IN THE ADJUSTMENT, OPERATION, AND MAINTENANCE OF THE SYSTEM INSTALLED RATHER THAN A GENERAL TRAINING COURSE.

2) PROVIDE 8 HOURS OF TRAINING FOR OWNER'S OPERATING AND MAINTENANCE PERSONNEL

F. ON-SITE ASSISTANCE

1) OCCUPANCY ADJUSTMENTS: WITHIN ONE YEAR OF DATE OF SUBSTANTIAL COMPLETION, PROVIDE UP TO THREE PROJECT-SITE VISITS, WHEN REQUESTED BY OWNER, TO ADJUST AND CALIBRATE COMPONENTS AND TO ASSIST OWNER'S PERSONNEL IN MAKING PROGRAM CHANGES AND IN ADJUSTING SENSORS AND CONTROLS TO SUIT ACTUAL CONDITIONS.

23. SEQUENCES OF OPERATIONS

A. GENERAL

1) ANY SAFETY SHUTDOWN SHALL ALLOW FOR AN AUTOMATIC LOCAL RESET AND A MANUAL REMOTE RESET AND RESTART FROM THE ATC SYSTEM. ALL SAFETY DEVICES SHALL BE HARDWIRED TO THE STARTER AND SHALL HAVE A SECOND CONTACT FOR MONITORING VIA THE ATC.

1) ALL SETPOINTS INCLUDING SETPOINTS INTERNAL TO CONTROL ALGORITHMS SHALL BE ADJUSTABLE FROM ALL ATC OPERATOR INTERFACES.THE RTU CONTROLLER OR THE VAV BOX THERMOSTAT.

1) ALL ALARM POINTS SHALL BE ANNUNCIATED AT THE ATC AUDIBLY AND VISUALLY. PROVIDE ONE (1) ALARM PANEL FOR CARBON DIOXIDE AND OUTSIDE AIR MONIORING ALARM PANEL LOCATED IN IT CLOSET.

2) ALL CONTROLLERS SHALL INCORPORATE PROPORTIONAL-INTEGRAL-DERIVATIVE CONTROL LOOPS.

3) ALL POINTS FOR A SPECIFIC MECHANICAL SYSTEM SHALL BE CONNECTED TO AND CONTROLLED BY THE SAME DDC CONTROLLER UNLESS OTHERWISE SPECIFIED. FOR EXAMPLE, IT IS NOT ACCEPTABLE TO CONTROL A SUPPLY FAN WITH ONE DDC CONTROLLER LOCATED AT A MOTOR CONTROL CENTER AND TO CONTROL THE REST OF THE AIR-HANDLING UNIT POINTS WITH A DDC CONTROLLER LOCATED AT THE AIR-HANDLING UNIT.

1) WHEN THERE IS A BUILDING WIDE EMERGENCY CONDITION, INCLUDING BUT NOT LIMITED TO, FIRE ALARM, LOSS OF POWER, SWITCHOVER FROM NORMAL POWER TO EMERGENCY POWER, SWITCHOVER FROM EMERGENCY POWER TO NORMAL POWER, ETC., ALL ATC ALARMS (I.E., FAN FAILURE, PUMP FAILURE, ETC.) DUE TO THESE CONDITIONS SHALL BE INHIBITED. ALL ALARMS INDICATING THE TYPE OF EMERGENCY CONDITION OR REASON FOR THE EMERGENCY CONDITION SHALL REMAIN ACTIVE.

4) SUBMIT ON WIRING DIAGRAMS AND CONTROL DIAGRAMS FOR ALL EQUIPMENT LISTED HEREIN REGARDLESS OF WHETHER THE CONTROLS ARE PACKAGED, PROVIDED BY OTHERS, ETC. IT IS THE INTENT OF THIS SPECIFICATION THAT THIS CONTRACTOR SHALL PROVIDE THE OWNER WITH COMPLETE AND FINAL O & M MANUALS THAT INCLUDE CONTROLS FOR ALL EQUIPMENT REGARDLESS OF WHO PROVIDED IT.

