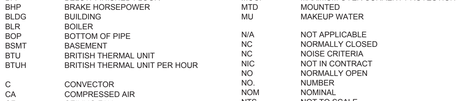
GENERIC HVAC ABBREVIATIONS

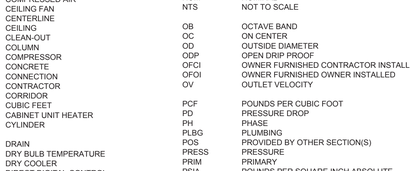
(REFER TO CONTROLS LEGEND ABBREVIATIONS FOR ADDITIONAL NOMENCLATURE)

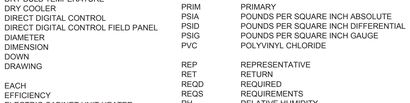
°F	DEGREES FAHRENHEIT	ID	INSIDE DIAMETER
°C	DEGREES CELSIUS	IN	INCHES
Ø	DIAMETER	INSUL	INSULATION
AD	ACCESS DOOR	KW	KILOWATT
ADA	AMERICANS WITH DISABILITIES ACT	KVA	KILOVOLT AMPERE
ADJ	ADJUSTABLE		
ADDL	ADDITIONAL	L	LENGTH
AFF	ABOVE FINISHED FLOOR	LB	POUND
AFG	ABOVE FINISHED GRADE	LAB	LABORATORY
ALT	ALTERNATE	LF	LINEAR FEET
AP	ACCESS PANEL	LVG	LEAVING
ARCH	ARCHITECT		
ATC	AUTOMATIC TEMPERATURE CONTROL	M	ONE THOUSAND
ATCC	ATC COMPRESSOR	MAX	MAXIMUM
ATCD	ATC COMPRESSOR DRYER	MBH	THOUSAND BRITISH THERMAL UNITS PER HOUR
ATCR	ATC COMPRESSOR RECEIVER	MCA	MINIMUM CIRCUIT AMPS
ATV	ATMOSPHERIC VENT	MCC	MOTOR CONTROL CENTER
AVG	AVERAGE	MECH	MECHANICAL
		MEZZ	MEZZANINE
BBD	BOILER BLOW DOWN	MFR	MANUFACTURER
BDT	BLOWDOWN TANK	MH	MANHOLE
BF	BOILER FEED WATER	MIN	MINIMUM
BFF	BELOW FINISHED FLOOR	MOCP	MAXIMUM OVER CURRENT PROTECTION
BHP	BRAKE HORSEPOWER	MTD	MOUNTED
BLDG	BUILDING	MU	MAKEUP WATER
BLR	BOILER		
BOP	BOTTOM OF PIPE	N/A	NOT APPLICABLE
BSMT	BASEMENT	NC	NORMALLY CLOSED
BTU	BRITISH THERMAL UNIT	NC	NOISE CRITERIA
BTUH	BRITISH THERMAL UNIT PER HOUR	NIC	NOT IN CONTRACT
		NO	NORMALLY OPEN
C	CONVECTOR	NO.	NUMBER
CA	COMPRESSED AIR	NOM	NOMINAL
CF	CEILING FAN	NTS	NOT TO SCALE
CL	CENTERLINE		
CLG	CEILING	OB	OCTAVE BAND
CO	CLEAN-OUT	OC	ON CENTER
COL	COLUMN	OD	OUTSIDE DIAMETER
COMP	COMPRESSOR	ODP	OPEN DRIP PROOF
CONC	CONCRETE	OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
CONN	CONNECTION	OFOI	OWNER FURNISHED OWNER INSTALLED
CONTR	CONTRACTOR	OV	OUTLET VELOCITY
CORR	CORRIDOR		
CUF	CUBIC FEET	PCF	POUNDS PER CUBIC FOOT
CUH	CABINET UNIT HEATER	PD	PRESSURE DROP
CYL	CYLINDER	PH	PHASE
		PLBG	PLUMBING
D	DRAIN	POS	PROVIDED BY OTHER SECTION(S)
DB	DRY BULB TEMPERATURE	PRESS	PRESSURE
DC	DRY COOLER	PRIM	PRIMARY
DDC	DIRECT DIGITAL CONTROL	PSIA	POUNDS PER SQUARE INCH ABSOLUTE
DDCFP	DIRECT DIGITAL CONTROL FIELD PANEL	PSID	POUNDS PER SQUARE INCH DIFFERENTIAL
DIA	DIAMETER	PSIG	POUNDS PER SQUARE INCH GAUGE
DIM	DIMENSION	PVC	POLYVINYL CHLORIDE
DN	DOWN		
DWG	DRAWING	REP	REPRESENTATIVE
		RET	RETURN
EA	EACH	REQD	REQUIRED
EFF	EFFICIENCY	REQS	REQUIREMENTS
ECUH	ELECTRIC CABINET UNIT HEATER	RH	RELATIVE HUMIDITY
ELEC	ELECTRICAL	RM	ROOM
ELEV	ELEVATION	RPM	REVOLUTIONS PER MINUTE
EMER	EMERGENCY		
EMS	ENERGY MANAGEMENT SYSTEM	SCCR	SHORT CIRCUIT CURRENT RATING
ENT	ENTERING	SCH	SCHEDULE
EQUIP	EQUIPMENT	SOV	SOLENOID OPERATED VALVE
EUH	ELECTRIC UNIT HEATER	SPECS	SPECIFICATIONS
EXH	EXHAUST	SQ	SQUARE
EXP	EXPANSION	SQFT	SQUARE FEET
		SS	STAINLESS STEEL
FTR	FINNED TUBE RADIATION	STD	STANDARD
FCV	FLOW CONTROL VALVE	STDBY	STANDBY
FFOP	FIREFIGHTERS OVERRIDE PANEL	STL	STEEL
FG	FIBERGLASS	SUCT	SUCTION
FLEX	FLEXIBLE	SUP	SUPPLY
FLR	FLOOR		
FLRDR	FLOOR DRAIN	TA	THROW-AWAY
FP	FIRE PROTECTION	TAV	THERMOSTATIC AIR VENT
FPM	FEET PER MINUTE	TEFC	TOTALLY ENCLOSED FAN COOLED
FT	FEET	TEL	TELEPHONE
FT/SEC	FEET PER SECOND	TEMP	TEMPERATURE
FURN	FURNISHED	TOD	TOP OF DUCT
FVNR	FULL VOLTAGE NON-REVERSING	TOP	TOP OF PIPE
		TYP	TYPICAL
G	GAS		
GA	GAUGE	UH	UNIT HEATER
GAL	GALLONS		
GALV	GALVANIZED	V	VENT
GC	GENERAL CONTRACTOR	VEL	VELOCITY
GND	GROUND	VERT	VERTICAL
GPH	GALLONS PER HOUR	VFC	VARIABLE FREQUENCY CONTROLLER
GPM	GALLONS PER MINUTE	VTR	VENT THROUGH ROOF
GRD	GRADE (GROUND LEVEL)		
GWB	GYPSUM WALL BOARD	W	WIDTH
		W/	WITH
H	HEIGHT	W/O	WITHOUT
HCPD	HANDICAPPED	WB	WET BULB TEMPERATURE
HD	HEAD	WF	WIDE FLANGE
HP	HORSEPOWER	WG	WATER GAUGE
HPG	HIGH PRESSURE GAS	WRT	WITH RESPECT TO
HR	HOUR		
HZ	HERTZ	X	EXISTING EQUIPMENT TO BE REMOVED
HX	HEAT EXCHANGER	XM	EXISTING EQUIPMENT TO REMAIN
		XN	NEW LOCATION OF RELOCATED EQUIPMENT
		XR	EXISTING EQUIPMENT TO BE RELOCATED

EQUIPMENT TAG SYMBOLS & ABBREVIATIONS



EXAMPLE EQUIPMENT TAGS:





** NOTE: CONSTANT VOLUME BOX INDICATED WHEN MAX AND MIN CFM'S ARE EQUAL

HYDRONIC SYSTEM SPECIFIC ABBREVIATIONS

ACV	AUTOMATIC CONTROL VALVE	LWT	LEAVING WATER TEMPERATURE
AS	AIR SEPARATOR		
AAV	AUTOMATIC AIR VENT	MAV	MANUAL AIR VENT
CH	CHILLER	NPSH	NET POSITIVE SUCTION HEAD
CHEM	CHEMICAL FEED		
CHW	CHILLED WATER	OS&Y	OUTSIDE STEM AND YOKE
CHWR	CHILLED WATER RETURN		
CHWS	CHILLED WATER SUPPLY	P	PUMP
COND	COOLING COIL CONDENSATE DRAIN PIPING	PHX	PLATE HEAT EXCHANGER
CT	COOLING TOWER	PROCHW	PROCESS CHILLED WATER
CTBD	COOLING TOWER BLOW DOWN	PROCHWR	PROCESS CHILLED WATER RETURN
CTW	COOLING TOWER WATER	PROCHWS	PROCESS CHILLED WATER SUPPLY
CTWR	COOLING TOWER WATER RETURN		
CTWS	COOLING TOWER WATER SUPPLY	S(XXX)	SECONDARY (SYSTEM DEPENDANT PREFIX)
CWR	CONDENSER WATER RETURN		
CWS	CONDENSER WATER SUPPLY	T(XXX)	TERTIARY (SYSTEM DEPENDANT PREFIX)
		TDH	TOTAL DYNAMIC HEAD
DOV	DRAIN OFF VALVE		
		UV	UNIT VENTILATOR
ET	EXPANSION TANK		
EWT	ENTERING WATER TEMPERATURE	WCC	WATER COOLED CONDENSER
		WCCU	WATER COOLED CONDENSING UNIT
GR	GLYCOL RETURN		
GS	GLYCOL SUPPLY	ALTERNATE HYDRONIC PIPING SYSTEM LABELING:	
HB	HOSE BIBB CONN W/CHAINED CAP	HWS180	HOT WATER SUPPLY 180 DEG F SYSTEM
HCR	HOT OR COLD WATER RETURN (DUAL TEMP)	HWR180	HOT WATER RETURN 180 DEG F SYSTEM
HCS	HOT OR COLD WATER SUPPLY (DUAL TEMP)	CHWS42	CHILLED WATER SUPPLY 42 DEG F SYSTEM
HRC	HEAT RECOVERY COIL - GLYCOL	CHWR42	CHILLED WATER RETURN 42 DEG F SYSTEM
HW	HOT WATER		
HWCUH	HOT WATER CABINET UNIT HEATER		
HWHC	HOT WATER HEATING COIL		
HWPHC	HOT WATER PREHEAT COIL		
HWRHC	HOT WATER REHEAT COIL		
HWR	HOT WATER RETURN		
HWS	HOT WATER SUPPLY		
HWUH	HOT WATER UNIT HEATER		

AIR SYSTEM SPECIFIC ABBREVIATIONS

AC	AIR CONDITIONING	IH	INTAKE HOOD
ACC	AIR COOLED CONDENSER		
ACCU	AIR COOLED CONDENSING UNIT	LAT	LEAVING AIR TEMPERATURE
ACD	AUTOMATIC CONTROL DAMPER	LD	LINEAR DIFFUSER
ACU	AIR CONDITIONING UNIT	LUVR	LOUVER
AF	AIR FOIL	LVDR	LOUVERED DOOR
AHU	AIR HANDLING UNIT		
ALD	ACOUSTICALLY LINED DUCTWORK	OA	OUTSIDE AIR
ATD	AIR TERMINAL DEVICE	OAI	OUTSIDE AIR INTAKE
AVS	AIR VOLUME TRAVERSE STATION	OBD	OPPOSED BLADE DAMPER
		OED	OPEN END DUCT
BDD	BACKDRAFT DAMPER		
BI	BACKWARD INCLINED	PHC	PREHEAT COIL
BOD	BOTTOM OF DUCT		
		RA	RETURN AIR
CACU	COMPUTER ROOM AIR CONDITIONING UNIT	RD	REFRIGERANT DISCHARGE (HOT GAS)
CC	COOLING COIL	RF	RETURN FAN
CD	CEILING DIFFUSER	RG	RETURN GRILLE
CFM	CUBIC FEET PER MINUTE	RHC	REHEAT COIL
CG	CEILING GRILLE	RL	REFRIGERANT LIQUID
		RLF	RELIEF
DD	DUAL DUCT SUPPLY AIR TERMINAL	RR	RETURN REGISTER
DIFF	DIFFUSER	RS	REFRIGERANT SUCTION
DWDI	DOUBLE WIDTH DOUBLE INLET	RTU	ROOF TOP UNIT
DWSI	DOUBLE WIDTH SINGLE INLET	RV	ROOF VENT
DX	DIRECT EXPANSION		
		SA	SUPPLY AIR
EAT	ENTERING AIR TEMPERATURE	SATT	SOUND ATTENUATOR
EF	EXHAUST FAN	SCR	SCREEN
EG	EXHAUST GRILLE	SD	SMOKE DAMPER
EHC	ELECTRICAL HEATING COIL	SDET	SMOKE DETECTOR
EPHC	ELECTRIC PREHEAT COIL	SEF	SMOKE EXHAUST FAN
ER	EXHAUST REGISTER	SF	SUPPLY FAN
ERHC	ELECTRIC REHEAT COIL	SG	SUPPLY GRILLE
ESP	EXTERNAL STATIC PRESSURE	SGD	SLIDE GATE DAMPER
		SM	SHEETMETAL
F	FAN	SP	STATIC PRESSURE
F&B	FACE AND BYPASS	SR	SUPPLY REGISTER
FB	FAN BOX	SWDI	SINGLE WIDTH DOUBLE INLET
FC	FORWARD CURVED	SWSI	SINGLE WIDTH SINGLE INLET
FA	FREE AREA		
FCU	FAN COIL UNIT	TE	TOILET EXHAUST
FD	FIRE DAMPER (W/ ACCESS DOOR)	TF	TRANSFER FAN
FLTR	FILTER	TG	TRANSFER GRILLE
FPI	FINS PER INCH	TR	TRANSFER
FSD	COMBINATION AUTOMATIC FIRE/SMOKE DAMPER WITH ACCESS DOOR	TSP	TOTAL STATIC PRESSURE
GE	GENERAL EXHAUST	UC	UNDERCUT DOOR
GH	GRAVITY HOOD		
		VD	VOLUME DAMPER
HC	HEATING COIL	VV	VARIABLE VOLUME SUPPLY AIR TERMINAL BOX
HEGA	HIGH EFFICIENCY GAS ABSORBER AIR FILTER	VVE	VARIABLE VOLUME EXHAUST AIR TERMINAL BOX
HEPA	HIGH EFFICIENCY PARTICULATE AIR FILTER		
HPU	HEAT PUMP UNIT	WMS	WIRE MESH SCREEN
HRU	HEAT RECOVERY UNIT		
HV	HEATING & VENTILATING UNIT		
HU	HUMIDIFIER		

HVAC GENERAL NOTES

GENERAL:

1. HVAC GENERAL NOTES, SYMBOLS LIST AND DETAILS ARE APPLICABLE TO ALL "M" SERIES DRAWINGS.
2. DRAWINGS ARE DIAGRAMMATIC AND ARE INTENDED TO INDICATE CAPACITY, SIZE, APPROXIMATE LOCATION AND GENERAL ARRANGEMENT. DETERMINE EXACT LOCATION OF SYSTEMS AND COMPONENTS IN FIELD.
3. DRAWINGS CANNOT BE FULLY AND CORRECTLY INTERPRETED WITHOUT REFERENCE TO LEGENDS, DETAILS, SCHEDULES AND SPECIFICATIONS. IT IS THE INTENT OF THE DRAWINGS TO SHOW THE INSTALLATION, AS DETAILED BY THE TYPICAL ARRANGEMENTS. ITEMS SHOWN ONCE ON FLOOR PLANS, ELEVATIONS, DETAILS OR DIAGRAMS MAY NOT BE REPEATED IN FULL FOR OTHER TYPICAL INSTANCES.
4. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
5. PROVIDE INFORMATION AND HARDWARE TO COORDINATE CONCRETE PADS AND STEEL PLATFORMS REQUIRED FOR MECHANICAL WORK.
6. COORDINATE ROOF AND WALL PENETRATIONS WITH WORK OF OTHER SECTIONS AND WITH FLASHING REQUIREMENTS. COORDINATE SLAB PENETRATIONS WITH WORK OF OTHER SECTIONS AND WITH EXISTING POST-TENSION CABLES.
7. RUN DUCTS AND PIPING CONCEALED, UNLESS SPECIFIED OTHERWISE, AND CLEAR OF CEILING INSERTS. ALL DUCTWORK SHALL BE INSTALLED AS CLOSE AS POSSIBLE TO WALL AND UNDERSIDE OF BEAMS AND JOISTS.
8. INSTALL SENSORS (TEMPERATURE, HUMIDITY, CO2, THERMOSTATS) AT LOCATIONS SHOWN ON PLANS OR AS DIRECTED BY ARCHITECT. MOUNTING HEIGHT AFF SHALL COMPLY WITH ADA AND SHALL BE MOUNTED LEVEL WITH ADJACENT SWITCHES (E.G. LIGHT SWITCHES).
9. COORDINATE WORK OF THIS SECTION WITH THAT OF OTHER SECTIONS. ALL WORK SHALL BE COORDINATED WITH ALL TRADES INVOLVED. OFFSETS IN PIPING AND DUCTS (INCLUDING DIVIDED DUCTS) AND TRANSITIONS AROUND OBSTRUCTIONS SHALL BE PROVIDED AT NO ADDITIONAL COST.
10. ACCESS PANELS SHALL BE PROVIDED TO CLEAN COILS AND SERVICE DAMPERS, HEATERS, VALVES AND ALL CONCEALED MECHANICAL EQUIPMENT. PROVIDE ACCESS PANELS THROUGH BUILDING ASSEMBLIES TO SERVICE AND MAINTAIN EQUIPMENT UNLESS SUCH EQUIPMENT IS INSTALLED IN EXPOSED LOCATIONS OR ABOVE LAY-IN CEILINGS. COORDINATE THE LOCATION OF ACCESS DOORS AND PANELS AND VERIFY THE EXACT QUANTITY, SIZE, AND LOCATIONS AFTER THE SYSTEMS AND EQUIPMENT REQUIRING ACCESS HAVE BEEN INSTALLED AND PRIOR TO THE CLOSURE OF THE AFFECTED CEILINGS AND BUILDING ASSEMBLIES. MINIMUM ACCESS PANEL AND DOOR SIZE SHALL BE 18"x18" UNLESS OTHERWISE NOTED. OBTAIN APPROVAL FOR ALL PANEL LOCATIONS FROM ARCHITECT
14. ELEMENTS OF THE WORK SHALL BE INSTALLED IN A MANNER SUCH THAT AT SUBSTANTIAL COMPLETION THE FOLLOWING ITEMS, NEW OR EXISTING SHALL BE "FULLY AND REASONABLY ACCESSIBLE": HVAC CONTROL BOXES, JUNCTION BOXES, VALVES (OF EVERY SHAPE, SORT AND FUNCTION), DDC CONTROL BOXES, ELECTRICAL PANELS, FILTERS, BELTS, WATER COILS, DISCONNECT SWITCHES, AND MAINTENANCE ACCESS ELEMENTS INCLUDING PULL SPACE.
    a. "FULLY AND REASONABLY ACCESSIBLE" SHALL BE DEFINED AS: NATIONAL ELECTRIC CODE REQUIRED CLEARANCE FOR POWERED EQUIPMENT AND CAPABLE OF BEING ACCESSED FOR SERVICE, REPAIR OR REPLACEMENT BY AN AVERAGE SIZED INDIVIDUAL (ON A LADDER IF NECESSARY) AND CAPABLE OF BEING SERVICED OR REMOVED WITHOUT REMOVING OR MODIFYING OR DISTORTING OTHER COMPONENTS OF THE WORK. THE DESIGN INTENT PROVIDES A MINIMUM 2' x 2' x 2' ZONE FOR MAINTENANCE. INCREASE WHERE REQUIRED BY MANUFACTURER INSTALLATION INSTRUCTIONS.
    b. CONFLICT WITH MEETING THESE REQUIREMENTS SHALL BE BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE IN A TIMELY MANNER AND SHALL BE CORRECTED AT NO ADDITIONAL COST.
15. SUPPORT ALL EQUIPMENT, PIPING AND DUCTWORK FROM BUILDING STRUCTURE. PROVIDE VIBRATION ISOLATION. FOR ROTATING EQUIPMENT, DUCTWORK AND PIPING IN ACCORDANCE WITH THE SPECIFICATIONS. PROVIDE TO THE CONSTRUCTION MANAGER OR GENERAL CONTRACTOR A LIST OF ALL WEIGHTS AND METHODS OF SUPPORT FOR COORDINATION. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
16. ALL CONTROL WIRE AND CONDUIT SHALL COMPLY WITH NATIONAL ELECTRIC CODE AND DIVISION 26.
17. ALL MATERIAL AND EQUIPMENT SHALL BE NEW.