B. SPECIFIC

1) ROOFTOP AIR HANDLING UNIT (RTU)

a. GENERAL

(1) THE ATC CONTRACTOR SHALL MOUNT AND WIRE ALL CONTROL COMPONENTS THAT ARE SHIPPED WITH THE UNIT THAT ARE NOT FACTORY INSTALLED. THIS SHALL INCLUDE BUT NOT BE LIMITED TO A SPACE TEMPERATURE SENSOR AND STATIC PRESSURE TRANSMITTER 2/3 DOWNSTREAM OF THE SUPPLY FAN.

(2) THE ATC CONTRACTOR SHALL FURNISH, MOUNT AND WIRE ANY ADDITIONAL COMPONENTS NOT PROVIDED BY THE UNIT MANUFACTURER TO ACHIEVE A COMPLETELY OPERATIONAL SYSTEM.

(3) THE UNIT SHALL BE FURNISHED WITH A PACKAGED MICROPROCESSOR CONTROLLER.

b. SAFETIES

(1) THE SUPPLY AND RETURN SMOKE DETECTORS SHALL STOP THE SUPPLY AND RETURN FANS UPON THE PRESENCE OF SMOKE THROUGH THE FAS.

(2) A HIGH DISCHARGE AIR PRESSURE SWITCH LOCATED DOWNSTREAM OF THE SUPPLY FAN AND UPSTREAM OF THE CLOSEST DAMPER SHALL STOP THE SUPPLY AND RETURN FANS WHEN DUCT PRESSURE EXCEEDS DESIGN. THE SUPPLY AND RETURN FANS SHALL REMAIN OFF UNTIL THE AIR PRESSURE SWITCH IS MANUALLY RESET.

(1) THE ATC CONTRACTOR FURNISH, MOUNT, WIRE ALL NECESSARY COMPONENTS REQUIRED FOR A FULLY OPERATIONAL AIR MONITORING ALARM PANEL LOCATED IN THE IT CLOSET. THIS SHALL INCLUDE, BUT NOT BE LIMITED TO, ALARM PANEL, CARBON DIOXIDE SENSOR, OUTSIDE AIR MONITORING STATION.

c. WARM-UP/COOL DOWN

(1) DURING THE HEATING SEASON, A WARM-UP PROGRAM SHALL BE INVOKED IF THE RETURN AIR TEMPERATURE IS BELOW 60°F (ADJ.) UPON UNIT START UP. THE WARM-UP PROGRAM SHALL RESET THE SUPPLY AIR TEMPERATURE TO 80°F (ADJ.) AND SHALL OPEN ALL DOWNSTREAM VAV BOXES TO THE MAXIMUM CFM POSITION. THE SUPPLY AIR TEMPERATURE SHALL BE RESET LINEARLY AND INVERSELY FROM 80°F (ADJ.) TO 70°F (ADJ.) AS THE RETURN AIR TEMPERATURE INCREASES FROM 60°F (ADJ.) TO 70°F (ADJ.). DURING THE WARM-UP MODE, THE AIR HANDLING UNIT SHALL OPERATE ON 100% RETURN AIR (OUTSIDE AIR DAMPER SHALL REMAIN CLOSED). AFTER WARM UP (RETURN AIR ABOVE 70°F (ADJ.)), THE UNIT SHALL BE CONTROLLED AS DESCRIBED IN OCCUPIED MODE.

(1) DURING THE COOLING SEASON, A COOL DOWN PROGRAM SHALL BE INVOKED IF THE RETURN AIR TEMPERATURE IS ABOVE 80°F (ADJ.) UPON UNIT START UP. THE COOL DOWN PROGRAM SHALL RESET THE SUPPLY AIR TEMPERATURE TO 55°F (ADJ.) AND SHALL OPEN ALL VAV BOXES TO THE MAXIMUM CFM POSITION. DURING THE COOL DOWN MODE, THE AIR HANDLING UNIT SHALL OPERATE ON 100% RETURN AIR. AFTER COOL DOWN (RETURN AIR BELOW 70°F (ADJ.)), THE UNIT SHALL BE CONTROLLED AS DESCRIBED IN OCCUPIED MODE.

d. OCCUPIED MODE

(1) THE AIR HANDLING UNIT SHALL BE STARTED BASED UPON A START TIME OPTIMIZATION PROGRAM, TIME OF DAY SCHEDULE, OR MANUAL COMMAND AND RUN CONTINUOUSLY.