AIR SYSTEM SPECIFIC NOTES:

1. VERIFY ALL EQUIPMENT CONNECTIONS WITH MANUFACTURER CERTIFIED DRAWINGS. VERIFY AND PROVIDE DUCT TRANSITIONS TO FURNISHED EQUIPMENT. FIELD VERIFY AND COORDINATE ALL DIMENSIONS BEFORE FABRICATION.
2. SHEETMETAL FITTINGS SHOWN ARE TO BE PROVIDED. NO SUBSTITUTES SHALL BE ALLOWED WITHOUT PRIOR CONSENT FROM ARCHITECT/ENGINEER.
3. REFER TO SPECIFICATIONS FOR DUCTWORK CONSTRUCTION CLASSES, SEAL, AND LEAKAGE CLASSES.
4. EXTERIOR LOUVERS ARE INDICATED FOR LOCATION ONLY.
5. SMOKE DETECTORS SHALL BE FURNISHED AND WIRED TO THE FIRE ALARM SYSTEM BY DIVISION 28. DIVISION 23 SHALL MOUNT THE DETECTORS IN DUCTWORK, WHERE REQUIRED BY CODE AND DIVISION 23, DIVISION 23 SHALL WIRE THE DETECTORS TO THE BAS SYSTEM AND FAN STARTERS FOR SHUTDOWN.
6. SMOKE DAMPERS SHALL BE UL555S LISTED. FIRE DAMPERS SHALL BE UL555 LISTED. PROVIDE FIRE DAMPERS, SMOKE DAMPERS AND FIRE/SMOKE DAMPERS AND ASSOCIATED ACCESS PANELS IN COMPLIANCE WITH APPLICABLE BUILDING AND MECHANICAL CODES AND NFPA 90A. ACCESS DOOR DIMENSIONS SHALL MEET REQUIREMENTS OF NFPA 90A AND NFPA 80.
7. REFER TO REFLECTED CEILING PLANS FOR EXACT LOCATIONS OF AIR TERMINAL DEVICES.
8. INTERNAL AIR FLOW DIMENSIONS ARE SHOWN FOR DUCTS. CONTRACTOR SHALL INCREASE SIZE FOR LINER IF APPLICABLE.
9. DIFFUSER SIZES SHOWN ARE NECK SIZES; REGISTER AND GRILLE SIZE ARE NOMINAL. REFER TO DIFFUSER SCHEDULE FOR DUCT RUN-OUT SIZES.
10. PROVIDE FLEXIBLE CONNECTIONS ON ALL DUCTS CONNECTING TO FANS AND AIR HANDLING UNITS UNLESS INTERNALLY ISOLATED. ALL DUCTS TO BE GROUNDED ACROSS FLEXIBLE CONNECTION WITH FLEXIBLE COPPER GROUNDING STRAPS.
11. THE INSIDE OF DUCTWORK AND ALL MECHANICAL COMPONENTS VISIBLE THROUGH A GRILLE OR DIFFUSER SHALL BE PAINTED FLAT BLACK.
12. ALL RETURN AIR OPENINGS ABOVE CEILING SHALL BE PROVIDED WITH A 1/2" MESH ALUMINUM SCREEN (80% FREE AREA MINIMUM).
13. INSULATE DUCTWORK: PERFORM TESTS BEFORE INSULATING.
14. ELBOWS IN DUCT SYSTEMS SHALL BE FULL RADIUS (CENTERLINE RADIUS = 1.5 DUCT WIDTH) WHERE SPACE PERMITS. WHERE LIMITED CLEARANCE OCCURS, PROVIDE SHORT RADIUS ELBOW WITH FULL LENGTH SPLITTER VANES PER SMACNA. MITERED (SQUARE) ELBOWS WITH TURNING VANES SHALL NOT BE USED.
15. UNLESS INDICATED OTHERWISE AND AS A MINIMUM PROVIDE 24"x24" MINIMUM SIZE CLEANOUTS IN KITCHEN EXHAUST DUCTS AT CHANGES IN DIRECTION, AT BASES OF RISERS, AND EVERY 10 FEET IN STRAIGHT RUNS.
16. MANUAL DAMPERS ARE NOT SHOWN ON THE DRAWINGS IN ORDER FOR DRAWING CLARITY. PROVIDE MANUAL ADJUSTABLE DAMPERS ON EACH LOW PRESSURE SUPPLY RETURN AND EXHAUST DUCT TAKE OFF, AND AT EACH TAKE OFF TO REGISTERS, GRILLES AND DIFFUSERS.

PIPING SPECIFIC NOTES:

1. VERIFY ALL EQUIPMENT CONNECTIONS WITH MANUFACTURER CERTIFIED DRAWINGS. VERIFY AND PROVIDE FITTINGS TO TRANSITION TO FURNISHED EQUIPMENT CONNECTION SIZES. FIELD VERIFY AND COORDINATE ALL DIMENSIONS BEFORE FABRICATION.
2. ALL CONDENSATE DRAIN LINES SHALL BE PIPED FULL SIZE OF THE UNIT DRAIN OUTLET, WITH "P" TRAP, CONNECTED TO BUILDING DRAINAGE SYSTEMS. SIZE DEPTH OF TRAP FOR ASSOCIATED AIR PRESSURE DIFFERENTIAL. REFER TO DETAIL ON DRAWINGS.
3. PERFORM TEST BEFORE INSULATING PIPING.
4. PROVIDE HANGERS, CLAMPS, OFFSETS, EXPANSION JOINTS, ANCHORS AND GUIDES TO PREVENT STRESS ON PIPING.
5. PROVIDE VENTS AT HIGH POINTS IN PIPING SYSTEMS AND DRAIN VALVES AT LOW POINTS.
6. PROVIDE AT LEAST THREE-ELBOW SWING FOR PIPE TAKE-OFFS TO TERMINAL EQUIPMENT AND RISERS.
7. ISOLATION VALVES IN PIPING SYSTEMS ARE NOT SHOWN ON PLANS (FOR CLARITY) BUT ARE REQUIRED AT ALL PIPE BRANCHES AND CONNECTIONS TO EQUIPMENT REFER TO DETAIL SHEETS AND FLOW DIAGRAMS.
8. PITCH HYDRONIC (WATER) PIPING UPWARD IN DIRECTION OF FLOW. PITCH STEAM AND CONDENSATE PIPING DOWNWARD IN DIRECTION OF FLOW. PITCH FUEL OIL PIPING TOWARD TANK. REFER TO SPECIFICATIONS FOR REQUIRED PITCH (I.E. GRADE OR SLOPE).
9. REFER TO EQUIPMENT SCHEDULES FOR PIPE RUN-OUT SIZES TO INDIVIDUAL PIECES OF EQUIPMENT.

RENOVATION PRE-BID SITE VISIT AND DEMOLITION NOTES

PRE-DEMOLITION TESTING, ADJUSTING AND BALANCING

1. CONFIRM SUPPLY AND EXHAUST SYSTEM AIRFLOW CAPACITY THROUGH PRE-CONSTRUCTION TESTING AND BALANCING REPORTS OF SYSTEMS TO BE EXTENDED. REPORTS SHALL INCLUDE COMPLETE FAN INFORMATION, CFM, ESP, TSP, RPM, VOLTS, AMPS AND VFD SPEEDS. PROVIDE AIRFLOW IN CFM AND DUCT STATIC PRESSURE MEASUREMENTS IN DUCT SYSTEMS TO DOCUMENT PERFORMANCE AT ALL SPACES SERVED BY SYSTEM, BOTH WITHIN PROJECT WORK SCOPE AREA AND BEYOND PROJECT WORK SCOPE AREA.
2. CONFIRM HYDRONIC SYSTEM CAPACITY THROUGH PRE-CONSTRUCTION TESTING AND BALANCING REPORTS OF SYSTEMS TO BE EXTENDED. REPORTS SHALL INCLUDE PIPE SIZE, FLOW RATE, SUPPLY PRESSURE AND RETURN PRESSURE. PROVIDE HYDRONIC SYSTEM FLOW (GPM) AND PIPE SYSTEM PRESSURE (PSIG) MEASUREMENTS IN PIPING SYSTEMS TO DOCUMENT PERFORMANCE AT ALL SPACES SERVED BY SYSTEM, BOTH WITHIN PROJECT WORK SCOPE AREA AND BEYOND PROJECT WORK SCOPE AREA.

DEMOLITION NOTES

1. SITE VISIT: BEFORE SUBMITTING BID, VISIT AND CAREFULLY EXAMINE SITE TO IDENTIFY EXISTING CONDITIONS AND DIFFICULTIES THAT WILL AFFECT WORK OF THIS SECTION. NO EXTRA PAYMENT WILL BE ALLOWED FOR ADDITIONAL WORK CAUSED BY UNFAMILIARITY WITH SITE CONDITIONS THAT ARE VISIBLE OR READILY CONSTRUED BY EXPERIENCED OBSERVER. SITE VISIT IS PARTICULARLY IMPORTANT BECAUSE THIS IS RENOVATION WORK.
2. EXISTING CONDITIONS AND PREPARATORY WORK: BEFORE STARTING WORK IN A PARTICULAR AREA OF THE PROJECT, VISIT SITE AND EXAMINE CONDITIONS UNDER WHICH WORK MUST BE PERFORMED INCLUDING PREPARATORY WORK DONE UNDER OTHER SECTIONS OR CONTRACTS BY OWNER. REPORT CONDITIONS THAT MIGHT AFFECT WORK ADVERSELY IN WRITING TO ARCHITECT AND OWNER. DO NOT PROCEED WITH WORK UNTIL DEFECTS HAVE BEEN CORRECTED AND CONDITIONS ARE SATISFACTORY. COMMENCEMENT OF WORK SHALL BE CONSTRUED AS COMPLETE ACCEPTANCE OF EXISTING CONDITIONS AND PREPARATORY WORK.
3. DEMOLITION SHALL BE COORDINATED WITH OWNER, ARCHITECT, GENERAL CONTRACTOR, CONSTRUCTION MANAGER AND ENGINEER.
4. PROVIDE MECHANICAL DEMOLITION TERMINATION; CUT, VALVE AND CAP. DROP MECHANICAL DISTRIBUTION TO FLOOR. REMOVAL OF SYSTEM EQUIPMENT SHALL BE BY THE HVAC CONTRACTOR.
5. PROVIDE 2 WEEKS NOTICE TO OWNER OPERATIONS FOR SHUT DOWN OF ANY SERVICES AND/OR SYSTEMS.
6. REFER TO ALL DRAWINGS FOR GENERAL DESCRIPTION OF AREAS REQUIRING DEMOLITION.
7. REFER TO CONSTRUCTION MANAGER INSTRUCTIONS FOR ALL EXISTING EQUIPMENT AND MATERIALS THAT SHALL REMAIN THE PROPERTY OF THE OWNER.
8. ITEMS OF VALUE WHICH ARE NOT DIRECTED TO BE RETURNED TO THE OWNER, SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED FROM SITE AND LEGALLY DISPOSED OF. STORAGE OR SALE OF ITEMS ON THE PROJECT SITE IS PROHIBITED.
9. PROTECTION: ENSURE THE SAFE PASSAGE OF PERSONS IN AND AROUND THE BUILDING DURING DEMOLITION. PREVENT INJURY TO PERSONS AND DAMAGE TO PROPERTY. PROVIDE ADEQUATE SHORING AND BRACING TO PREVENT COLLAPSE. IMMEDIATELY REPAIR DAMAGED PROPERTY TO THE CONDITION BEFORE BEING DAMAGED. TAKE EFFECTIVE MEASURES TO PREVENT WINDBLOWN DUST.
10. UTILITIES: MAINTAIN ALL UTILITIES EXCEPT THOSE REQUIRING REMOVAL OR RELOCATION. KEEP UTILITIES IN SERVICE AND PROTECT FROM DAMAGE. DO NOT INTERRUPT UTILITIES SERVING OCCUPIED AREAS WITHOUT FIRST OBTAINING PERMISSION FROM THE CLINET IN WRITING. PROVIDE TEMPORARY SERVICES.
11. DRAWINGS ARE DIAGRAMMATIC ONLY AND REFLECT OVERALL SYSTEM REMOVAL. NOT EVERY ITEM OR COMPONENT OF A SYSTEM IS SHOWN.
12. PROVIDE SHUT DOWN OF SERVICES (FANS, PUMPS, AHUS, ETC.) AND TRACING OF ALL RISERS WITHIN BASE BID.

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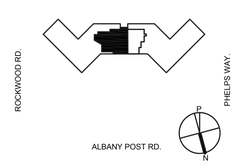
TEL 212.370.1776

Key Plan:



Project Address: 1 ROCKWOOD ROAD SLEEPY HOLLOW NY 10591

Revision	Date	Description
	04/07/21	ISSUE FOR BID
	05/13/21	ISSUE FOR BID
	05/25/21	ISSUE FOR PERMIT
	06/01/21	ISSUE FOR BID

Plot Date::

Professional Seal and Signature:

FCA FRANCIS CAUFFMAN ARCHITECTS
FCA Project: 20-7168 Author
ARCHITECTURE

Drawing: HVAC LEGEND, ABBREVIATION & GENERAL NOTES, SHEET NO. 1

SCALE: As indicated FLOOR:

M-001

PRINTED: FILE:

PIPING LEGEND

- GATE VALVE
- BALL VALVE
- BALL VALVE WITH MEMORY STOP (BALANCING VALVE)
- BALL VALVE WITH HOSE BIBB, CAP & CHAIN (DRAIN VALVES)
- BUTTERFLY VALVE
- BUTTERFLY VALVE WITH MEMORY STOP (BALANCING VALVE)
- GLOBE VALVE
- PLUG VALVE
- PRESSURE REDUCING VALVE
- CHECK VALVE
- STRAINER W/BALL VALVE, HOSE BIBB & CAP (GATE VALVE FOR STEAM)
- FLOAT OPERATED VALVE
- STRAINER, DUPLEX
- ANGLE VALVE (SECTION VIEW)
- ANGLE VALVE (PLAN VIEW)
- STRAINER, BASKET TYPE W/DRAIN VALVE, HOSE BIBB & CAP
- SOLENOID VALVE
- AUTOMATIC CONTROL VALVE, MODULATING ACTUATOR
- AUTOMATIC CONTROL VALVE, TWO POSITION ACTUATOR
- THREE WAY AUTOMATIC CONTROL VALVE, MODULATING ACTUATOR
- THREE WAY AUTOMATIC CONTROL VALVE, TWO POSITION ACTUATOR
- AUTOMATIC FLOW CONTROL VALVE (PRESSURE INDEPENDENT)
- COMBINATION FLOWMETER/SHUT OFF/BALANCING VALVE (CIRCUIT SETTER)
- FM — FLOW MEASURING DEVICE
- FLOW SWITCH
- SAFTEY RELIEF VALVE
- UNION OR FLANGE (AS INDICATED BY PIPE SIZE - SEE SPEC.)
- BLIND FLANGE
- END CAP
- PRESSURE GAUGE WITH GAUGE CLOCK
- STEAM PRESSURE GAUGE WITH A GAUGE COCK AND COIL SYPHON
- THERMOMETER
- FAT — FLOAT & THERMOSTATIC STEAM TRAP
- IB — INVERTED BUCKET STEAM TRAP
- T — THERMOSTATIC STEAM TRAP
- TD — THERMODYNAMIC STEAM TRAP
- VB — VACUUM BREAKER
- PT — PRESSURE/TEMPERATURE WELL
- OR AAV — AUTOMATIC AIR VENT WITH ISOLATION VALVE
- MAV — MANUAL AIR VENT
- TAV — THERMOSTATIC AIR VENT (STEAM ONLY)
- REDUCER (ECCENTRIC-FLAT ON BOTTOM OR FLAT ON TOP)
- REDUCER (CONCENTRIC)
- FLEXIBLE CONNECTION
- E — EXPANSION JOINT
- PIPE GUIDE
- ANCHOR
- QUICK OPENING VALVE (USED WITH BLOW DOWN)
- QUICK CLOSING VALVE, FUSIBLE LINK (USED WITH FUELS)
- RISE (SINGLE LINE - PLAN VIEW)
- DROP (SINGLE LINE - PLAN VIEW)
- VALVE IN VERTICAL
- TOP TAKEOFF
- BOTTOM TAKEOFF
- PIPE BREAK (SINGLE LINE)
- W — WATER METER DIAL TYPE
- DIRT LEG
- CO — CLEAN-OUT FOR CONDENSATE DRAIN
- RISE (DOUBLE LINE - PLAN VIEW)
- DROP (DOUBLE LINE - PLAN VIEW)
- PIPE BREAK (DOUBLE LINE)
- DIRECTION OF FLOW IN PIPE
- UP — PITCH PIPE UP IN DIRECTION OF FLOW
- DN — PITCH PIPE DOWN IN DIRECTION OF FLOW
- NEW WORK
- NEW SUPPLY LINES
- NEW RETURN LINES
- EXISTING PIPING TO REMAIN
- OR — DEMO/EXISTING TO BE REMOVED
- FUTURE

FLOW DIAGRAM EQUIPMENT SYMBOLS

- FILTER BANK
- HEATING COIL
- PREHEAT COIL
- REHEAT COIL
- COOLING COIL
- CABINET HEATER
- UNIT HEATER
- VFD — VARIABLE FREQUENCY DRIVE
- FINNED TUBE RADIATION
- SDET — SMOKE DETECTOR
- PUMP
- CENTRIFUGAL FAN WITH INLET GUIDE VANES
- CENTRIFUGAL FAN
- PROPELLER FAN
- TUBEAXIAL OR VANEAXIAL FAN
- INLINE CENTRIFUGAL FAN
- OPPOSED BLADE DAMPER W/ TWO POSITION ACTUATOR
- OPPOSED BLADE DAMPER W/ MODULATING ACTUATOR
- PARALLEL BLADE DAMPER W/ TWO POSITION ACTUATOR
- PARALLEL BLADE DAMPER W/ MODULATING ACTUATOR
- BACKDRAFT DAMPER
- AIR TERMINAL BOX
- AIR TERMINAL BOX WITH REHEAT COIL

CALL OUT SYMBOLS

- CONNECT NEW TO EXISTING
- POINT OF DISCONNECT
- 1 / H3.1 — SECTION DESIGNATION / SHEET NUMBER
- 1 / H3.1 — DETAIL DESIGNATION / SHEET NUMBER
- 1 — REVISION NUMBER
- S/R / 1 — SUPPLY OR RETURN AIR RISER DESIGNATION
- HWS / 1 — PIPING SYSTEM RISER DESIGNATION
- EQUIPMENT ACCESS ZONE
- TEXT INDICATES DRAWING TO REFERENCE FOR CONTINUATION
- SYMBOL DESIGNATES ASSOCIATED SYSTEM OR SERVICE (CHW, HW, S15, LPS, LPR)
- DIFFUSER, GRILLE, REGISTER LETTER DESIGNATOR (SEE SCHEDULE FOR ATD TYPE)
- DESIGN CFM
- A(200) / (200) — ALTERNATE CFM LOCATION

REFER TO CONTROLS LEGEND SHEET FOR SYMBOLS USED ON FLOOR PLANS TO INDICATE LOCATION OF TEMPERATURE SENSORS/THERMOSTATS, HUMIDITY SENSORS, PRESSURE SENSORS AND GAS SENSORS (E.G. CARBON DIOXIDE)

DUCTWORK

SINGLE LINE	DOUBLE LINE
NEW DUCT LINETYPE	
ROUND SUPPLY DUCT UP	
SUPPLY DUCT UP	
ROUND SUPPLY DUCT DN	
SUPPLY DUCT DOWN	
STANDARD RADIUS ELBOW (R = W) SUPPLY/RETURN EXHAUST	R
BULLHEAD SPLIT SUPPLY	GOOD FOR TAKEOFF TO RING DUCT
TAKEOFF TO DIFF/GRILLE W/BRANCH TAKE-OFF VOLUME DAMPER	HARD ELBOW
CEILING DUCT MTD DIFF/GRILLE W/BRANCH TAKE-OFF VOLUME DAMPER	
ACOUSTICALLY LINED DUCT	
EXISTING DUCT TO REMAIN	
OR — EXISTING DUCT TO BE REMOVED	OR
OPEN END DUCT W/VD & 1/2"x1/2" WMS	

SINGLE LINE	DOUBLE LINE
EXISTING DUCT LINETYPE	
ROUND RETURN OR EXHAUST DUCT UP	
RETURN/EXHAUST DUCT UP	
RETURN/EXHAUST DUCT DOWN	
ROUND RETURN OR EXHAUST DUCT DN	
HORIZONTAL OFFSET SUPPLY/RETURN /EXHAUST	
RISE/DROP — RISE OR DROP SUPPLY/RETURN/ EXHAUST	RISE/DROP
90° TAKE-OFF W/BRANCH TAKE-OFF VOLUME DAMPER (VD IN LOW PRESSURE SYSTEMS ONLY)	RING DUCT
BULLHEAD CONVERGE RETURN/EXHAUST W/BRANCH TAKE-OFF VOLUME DAMPER	
SIDEWALL DUCT MTD REGISTER/GRILLE W/BRANCH TAKE-OFF VOLUME DAMPER	
SUPPLY SIDEWALL LINEAR DIFFUSER (W/ 1" INTERNALLY LINED SM PLENUM) BRANCH CONN W/VD FOR EVERY 4' OF LINEAR	
SUPPLY CEILING LINEAR DIFFUSER (W/ 1" INTERNALLY LINED SM PLENUM) BRANCH CONN W/VD FOR EVERY 4' OF LINEAR	BOOT BY LD MFR
FLEXIBLE DUCT	

- AVS — AIR VOLUME TRAVERSE STATION
- SGD — SLIDE GATE DAMPER
- VD — MANUAL VOLUME DAMPER
- FD — SELF-CLOSING FIRE DAMPER W/ACCESS DOOR
- ACD — AUTOMATIC CONTROL DAMPER W/ACCESS DOOR
- SD — AUTOMATIC SMOKE DAMPER W/ACCESS DOOR
- FSD — COMBINATION FIRE/SMOKE DAMPER W/ACCESS DOOR
- BDD — BACKDRAFT DAMPER
- STANDARD 4-WAY BLOW SUPPLY DIFFUSER
- BLANKED FOR 3-WAY BLOW SUPPLY DIFFUSER
- OR — BLANKED FOR 2-WAY BLOW SUPPLY DIFFUSER
- BLANKED FOR 1-WAY BLOW SUPPLY DIFFUSER
- OR — ROOF EXHAUST FAN SHOWN ON ROOF
- OR — ROOF EXHAUST FAN SHOWN ON FLOOR PLAN
- UC 1/2" — UNDERCUT DOOR
- LVDR 1.5 SF — LOUVERED DOOR
- RETURN OR EXHAUST AIR FLOW
- SUPPLY AIR FLOW
- T — THERMOSTAT

REGENERON
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ACOUSTICS
CERAMI ASSOCIATES
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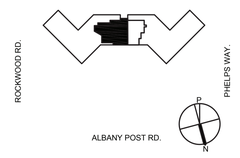
Key Plan:

ROCKWOOD RD.



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SCALE: As indicated FLOOR:

M-002

PRINTED: FILE:

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. INSTALL ALL NEW WORK IN A NEAT WORKMANLIKE MANNER READILY ACCESSIBLE FOR OPERATION, MAINTENANCE AND REPAIR.

B. CODES, PERMITS AND INSPECTIONS:
1. ALL WORK SHALL COMPLY WITH REQUIREMENTS OF THE 2014 NYC BUILDING CODE, NYC BUILDING DEPARTMENT, BUILDING MANAGEMENT, AND ALL AUTHORITIES HAVING JURISDICTION AND APPLICABLE NATIONAL, STATE AND LOCAL CODES, LAWS AND REGULATIONS GOVERNING OR RELATING TO ANY PORTION OF THIS WORK SHALL BE INCORPORATED INTO AND MADE A PART OF THESE SPECIFICATIONS. CONTRACTOR IS TO INFORM ENGINEER OF ANY EXISTING WORK OR MATERIALS WHICH VIOLATE ANY OF THE ABOVE LAWS AND REGULATIONS. ANY WORK DONE BY THE CONTRACTOR CAUSING SUCH VIOLATION SHALL BE CORRECTED AT THE CONTRACTOR'S EXPENSE BY THIS CONTRACTOR AND AT NO EXPENSE TO THE OWNER.
2. THIS CONTRACTOR SHALL OBTAIN ALL EQUIPMENT APPROVALS AS REQUIRED BY STATE AND LOCAL AUTHORITIES. PERMITS SHALL BE TURNED OVER TO OWNER AT JOB COMPLETION.

C. SITE VERIFICATION:
1. PRIOR TO SUBMISSION OF THE BID, THIS CONTRACTOR SHALL VISIT THE JOB SITE TO ASCERTAIN THE ACTUAL FIELD CONDITIONS AS THEY RELATE TO THE WORK INDICATED ON THE DRAWINGS AND DESCRIBED HEREIN. DISCREPANCIES, IF ANY, SHALL BE BROUGHT TO THE ENGINEER=S ATTENTION PRIOR TO SUBMISSION OF THE BID, AND IF NOT RESOLVED TO SATISFACTION, SHALL BE SUBMITTED AS A WRITTEN QUALIFICATION OF THE BID. SUBMISSION OF A BID SHALL BE EVIDENCE THAT SITE VERIFICATION HAS BEEN PERFORMED AS DESCRIBED ABOVE.

D. CONTRACT DOCUMENTS:
1. PRIOR TO SUBMISSION OF A FORMAL BID, THIS CONTRACTOR SHALL REVIEW ALL DRAWINGS OF THE ENTIRE PROJECT INCLUDING GENERAL CONSTRUCTION, DEMOLITION, ARCHITECTURAL, MECHANICAL, ELECTRICAL, PLUMBING AND SPRINKLER AND SHALL INCLUDE ANY WORK REQUIRED IN THE BID WHICH IS INDICATED OR IMPLIED TO BE PERFORMED BY THIS TRADE IN OTHER SECTIONS OF THE WORK.
2. DRAWINGS ARE DIAGRAMMATIC AND INDICATE GENERAL ARRANGEMENT OF WORK AND APPROXIMATE LOCATION OF EQUIPMENT. REFER TO ARCHITECTURAL DRAWINGS FOR ALL DIMENSIONS AND COORDINATE FINAL LOCATIONS OF DIFFUSERS, GRILLES, REGISTERS, THERMOSTATS, SENSORS, SWITCHES AND ANY WALL MOUNTED DEVICES. ALL WORK SHALL BE COORDINATED WITH OTHER TRADES TO AVOID CONFLICT.
3. IF A CONFLICT OCCURS IN THE SPECIFICATIONS AND/OR ON THE DRAWINGS, THE MORE STRINGENT SITUATION SHALL APPLY.

E. GUARANTEE:
1. ALL MATERIALS AND WORKMANSHIP SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR FROM DATE OF FINAL ACCEPTANCE OF THIS WORK. FINAL ACCEPTANCE SHALL BE DEFINED AS THE TIME AT WHICH THE MECHANICAL WORK IS TAKEN OVER AND ACCEPTED BY THE OWNER, AND IS UNDER CARE, CUSTODY, AND CONTROL OF THE OWNER. ENGAGE THE SERVICES OF VARIOUS MANUFACTURERS SUPPLYING THE EQUIPMENT FOR THE PROPER STARTUP AND OPERATION OF ALL SYSTEMS INSTALLED. INSTRUCT THE OWNER'S PERSONNEL IN THE PROPER OPERATION AND SERVICING OF THE SYSTEM.
2. THE CONTRACTOR SHALL GUARANTEE TO REPLACE OR REPAIR PROMPTLY AND ASSUME RESPONSIBILITY FOR ALL EXPENSES INCURRED FOR ANY WORKMANSHIP AND EQUIPMENT IN WHICH DEFECTS DEVELOP WITHIN THE GUARANTEE PERIOD. THIS WORK SHALL BE DONE AS DIRECTED BY THE OWNER. THIS GUARANTEE SHALL INCLUDE RESPONSIBILITY FOR ALL EXPENSES INCURRED IN REPAIRING AND REPLACING WORK OF OTHER TRADES AFFECTED BY DEFECTS, REPAIRS OR REPLACEMENTS IN EQUIPMENT SUPPLIED BY THIS CONTRACTOR.
3. THIS CONTRACTOR IS RESPONSIBLE FOR THE MAINTENANCE AND OPERATION OF ALL SYSTEMS UNTIL THE FINAL ACCEPTANCE OF THE WORK.
4. ALL AIR CONDITIONING UNIT COMPRESSORS AND REFRIGERATION COMPONENTS SHALL HAVE A 5-YEAR WARRANTY.

F. THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION AIA DOCUMENT A201, LATEST EDITION, OR AS REQUIRED BY THE ARCHITECT'S DOCUMENTS, AND/OR THE STRUCTURAL ENGINEER'S DOCUMENTS, AS APPLICABLE, ARE PART OF THIS CONTRACT.

G. DEFINITIONS:
1. MECHANICAL CONTRACTOR, "THIS CONTRACTOR" - THE PARTY OR PARTIES HAVE BEEN DULY AWARDED THE CONTRACT FOR AND ARE THEREBY MADE RESPONSIBLE FOR THE MECHANICAL WORK AS DESCRIBED HEREIN.
2. "THIS CONTRACT", "THE CONTRACT" - THE AGREEMENT COVERING THE WORK TO BE PERFORMED BY THIS CONTRACTOR.
3. "APPROVED", "EQUAL", "SATISFACTORY", "ACCEPTED", "ACCEPTABLE", "EQUIVALENT" - SUITABLE FOR USE ON THE PROJECT, AS DETERMINED BY THE ENGINEER BASED ON DOCUMENTS PRESENTED FOR SUCH DETERMINATION.
4. "THESE SPECIFICATIONS", "THIS SECTION, PART, DIVISION" (OF THE SPECIFICATION) - THE DOCUMENT SPECIFYING THE WORK TO BE PERFORMED BY "THIS CONTRACTOR".
5. "THE MECHANICAL WORK", "THIS WORK" - ALL LABOR MATERIALS, EQUIPMENT, APPARATUS, CONTROLS, ACCESSORIES, AND OTHER ITEMS REQUIRED FOR A PROPER AND COMPLETE INSTALLATION BY THE MECHANICAL CONTRACTOR.
6. "ARCHITECT", "ENGINEER", "OWNER'S REPRESENTATIVE" - THE PARTY OR PARTIES RESPONSIBLE FOR INTERPRETING, ACCEPTING AND OTHERWISE RULING ON THE PERFORMANCE UNDER THIS CONTRACT.
7. "FURNISH" - PURCHASE AND DELIVER TO THE PROJECT SITE COMPLETE WITH EVERY NECESSARY APPURTENANCE AND SUPPORT, ALL AS PART OF THE MECHANICAL WORK.
8. "INSTALL" - UNLOAD AT THE DELIVERY POINT AT THE SITE AND PERFORM EVERY OPERATION NECESSARY TO ESTABLISH SECURE MOUNTING INSTALLATION AND CORRECT OPERATION AT THE PROPER LOCATION IN THE PROJECT, ALL AS PART OF THE MECHANICAL WORK.
9. "PROVIDE" - "FURNISH" AND "INSTALL".
10. "NEW" - MANUFACTURED WITHIN THE PAST TWO YEARS AND NEVER BEFORE USED.
11. "RELOCATE" - MOVE EXISTING EQUIPMENT AND ALL ACCESSORIES AS REQUIRED.
12. "REMOVE" - DISMANTLE AND CART AWAY FROM SITE INCLUDING ALL RELATED ACCESSORIES. ALL ITEMS SHALL BE LEGALLY DISPOSED OF. ALL OTHER EQUIPMENT AND OPERATIONS IN ANY WAY AFFECTED BY THE REMOVAL IS TO REMAIN IN FULL OPERATION. PROVIDE ALL NECESSARY COMPONENTS TO MAINTAIN SUCH OPERATION.

1.02 SCOPE OF WORK: ADDITION OF VAV BOXES, DUCTWORK, PIPING, UNIT HEATERS, AND CONTROLS. REPLACEMENT OF VAV BOXES, FPVAV BOX, CONTROL UPGRADES AND AIR AND WATER BALANCING.

A. PROVIDE ALL LABOR, MATERIALS, EQUIPMENT, AND CONTRACTOR'S SERVICES NECESSARY FOR COMPLETE, SAFE INSTALLATION OF ALL MECHANICAL WORK. THE SCOPE OF WORK SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING:
1. DEMOLITION AND REMOVAL OF ITEMS AS REQUIRED.
2. DUCTWORK AND DUCTWORK ACCESSORIES.
3. AIR DISTRIBUTION SYSTEM (AIR OUTLETS, VAV BOXES, ETC.).
4. PIPING AND PIPING ACCESSORIES INCLUDING ALL VALVING.
5. INSULATION OF PIPING AND DUCTWORK.
6. AUTOMATIC TEMPERATURE CONTROLS.
7. TESTING AND BALANCING.
8. CUTTING AND PATCHING.
9. SHOP DRAWINGS.
10. AS-BUILT DRAWINGS.
11. OPERATING AND MAINTENANCE MANUALS.
12. FULL COORDINATION WITH OTHER TRADES.
13. WARRANTY AND GUARANTY.
14. PREMIUM TIME FOR WORK TO BE PERFORMED AFTER-HOURS AS REQUIRED BY BUILDING MANAGEMENT AND/OR OWNER.
15. FILING, PERMITS, SPECIAL INSPECTIONS.
16. FULL TESTING AND STARTUP OF ALL SYSTEMS.
17. COMMISSIONING

B. SECURE CERTIFICATES, PAY ALL FEES AND CHARGES FOR ALL WORK INSTALLED, CERTIFYING COMPLIANCE WITH ALL AUTHORITIES. CONTRACTOR TO COORDINATE WITH OWNER FOR REQUIRED SPECIAL INSPECTIONS AND OBTAIN ALL APPROVALS. DELIVER CERTIFICATES TO OWNER FOR SIGNING BEFORE FILING.

1.03 COORDINATION WITH BUILDING MANAGEMENT

A. THIS CONTRACTOR IS TO OBTAIN A COPY OF THE BUILDING RULES AND REGULATIONS PRIOR TO BID SUBMISSION TO DETERMINE THE REQUIREMENTS AND THE EXTENT OF PREMIUM TIME WORK REQUIRED BY THE BUILDING.

B. THIS CONTRACTOR IS RESPONSIBLE FOR ADHERING TO THE BUILDING OWNER'S RULES AND REGULATIONS. ANY DISCREPANCIES BETWEEN THE CONTRACT DOCUMENTS AND THE BUILDING RULES AND REGULATIONS SHALL BE SUBMITTED IN WRITING TO THE ARCHITECT/ENGINEER FOR REVIEW WITH BID SUBMISSION.

C. COORDINATE WITH BUILDING OWNER FOR ANY SERVICE INTERRUPTION OF EXISTING SYSTEMS AND GIVE NOTICE AS REQUIRED BY BUILDING RULES AND REGULATIONS, OR CONTRACTOR TO PROVIDE A MINIMUM OF TWO (2) DAYS NOTICE PRIOR TO ANY WORK BEING PERFORMED, WHICHEVER IS THE MORE STRINGENT. CONTRACTOR IS TO PERFORM WORK ON PREMIUM TIME, IF SO DIRECTED BY BUILDING OWNER, SO AS NOT TO DISTURB EXISTING TENANTS ON OTHER FLOORS.

1.04 SHOP DRAWINGS

A. SUBMIT SHOP DRAWINGS CERTIFIED BY ALL TRADES THAT COORDINATION HAS BEEN COMPLETED. SUBMIT ALL CERTIFIED EQUIPMENT CUTS WITH CONSTRUCTION WIRING DIAGRAMS AND AUTOMATIC TEMPERATURE CONTROL REQUIREMENTS. SHOP DRAWINGS SUBMISSION SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING:
1. DUCTWORK - PROVIDE DUCT SHOP STANDARDS AND LEAKAGE TEST CERTIFICATION, AS REQUIRED, AND 3/8 SCALE DUCT LAYOUT.
2. PIPING LAYOUT AND APPURTENANCES - PROVIDE PIPING, VALVING, CHEMICAL TREATMENT, SHOP STANDARDS AND 3/8 SCALE PIPING LAYOUT WITH ALL VALVING.
3. INSULATION FOR DUCTWORK AND PIPING.
4. EQUIPMENT CATALOG CUTS FOR ALL ITEMS TO BE UTILIZED ON PROJECT (VAV BOXES, ETC.).
5. AIR OUTLETS (DIFFUSERS, REGISTERS, GRILLES, ETC.).
6. AUTOMATIC TEMPERATURE CONTROL DIAGRAMS, DEVICES AND SEQUENCE OF OPERATION.
7. CERTIFIED AIR AND WATER BALANCING REPORT.
8. AS-BUILT DRAWINGS AT PROJECT COMPLETION OF THE INSTALLED CONDITION OF WORK.

B. THE QUANTITY OF SHOP DRAWINGS SHALL AS A MINIMUM BE FOUR (4) COPIES OF 8-1/2" X 11" SUBMISSIONS AND FIVE (5) PRINTS OF ALL DRAWINGS. SPECIFIC JOB REQUIREMENTS MAY BE MORE STRINGENT, AND CONTRACTOR IS RESPONSIBLE TO OBTAIN REQUIREMENTS FROM OWNER, CONSTRUCTION MANAGER, AND GENERAL CONTRACTOR OR ARCHITECT.

C. THE CONTRACTOR SHALL ALLOW AN ADDITIONAL EIGHT (8) HOURS OF SKETCHING TIME FOR ANY REVISIONS REQUIRED DUE TO THE ENGINEER'S REVIEW OF SHOP DRAWINGS FOR EQUIPMENT, DUCTWORK AND PIPING LAYOUTS.

1.05 MAINTENANCE MANUALS

A. SUBMIT FOUR (4) LOOSE-LEAF BOUND OPERATING AND MAINTENANCE MANUALS WITH INDEX AND INDEX TABS TO INCLUDE THE FOLLOWING:
1. OPERATING AND MAINTENANCE INSTRUCTIONS ON ALL SYSTEMS.
2. MANUFACTURERS= CATALOG CUTS ON ALL EQUIPMENT.
3. AUTOMATIC TEMPERATURE CONTROL SYSTEMS WITH SEQUENCE OF OPERATIONS, CATALOG CUTS OF ALL DEVICES AND POINT-TO-POINT WIRING DIAGRAMS.
4. CERTIFIED FINAL AIR AND WATER BALANCING REPORT.
5. DUCT AND PIPING AS-BUILT DRAWINGS WITH VALVE CHART AND KEY PLAN DRAWINGS INSERTED IN BINDER.
6. ALL ITEMS SUBMITTED FOR REVIEW IN SHOP DRAWING SECTION.

1.06 AS-BUILT DRAWINGS

A. CONTRACTOR SHALL MAINTAIN RECORD DRAWING PRINTS ON JOB SITE AND RECORD, AT TIME OF OCCURRENCE, DEVIATIONS FROM CONTRACT DOCUMENTS DUE TO FIELD COORDINATION, BULLETINS, OR ADDENDA.

B. CONTRACTOR SHALL REVISE SHOP DRAWINGS TO CONFORM TO RECORD DRAWINGS AND SUBMIT AS-BUILT CONDITION (PIPING AND DUCTWORK) DRAWINGS UPON COMPLETION OF THE PROJECT. FINAL SUBMISSION OF REPRODUCIBLE AS-BUILT DRAWINGS ARE TO BE SIGNED AND CERTIFIED BY THE INSTALLING CONTRACTOR THAT THIS IS THE AS-BUILT CONDITION OF THE WORK.

1.07 SERVICE AND WARRANTY (MAINTENANCE CONTRACT)

A. THIS CONTRACTOR SHALL PROVIDE AS AN ADD ALTERNATE PRICE, A FULL ONE YEAR SERVICE AND WARRANTY OF ALL MECHANICAL COMPONENTS AND SYSTEMS, WITH PRICES FOR YEARS 2, 3 AND 4 FOLLOWING THIS FIRST YEAR. AT THE TIME OF ACCEPTANCE OF PROJECT, THE TENANT OR OWNER'S REPRESENTATIVE WILL DECIDE TO ACCEPT WHICH ALTERNATE, IF ANY.

1.08 SUBSTITUTIONS

A. NO SUBSTITUTE MATERIAL OR MANUFACTURER OF EQUIPMENT SHALL BE PERMITTED WITHOUT A FORMAL WRITTEN SUBMITTAL TO THE ENGINEER WHICH INCLUDES ALL DIMENSIONAL, PERFORMANCE AND MATERIAL SPECIFICATIONS. ANY CHANGES IN LAYOUT, ELECTRICAL CHARACTERISTICS, STRUCTURAL REQUIREMENTS, OR DESIGN DUE TO THE USE OF A SUBSTITUTION SHALL BE SUBMITTED TO THE ENGINEER AS PART OF THIS PROPOSAL. THE CONTRACTOR TAKES FULL RESPONSIBILITY FOR THE SUBSTITUTION AND ALL CHANGES RESULTING FROM SUBSTITUTION. ALL ITEMS SHALL BE SUBMITTED FOR REVIEW IN CONJUNCTION WITH THE SUBMITTAL OF THE SUBSTITUTION. ANY SUBSTITUTION MUST BE SUBMITTED WITH AN EXPLANATION AS TO WHY A SUBSTITUTION IS BEING UTILIZED. IF THE SUBSTITUTED ITEM DEVIATES FROM THE SPECIFIED ITEM, THOSE DEVIATIONS ARE TO BE IDENTIFIED ON A LINE-BY-LINE BASIS. IF THE SUBSTITUTE IS BEING UTILIZED FOR FINANCIAL REASONS, THE ASSOCIATED CREDIT MUST BE SIMULTANEOUSLY SUBMITTED.

B. ALL SUBSTITUTED EQUIPMENT SHALL CONFORM TO SPACE REQUIREMENTS AND PERFORMANCE REQUIREMENTS SHOWN ON CONTRACT DOCUMENTS. CONTRACTOR SHALL REPLACE ANY EQUIPMENT THAT DOES NOT MEET THESE REQUIREMENTS AT HIS OWN EXPENSE. ANY MODIFICATIONS TO ASSOCIATED SYSTEMS OR ADDITIONAL COSTS ATTRIBUTED TO THIS SUBSTITUTION SHALL BE AT THIS CONTRACTOR'S EXPENSE.

C. CONTRACTOR SHALL SUBMIT BID BASED ON SPECIFIED ITEMS AND SHALL SUPPLY AS AN ALTERNATE PRICE ANY SUBSTITUTIONS.

1.09 ACCESS DOORS IN GENERAL CONSTRUCTION

A. THIS CONTRACTOR SHALL SUBMIT TO THE ARCHITECT FOR APPROVAL A PLAN INDICATING THE SIZE AND LOCATION OF ALL ACCESS DOORS REQUIRED FOR OPERATION AND MAINTENANCE OF ALL CONCEALED EQUIPMENT, DEVICES, VALVES, DAMPERS AND CONTROLS. CONTRACTOR SHALL ARRANGE FOR FURNISHING AND INSTALLATION OF ALL ACCESS DOORS IN FINISHED CONSTRUCTION AND INCLUDE COSTS IN THE BID. ACCESS DOORS SHALL BE OF ADEQUATE SIZE TO PROVIDE ACCESS TO CONCEALED ITEMS FOR OPERATION AND MAINTENANCE, WITH A MINIMUM SIZE OF 24" X 24".

B. APPROVED MANUFACTURERS: KARP, MIL-COR, RUSKIN.

1.10 UNIT PRICES

A. GENERAL:
1. AMOUNTS INDICATED SHALL BE FOR WORK FULLY INSTALLED, COMPLETE WITH ALL ASSOCIATED COMPONENTS. AMOUNTS INDICATED SHALL BE BINDING FOR THE DURATION.
2. UNIT PRICES SHALL INCLUDE ALL RELATED GENERAL CONDITIONS, OVERHEAD, PROFIT, INSURANCES, LABOR, ENGINEERING MATERIALS, SUPERVISION AND FRINGES REQUIRED. UNIT PRICES TO BE TAKEN EQUALLY FOR ALL ADDS AND DEDUCTS TO THE CONTRACT DOCUMENTS.
3. UNIT PRICES ARE TO BE OF MAXIMUM PRICE, NOT TO EXCEED COST UNDER ANY CIRCUMSTANCES.