(1) ALL ASSOCIATED VAV BOXES SHALL BE ENABLED PRIOR TO THE SUPPLY FAN STARTING.

(2) UPON A COMMAND TO START, ALL ASSOCIATED ISOLATION DAMPERS SHALL OPEN. ISOLATION DAMPERS SHALL BE HARDWIRE INTERLOCKED TO

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date: 12-27-07

drawn by: MG

scale: NTS

title: HVAC SPECIFICATIONS 7 OF 9

number: H-5.6

THE SUPPLY FAN STARTER BY THE ATC CONTRACTOR. THE OUTSIDE AIR DAMPERS SHALL MODULATE TO MINIMUM POSITION AND . HARDWIRED ASSOCIATED DAMPER END SWITCHES ON ALL TWO–POSITION DAMPERS SHALL ENERGIZE THE SUPPLY AND RETURN FAN STARTERS WHEN ALL ASSOCIATED DAMPERS ARE IN THEIR FULLY OPEN POSITIONSHALL BE ENERGIZED.

(3) THE SUPPLY AND RETURN FAN VARIABLE FREQUENCY DRIVES SHALL START UNLOADED AND SLOWLY RAMP UP TO SPEED AS REQUIRED. IN THE OCCUPIED MODE, THE SUPPLY AND RETURN FANS RUN CONTINUOUSLY. THE SUPPLY FAN VARIABLE FREQUENCY DRIVE SHALL BE CONTROLLED TO MAINTAIN THE SUPPLY STATIC PRESSURE SETPOINT, AS SENSED AT A POINT 2/3 DOWNSTREAM OF THE SUPPLY FAN. THE RETURN FAN VARIABLE FREQUENCY DRIVE SHALL BE CONTROLLED TO MAINTAIN THE RETURN CFM, AS SENSED BY A RETURN AIRFLOW MEASURING STATION, AT THE RETURN CFM SETPOINT. THE RETURN CFM SETPOINT SHALL BE CALCULATED BY ADDING A FIXED VALUE (THE VALUE MAY BE POSITIVE OR NEGATIVE AND SHALL BE ADJ.) TO THE SUPPLY CFM, AS SENSED BY A SUPPLY AIRFLOW MEASURING STATION.

(4) ECONOMIZER MODE SHALL BE AVAILABLE WHENEVER THE OUTSIDE AIR ENTHALPY IS LESS THAN THE AIR HANDLING UNIT RETURN AIR ENTHALPY. IF ECONOMIZER IS AVAILABLE AND THERE IS A RISE IN SUPPLY AIRSPACE TEMPERATURE ABOVE THE SPACE SUPPLY AIR TEMPERATURE SETPOINT, THE OUTSIDE AIR DAMPERS SHALL BE MODULATED OPEN FROM MINIMUM POSITION TO 100% OPEN AS NECESSARY TO MAINTAIN THE SPACE SUPPLY AIR TEMPERATURE SETPOINT. IF THE OUTSIDE AIR DAMPERS ARE IS 100% OPEN AND THERE IS A FURTHER RISE IN TEMPERATURE ABOVE THE SPACE SUPPLY AIR TEMPERATURE SETPOINT, THE OUTSIDE AIR DAMPERS SHALL REMAIN 100% OPEN AND THE DX–COOLING SHALL BE STAGED AS NECESSARY TO MAINTAIN THE SPACE SUPPLY AIR TEMPERATURE SETPOINT.