B. LIST OF UNIT PRICES:
1. MECHANICAL

a. PIPING - STEEL SCHEDULE 40 ($/LIN. FT.)
- STEEL SCHEDULE 80 ($/LIN. FT.)

DESCRIPTION	ADD	DEDUCT
INCH (INSULATED)		
INCH (UNINSULATED)		

a. PIPING - COPPER ($/LIN. FT.)

DESCRIPTION	ADD	DEDUCT
INCH (INSULATED)		
INCH (UNINSULATED)		

b. VALVES ($/EACH):

SIZE	GATE	GLOBE VALVE*	PLUG VALVE*	BALL	CHECK	BUTTERFLY	CONTROL

CONTROL VALVES:
*BALL VALVES FOR 2-1/2 IN. AND SMALLER
*BUTTERFLY VALVES FOR 4 IN. AND LARGER

c. INSULATION ($/SQ. FT.)

DESCRIPTION	ADD	DEDUCT
PIPING FIBERGLASS		
CALCIUM SILICATE		
DUCTWORK (FIBERGLASS)		

d. DUCTWORK AND ACCESSORIES

DESCRIPTION	ADD	DEDUCT
$/LB. OF LOW PRESSURE DUCTWORK		
$/LB. OF MEDIUM PRESSURE DUCTWORK		
$/LB. OF DOUBLE-WALL DUCTWORK WITH PERFORATED LINER		
$/FT. OF LINEAR DIFFUSER INSTALLED		
$/DIFFUSER INSTALLED		
$/FIRE/SMOKE DAMPER INSTALLED		
FIRE DAMPER		
SMOKE DAMPER		
ELECTRIC MOTOR AND WIRING		
$/VOLUME DAMPER INSTALLED		
$/MOTORIZED DAMPER INSTALLED		
$/SOUND ATTENUATORS		
$/SQ. FT. ACCESS BOX		
$/VAV BOX		
$/VAV DIFFUSER		
$/THERMOSTAT		
$/SENSOR		

PART 2 - PRODUCTS/APPLICATIONS

2.01 DUCTWORK AND ACCESSORIES

A. ALL DUCTWORK SHALL BE FABRICATED AND INSTALLED IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE, LATEST EDITION, SMACNA HVAC AIR DUCT LEAKAGE TEST MANUAL, LATEST EDITION, NFPA 90A LATEST EDITION, AND 2014 NEW YORK CITY BUILDING CODE. THE MORE STRINGENT REQUIREMENT OF ANY CODES SHALL APPLY.

B. PROVIDE ALL SUPPORTING AND HANGING DEVICES IN ACCORDANCE WITH NEW YORK CITY BUILDING CODE AND SMACNA.

C. DUCTWORK LAYOUT AND ROUTING IS SCHEMATIC, AND THE MECHANICAL CONTRACTOR IS RESPONSIBLE FOR ALL DUCT SIZE CHANGES AND RELOCATIONS TO ACCOMMODATE SPACE AND STRUCTURAL CONDITIONS. OFFSETS AND TRANSFORMATIONS SHALL PRESERVE THE FULL INSIDE CROSS-SECTIONAL AREA OF DUCTWORK SHOWN ON THE DRAWINGS.

D. DUCTWORK (NEW AND EXISTING TO BE REUSED) SHALL HAVE PRESSURE CLASSIFICATION, SEALING REQUIREMENTS AND LEAKAGE TESTING IN ACCORDANCE WITH SMACNA AND AS LISTED BELOW UNLESS OTHERWISE SPECIFIED OR SHOWN ON THE DRAWINGS.
1. 4" CLASS: ALL SUPPLY DUCTWORK FROM DISCHARGE OF AIR UNITS TO INLETS OF TERMINAL BOXES. SEAL CLASS B, LEAKAGE CLASS 4.
2. 2" CLASS: ALL OTHER LOW-PRESSURE DUCTWORK (SUPPLY, RETURN, EXHAUST). SEAL CLASS B, LEAKAGE CLASS 6.
3. LEAKAGE TESTING:
ALL TESTING SHALL BE DONE IN THE PRESENCE OF THE ENGINEER OR OWNERS REPRESENTATIVE. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL COLLARS, CAPS, ELECTRIC POWER, ETC. NECESSARY TO PERFORM THE TESTS. THE CONTRACTOR IS ALSO RESPONSIBLE FOR SCHEDULING THE TEST NO LESS THAN THREE (3) BUSINESS DAYS PRIOR TO ITS INTENDED OCCURRENCE. MEDIUM PRESSURE SUPPLY DUCTWORK (4"CLASS) SHALL BE LEAK TESTED IN ITS ENTIRETY. LEAKAGE TEST PROCEDURES SHALL FOLLOW THE OUTLINES AND CLASSIFICATIONS IN THE SMACNA HVAC DUCT LEAKAGE TEST MANUAL. IF SPECIMEN FAILS TO MEET ALLOTTED LEAKAGE LEVEL, THE CONTRACTOR SHALL MODIFY TO BRING IT INTO COMPLIANCE AND SHALL RETEST IT UNTIL ACCEPTABLE LEAKAGE IS DEMONSTRATED. TESTS AND NECESSARY REPAIR SHALL BE COMPLETED PRIOR TO CONCEALMENT OF DUCTS.

E. MATERIALS:
1. SHEETMETAL: UNLESS OTHERWISE SPECIFIED OR INDICATED, DUCTS SHALL BE CONSTRUCTED OF HOT-DIPPED GALVANIZED SHEETMETAL WITH 60 COMMERCIAL COATING ACCORDING TO ASTM 653 AND A924.
2. FLEXIBLE CONNECTIONS AT FANS SHALL BE NEOPRENE COATED, FLAME RETARDANT GLASS FABRIC (COMPLYING WITH NFPA 90 AND 96), 30 OZ./SQ. YD. WITH SOWN AND CEMENTED SEAMS.
3. FLEXIBLE DUCTWORK SHALL NOT BE USED ON THIS PROJECT.

F. FABRICATION:
1. CONFORM TO SMACNA AND 2014 NEW YORK CITY MECHANICAL CODE REQUIREMENTS FOR METAL THICKNESS, REINFORCING, JOINTS, AND SEALING FOR MAXIMUM STATIC PRESSURES INVOLVED. ALL SEAMS AND JOINTS SHALL BE SEALED AND TAPED.
2. ELBOWS SHALL CONFORM TO SMACNA REQUIREMENTS AND THE FOLLOWING:
   A) PROVIDE LONG RADIUS TYPE WITH CENTERLINE RADIUS MINIMUM 1.5 TIMES DUCT WIDTH. PROVIDE SHORT RADIUS OR SQUARE ELBOWS WHERE INDICATED OR WHERE REQUIRED TO FIT RESTRICTED SPACES. PROVIDE DOUBLE THICKNESS TURNING VANES ON ALL SHORT RADIUS AND MITERED ELBOWS. CONFORM TO SMACNA FOR THE NUMBER OF VANES FOR FITTINGS.
3. BRANCH CONNECTIONS: PROVIDE 45 DEGREE ENTRY OR CONICAL TAPS. PROVIDE RADIUS TYPE FITTINGS FOR DIVIDED FLOW BRANCHES.
4. THE FOLLOWING LONGITUDUNAL SEAMS ARE NOT PERMITTED:
   A) BUTTON PUNCH/SNAP LOCK (L-2)
   B) STANDING SEAM (L-4)
   C) SINGLE-CORNER SEAM (L-5)
5. THE FOLLOWING TRAVERSE JOINTS ARE NOT PERMITTED:
   A) LAP (T-4)
   B) REINFORCED STANDING SEAM (T-16)
   C) REINFORCED S SLIP (T-7)
   D) STANDING SEAM (T-15)
   E) REINFORCED STANDING SEAM (T-16)
   F) POCKET LOCK (T-17)
   G) REINFORCED POCKET LOCK (T-18 AND T-19)
   H) CAPPED FLANGE (T-20)
6. WHERE MANUFACTURED TRANSVERSE JOINTS ARE USED (SMACNA T-25A, T-25B, I.E., DUCTMATE, TDC, TDF, ETC.), THEY SHALL BE SUBMITTED WITH THE MANUFACTURER'S STANDARDS FOR CONSTRUCTION AND INSTALLATION AND INSTALLED IN ACCORDANCE WITH THOSE STANDARDS.

G. VOLUME DAMPERS:
1. GALVANIZED STEEL OR SAME AS DUCT CONSTRUCTION. CONFORM TO SMACNA HVAC DUCT CONSTRUCTION STANDARDS, 1995 OR LATEST EDITION, OPPOSED BLADE TYPE. PROVIDE BEARING AT BOTH ENDS OF DAMPER ROD AND QUADRANT, WITH LEVER AND LOCKSCREW, AT ONE END. INSTALL WITH LEVERS ACCESSIBLE THROUGH INSULATION. SPLITTER DAMPER OR AIR EXTRACTORS SHALL NOT BE USED ON THIS PROJECT.
2. PROVIDE MANUAL BALANCING VOLUME DAMPERS AS REQUIRED TO PROPERLY BALANCE THE AIR DISTRIBUTION SYSTEM. IF THE LOCATION OF BALANCING DAMPERS ARE NOT DEFINED ON THE DRAWINGS, THE FOLLOWING MINIMUM STANDARDS SHALL GOVERN:
   A) LOW PRESSURE: ALL SUPPLY AIR MAIN BRANCHES FROM TRUNK, EACH SPLIT, AND ALL SUB-BRANCHES FROM MAINS SHALL BE PROVIDED WITH BALANCING DAMPERS.
   B) LOW PRESSURE: ALL EXHAUST AND RETURN BRANCHES FROM TRUNK, EACH SPLIT, AND ALL SUB-BRANCHES FROM MAINS SHALL BE PROVIDED WITH BALANCING DAMPERS.
   C) MEDIUM PRESSURE: ALL BRANCHES AND TAKEOFFS DOWNSTREAM OF TERMINAL BOXES (VAV OR CAV) SHALL BE PROVIDED WITH BALANCING DAMPERS.
   D) AS NOTED ON PLANS.
   E) PROVIDE CABLE OPERATED DAMPERS FOR ALL DAMPERS LOCATED ARE GYPSUM CEILINGS OR OTHER INACCESSIBLE CEILING AND HINGED.

H. DUCT ACCESS DOORS:
1. CONFORM TO SMACNA WITH TWO SASH LOCKS AND DOOR GASKETS. SCREWED ACCESS PANELS ARE NOT PERMITTED. PROVIDE REMOVABLE ACCESS DOORS WHERE DOOR SWING CANNOT BE ACCOMMODATED.
2. SIZE: MINIMUM 20"X14" EXCEPT DUCTS LESS THAN 16", ONE DIMENSION 20" AND THE OTHER DIMENSION, 2" LESS THAN THE DUCT WIDTH.
3. PROVIDE ACCESS DOORS: AT ENTERING AND LEAVING SIDES OF COILS IN DUCTS; AUTOMATIC DAMPERS ON LINKAGE SIDE, MANUAL VOLUME DAMPERS 2 SQ. FT. AND LARGER, FIRE DAMPERS, SMOKE DAMPERS, COMBINATION FIRE/SMOKE DAMPERS, SMOKE DETECTION HEADS, FAN BEARINGS ENCLOSED IN DUCTS, SUCTION AND DISCHARGE SIDES OF CEILING MOUNTED FANS, FILTERS, REHEAT COILS, AT ALL EQUIPMENT REQUIRING ACCESS AND AS INDICATED ON DRAWINGS.

I. SEAL OPENINGS AROUND DUCTS THROUGH WALLS WITH MINERAL WOOL OR OTHER NON-COMBUSTIBLE MATERIAL. SEAL ALL DUCT PENETRATIONS THROUGH WALLS AIRTIGHT.

J. ALL DUCTS EXPOSE TO MOISTURE SHALL BE ALUMINUM, SLOPED AND DRAINED AND SHALL NOT BE INTERNALLY LINED.

2.02 PIPING AND ACCESSORIES

A. PROVIDE ALL PIPING, FITTINGS, VALVES, SPECIALTIES, THERMOMETERS, AND PRESSURE GAUGES REQUIRED FOR THE OPERATING AND MAXIMUM PRESSURE AND TEMPERATURE OF THE PIPING SYSTEMS.

B. ALL PIPING SHALL BE NEW, STANDARD SIZE, FREE FROM SCALE OR RUST WITH ENDS CAPPED FOR DELIVERY AND STORAGE. EACH LENGTH OF PIPING SHALL BE PROPERLY MARKED AT THE MILL FOR PROPER IDENTIFICATION WITH NAME OR SYMBOL OF MANUFACTURER.

C. ALL HORIZONTAL CONDENSATE PIPING SHALL BE PITCHED A MINIMUM OF 1/8" PER FOOT OF LENGTH. CONDENSATE PIPING SHALL NOT BE LESS THAN ¾" DIAMETER.

D. PIPE APPLICATION SCHEDULE:

SERVICE	SIZE	MATERIAL	WEIGHT	JOINT STANDARD	JOINT TYPE	FITTING
HOT WATER	ALL	HARD COPPER	TYPE L	ASTM B88	SILVER SOLDER 95/5 OR PROPRESS	WROUGHT COPPER

PROVIDE DIELECTRIC FITTING AT ALL PIPING CONNECTIONS JOINING DISSIMILAR METALS, SUCH AS STEEL AND COPPER.

E. VALVES
1. VALVES SHALL HAVE NAME OF MANUFACTURER AND GUARANTEED WORKING PRESSURE CAST OR STAMPED ON BODIES. VALVES OF SIMILAR TYPE SHALL BE BY A SINGLE MANUFACTURER. VALVES LOCATED 7 FEET OR MORE ABOVE OPERATING FLOOR, OR PLATFORM SHALL BE PROVIDED WITH CHAIN OPERATED HANDWHEELS, RUSTPROOF CHAIN AND CHAIN GUIDE. GASKETS AND PACKINGS SHALL NOT CONTAIN ASBESTOS.
2. ALL VALVING AND VALVE MATERIALS SHALL BE SUITABLE FOR THE OPERATING TEST AND MAXIMUM PRESSURE AND TEMPERATURE REQUIREMENTS OF THE PIPING SYSTEM FOR WHICH THEY ARE BEING UTILIZED.
3. ALL VALVING SHALL BE RATED AS FOLLOWS FOR EACH SYSTEM TYPE:

SYSTEM	PRESSURE RATING
CONDENSER WATER	150 PSIG

4. VALVING SHALL BE AS SHOWN ON THE DRAWINGS AND INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING:
   A) GATE VALVES (CRANE)
   GLOBE VALVES (CRANE, GRINNELL, MILWAUKEE, NORDSTROM, POWELL)
   SWING CHECK VALVES (CRANE GRINNELL, MILWAUKEE, NORDSTROM, STOCKHAM)
   BALL VALVES (APOLLO, JAMESBURY, MILWAUKEE, ROCKWELL)
   HIGH PERFORMANCE BUTTERFLY VALVES - LUG TYPE (JAMESBURY)
   PLUG VALVES (ROCKWELL-NORDSTROM)
   STRAINERS (MUELLER/MUESSCO)
   BALANCING VALVES (T&A, ARMSTRONG, AUTOFLOW, FLOW DESIGN, MILLIKEN, BELL & GOSSET)
   STRAINERS (MUELLER, SARCO)
   B) ALL VALVE MANUFACTURERS SHALL BE AS LISTED OR APPROVED EQUAL BY THE ENGINEER.
   C) BALANCING VALVES: 2" AND SMALLER - BALL OR GLOBE VALVE; 2 1/2" AND LARGER - BALL OR PLUG VALVE.
   D) SHUT-OFF VALVE: 2 1/2" AND SMALLER - BALL VALVE; 3" AND LARGER - HIGH PERFORMANCE BUTTERFLY.
   E) CHECK VALVES: ALL SIZES - SWING CHECK.
5. CONTROL VALVES: REFER TO AUTOMATIC TEMPERATURE CONTROL SECTION.

F. ALL INSTRUMENTAL (PRESSURE GAUGES AND THERMOMETERS) SHALL BE RATED FOR THE SAME PRESSURE AND TEMPERATURE AS PIPING SYSTEM AND RATED SPECIFICALLY FOR THE SAME SERVICE AS THE PIPING. PRESSURE GAUGES ARE TO BE LIQUID FILLED WITH 1% ACCURACY. SELECT GAUGES AND THERMOMETERS SO THAT THE MIDPOINT IS AT THE WORKING PRESSURE AND TEMPERATURE.
1. PROVIDE THERMOMETERS IN PIPING AS INDICATED ON THE DRAWINGS AND AT THE INLET AND OUTLET OF EACH PIECE OF EQUIPMENT THAT INVOLVES A DIFFERENTIAL TEMPERATURE.
2. PIPE THERMOMETERS SHALL BE STEM-TYPE WITH CAST-GLASS/MINERAL-REINFORCED POLYESTER CASES WITH ENVIRONMENTALLY SAFE ORGANIC SPIRIT-FILL, RED READING, 9 INCH (230 MM) SCALE, HAVING A SEPARABLE SOCKET AND BE FIELD-ADJUSTABLE IN ALL PLANES TO PERMIT A CONVENIENT VIEWING ANGLE.
3. PROVIDE PRESSURE GAUGES IN PIPING AS INDICATED ON THE DRAWINGS AND AT EACH PIECE OF EQUIPMENT THAT INVOLVES A DIFFERENTIAL PRESSURE.
4. PRESSURE GAUGES FOR WATER SYSTEMS SHALL BE PHOSPHOR BRONZE BOURDON TYPE, WITH 1/4 INCH (6 MM) NPT BOTTOM OUTLET, 4-1/2 INCH (114 MM) DIALS, ADJUSTABLE POINTERS, ALUMINUM CASES WITH RUBBER BLOW-OUT DISCS IN REAR AND ACRYLIC LENSES. GAUGES SHALL BE FITTED WITH PULSATION SNUBBERS AND BRASS BAR STOCK NEEDLE VALVES OR BALL VALVES RATED AT 600 PSI (40 BAR) WOG (BALL COCKS WITH PLUG-TYPE MECHANISMS ARE NOT ACCEPTABLE).
5. THERMOMETER APPROVED MANUFACTURERS: ASHCROFT, H.O. TRERICE CO., WEISS, WEKSLER.
6. PRESSURE GAUGE APPROVED MANUFACTURERS: ASHCROFT, H.O. TRERICE CO., WEISS, WEKSLER.

G. ALL PIPING TO BE VENTED AT HIGH POINTS AND PROVIDED WITH ASSOCIATED DRAIN VALVES AT LOW POINTS. PROVIDE AUTOMATIC AIR VENTS WITH GATE VALVES PIPED TO DISCHARGE TO THE NEAREST DRAIN UNLESS DRAWINGS INDICATE MANUAL AIR VENTS.

H. PROVIDE CORE DRILLED OPENINGS WITH PIPE SLEEVES AT ALL SLAB AND SHAFT PENETRATIONS. PROVIDE FIREPROOFING AS REQUIRED TO MAINTAIN WALL, SHAFT AND SLAB FIRE RATINGS.

I. PROVIDE LABELING OF ALL PIPING (BOTH EXPOSED AND CONCEALED) IN ACCORDANCE WITH ANSI STANDARDS AND COLOR-CODED AS PER BUILDING MANAGEMENT STANDARDS. LABELS TO BE SECURELY FASTENED TO PIPING WITH LETTERING OF SUFFICIENT SIZE FOR EASY IDENTIFICATION BY OPERATING PERSONNEL.

J. ALL PIPING TO BE MAINTAINED AT THE HIGHEST ELEVATIONS POSSIBLE SO AS NOT TO INTERFERE WITH EXISTING OPERATIONS AND SERVICE/MAINTENANCE REQUIREMENTS.

K. HANGERS AND SUPPORTS:
1. PROVIDE ALL PIPE HANGERS, HANGAR RODS SUPPORTS, INSERTS, ATTACHMENTS, CLAMPS, GUIDES, SUPPLEMENTAL STEEL AND ANCHORS AS REQUIRED TO INSTALL PIPING SYSTEM SIZED TO ACCOMMODATE THE SYSTEM LOADS. HANGERS AND SUPPORTS ARE TO BE IN ACCORDANCE WITH MSS RECOMMENDATIONS AND TO BE MANUFACTURED BY GRINNELL OR APPROVED EQUAL.
2. PROVIDE INSULATED PROTECTIVE SADDLES FOR INSULATED PIPING.
3. HANGERS SUPPORTS, AND ANCHORS SHALL BE INSTALLED WITH THREMAL BREAKS TO AVOID CONDENSATION.
4. PIPING SHALL BE SUPPORTED IN ACCORDANCE WITH RECOMMENDATIONS OF MSS SP-69 AND ALL APPLICABLE CODES. ALL THREADED ROD IS TO BE GALVANIZED. PROVIDE 2" VERTICAL ADJUSTMENT FOR ALL HANGERS. PROVIDE ADDITIONAL SUPPORTS AT CHANGES IN DIRECTION, BRANCH PIPING OVER 5 FEET, AND CONCENTRATED LOADS DUE TO VALVES, STRAINERS AND OTHER ACCESSORIES.