(5) WHEN ECONOMIZER MODE IS NOT AVAILABLE, THE DX–COOLING AND GAS–FIRED HEATING SHALL BE STAGED IN SEQUENCE AS NECESSARY TO MAINTAIN THE SPACE SUPPLY AIR TEMPERATURE SETPOINT.

(1) THE SUPPLY STATIC PRESSURE SETPOINT SHALL BE RESET BASED ON VAV BOX DAMPER POSITION. IF NO VAV BOX IS GREATER THAN 95% (ADJ.) OPEN, DECREASE THE SUPPLY AIR STATIC PRESSURE UNTIL AT LEASE ONE VAV BOX IS GREATER THAN 95% (ADJ.) OPEN. IF A VAV BOX IS GREATER THAN 95% (ADJ.) OPEN AND NOT MAINTAINING THE SPACE TEMPERATURE SETPOINT, INCREASE THE STATIC PRESSURE SETPOINT UNTIL THE SPACE TEMPERATURE SETPOINT IS BEING MAINTAINED.

(1) THE SUPPLY TEMPERATURE SETPOINT SHALL BE RESET BASED ON VAV CFM. EVERY 15 MINUTES EACH VAV BOX SHALL BE POLLED. IF ANY VAV BOX IS PROVIDING MAXIMUM CFM, LOWER SUPPLY AIR TEMPERATURE BY .25°F. IF NO VAV BOX IS PROVIDING GREATER THAN 75% (ADJ.) OF MAXIMUM CFM, INCREASE THE SUPPLY AIR TEMPERATURE BY .25°F. IF NEITHER CONDITION EXISTS, SUPPLY TEMPERATURE SETPOINT SHALL REMAIN UNCHANGED. THIS PROGRAM SHALL BE ACTIVATED 1 HOUR AFTER OCCUPANCY START TIME.

(1) THE OUTSIDE AIR DAMPERS ASSOCIATED WITH RTU AND OUTDOOR AIR DAMPER ASSOCIATED WITH OUTSIDE AIR MONITORING STATION SHALL BE OVERRIDDEN OPEN AS NECESSARY TO MAINTAIN EACH INDIVIDUAL SPACE CARBON DIOXIDE LEVEL AT THE SPACE CARBON DIOXIDE SETPOINT. THE SPACE CARBON DIOXIDE LEVEL SETPOINT SHALL BE EQUAL TO 700 PPM (ADJ.).

e. UNOCCUPIED MODE

(1) THE SUPPLY AND RETURN FANS SHALL REMAIN OFF AND THE VARIABLE FREQUENCY DRIVES SHALL BE SET TO 0%. THE OUTSIDE AIR DAMPERS SHALL BE CLOSE. ALL ISOLATION DAMPERS SHALL CLOSE. THE DX–COOLING AND GAS FIRED HEATING SHALL BE DE–ENERGIZED.

(1) IF THE RETURN AIR TEMPERATURE OR ANY SPACE TEMPERATURE FALLS BELOW 60°F (ADJ.), THE UNIT SHALL RUN AS PER WARM–UP MODE UNTIL THE RETURN AIR TEMPERATURE OR SPACE TEMPERATURE EXCEEDS 64°F (ADJ.). THE UNIT SHALL RUN A MINIMUM OF ½ HOUR (ADJ.) AFTER START UP.

(1) IF THE RETURN AIR TEMPERATURE OR ANY SPACE TEMPERATURE RISES ABOVE 80°F (ADJ.), THE UNIT SHALL RUN AS PER COOL–DOWN MODE UNTIL THE RETURN AIR TEMPERATURE OR SPACE TEMPERATURE FALLS BELOW 76°F (ADJ.). THE UNIT SHALL RUN A MINIMUM OF ½ HOUR (ADJ.) AFTER START UP.

f. PROVIDE THE FOLLOWING POINTS HARDWIRED TO THE ROOFTOP UNIT CONTROLLER:

(1) FILTER DIFFERENTIAL PRESSURE (VIA DIFFERENTIAL PRESSURE TRANSMITTER).

(1) HIGH AND LOW SPACE CARBON DIOXIDE LEVEL ALARMS (VIA ALARM PANEL IN IT CLOSET).

(1) INDIVIDUAL SPACE CARBON DIOXIDE LEVEL.

(2) MIXED AIR TEMPERATURE.

(3) OUTSIDE AIR DAMPER CONTROL (0–100%).

(4) OUTSIDE AIR TEMPERATURE (PROVIDE A SENSOR FOR EACH UNIT, IT IS NOT ACCEPTABLE TO UTILIZE A GLOBAL POINT).

(5) OUSIDE AIR HUMIDITY.

(6) REHEAT GAS– FIRED CONTROLHEATING COMMAND.

(7) RETURN AIR CFM.

(8) RETURN AIR TEMPERATURE.

(9) RETURN AIR HUMIDITY.

(10) RETURN FAN STATUS.

(1) RETURN FAN VFD BYPASS STATUS.

(11) RETURN FAN VFD COMMAND (ENABLE/DISABLE).

(1) RETURN FAN VFD COMMON ALARM.

(12) RETURN FAN VFD SPEED CONTROL (0–100%).

(1) RETURN HUMIDITY.

(13) STAGES OF DX –COOLING COMMAND.

(14) SUPPLY AIR CFM.

(15) SUPPLY AIR STATIC PRESSURE.

(16) SUPPLY SPACEAIR TEMPERATURE.

(1) SUPPLY AIR HUMIDITY

(17) SUPPLY FAN HIGH DISCHARGE PRESSURE SWITCH STATUS.

(18) SUPPLY FAN STATUS.

(1) SUPPLY FAN VFD BYPASS STATUS.

(19) SUPPLY FAN VFD COMMAND (ENABLE/DISABLE).

(1) SUPPLY FAN VFD COMMON ALARM.

(20) SUPPLY FAN VFD SPEED CONTROL (0–100%).

g. PROVIDE THE FOLLOWING POINTS ON THE ASSOCIATED EQUIPMENT GRAPHIC ON THE RTU CONTROLLER DISPLAY IN ADDITION TO THE HARDWIRED POINTS INDICATED ABOVE:

(1) AHU COMMAND (ENABLE/DISABLE).

(2) AHU MODE (WARM–UP, COOL–DOWN, ECONOMIZER, NORMAL, ETC.)

(1) AHU STATUS (ON/OFF).

(3) DIRTY FILTER ALARM (INDICATED IF FILTER DIFFERENTIAL PRESSURE EXCEEDS 1? (ADJ.)).

(4) HIGH AND LOW RETURN AIR CFM SETPOINT ALARMS.

(5) HIGH AND LOW SUPPLY AIR STATIC PRESSURE ALARMS.

(6) HIGH AND LOW SUPPLY AIRSPACE TEMPERATURE ALARMS.

(1) OCCUPIED/UNOCCUPIED PREHEAT COIL DISCHARGE AIR TEMPERATURE SETPOINT.

(7) OUTSIDE AIR ENTHALPY.

(8) RETURN AIR CFM SETPOINT.

(1) RETURN AIR HUMIDITY SETPOINT.

(9) RETURN FAN FAILURE.

(1) RETURN FAN LOW INTAKE PRESSURE ALARM.

(10) RETURN AIR ENTHALPY.

(1) SPACE CARBON DIOXIDE LEVEL SETPOINT.

(1) SUPPLY AIR HUMIDITY HIGH LIMIT SETPOINT.

(1) SUPPLY AIR STATIC PRESSURE RESET PARAMETERS.

(11) SUPPLY AIR STATIC PRESSURE SETPOINT.

(1) SUPPLY AIR TEMPERATURE RESET PARAMETERS.

(12) SUPPLY AIRSPACE TEMPERATURE HEATING/COOLING SETPOINTS.

(13) SUPPLY FAN FAILURE.

(14) SUPPLY FAN HIGH DISCHARGE PRESSURE ALARM.