L. EXPANSION COMPENSATION:
1. ALL PIPING SHALL BE INSTALLED TO COMPENSATE FOR EXPANSION TO PROTECT THE BUILDING, EQUIPMENT AND PIPING SYSTEMS. PROVIDE ALL GUIDES, ANCHORS, EXPANSION LOOPS, SUPPLEMENTAL STEEL AND APPROVED TYPE EXPANSION JOINTS AS INDICATED OR REQUIRED FOR CONTROL OF EXPANSION.

M. TESTING:
1. GENERAL
   A) TESTS SHALL BE CONDUCTED AFTER COMPLETION AND ASSEMBLY OF PIPING SYSTEM, BEFORE ANY INSULATION OR PAINT IS APPLIED TO JOINTS, INCLUDING WELDS AND PRIOR TO MAKING THE SYSTEM OPERABLE. INSULATION MATERIALS INSTALLED PRIOR TO THE TESTS SHALL BE REMOVED.
   B) THE MECHANICAL CONTRACTOR SHALL PROVIDE ALL NECESSARY TEMPORARY PIPING CONNECTIONS, TEES, VALVES, EQUIPMENT, AND LABOR TO PRESSURE TEST PIPING AND EQUIPMENT.
   C) EQUIPMENT THAT IS NOT SUBJECTED TO THE PRESSURE TEST SHALL BE EITHER DISCONNECTED FROM THE SYSTEM OR ISOLATED BY A BLANK OR SIMILAR MEANS. VALVES MAY BE USED FOR THIS PURPOSE PROVIDED THAT VALVE CLOSURE IS SUITABLE FOR THE PROPOSED TEST PRESSURE.
   D) SUBMIT TO THE ENGINEER AND OWNER REPRESENTATIVE A RECORD OF TEST PRESSURE APPLIED TO EACH PIPING SYSTEM.
2. WATER PIPING
   A) ALL PIPING IS TO BE HYDROSTATICALLY TESTED FOR A PERIOD OF FOUR HOURS, DURING WHICH TIME PIPING IS TO SHOW NO LEAKS. PIPING WHICH IS NOT TIGHT UNDER THE TESTS SHALL BE TAKEN DOWN AND REASSEMBLED. ALL TESTING SHALL BE DONE USING WATER AS A TEST MODEM.
   B) PIPING SHALL BE HYDROSTATICALLY 1-1/2 TIMES THE NORMAL OPERATING PRESSURE BUT NOT EXCEEDING 225 PSI FOR A MINIMUM OF 2 HOURS.

N. WATER TREATMENT AND PIPE CLEANING:
1. NEW PIPING SYSTEMS SHALL BE ISOLATED, CLEANED AND CHEMICALLY TREATED WHEN THE INSTALLATION IS COMPLETED TO REMOVE ANY CONSTRUCTION DEBRIS AND PROVIDE CORROSION PROTECTION.
2. PROVIDE THE NECESSARY APPARATUS, COMPLETE WITH RELIEF VALVES, ISOLATING VALVES, CHECK VALVES, PIPING, POWER, WIRING, CHEMICALS, FEED TANKS, AND SERVICE TO PROVIDE PROPER WATER TREATMENT FOR THE CONTROL OF SCALE, CORROSION AND MICROBIOLOGICAL GROWTHS IN THE PIPING SYSTEMS. ALL CHEMICALS USED SHALL COMPLY WITH POLLUTION CONTROLS ESTABLISHED BY ALL AUTHORITIES HAVING JURISDICTION. CHLORATES SHALL NOT BE USED.
3. PIPE CLEANING
   A) FURNISH ALL REQUIRED PIPE CLEANING CHEMICALS, PORTABLE PUMPS, CHEMICAL FEED EQUIPMENT, MATERIALS, AND LABOR NECESSARY TO CLEAN ALL PROJECT PIPING SYSTEMS.
   B) PROVIDE A PRE-STARTUP NON-FOAMING, LIQUID DETERGENT DISPERSANT CLEANER FOR CLEANING OF ALL SYSTEMS TO REMOVE OIL AND FOREIGN MATTER FROM THE PIPING AND EQUIPMENT PRIOR TO THE FINAL FILLING OF THE SYSTEMS. USE CHEMICAL THAT IS NOT INJURIOUS TO PERSONS, PIPING, PIPE JOINT COMPOUNDS, PACKING, COILS, VALVES, PUMPS AND THEIR MECHANICAL SEALS OR OTHER PARTS OF THE SYSTEM. AFTER FINAL FILL, PERFORM A CHEMICAL TEST TO TEST THAT THE PH OF THE NEW SYSTEM IS WITHIN 0.5 OF FRESH INCOMING WATER.
   C) THE MECHANICAL CONTRACTOR SHALL PROVIDE ALL NECESSARY TEMPORARY PIPING CONNECTIONS, TEES, VALVES, EQUIPMENT AND LABOR TO PERFORM PIPE CLEANING.

2.03 INSULATION

A. ALL INSULATION SHALL MEET THE REQUIREMENTS OF ASTM, NFPA, 2014 NEW YORK CITY ENERGY CODE AND ALL AUTHORITIES HAVING JURISDICTION. ALL MECHANICAL INSULATION (JACKETING, COVERINGS, ADHESIVES, MASTICS, FACINGS, TAPES, ETC.), SHALL HAVE RATINGS NOT EXCEEDING A FLAME SPREAD OF 25 OR LESS AND SMOKE DEVELOPED INDEX OF 50 OR LESS.

B. BEFORE APPLYING INSULATION, ALL PRESSURE AND LEAK TESTS SHALL BE COMPLETED AND APPROVED. FURNISH AND INSTALL AS PER MANUFACTURERS REQUIREMENTS.

C. INSULATION FOR FITTINGS OR ACCESSORIES REQUIRING SERVICING OR INSPECTION SHALL HAVE INSULATION REMOVABLE AND REPLACEABLE WITHOUT DAMAGE.

D. APPROVED MANUFACTURERS: ARMSTRONG, JOHNS-AMNVILLE, OWWNS-CORNING.

E. PIPE INSULATION:
1. FIBERGLASS PIPE INSULATION: ONE-PIECE MOLDED SECTIONAL FIBERGLASS INSULATION, CONFORMING TO ASTM C-547, CLASS 1, 2, 3 TO 850EF WITH 4 LB./CU. FT. DENSITY WITH A THERMAL CONDUCTIVITY OF NOT OVER 0.23 AT 75EF MEAN. PROVIDE WITH FACTORY-APPLIED ALL SERVICE JACKET AND DOUBLE ADHESIVE SELF-SEALING LAP. COLD WATER PIPE INSULATION JACKET SHALL BE OF THE CONTINUOUS VAPOR BARRIER TYPE.
2. INSULATION FOR FITTINGS, FLANGES, AND VALVES: PROVIDE INSULATION FOR FITTINGS, FLANGES, AND VALVES PREMOLDED, PRECUT, OR JOB FABRICATED OF THE SAME THICKNESS AND CONDUCTIVITY AS USED ON ADJACENT PIPING.
3. VALVES INSTALLED IN INSULATED PIPING LINES SHALL HAVE REMOVABLE INSULATED JACKETS AND VALVE HANDLE EXTENSIONS THAT CLEAR THE OTER INSULATION SURFACE. AFFIX LABELS FOR VALVE LOCTIONS AND DIRECTIONAL FLOW.
4. PIPE LABELING AND COLOR CODE REQUIREMENTS:
   A) CONDENSER WATER SUPPLY AND RETURN:
      a) MARKINGS - CWS/CWR
      b) COLOR - LIGHT GREEN
      c) SHERWIN WILLIAMS N0. - CIRCUIT BREAKER SW4077
   B) HEATING HOT WATER WATER SUPPLY AND RETURN
      a) MARKINGS - HWS/HWR
      b) COLOR - YELLOW
      c) SHERWIN WILLIAMS N0. - SAFETY GREEN SW4085
5. HANGERS SUPPORTS, AND ANCHORS SHALL BE INSTALLED WITH THREMAL BREAKS TO AVOID CONDENSATION.
6. PROVIDE INSULATION FOR PIPING, FITTINGS, FLANGES AND VALVES.
7. INSULATION THICKNESS: CONDENSER WATER & HOT WATER SUPPLY AND RETURN - 1 1/2 INCHES; CONDENSATE PIPING - 1 INCH.

F. DUCT INSULATION:
1. GENERAL
   A) INSULATION SHALL BE APPLIED WITH MASTICS, ADHESIVES, AND COATINGS, WITH COVERS, WEATHER-PROTECTION AND OTHER WORK AS REQUIRED BY MANUFACTURER'S RECOMMENDATIONS. DO NOT INSULATE SOUND LINED DUCTWORK. MATERIALS SHALL MEET REQUIREMENTS OF ADHESIVE AND SEALANT COUNCIL STANDARDS AND SMACNA.
   B) ALL SUPPLY AND RETURN DUCTS AND PLENUMS SHALL BE INSULATED WITH A MINIMUM OF R-6 INSULATION WHEN LOCATED IN UNCONDITIONED SPACES, WHEN A DUCT OR PLENUM IS LOCATED WITHIN THE BUILDING ENVELOPE ASSEMBLY, THE DUCT OR PLENUM SHALL BE SEPERATED FROM THE BUILDING EXTERIOR OR UNCONDITIONED SPACES BY A MINIMUM OF R-12 INSULATION.
2. CONCEALED DUCTWORK
   A) INSULATE SUPPLY AND FRESH AIR DUCTS AND PLENUMS IN CONCEALED SPACES AND RETURN DUCT NOT IN CEILING PLENUM WITH AT LEAST 2" THICK, 1 LB DENSITY, FIBROUS GLASS DUCT WRAP, WITH A MINIMUM R VALUE OF R-6 AND FOIL-KRAFT FLAME RESISTANT VAPOR BARRIER.
3. THE FOLLOWING DUCTWORK SHALL BE INSULATED: SUPPLY AIR.

2.04 ELECTRICAL WORK

A. GENERAL
1. ELECTRICAL POWER WIRING SHALL BE PROVIDED BY THE ELECTRICAL CONTRACT; CONTROL WIRING SHALL BE BY THE HVAC CONTRACT. CONTROL WIRING SHALL BE DEFINED AS ANY 12V, 24V, OR 120V WIRING INSTALLED FOR PURPOSES OTHER THAN PROVIDING PRIMARY ELECTRICAL POWER TO EQUIPMENT.
2. ALL ELECTRICAL CONTROL WIRING SHALL COMPLY WITH LOCAL ELECTRICAL CODE, ALL AUTHORITIES HAVING JURISDICTION AND THE PROJECT ELECTRICAL SPECIFICATIONS.
3. MECHANICAL CONTRACTOR TO OBTAIN QUANTITY OF CONTROLLERS REQUIRED AND COORDINATE WITH THE ELECTRICAL CONTRACTOR FOR ALL OPERATING REQUIREMENTS, INTERLOCKS AND CONNECTIONS FOR STARTERS.
4. THE MECHANICAL CONTRACTOR SHALL PREPARE AND SUBMIT FOR APPROVAL POINT-TO-POINT, COMPLETELY COORDINATED WIRING DIAGRAMS AND INDICATE ALL SOURCE POWER REQUIREMENTS AND ALL FIELD WIRING TO BE PERFORMED BY THE ELECTRICAL CONTRACTOR.

2.05 VIBRATION ISOLATION PRODUCTS

A. FURNISH AND INSTALL ALL NECESSARY VIBRATION ISOLATORS, VIBRATION HANGERS, MOUNTING PADS, RAILS, ETC., TO ISOLATE VIBRATION AND SOUND FROM BEING TRANSMITTED TO THE BUILDING CONSTRUCTION. ALL VIBRATION ISOLATION PRODUCTS SHALL BE SPECIFICALLY DESIGNED FOR THEIR INTENDED USE.

B. MANUFACTURER OF VIBRATION ISOLATION EQUIPMENT SHALL HAVE THE FOLLOWING RESPONSIBILITIES:
1. DETERMINE VIBRATION ISOLATOR SIZES AND LOCATIONS.
2. PROVIDE SUITABLE PIPING AND EQUIPMENT VIBRATION ISOLATION SYSTEMS.
3. GUARANTEE SPECIFIED ISOLATION SYSTEM ATTENUATION AND DEFLECTION.
4. PROVIDE INSTALLATION INSTRUCTIONS, DRAWINGS AND FIELD SUPERVISION TO ASSURE PROPER INSTALLATION AND PERFORMANCE.

C. APPROVED MANUFACTURES: MASON INDUSTRIES (M.I.I.), VIBRATION ELIMINATOR COMPANY (V.E.C.), OR VIBRATION MOUNTINGS & CONTROLS (V.M.C.I.).

D. MOUNTING TYPES:
1. STATIC DEFLECTION OF ISOLATORS SHALL BE A MINIMUM OF 90% EFFICIENCY.
2. SUPPORT OF PIPING IN EQUIPMENT ROOMS AND WHERE EXPOSED ON ROOF.
   A) ALL WATER PIPING WITHIN 50 FEET OF CONNECTED ROTATING EQUIPMENT TO BE SUPPLIED WITH ISOLATORS.
   B) HANGER ROD ISOLATORS (M.I.I TYPE DNHS) MOUNTINGS.
   C) FLOOR SUPPORTED PIPING ISOLATORS (TYPE SLR).
3. PROVIDE FLEXIBLE CONNECTIONS BETWEEN ALL DUCTWORK (REFER TO DUCTWORK SECTION FOR SPECIFICATIONS).

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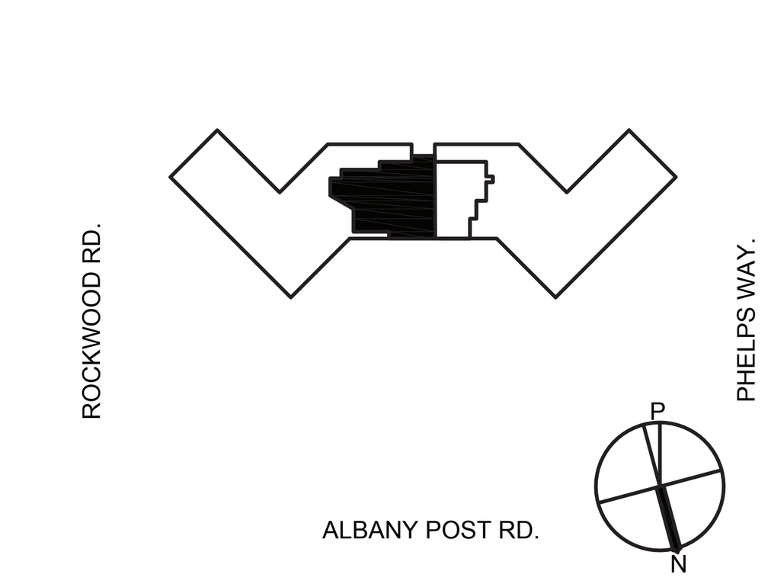
Key Plan:



Project Address: 1 ROCKWOOD ROAD SLEEPY HOLLOW NY 10591

Revision	Date	Description
	04/07/21	ISSUE FOR BID
	05/13/21	ISSUE FOR BID
	05/25/21	ISSUE FOR PERMIT
	06/01/21	ISSUE FOR BID

Plot Date::

Professional Seal and Signature:

FCA FRANCIS CAUFFMAN ARCHITECTS
FCA Project: 20-7168 Author
ARCHITECTURE

Drawing: HVAC SPECIFICATIONS SHEET NO. 1

SCALE: As indicated FLOOR:

M-003

2.07 TESTING AND BALANCING

A. GENERAL:

1. TESTING AND BALANCING WORK SHALL BE PERFORMED BY AN INDEPENDENT COMPANY (NOT ASSOCIATED WITH THE HVAC CONTRACTOR), AABC CERTIFIED OR AS APPROVED BY THE ENGINEER BEFORE COMMENCEMENT OF WORK. APPROVED COMPANIES INCLUDE MERENDINO ASSOCIATES, R.H. MCDERMOTT, INTERNATIONAL TESTING AND BALANCING OR AS APPROVED BY THE ENGINEER AND BUILDING MANAGEMENT.
2. AFTER ALL PROJECT HVAC WORK IS COMPLETE, TESTED, AND IN FULL WORKING ORDER, THE AGENCY SHALL PERFORM THE BALANCING AND TESTING OF THE PROJECT HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS.
3. UPON THE COMPLETION OF THE AIR CONDITIONING SYSTEM, THE BALANCING AGENCY SHALL PERFORM TESTING AND BALANCING AND COMPILE ALL TEST DATA IN A CERTIFIED REPORT AND SUBMIT FOUR (4) COPIES FOR REVIEW AND APPROVAL TO THE ENGINEER.
4. THE REPORT SHALL INCLUDE DESIGN AND ACTUAL READINGS FOR ALL EQUIPMENT AND LOCATION PLAN INDICATING WHERE ALL WORK HAS BEEN PERFORMED, AND METHODS OF BALANCING AND DETAILS OF INSTRUMENTS USED.
5. IF DISCREPANCIES EXIST IN THE REPORT THAT REQUIRE FIELD VERIFICATION, THE TESTING AND BALANCING COMPANY IN THE PRESENCE OF THE ENGINEER SHALL VISIT THE JOBSITE FOR FIELD VERIFICATION OF THE REPORT.
6. AFTER SUBMISSION OF THE FIELD VERIFIED BALANCING REPORT, THE AIR BALANCING COMPANY SHALL RETURN TO THE JOB SITE TO PERFORM TWO (2) OCCUPANT COMFORT BALANCES AS DIRECTED BY THE OWNER OR ENGINEER.
7. THE FINAL REPORT AFTER THE COMFORT BALANCE IS TO BE INCLUDED IN PROJECT OPERATING AND MAINTENANCE MANUAL.
8. THE TESTING AND BALANCING AGENCY SHALL INCLUDE AS PART OF THEIR WORK AN EXTENDED WARRANTY OF 90 DAYS AFTER COMPLETION OF TEST AND BALANCE WORK. THE ENGINEER AT HIS DISCRETION DURING THE WARRANTY PERIOD MAY REQUEST A RECHECK OR RESETTING OF ANY EQUIPMENT. THE MECHANICAL CONTRACTOR AND THE BALANCING CONTRACTOR SHALL PROVIDE THE NECESSARY TECHNICIANS TO FACILITATE THIS WORK.
9. THE BALANCING AGENCY SHALL PERMANENTLY MARK ALL ADJUSTMENT DEVICES (VALVES, DAMPERS, ETC.) TO ENABLE THE SETTING TO BE RESTORED.

B. AIR BALANCING

1. HVAC CONTRACTOR SHALL ENSURE THAT A FIRST SET OF AIR FILTERS ARE IN PLACE, WHENEVER FANS ARE RUNNING AND REPLACED WITH A NEW CLEAN SET OF FILTERS BEFORE TESTING IS COMMENCED.
2. TEST, ADJUST, REPLACE SHEAVES, AND BALANCE ALL EQUIPMENT AND AIR DISTRIBUTION SYSTEMS TO PROVIDE AIR QUANTITIES INDICATED ON PLANS WITHIN PLUS OR MINUS 5 PERCENT.
   A) INDIVIDUAL AIR INLET/OUTLETS ARE TO BE BALANCED AT AIR QUANTITIES INDICATED ON PLANS WITHIN PLUS OR MINUS 10 PERCENT.
3. TEST REPORT SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING:
   A) FLOW, LEAKAGE CLASS, TEMPERATURE, STATIC PRESSURE OF AIR AT ALL TRUNK DUCTS SERVING AREAS OF WORK.
   B) TEMPERATURE OF AIR LEAVING OUTLETS AT TWO (2) TYPICAL AIR OUTLETS.
   C) QUANTITY OF AIR AT EACH AIR INLET AND OUTLET AFTER BALANCING.
   D) PROVIDE FOR ALL FANS, FAN MOTOR HP, AMPS, VOLTS, FAN RPM, CFM, INLET AND DISCHARGE STATIC PRESSURE, SHEAVE POSITION. MIXED AIR AND SUPPLY AIR TEMPERATURES (DRY BULB - COOLING AND HEATING, WET-BULB-COOLING). INDICATE UNIT OPERATING
   E) PROVIDE FOR ALL AIR CONDITIONING UNITS, SUPPLY CFM, OUTSIDE AIR CFM, RETURN AIR CFM, MIXED AIR CFM. PROVIDE OUTSIDE AIR, MODE DURING TEST.
   F) CALIBRATE ALL NEW TERMINAL BOXES (VAV,) AS REQUIRED TO MEET SPECIFIED MINIMUM/MAXIMUM CFM.
   G) LISTING OF DESIGN AND ACTUAL READINGS AS WELL AS ALL MANUFACTURER'S DATA FOR EQUIPMENT.

C. WATER BALANCING

1. TEST, ADJUST, AND BALANCE NEW DISTRIBUTION SYSTEMS TO PROVIDE FLOW QUANTITIES INDICATED N THE DRAWINGS WITHIN PLUS OR MINUS 2 PERCENT.
2. PLACE SYSTEM IN FULL AUTOMATIC OPERATION, WITH AUTOMATIC CONTROLS SET IN ACCORDANCE WITH DESIGN CONDITIONS, AND ALLOW WATER TO REACH DESIGN TEMPERATURE AND PRESSURE.
3. ALL PIPE TESTING SHALL BE COMPLETED BEFORE COMMENCING BALANCING.
4. SET ZONE OR CIRCUIT BALANCING VALVES AT EACH PIECE OF EQUIPMENT (AIR HANDLING UNIT, ETC.) TO HANDLE THE DESIGN FLOW.
5. AIR HANDLING UNITS CONTAINING COILS, CHECK AND ADJUST EACH UNIT TO INSURE THE PROPER VOLUME OF AIR IS PASSING THROUGH THE COILS, WHILE THE BALANCING PROCEDURE IS IN PROGRESS.
6. THE TEST REPORT SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING:
   A) THE PRESSURE DROP ACROSS AND FLOW AT EACH PIECE OF EQUIPMENT AND AT EACH MAIN.
7. PROVIDE FLOW DIAGRAMS INDICATING PIPING LAYOUT, FLOW BALANCING VALVES AND WHERE THE READING OF EACH INDIVIDUAL PIECE OF EQUIPMENT HAS BEEN TAKEN.
8. MARK VALVE TAG AFTER BALANCING OF EACH BALANCING VALVE TO INDICATE POSITION OF VALVE.