2) VARIABLE AIR VOLUME (VAV) BOXES

a. COORDINATE FACTORY MOUNTING AND WIRING OF SECONDARY CONTROL PANEL, ACTUATOR, AND TRANSFORMER WITH THE VAV BOX MANUFACTURER. THE BMS CONTRACTOR SHALL BE RESPONSIBLE FOR FURNISHING, INSTALLING, AND WIRING OF CONTROLS NOT FURNISHED, INSTALLED, OR WIRED BY OTHERS THAT ARE REQUIRED FOR AN OPERATIONAL SYSTEMTHE VAV BOXES SHALL OPERATE AS PER THE MANUFACTURER PROVIDED CONTROLS.

b. THE VAV BOX SHALL MODULATE AS NECESSARY TO MAINTAIN THE SPACE TEMPERATURE SETPOINT.

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c. IF THE SUPPLY AIR TEMPERATURE ENTERING THE VAV BOX RISES ABOVE SETPOINT, THE VAV BOX DAMPER SHALL OPEN FULLY TO FACILITATE WARM–UP MODE.

a. OCCUPIED MODE

(1) IF THE VAV BOX ENTERING TEMPERATURE IS LESS THAN 65°F, THE VAV BOX SHALL OPERATE IN COOLING MODE. UPON A FALL IN SPACE TEMPERATURE BELOW SETPOINT, THE BOX DAMPER SHALL MODULATE CLOSED TO THE MINIMUM CFM SETPOINT. UPON A RISE IN SPACE TEMPERATURE, THE BOX DAMPER SHALL MODULATE FROM THE MINIMUM TO THE MAXIMUM CFM SETTING AS NECESSARY TO MAINTAIN THE CFM SETPOINT AS RESET BY THE SPACE TEMPERATURE. THE MINIMUM AND MAXIMUM CFM SETTINGS SHALL BE THOSE SCHEDULED ON THE MECHANICAL DRAWINGS.

(1) IF THE VAV BOX ENTERING TEMPERATURE IS GREATER THAN 65°F PLUS A DIFFERENTIAL, THE VAV BOX SHALL OPERATE IN HEATING MODE. UPON A RISE IN SPACE TEMPERATURE ABOVE SETPOINT, THE BOX DAMPER SHALL MODULATE CLOSED TO THE MINIMUM CFM SETPOINT. UPON A FALL IN SPACE TEMPERATURE, THE BOX DAMPER SHALL MODULATE FROM THE MINIMUM TO THE MAXIMUM CFM SETTING AS NECESSARY TO MAINTAIN THE CFM SETPOINT AS RESET BY THE SPACE TEMPERATURE. THE MINIMUM AND MAXIMUM CFM SETTINGS SHALL BE THOSE SCHEDULED ON THE MECHANICAL DRAWINGS.

a. UNOCCUPIED MODE

(1) WHEN THE PRIMARY FAN SYSTEM SERVING THE VAV BOX IS NOT RUNNING, THE VAV BOX DAMPER SHALL CLOSE.

(1) IF THE SPACE TEMPERATURE FALLS BELOW THE UNOCCUPIED SETBACK TEMPERATURE SETPOINT OF 62°F (ADJ.), THE FAN SYSTEM SERVING THE VAV BOXES SHALL BE INDEXED TO OCCUPIED MODE AND SHALL CONTROL TO MAINTAIN A SUPPLY AIR TEMPERATURE OF 80°F. THE VAV BOXES SHALL BE INDEXED TO THEIR MAXIMUM CFM SETPOINT. THE FAN SHALL RUN UNTIL THE SPACE TEMPERATURE EXCEEDS 64°F OR UNTIL THE UNIT RUNS FOR A MINIMUM OF 1/2 HOUR.