2.08 EQUIPMENT

A. PROVIDE ALL EQUIPMENT AND ACCESSORIES OF THE SIZES AND CAPACITIES AS SCHEDULED AND AS INDICATED ON THE DRAWINGS.

B. INSTALL EQUIPMENT IN ACCORDANCE WITH APPROVED SHOP DRAWINGS, MANUFACTURER'S RECOMMENDATIONS, INSTRUCTIONS, AND ALL AUTHORITIES HAVING JURISDICTION.

C. PROVIDE EQUIPMENT SUPPORTS AND/OR MOUNTINGS AS INDICATED ON THE DRAWING, IN VIBRATION SPECIFICATION AND AS FOLLOWS:
1. FLOOR MOUNTED EQUIPMENT - PROVIDE DIMENSIONS FOR A 4" CONCRETE HOUSEKEEPING PAD WITH ALL REQUIRED WATERPROOFING TO THE CONSTRUCTION MANAGER.
2. EQUIPMENT ON FLOOR STANDS - PROVIDE FLOOR STAND OF STRUCTURAL STEEL OR STEEL PIPES AND FITTINGS AND BOLT TO FLOOR.
3. CEILING MOUNTED EQUIPMENT - PROVIDE SUPPORTS WITH APPROVED SUITABLE ANCHORS SUSPENDED DIRECTLY FROM BUILDING STEEL STRUCTURE.
4. PROVIDE SUPPLEMENTAL STEEL AS REQUIRED TO ADEQUATELY SUPPORT THE EQUIPMENT LOAD.

D. EQUIPMENT SHALL BE INSTALLED WITH VIBRATION ISOLATION, REFER TO VIBRATION ISOLATION SECTION.

E. DIFFUSERS, GRILLES AND REGISTERS

1. GENERAL
   A) GRILLES, REGISTERS AND DIFFUSERS SHALL BE TESTED IN ACCORDANCE WITH ASHRAE STANDARD 70-1991 OR LATEST EDITION. THE MANUFACTURER SHALL PROVIDE PUBLISHED PERFORMANCE DATA FOR ALL AIR INLETS AND OUTLETS TO BE USED ON PROJECT AS PART OF THE SUBMISSION.
   B) THE MECHANICAL CONTRACTOR TO COORDINATE THE LOCATION OF DIFFUSERS, GRILLES AND REGISTERS WITH OTHER TRADES AND WITH CEILING AND WALL CONSTRUCTION. THE MECHANICAL CONTRACTOR IS TO VERIFY THAT ALL DIFFUSERS, GRILLES AND REGISTERS ARE COMPATIBLE WITH CEILING CONSTRUCTION TO WHICH THEY ARE TO BE INSTALLED.
   C) COORDINATE ALL WORK WITH THE GENERAL CONTRACTOR AND REFER TO THE ARCHITECTURAL DRAWINGS FOR THE EXACT LOCATION, LENGTHS AND FOR FRAMING AND MITERING ARRANGEMENTS THAT MAY DIFFER FROM THOSE SHOWN ON HVAC DRAWINGS. PROVIDE ALL REQUIRED GENERAL CONSTRUCTION, FRAMING, BLOCKING, PLASTERING AND SUPPORTS TO MATCH CEILING, SOFFIT OR WALL CONSTRUCTION AS PART OF THE PROJECT.
   D) INLETS AND OUTLETS SHALL HANDLE AIR QUANTITIES INDICATED AT OPERATING VELOCITIES WITH SOUND PRESSURE LEVEL NOT TO EXCEED NC-30, UNLESS NOTED OTHERWISE.
   E) DIFFUSERS, GRILLES AND REGISTERS SHALL BE INSTALLED WITH FACES SET LEVEL AND PLUM AND MOUNTED TIGHTLY AGAINST MOUNTING SERVICE.
   F) ALL AIR INLETS AND OUTLETS TO BE STEEL OR ALUMINUM IF EXPOSED TO MOISTURE UNLESS OTHERWISE INDICATED. FINISHES TO BE SELECTED BY THE ARCHITECT.
   H) SUBMIT FOR APPROVAL A COMPLETE SCHEDULE OF ALL AIR INLETS AND OUTLETS TO BE USED ON PROJECT INCLUDING MANUFACTURER'S MODELS, SIZES, PERFORMANCES, ACCESSORIES, ACOUSTIC INFORMATION, FINISHES, ETC., BEFORE RELEASE FOR FABRICATION. NOTE ANY DEVIATIONS FROM SPECIFICATIONS AND SCHEDULES SHALL BE INDICATED ON SUBMITTAL.
2. AIR INLET AND OUTLET DEVICES:
   A) PROVIDE DIFFUSERS, GRILLES AND REGISTERS FOR SUPPLY, RETURN AND EXHAUST INLETS AND OUTLETS, OF THE SIZE, TYPE AND DESIGN INDICATED ON DRAWINGS.
   B) ALL SUPPLY RETURN AND EXHAUST AIR INLETS AND OUTLETS SHALL BE PROVIDED WITH AN OPPOSED BLADE DAMPER AND GRID (ADJUSTABLE THROUGH THE FACE) FOR TRIM BALANCING.
   C) SUPPLY REGISTERS SHALL HAVE TWO SETS OF DIRECTIONAL CONTROL BLADES.
   D) ONLY 4-WAY DIFFUSERS SHALL BE USED. PROVIDE BLANK-OFF SHEETMETAL BAFFLE FOR ALL 1-WAY, 2-WAY AND 3-WAY DIFFUSERS.
   E) ALL LINEAR DIFFUSERS SHALL BE PROVIDED WITH CABLE OPERATED OPPOSED BLADE DAMPER ADJUSTABLE THROUGH THE FACE OF THE DIFFUSER. DAMPERS AND PLENUM TAPS SHALL BE SPACED AT A MAXIMUM OF 4 FEET ON CENTER. PROVIDE DIFFUSERS WITH ADJUSTABLE AIR PATTERN CONTROL VALVES.

2.09 AUTOMATIC TEMPERATURE CONTROLS

A. GENERAL:
1. FURNISH AND INSTALL AS HEREIN SPECIFIED, A COMPLETE DDC AUTOMATIC TEMPERATURE CONTROL SYSTEM.
2. APPROVED MANUFACTURERS: JCI
3. ALL TEMPERATURE CONTROL SYSTEMS AND COMPONENTS UNDER THIS SUBCONTRACT ARE TO BE FULLY MODULATING TYPE, EXCEPT WHERE NOTED OTHERWISE. THE SYSTEM SHALL BE COMPLETE IN ALL RESPECTS INCLUDING ALL ASSOCIATED CONTROL EQUIPMENT, THERMOSTATS, CONTROL VALVES, VALVE ACTUATORS, DAMPER OPERATORS, RELAYS, PILOT POSITIONERS, CONTROL WIRING, SWITCHES, INTERLOCK WIRING, ELECTRICAL CONTROL COMPONENTS AND ASSOCIATED WIRING, APPURTENANCES, ETC., TO PROVIDE THE FUNCTIONS DESCRIBED IN THESE SPECIFICATIONS AND PLANS, REGARDLESS OF WHETHER OR NOT SAID DEVICE RELAY, ETC. IS SPECIFICALLY MENTIONED HEREAFTER.
4. THE SYSTEM SHALL BE SUPERVISED AND CHECKED OUT COMPLETELY IN ALL RESPECTS BY COMPETENT MECHANICS, REGULARLY EMPLOYED BY THE MANUFACTURER.
5. THE SYSTEM AND COMPONENTS PROVICDED SHALL BE THE MOST CURRENT SYSTEM THE MANUFACTURER HAS TO OFFER AT THE TIME OF INSTALLATION.
6. ALL CONTROLS MUST BE THE PRODUCT OF ONE MANUFACTURER. ALL AUTOMATIC CONTROL VALVES, SENSORS AND DAMPER OPERATORS SHALL BE MANUFACTURED BY THE TEMPERATURE CONTROL MANUFACTURER.
7. FIELD MOUNTED SENSORS AND TRANSMITTERS FOR TEMPERATURE, RELATIVE HUMIDITY AND STATIC PRESSURE INPUTS TO DIRECT DIGITAL CONTROLLERS SHALL BE ELECTRONIC WITH A 4-20 MA CURRENT OUTPUT SIGNAL.
8. ACTUATION OF AUTOMATIC CONTROL VALVES AND DAMPERS SHALL BE ELECTRIC.
9. OPEN SYSTEM ARCHITECTURE: THE BMS SYSTEM MUST ENSURE OPEN ARCHITECTURE. THE BMS SHALL HAVE OPEN BACNET COMMUNICATION PROTOCOL. IT SHALL HAVE THE ABILITY TO COMMUNICATE THROUGH KNX, LONWORKS, MODBUS, M-BUS, DALI, ETC.
10. THE CONTROL SYSTEMS SHALL BE IN ACCORDANCE WITH THE FOLLOWING DESCRIPTION OF SYSTEM OPERATIONS AND/OR DETAIL INFORMATION SHOWN ON THE PLANS AND AS DESCRIBED HEREIN.
   A) THE MANUFACTURER OF THE AUTOMATIC CONTROL EQUIPMENT SHALL SUBMIT THE FOLLOWING FOR APPROVAL: A SCHEMATIC DIAGRAM OF EACH CONTROL SYSTEM WHICH SHALL INDICATE THE PROPER SEQUENCE OF OPERATION AND RANGE OF THE CONTROLS FOR ALL CYCLES. A COMPLETE DESCRIPTION OF THE AUTOMATIC OPERATION OF EACH SYSTEM. THE DESCRIPTION SHOULD INCLUDE THE DUTY OF EACH THERMOSTAT, VALVE, SWITCH, ETC., INCORPORATED IN THE CONTROL SYSTEM WITH A SCHEDULE AND ILLUSTRATION OF ALL CONTROL INSTRUMENTS AND EQUIPMENT INCLUDING CONTROL PANELS AND DEVICES FOR EACH SYSTEM.

B. DIRECT DIGITAL CONTROL SYSTEM
1. THE DIRECT DIGITAL CONTROL SYSTEM SHALL CONSIST OF A NETWORK OF ALC, SCHNEIDER, OR SIEMENS SOFTWAREA ND MICROPROCESSOR BASED DIRECT DIGITAL CONTROL UNITS (DDC). EACH DIRECT DIGITAL CONTROL UNIT SHALL PERFORM ALL SPECIFIED CONTROL AND MONITORING FUNCTIONS INDEPENDENTLY. FAILURE OF ONE CONTROL UNIT SHALL HAVE NO EFFECT UPON ANY OTHER UNIT IN THE NETWORK. THE DIRECT DIGITAL CONTROL UNITS SHALL COMMUNICATE WITH EACH OTHER AND AN EXISTING CAMPUS PC BASED NETWORK COMPUTERS.
2. THE BMS SYSTEM MUST ENSURE OPEN ARCHITECTURE. THE BMS SHALL HAVE OPEN BACNET COMMUNICATION PROTOCOL. IT SHALL HAVE THE ABILITY TO COMMUNICATE THROUGH LONWORKS, MODBUS, ETC.
3. THE OPERATOR, THROUGH ANY WCMC ITS TAGGED NETWORK DEVICE, SHALL HAVE THE ABILITY TO MONITOR DDC APPLICATION AND SENSOR DAT, OVERRIDE SET POINTS AND SCHEDULES, SET AND RESET CONTROL POINTS, AND DOWNLOAD PROGRAMS TO THE LOCA; DIRECT DIGITA CONTROL UNITS.
4. SYSTEM INPUT/OUTPUT POINT CAPACITY SHALL BE EXPANDABLE BY THE ADDITION OF DDC UNITS OR OTHER CONTROLLERS TO THE COMMUNICATIONS NETWORK. INSTALLED CABINETS SHALL HAVE 10% SPARE OF EACH TYPE OF INPUT/OUTPUT USED IN THE CABINET (I.E. DI, DO, AI, AO, ETC.), WITH A MINIMUM OF TWO (2) SPARES FOR EACH TYPE USED.
5. PROVIDE 10% SPARE PARTS (MINIMUM 1) OF EACH TYPE OF SENSOR USED (I.E. THERMOSTATS, PRESSURE SENSOR, TEMPERATURE SENSOR, AIRFLOW, WATER FLOW, DIFFERENTIAL PRESSURE, ETC.).

C. ELECTRIC WIRING:
1. ALL ELECTRICAL WORK (EXCEPT FOR MOTOR FEEDERS, WIRING BETWEEN MOTORS, MOTOR CONTROLLERS, FEEDER PANELS, FUSES, CIRCUIT BREAKERS AND BUS BARS) REQUIRED FOR THE AUTOMATIC TEMPERATURE CONTROL SYSTEM SHALL BE PROVIDED BY THIS CONTRACTOR. WORK SHALL INCLUDE BUT NOT BE LIMITED TO TIME SWITCHES, DAMPER MOTORS, DAMPER SWITCHES, ELECTRIC THERMOSTATS, ELECTRIC RELAYS, E/P SWITCHES, INTERLOCKING WIRING, WIRE, CONDUIT, ETC.
2. ALL 115 VOLT POWER REQUIRED FOR CONTROL PURPOSES SHALL BE PROVIDED BY THE CONTROL CONTRACTOR FROM A SOURCE ESTABLISHED BY THE ELECTRICAL CONTRACTOR.
3. THE CONTROL MANUFACTURER SHALL INCLUDE WIRING DIAGRAMS IN THE SHOP DRAWINGS SUBMITTALS FULLY COORDINATED WITH THE ELECTRICAL CONTRACTOR'S WORK. IT SHALL BE THE AUTOMATIC TEMPERATURE CONTROL CONTRACTOR'S RESPONSIBILITY TO PROVIDE ALL WIRING AND CONDUIT AS REQUIRED TO ACHIEVE THE FUNCTION CALLED FOR IN THESE SPECIFICATIONS, CONFORMING WITH LOCAL CODES FOR MATERIAL AND INSTALLATION. THE ELECTRICAL SPECIFICATION FOR THE PROJECT'S ELECTRICAL WORK IS TO BE FOLLOWED.
4. FURNISH A CERTIFICATE INDICATING THE METHOD OF WIRING COMPLIANCE WITH LOCAL CODES AS PART OF THE FIRST SHOP DRAWING SUBMITTAL.

D. INSTRUMENTATION
1. TEMPERATURE TRANSMITTERS
   A) DUCT MOUNTED AVERAGING TYPE TRANSMITTERS SHALL CONSIST OF A 1000-OHM PLATINUM RTD AVERAGING ELEMENT WITH AN ACCURACY OF ±1°F. OVER ENTIRE OPERATING SPAN. PROBE LENGTH SHALL BE ONE (1) LINEAR FOOT PER FOUR (4) SQUARE FEET OF DUCT AREA.
   B) DUCT MOUNTED NON-AVERAGING TYPE TRANSMITTERS SHALL CONSIST OF A 1000-OHM PLATINUM RTD ELEMENT WITH AN ACCURACY OF ±0.5°F. OVER THE ENTIRE OPERATING SPAN. PROBE LENGTH SHALL BE FULL LENGTH OF DUCT.
   C) LIQUID INSERTION TYPE TRANSMITTERS SHALL CONSIST OF A SPRING LOADED 1000-OHM PLATINUM RTD WITH AN ACCURACY OF ± 1.0°F. OVER ENTIRE OPERATING SPAN.
   D) SPACE TRANSMITTER SHALL CONSIST OF A 1000-OHM PLATINUM RTD ELEMENT WITH AN ACCURACY OF ±1°F. OVER ENTIRE OPERATING SPAN.
   E) SPACE THERMOSTATS SHALL BE PROVIDED WITH A USER ACCESSIBLE OVERRIDE BUTTON SO THAT USERS CAN MANUALLY OVERRIDE A NIGHT SETBACK SETTING FOR A PRE-DETERMINED TIME PERIOD. THE DEFAULT SETTING FOR SUCH TIME PERIOD IS ONE HOUR. DEVICES SHOULD NOT DISPLAY TEMPERATURES LOCALLY.
   F) ALL SENSORS SHALL BE PROVIDED WITH A COMMUNICATIONS PORT ACCESS TO OPERATIONS INFORMATION. AN OPERATOR SHALL BE CAPABLE OF ACCESSING THE INFORMATION VIA A HAND-HELD TERMINAL UNIT.
   G) HEATING AND COOLING THERMOSTATS SHALL BE PROVIDED WITH A TEMPAERATURE RANGE OR DEADBAND OF AT LEAST 5°F.

CONTROL VALVES:
1. ALL AUTOMATIC CONTROL VALVES SHALL BE OF THE ELECTRONIC TYPE, FULLY PROPORTIONING, UNLESS OTHERWISE SPECIFIED, QUIET IN OPERATION, AND SHALL BE ARRANGED TO FAIL SAFE, IN EITHER A NORMALLY OPEN OR NORMALLY CLOSED POSITION, IN THE EVENT OF POWER FAILURE. THE OPEN OR CLOSED POSITION SHALL BE AS SPECIFIED OR AS REQUIRED TO SUIT JOB CONDITIONS. PROVISIONS SHALL BE MADE FOR VALVES OPERATING IN SEQUENCE WITH OTHER VALVES OR DAMPER OPERATORS TO HAVE ADJUSTABLE OPERATING RANGES AND STARTING POINTS TO PROVIDE FLEXIBILITY OF ADJUSTMENT IN SEQUENCING AND THROTTLING RANGE. MODULATING VALVES SHALL BE PROVIDED WITH PILOT POSITIONERS. VALVES SHALL BE SIZED BY THE TEMPERATURE CONTROL MANUFACTURER AND GUARANTEED TO MEET THE HEATING OR COOLING REQUIREMENTS AS SPECIFIED. ALL VALVE BODIES SHALL HAVE THE SAME PRESSURE CHARACTERISTICS AS THE PIPE IN WHICH IT IS INSTALLED.
2. VALVES 2 INCHES AND SMALLER UNLESS OTHERWISE SPECIFIED SHALL HAVE BRONZE BODIES WITH SCREWED CONNECTIONS. VALVES SHALL BE FISHER TYPE ED, WARREN TYPE 20/70, K&M SERIES GCG, OR AS APPROVED.
3. WHENEVER THE FLOW RATE IS SUCH AS TO REQUIRE A SINGLE VALVE LARGER THAN 2-1/2 INCHES, PROVIDE TWO VALVES IN PARALLEL, ARRANGED TO OPERATE IN SEQUENCE. PROVIDE A SEPARATE CONTROL SIGNAL TO EACH VALVE.
4. CONTROL VALVES OPERATING IN SEQUENCE WITH OTHER VALVES OR DAMPERS IN MODULATING SERVICE SHALL BE PROVIDED WITH PILOT POSITIONING RELAYS. PROVIDE A SEPARATE CONTROL SIGNAL TO EACH VALVE.

D) ALARMS
a. ALARM FEATURE SHALL ALLOW USER CONFIGURATION OF CRITERIA TO CREATE, ROUTE, AND MANAGE ALARMS AND EVENTS. IT SHALL BE POSSIBLE FOR SPECIFIC ALARMS FROM SPECIFIC POINTS TO BE ROUTED TO SPECIFIC ALARM RECIPIENTS. THE ALARM MANAGEMENT PORTION OF THE USER INTERFACE SHALL, AT THE MINIMUM, PROVIDE THE FOLLOWING FUNCTIONS:
   (1) ALLOW CONFIGURATION TO GENERATE ALARMS ON ANY NUMERIC, BINARY, OR DATA POINT IN THE SYSTEM.
   (2) GENERATE ALARM RECORDS THAT CONTAIN A MINIMUM OF A TIMESTAMP, ORIGINAL STATE, ACKNOWLEDGED STATE, ALARM CLASS AND PRIORITY.
b. ALLOW THE ESTABLISHMENT OF ALARM CLASSES THAT PROVIDE THE ROUTING OF ALARMS WITH SIMILAR CHARACTERISTICS TO COMMON RECIPIENTS.
   (1) ALLOW A USER, WITH THE APPROPRIATE SECURITY LEVEL, TO MANAGE ALARMS - INCLUDING SORTING, ACKNOWLEDGING, AND TAGGING ALARMS.

E) PASSWORD
a. MULTIPLE-LEVEL PASSWORD ACCESS PROTECTION SHALL BE PROVIDED TO ALLOW THE USER/MANAGER TO USER INTERFACE CONTROL, DISPLAY, AND DATABASE MANIPULATION CAPABILITIES DEEMED APPROPRIATE FOR EACH USER, BASED ON AN ASSIGNED PASSWORD.

F) DYNAMIC COLOR GRAPHICS
a. THE GRAPHICS APPLICATION PROGRAM SHALL BE SUPPLIED AS AN INTEGRAL PART OF THE USER INTERFACE. THE GRAPHICS APPLICATIONS SHALL INCLUDE A CREATE/EDIT FUNCTION AND A RUNTIME FUNCTION. THE SYSTEM ARCHITECTURE SHALL SUPPORT AN UNLIMITED NUMBER OF GRAPHICS DOCUMENTS (GRAPHIC DEFINITION FILES) TO BE GENERATED AND EXECUTED. THE GRAPHICS SHALL BE ABLE TO DISPLAY REAL-TIME DATA THAT IS ACQUIRED, DERIVED, OR ENTERED.

2. NETWORK AREA CONTROLLER (NAC)
A) THE NAC MUST PROVIDE THE FOLLOWING HARDWARE FEATURES AS A MINIMUM:
a. COMMUNICATIONS
   (1) ONE 10/100 MB ETHERNET PORT - RJ-45 CONNECTION
   (2) ONE RS-485 PORT (UP TO 57,600 BAUD)
   (3) ALL REQUIRED PROTOCOL DRIVERS ARE INCLUDED.
b. BATTERY BACKUP
   (1) BATTERY BACKUP PROVIDED FOR ALL ON BOARD FUNCTIONS INCLUDING I/O
   (2) BATTERY IS MONITORED, AND TRICKLE CHARGED
   (3) BATTERY MAINTAINS PROCESSOR OPERATION THROUGH POWER FAILURES FOR A PRE-DETERMINED INTERVAL, AND THEN WRITES ALL DATA TO FLASH MEMORY, SHUTS THE PROCESSOR DOWN, AND MAINTAINS THE CLOCK FOR FIVE YEARS.
c. ENVIRONMENT
   (1) MUST BE CAPABLE OF OPERATION OVER A TEMPERATURE RANGE OF 0ºC TO 55ºC.
   (2) MUST BE CAPABLE OF WITHSTANDING STORAGE TEMPERATURES OF BETWEEN 0ºC AND 70ºC.
   (3) MUST BE CAPABLE OF OPERATION OVER A HUMIDITY RANGE OF 5% TO 95% RH, NON-CONDENSING
d. PERFORMANCE
   (1) SUPPORTS UP TO 100 DEVICES.
   (2) THE NETWORK AREA CONTROLLER (NAC) SHALL BE A FULLY USER-PROGRAMMABLE DEVICE.
e. AUTOMATION NETWORK - THE NETWORK AREA CONTROLLER (NAC) SHALL RESIDE ON THE AUTOMATION NETWORK. EACH NAC SHALL SUPPORT ONE OR MORE SUB-NETWORKS OF CONTROLLERS.
f. USER INTERFACE - EACH NETWORK AREA CONTROLLER (NAC) SHALL HAVE THE ABILITY TO DELIVER A WEB BASED USER INTERFACE AS PREVIOUSLY DESCRIBED. ALL COMPUTERS CONNECTED PHYSICALLY OR VIRTUALLY TO THE AUTOMATION NETWORK SHALL HAVE ACCESS TO THE WEB BASED UI.
g. POWER FAILURE - IN THE EVENT OF THE LOSS OF NORMAL POWER, THE NETWORK AREA CONTROLLER (NAC) SHALL CONTINUE TO OPERATE FOR A DEFINED PERIOD AFTER WHICH THERE SHALL BE AN ORDERLY SHUTDOWN OF ALL PROGRAMS TO PREVENT THE LOSS OF DATABASE OR OPERATING SYSTEM SOFTWARE. FLASH MEMORY SHALL BE INCORPORATED FOR ALL CRITICAL CONTROLLER CONFIGURATION DATA. DURING A LOSS OF NORMAL POWER, THE CONTROL SEQUENCES SHALL GO TO THE NORMAL SYSTEM SHUTDOWN CONDITIONS. UPON RESTORATION OF NORMAL POWER AND AFTER A MINIMUM OFF-TIME DELAY, THE CONTROLLER SHALL AUTOMATICALLY RESUME FULL OPERATION WITHOUT MANUAL INTERVENTION THROUGH A NORMAL SOFT-START SEQUENCE.
h. CERTIFICATION - ALL CONTROLLERS SHALL BE LISTED BY UNDERWRITERS LABORATORIES (UL).

3. LOCAL WEB BROWSER / OPERATOR WORKSTATION PC
A) A NEW OPERATOR WORKSTATION PC/PORTABLE LAPTOP SHALL BE INSTALLED AT A LOCATION TO BE DETERMINED BY THE OWNER.
B) MONITOR: MINIMUM 19" HIGH DEFINITION FLAT PANEL DISPLAY.
C) REMOTE ACCESS: LOCAL AREA NETWORK INSTALLATIONS SHALL HAVE REMOTE ACCESS TO THE BMS PROVIDED VIA THE INTERNET. THE OWNER SHALL PROVIDE A CONNECTION TO THE INTERNET TO ENABLE THIS ACCESS VIA ISDN, ADSL, HIGH-SPEED CABLE, OR T1 CONNECTION, OR VIA THE CUSTOMER'S INTRANET TO A CORPORATE SERVER PROVIDING ACCESS TO AN INTERNET SERVICE PROVIDER (ISP).

I. SEQUENCE OF OPERATIONS: REFER TO CONTROL DRAWINGS FOR SEQUENCE OF OPERATIONS.

PART 3 - EXECUTION

3.01 DEMOLITION, REMOVAL AND RELOCATION
A. REMOVAL, TEMPORARY CONNECTIONS AND RELOCATION OF CERTAIN EXISTING WORK WILL BE NECESSARY FOR THE INSTALLATION OF THE NEW SYSTEMS. ALL EXISTING CONDITIONS ARE NOT TO BE COMPLETELY DETAILED ON THE DRAWINGS. THE CON-TRACTOR SHALL SURVEY THE SITE AND MAKE ALL NECESSARY CHANGES REQUIRED BASED ON EXISTING CONDITIONS FOR PROPER INSTALLATION OF NEW WORK.
B. DISCONNECT, REMOVE AND/OR RELOCATE EXISTING MATERIAL, EQUIPMENT, AND OTHER WORK AS NOTED OR REQUIRED FOR PROPER INSTALLATION OF NEW SYSTEM.
C. EQUIPMENT REQUIRED TO BE TEMPORARILY DISCONNECTED AND RELOCATED SHALL BE CAREFULLY REMOVED, STORED, CLEANED, REINSTALLED, RECONNECTED, AND MADE OPERATIONAL.
D. ALL EXISTING WORK NOT INDICATED FOR DEMOLITION SHALL BE PROTECTED FROM DAMAGE. WHERE EXISTING WORK TO REMAIN IS DAMAGED OR DISTURBED, THE CONTRACTOR SHALL REPAIR OR REPLACE TO OWNER'S AND BUILDING MANAGER'S SATISFACTION AT NO COST TO THE OWNER OR BUILDING MANAGEMENT.
E. GENERAL CONTRACTOR REMOVE ALL CEILING IN AREAS WHERE NEW DUCTWORK OR PIPING IS TO BE INSTALLED OR EXISTING IS ALTERED, AS PER ARCHITECT'S INSTRUCTIONS.
F. ALL NECESSARY CUTTING AND PATCHING TO ACCOMMODATE THE NEW HVAC WORK SHALL BE PERFORMED BY THIS CONTRACTOR AND COORDINATED WITH BUILDING MANAGEMENT SO AS TO MINIMIZE DISRUPTION OF EXISTING TENANTS AND SERVICES. RESTORE ALL ITEMS TO MATCH EXISTING CONDITIONS.
G. ALL EXISTING MATERIAL AND EQUIPMENT TO BE REMOVED UNDER THIS CONTRACT WILL REMAIN THE PROPERTY OF THE OWNER OR SHALL BE LEGALLY DISPOSED OF BY THIS CONTRACTOR AS DIRECTED BY THE ARCHITECT OR OWNER. REFRIGERATION CONTAINED IN EXISTING EQUIPMENT TO BE REMOVED SHALL BE RECLAIMED OR LEGALLY DISPOSED OF IN ACCORDANCE WITH EPA REQUIREMENTS AND ASHRAE.
H. PROVIDE FOR LEGAL REMOVAL AND DISPOSAL OF ALL RUBBISH AND DEBRIS FROM THE BUILDING AND SITE. COORDINATE ALL DEMOLITION AND REMOVALS WITH BUILDING MANAGEMENT.

3.02 CONNECTION TO EXISTING WORK
A. 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 MANAGEMENT. INSTALL ISOLATION VALVES AT POINT OF CONNECTION TO THE EXISTING PIPING. INSTALL ISOLATION DAMPERS AT CONNECTION TO EXISTING DUCTWORK. PROVIDE TEMPORARY DUCTWORK AND PIPING CONNECTIONS AS REQUIRED TO MINIMIZE SHUTDOWN TIME.
B. CONNECT NEW WORK TO EXISTING WORK IN A NEAT AND APPROVED MANNER. RESTORE EXISTING WORK DISTURBED WHILE INSTALLING NEW WORK TO ACCEPTABLE CONDITION AS DETERMINED BY ARCHITECT AND BUILDING MANAGER.
C. MAINTAIN CONTINUOUS OPERATION OF EXISTING FACILITIES.

3.03 CHASING, CHOPPING OR CORE DRILLING
A. PRIOR TO ANY CHASING, CHOPPING, OR CORE DRILLING BEING PERFORMED, THIS CONTRACTOR SHALL FIELD INVESTIGATE EXISTING CONDITIONS AND COORDINATE WITH ALL APPROPRIATE TRADES AND BUILDING MANAGEMENT TO ENSURE THAT WORK WILL BE IN HARMONY WITH OTHER WORK AND NOT AFFECT ANY EXISTING BUILDING SYSTEMS. THIS WORK MUST BE APPROVED BY BUILDING MANAGEMENT PRIOR TO PROCEEDING.

3.04 COMMISSIONING REQUIREMENTS FOR MECHANICAL SYSTEMS
A. GENERAL
1. COMMISSIONING IS A QUALITY-ORIENTED PROCESS FOR ACHIEVING, VERIFYING, AND DOCUMENTING THAT THE PERFORMANCE OF FACILITIES, SYSTEMS, AND ASSEMBLIES MEET DEFINED OBJECTIVES AND CRITERIA. THE COMMISSIONING PROCESS BEGINS AT PROJECT INCEPTION, DURING THE PRE-DESIGN PHASE, AND CONTINUES THROUGH THE LIFE OF THE FACILITY. THE COMMISSIONING PROCESS INCLUDES SPECIFIC TASKS TO BE CONDUCTED DURING EACH PHASE IN ORDER TO VERIFY THAT DESIGN, CONSTRUCTION, AND TRAINING MEETS THE OWNER'S PROJECT REQUIREMENTS.
2. THE GOALS OF THE COMMISSIONING PROCESS ARE TO:
3. VERIFY THAT APPLICABLE EQUIPMENT AND SYSTEMS ARE INSTALLED ACCORDING TO THE CONTRACT DOCUMENTS, MANUFACTURER'S RECOMMENDATIONS, AND INDUSTRY ACCEPTED MINIMUM STANDARDS AND THAT THEY RECEIVE ADEQUATE OPERATIONAL CHECKOUT BY INSTALLING CONTRACTORS.
4. VERIFY AND DOCUMENT PROPER PERFORMANCE OF EQUIPMENT AND SYSTEMS.
5. VERIFY THAT O&M DOCUMENTATION LEFT ON SITE IS COMPLETE.
6. VERIFY THAT THE OWNER'S OPERATING PERSONNEL ARE ADEQUATELY TRAINED.
7. THE COMMISSIONING PROCESS DOES NOT TAKE AWAY FROM OR REDUCE THE RESPONSIBILITY OF THE SYSTEM DESIGNERS OR INSTALLING CONTRACTORS TO PROVIDE A FINISHED AND FULLY FUNCTIONING PRODUCT.

1.2 SUMMARY
1. THIS SECTION INCLUDES GENERAL REQUIREMENTS THAT APPLY TO THE IMPLEMENTATION OF THE COMMISSIONING PROCESS AS RELATED TO MECHANICAL SYSTEMS, ASSEMBLIES, AND COMPONENTS.

1.3 SUBMITTALS
1. PRODUCT DATA SUBMITTALS
2. CERTIFICATES OF READINESS
3. CERTIFICATES OF COMPLETION OF INSTALLATION, PRESTART, AND STARTUP ACTIVITIES.
4. O&M MANUALS
5. TEST REPORTS
6. AS-BUILT RECORD DOCUMENTS

1.4 EQUIPMENT/SYSTEMS TO BE COMMISSIONED
1. THE FOLLOWING EQUIPMENT/SYSTEMS WILL BE COMMISSIONED IN THIS PROJECT:
1. MECHANICAL SYSTEMS
   a. DX AIR HANDLING UNIT
   b. VARIABLE AIR VOLUME BOXES WITH HEATING COILS
   c. FAN POWERED VARIABLE AIR VOLUME BOXES WITH HEATING COILS
   d. IT ROOM AIR CONDITIONING UNIT
   e. EXHAUST FANS
   f. UNIT HEATER

1.5 QUALITY ASSURANCE
1. TEST EQUIPMENT CALIBRATION REQUIREMENTS
1. CONTRACTORS WILL COMPLY WITH TEST MANUFACTURER'S CALIBRATION PROCEDURES AND INTERVALS. RECALIBRATE TEST INSTRUMENTS IMMEDIATELY AFTER INSTRUMENTS HAVE BEEN REPAIRED RESULTING FROM BEING DROPPED OR DAMAGED. AFFIX CALIBRATION TAGS TO TEST INSTRUMENTS. FURNISH CALIBRATION RECORDS TO CXA UPON REQUEST.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT
1. ALL STANDARD TESTING EQUIPMENT REQUIRED TO PERFORM STARTUP, INITIAL CHECKOUT AND FUNCTIONAL PERFORMANCE TESTING SHALL BE PROVIDED BY THE CONTRACTOR FOR THE EQUIPMENT BEING TESTED. FOR EXAMPLE, THE MECHANICAL CONTRACTOR OF DIVISION 23 SHALL ULTIMATELY BE RESPONSIBLE FOR ALL STANDARD TESTING EQUIPMENT FOR THE HVAC&R SYSTEM AND CONTROLS SYSTEM IN DIVISION 23, EXCEPT FOR EQUIPMENT SPECIFIC TO AND USED BY TAB CONTRACTOR IN THEIR COMMISSIONING RESPONSIBILITIES. A SUFFICIENT QUANTITY OF TWO-WAY RADIOS SHALL BE PROVIDED BY EACH SUBCONTRACTOR, AS NECESSARY.
2. SPECIAL EQUIPMENT, TOOLS AND INSTRUMENTS (SPECIFIC TO A PIECE OF EQUIPMENT AND ONLY AVAILABLE FROM VENDOR) REQUIRED FOR TESTING SHALL BE INCLUDED.
3. PROPRIETARY TEST EQUIPMENT AND SOFTWARE REQUIRED BY ANY EQUIPMENT MANUFACTURER FOR PROGRAMMING AND/OR START-UP, WHETHER SPECIFIED OR NOT, SHALL BE PROVIDED BY THE MANUFACTURER OF THE EQUIPMENT. MANUFACTURER SHALL PROVIDE THE TEST EQUIPMENT, DEMONSTRATE ITS USE, AND ASSIST IN THE COMMISSIONING PROCESS AS NEEDED. PROPRIETARY TEST EQUIPMENT (AND SOFTWARE) SHALL BECOME THE PROPERTY OF THE OWNER UPON COMPLETION OF THE COMMISSIONING PROCESS.
4. IF REQUIRED AND NECESSARY, DATA LOGGING EQUIPMENT AND SOFTWARE REQUIRED FOR TESTING WILL BE PROVIDED BY THE CXA, BUT SHALL NOT BECOME THE PROPERTY OF THE OWNER.
5. ALL TESTING EQUIPMENT SHALL BE OF SUFFICIENT QUALITY AND ACCURACY TO TEST AND/OR MEASURE SYSTEM PERFORMANCE WITH THE TOLERANCES SPECIFIED IN THE SPECIFICATIONS. IF NOT OTHERWISE NOTED, THE FOLLOWING MINIMUM REQUIREMENTS APPLY: TEMPERATURE SENSORS AND DIGITAL THERMOMETERS SHALL HAVE A CERTIFIED CALIBRATION WITHIN THE PAST YEAR TO AN ACCURACY OF 0.5°F AND A RESOLUTION OF + OR - 0.1°F. PRESSURE SENSORS SHALL HAVE AN ACCURACY OF + OR - 2.0% OF THE VALUE RANGE BEING MEASURED (NOT FULL RANGE OF METER) AND HAVE BEEN CALIBRATED WITHIN THE LAST YEAR.

PART 3 - EXECUTION

3.1 CONSTRUCTION CHECKLISTS
1. THE CXA SHALL PROVIDE PRE-FUNCTIONAL EQUIPMENT CHECKLISTS TO THE CONTRACTORS FOR EXECUTION THAT WILL INDICATE EXPECTED QUALITY CONTROL FEATURES REQUIRED FOR A HIGHEST-QUALITY INSTALLATION. THE CONTRACTOR SHALL COMPLETE THE CHECKLISTS AS CONSTRUCTION PROGRESSES AND RETURN THEM TO THE CXA AS INDICATED IN SECTION 01 91 00 COMMISSIONING GENERAL REQUIREMENTS.
2. THE MANUFACTURER AND CONTRACTOR SHALL DEVELOP THE DETAILED STARTUP PLANS FOR ALL EQUIPMENT, INCLUDING FIELD CHECKOUT SHEETS. THE PRIMARY ROLE OF THE CXA IN THIS PROCESS IS TO ENSURE THAT THERE IS WRITTEN DOCUMENTATION THAT EACH OF THE MANUFACTURER-RECOMMENDED PROCEDURES HAVE BEEN COMPLETED BY THE INSTALLING CONTRACTOR(S).

3.2 PREREQUISITES TO TESTING
1. PRIOR TO THE TESTING OF THESE SYSTEMS, THE CONTRACTOR SHALL CERTIFY IN WRITING THAT:
1. THE SYSTEM IS COMPLETELY INSTALLED, FUNCTIONAL, AND DOCUMENTED.
2. WORK PERFORMED BY OTHER TRADES, BUT ESSENTIAL FOR THIS SYSTEM OR ASSEMBLY'S OPERATION, IS COMPLETE (E.G., ELECTRICAL COMPONENTS ARE WIRED AND POWER IS PROVIDED)
3. ALL CONTRACTOR-PERFORMED START-UP PROCEDURES AND TESTS ARE COMPLETE AND DOCUMENTED.
4. THE SYSTEM OR ASSEMBLY IS READY FOR THE OWNER TO TAKE BENEFICIAL USE.

3.3 TESTING, ADJUSTING, AND BALANCING
1. AIR AND WATER TESTING, BALANCING AND EQUIPMENT PERFORMANCE VERIFICATION SHALL BE ACCOMPLISHED BY AN INDEPENDENT TEST AND BALANCE FIRM. THE CXA SHALL SPOT CHECK THIS WORK TO VERIFY ACCURACY OF RESULTS.
2. PRIOR TO PERFORMANCE OF TESTING, ADJUSTING, AND BALANCING WORK, PROVIDE COPIES OF REPORTS, SAMPLE FORMS, CHECKLISTS, AND CERTIFICATES TO THE CXA.
3. NOTIFY THE CXA AT LEAST TEN (10) DAYS IN ADVANCE OF TESTING AND BALANCING WORK, AND PROVIDE ACCESS FOR THE CXA TO WITNESS TESTING AND BALANCING WORK.
4. PROVIDE TECHNICIANS, INSTRUMENTATION, AND TOOLS TO VERIFY TESTING AND BALANCING OF HVAC&R SYSTEMS AT THE DIRECTION OF THE CXA.
5. SUBMIT THE FINAL, STAMPED REPORT.
6. ONCE THE SUBMITTED REPORT IS APPROVED BY THE MECHANICAL ENGINEER AND ALL COMMENTS ARE ADDRESSED, THE CXA WILL NOTIFY TESTING AND BALANCING SUBCONTRACTOR TEN (10) DAYS IN ADVANCE OF THE DATE OF FIELD VERIFICATION. NOTICE WILL NOT INCLUDE DATA POINTS TO BE VERIFIED.
7. THE TESTING AND BALANCING SUBCONTRACTOR SHALL USE THE SAME INSTRUMENTS (BY MODEL AND SERIAL NUMBER) THAT WERE USED WHEN ORIGINAL DATA WERE COLLECTED.
8. VERIFIED RESULTS ARE EXPECTED TO BE WITHIN +/- 10% OR THE REPORT VALUES. RESULTS OUTSIDE OF THESE VALUES WILL CONSTITUTE A FAILED TEST AND WILL REQUIRE RETESTING BY THE TESTING, ADJUSTING, AND BALANCING CONTRACTOR.

3.4 GENERAL TESTING REQUIREMENTS
1. PROVIDE TECHNICIANS, INSTRUMENTATION, AND TOOLS TO PERFORM COMMISSIONING TEST AT THE DIRECTION OF THE CXA.
2. SCOPE OF MECHANICAL TESTING SHALL INCLUDE ENTIRE MECHANICAL INSTALLATION. TESTING SHALL INCLUDE VERIFICATION OF DYNAMIC OPERATION OF THE SYSTEM.
3. TEST ALL OPERATING MODES, INTERLOCKS, CONTROL RESPONSES, AND RESPONSES TO ABNORMAL OR EMERGENCY CONDITIONS, AND VERIFY PROPER RESPONSE OF BUILDING AUTOMATION SYSTEM CONTROLLERS AND SENSORS.
4. THE CXA ALONG WITH THE MECHANICAL CONTRACTOR, TESTING AND BALANCING SUBCONTRACTOR, AND HVAC&R INSTRUMENTATION AND CONTROL SUBCONTRACTOR SHALL PREPARE DETAILED TESTING PLANS, PROCEDURES, AND CHECKLISTS FOR MECHANICAL SYSTEMS, SUBSYSTEMS, AND EQUIPMENT.
5. TESTS WILL BE PERFORMED USING DESIGN CONDITIONS WHENEVER POSSIBLE.
6. SIMULATED CONDITIONS MAY NEED TO BE IMPOSED USING AN ARTIFICIAL LOAD WHEN IT IS NOT PRACTICAL TO TEST UNDER DESIGN CONDITIONS. BEFORE SIMULATING CONDITIONS, CALIBRATE TESTING INSTRUMENTS. PROVIDE EQUIPMENT TO SIMULATE LOADS. SET SIMULATED CONDITIONS AS DIRECTED BY THE CXA AND DOCUMENT SIMULATED CONDITIONS AND METHODS OF SIMULATION. AFTER TESTS, RETURN SETTINGS TO NORMAL OPERATING CONDITIONS.
7. THE CXA MAY DIRECT TO ALTER SET POINTS WHEN SIMULATING CONDITIONS IS NOT PRACTICAL.
8. IF TESTS CANNOT BE COMPLETED BECAUSE OF A DEFICIENCY OUTSIDE THE SCOPE OF THE HVAC&R SYSTEM, DOCUMENT THE DEFICIENCY AND REPORT IT TO THE OWNER. AFTER DEFICIENCIES ARE RESOLVED, RESCHEDULE TESTS.