(1) IF THE SPACE TEMPERATURE RISES ABOVE THE UNOCCUPIED SETUP TEMPERATURE SETPOINT OF 80°F (ADJ.), THE FAN SYSTEM SERVING THE VAV BOXES SHALL BE INDEXED TO OCCUPIED MODE AND SHALL CONTROL TO MAINTAIN A SUPPLY AIR TEMPERATURE OF 55°F. THE VAV BOXES SHALL BE INDEXED TO THEIR MAXIMUM CFM SETPOINT. THE FAN SHALL RUN UNTIL THE SPACE TEMPERATURE FALLS BELOW 76°F OR UNTIL THE UNIT RUNS FOR A MINIMUM OF 1/2 HOUR.

(1) THE VAV DDC CONTROLLER SHALL BE PROGRAMMED FOR OCCUPANCY OVERRIDE. BY DEPRESSING THE OCCUPANCY OVERRIDE BUTTON LOCATED ON THE SPACE TEMPERATURE SENSOR, THE VAV BOX AND THE FAN SYSTEM SERVING THE VAV BOX SHALL BE RESTORED TO THE OCCUPIED MODE

(1) THE VAV BOX SHALL NOT OPEN BEYOND THE MAXIMUM CFM SETTING. PROVIDE ONE DDC CONTROLLER AND ONE TEMPERATURE SENSOR FOR EACH VAV BOX.

3) EXHAUST FANS

a. THE EXHAUST FAN SHALL BE CONTROLLED BY A MANUAL SWITCH AND RUN CONTINUOUSLY.

b. UPON A COMMAND TO START THE FAN, THE FAN DISCHARGE DAMPER SHALL OPEN. WHEN THE DAMPER IS OPEN AS SENSED BY A DAMPER ENDSWITCH, THE FAN SHALL ENERGIZE. UPON A COMMAND TO DE–ENERGIZE THE FAN, THE DISCHARGE DAMPER SHALL HAVE AN ADJUSTABLE TIME DELAY TO KEEP THE DAMPER OPEN UP TO 30 SECONDS AFTER THE FAN IS DE–ENERGIZED.

4) TOILET EXHAUST FANS

a. THE FAN SHALL RUN WHENEVER THE FACILITY IS OCCUPIED. THE FAN SHALL BE DE–ENERGIZED WHENEVER THE FACILITY IS UNOCCUPIED.

b. UPON A COMMAND TO START THE FAN, THE FAN DISCHARGE DAMPER SHALL OPEN. WHEN THE DAMPER IS OPEN AS SENSED BY A DAMPER END SWITCH, THE FAN SHALL ENERGIZE. UPON A COMMAND TO DE–ENERGIZE THE FAN, THE DISCHARGE DAMPER SHALL HAVE AN ADJUSTABLE TIME DELAY TO KEEP THE DAMPER OPEN UP TO 30 SECONDS AFTER THE FAN IS DE–ENERGIZED.

5) SPACE CARBON DIOXIDE MONITORING

a. THIS CONTRACTOR SHALL PROVIDE SPACE CARBON DIOXIDE SENSORS AS INDICATED ON THE MECHANICAL PLANS. THE CARBON DIOXIDE SENSORS SHALL BE CONNECTED TO A PANEL INSTALLED IN THE IT CLOSET. AN AUDIBLE AND VISUAL ALARM SHALL BE GENERATED AT THE PANEL WHENEVER A READING FROM ANY SENSOR RISES ABOVE THE SPACE CARBON DIOXIDE LEVEL HIGH LIMIT SETPOINT OF 700 PPM (ADJ.).

b. PROVIDE THE FOLLOWING POINTS HARDWIRED TO THE PANEL LOCATED IN THE IT CLOSET:

(1) INDIVIDUAL CARBON MONOXIDE SENSOR READING.

(2) ALARM OUTPUT.

c. PROVIDE THE FOLLOWING POINTS ON THE LED/LCD DISPLAY ON THE FACE OF THE PANEL LOCATED IN THE IT CLOSET IN ADDITION TO THE HARDWIRED POINTS INDICATED ABOVE:

(1) CARBON DIOXIDE HIGH LIMIT SETPOINT.

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