3.5 MECHANICAL SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES
1. PROVIDE SUBMITTALS, TEST DATA, INSPECTOR RECORD, AND CERTIFICATIONS TO THE CXA.
2. THE WORK INCLUDED IN THE COMMISSIONING PROCESS INVOLVES A COMPLETE AND THOROUGH EVALUATION OF THE OPERATION AND PERFORMANCE OF ALL COMPONENTS, SYSTEMS AND SUB-SYSTEMS. THE FOLLOWING EQUIPMENT AND SYSTEMS SHALL BE EVALUATED:
3. VARIABLE AIR VOLUME TERMINAL UNITS WITH REHEAT COILS
4. WATER COOLED AIR HANDLING UNIT
5. EXHAUST FANS
6. BUILDING AUTOMATION SYSTEM
7. DUCTWORK AND ACCESSORIES
8. TESTING, ADJUSTING AND BALANCING

3.6 TRAINING OF OWNER PERSONNEL
1. PROVIDE THE CXA WITH A TRAINING PLAN TWO WEEKS BEFORE THE PLANNED TRAINING.
2. PROVIDE DESIGNATED OWNER PERSONNEL WITH COMPREHENSIVE ORIENTATION AND TRAINING IN THE UNDERSTANDING OF THE SYSTEMS AND THE OPERATION AND MAINTENANCE OF EACH PIECE OF PLUMBING EQUIPMENT.
3. TRAINING SHALL OCCUR AFTER FUNCTIONAL TESTING IS COMPLETE, UNLESS APPROVED OTHERWISE BY THE OWNER.

PART 4 - CLOSEOUT PHASE

4.1 PROJECT RECORD DOCUMENTS
1. THE CONTRACTOR WILL VERIFY ALL EQUIPMENT, SYSTEMS, INSTRUMENTATION, WIRING AND COMPONENTS ARE SHOWN CORRECTLY ON "AS-BUILT" RECORD DRAWINGS. PRIOR TO FULL OPERATION, A COMPLETE DEMONSTRATION AND TESTING OF THE SYSTEM OPERATING FUNCTIONS AND ALARMS SHALL BE PERFORMED BY THIS AN APPROVED COMMISSIONING AGENT IN THE PRESENCE OF THE OWNER'S REPRESENTATIVE AND ENGINEER. THIS TESTING SHALL TAKE PLACE AFTER HAVING SATISFACTORILY MET THE REQUIREMENTS OF SHOP DRAWING ACCEPTANCE. COMMISSIONING OF THE SYSTEM SHALL BE SCHEDULED BEFORE THE SPACE IS OCCUPIED LEAVING ENOUGH TIME TO CORRECT THE SYSTEM'S DEFICIENCIES AND AFTER SHOP DRAWING ACCEPTANCE. UPON SUCCESSFUL COMPLETION OF SYSTEM OPERATION, THE CONTRACTOR SHALL SUBMIT A STATEMENT STATING THAT THE FULL OPERATION OF ALL SYSTEMS, FUNCTIONS AND ALARMS HAS BEEN DEMONSTRATED AND ARE OPERATIONAL AS WELL AS A LISTING OF ALL SYSTEMS, ALARMS AND FUNCTIONS THAT HAVE BEEN COMMISSIONED. ALL ITEMS SHALL BE SUBMITTED FOR REVIEW AND ACCEPTANCE TO THE OWNER, OWNER'S REPRESENTATIVE AND ENGINEER BEFORE FINAL ACCEPTANCE CAN TAKE PLACE.

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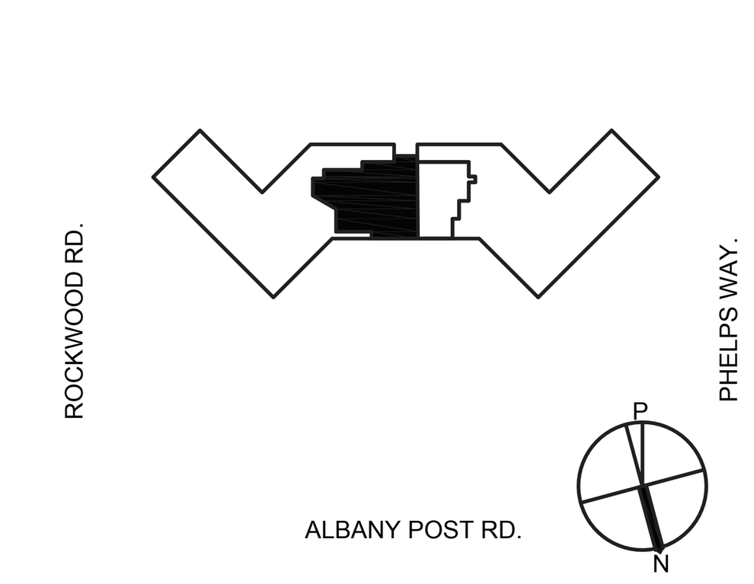
Key Plan:



Project Address: 1 ROCKWOOD ROAD SLEEPY HOLLOW NY 10591

Revision	Date	Description
	04/07/21	ISSUE FOR BID
	05/13/21	ISSUE FOR BID
	05/25/21	ISSUE FOR PERMIT
	06/01/21	ISSUE FOR BID

Plot Date::

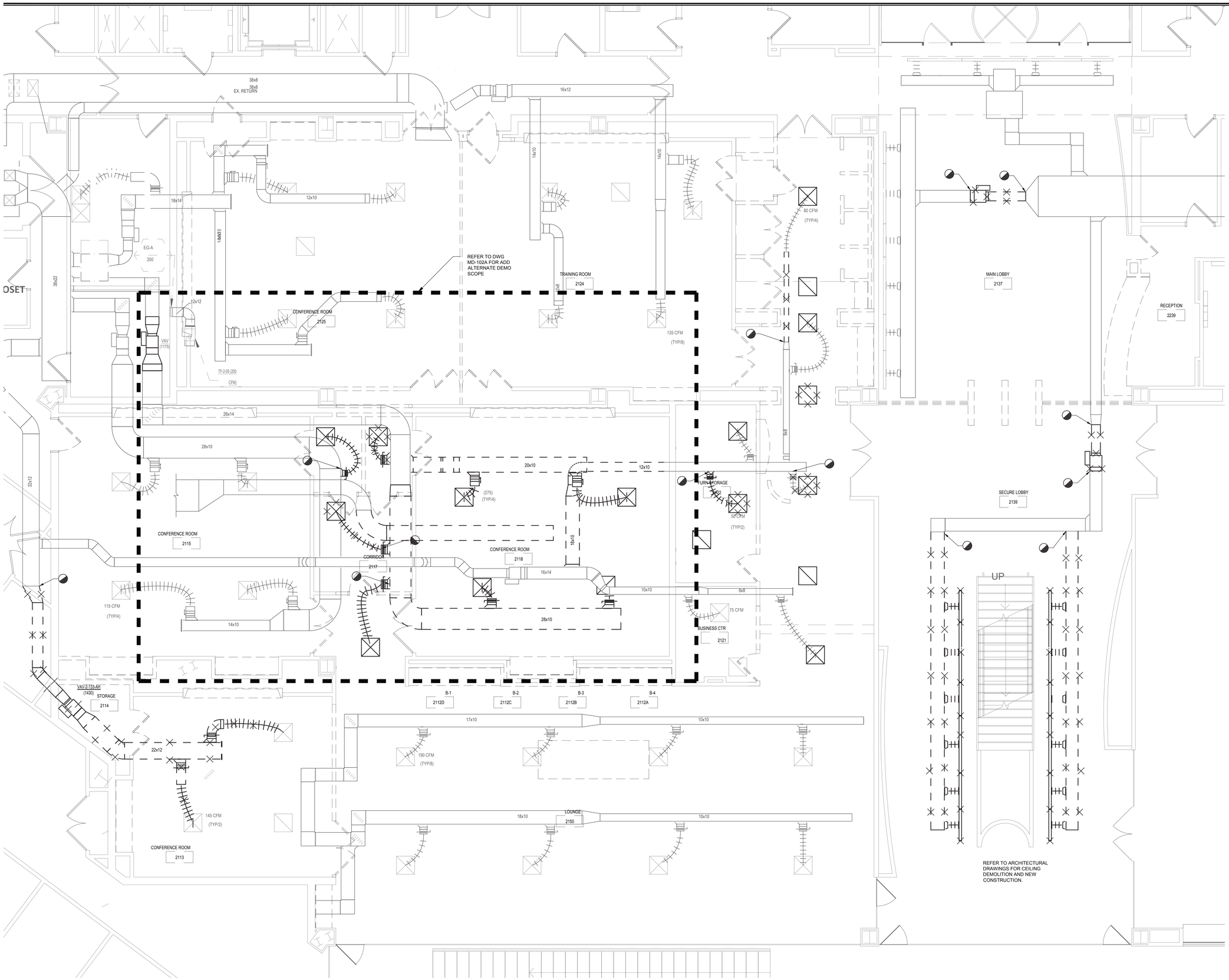
Professional Seal and Signature:

FCA FRANCIS CAUFFMAN ARCHITECTS
FCA Project: 20-7168 Author
ARCHITECTURE

Drawing:
HVAC SPECIFICATIONS
SHEET NO. 2

SCALE: As indicated FLOOR:

M-004



1 LEVEL 2 MECHANICAL DEMOLITION PLAN - PART PLAN

MD-102 SCALE: 1/4" = 1'-0"

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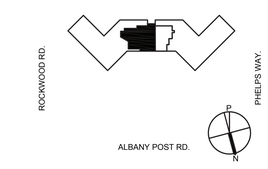

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	05/13/21	**ISSUE FOR BID**
	05/25/21	ISSUE FOR PERMIT
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ARCHITECTURE

Drawing:

SECOND FLOOR MECHANICAL DEMOLITION - PART PLAN

SCALE: As indicated FLOOR:

MD-102

XX XX

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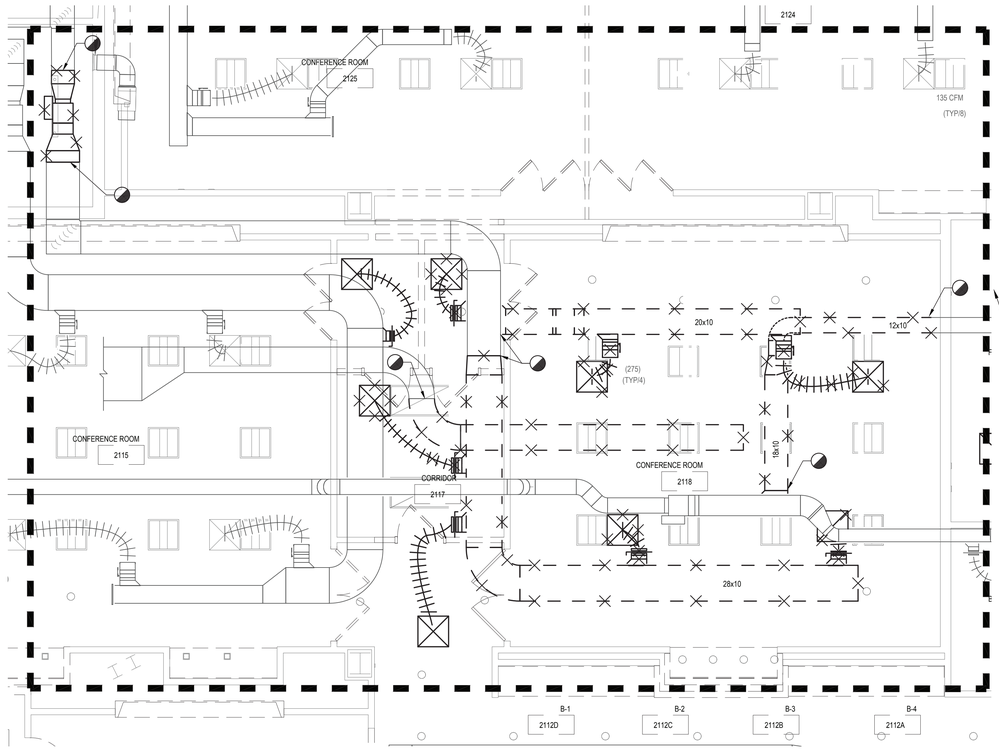

1 LEVEL 2 MECHANICAL DEMOLITION PLAN ADD ALTERNATE - PART PLAN

MD-102A SCALE: 1/4" = 1'-0"

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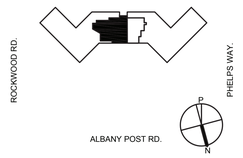

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Revision	Date	Description
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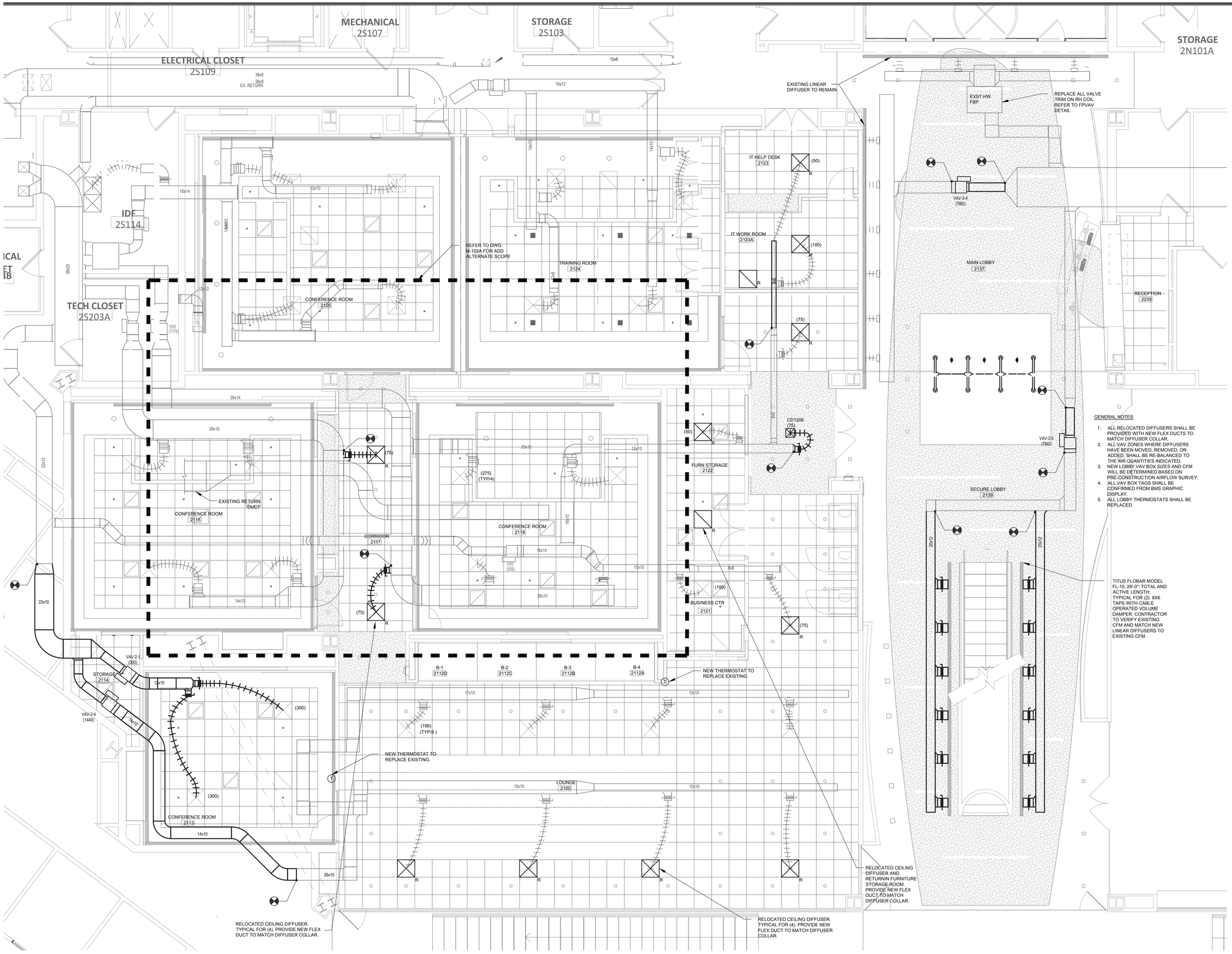
SECOND FLOOR MECH DEMOLITION ADD ALTERNATE - PART PLAN

SCALE: As indicated FLOOR:

MD-102A

XX XX

PRINTED: FILE:



1 LEVEL 2 MECHANICAL CONSTRUCTION PLAN

M-102 SCALE: 1/4" = 1'-0"

GENERAL NOTES

1. ALL RELOCATED DIFFUSERS SHALL BE PROVIDED WITH NEW FLEX DUCTS TO MATCH DIFFUSER COLLAR.
2. ALL VAV ZONES WHERE DIFFUSERS HAVE BEEN MOVED, REMOVED, OR ADDED, SHALL BE RE-BALANCED TO THE AIR QUANTITIES INDICATED.
3. NEW LOBBY VAV BOX SIZES AND CFM WILL BE DETERMINED BASED ON PRE-CONSTRUCTION AIRFLOW SURVEY.
4. ALL VAV BOX TAGS SHALL BE CONFIRMED FROM BMS GRAPHIC DISPLAY.
5. ALL LOBBY THERMOSTATS SHALL BE REPLACED

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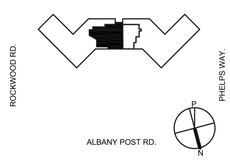

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	06/01/21	ISSUE FOR BID

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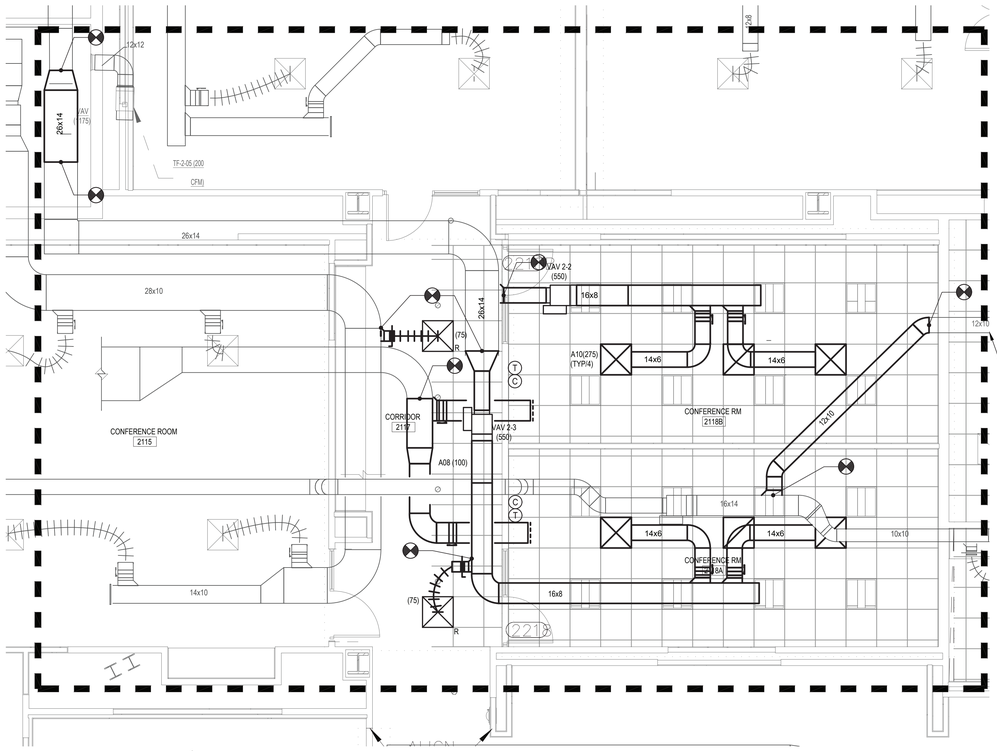
2ND FLOOR
MECHANICAL PLAN

SCALE: As indicated FLOOR:

M-102

PRINTED: FILE:



NOTES

1. EXTEND EXISTING 1" HWS&R PIPING FROM REHEAT COIL TO NEW VAV BOX REHEAT COILS SERVING CONFERENCE ROOMS.
2. THE SCOPE OF THIS DRAWING IS IN ADDITION TO M-102.
3. ALL VAV BOX TAGS SHALL BE CONFIRMED FROM BMS GRAPHIC DISPLAY.

REFER TO M-102 FOR CONTINUATION

1 LEVEL 2 MECHANICAL CONSTRUCTION PLAN - ADD ALTERNATE

M-102A SCALE: 1/4" = 1'-0"

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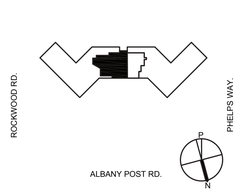

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	05/25/21	ISSUE FOR PERMIT
	06/01/21	ISSUE FOR BID

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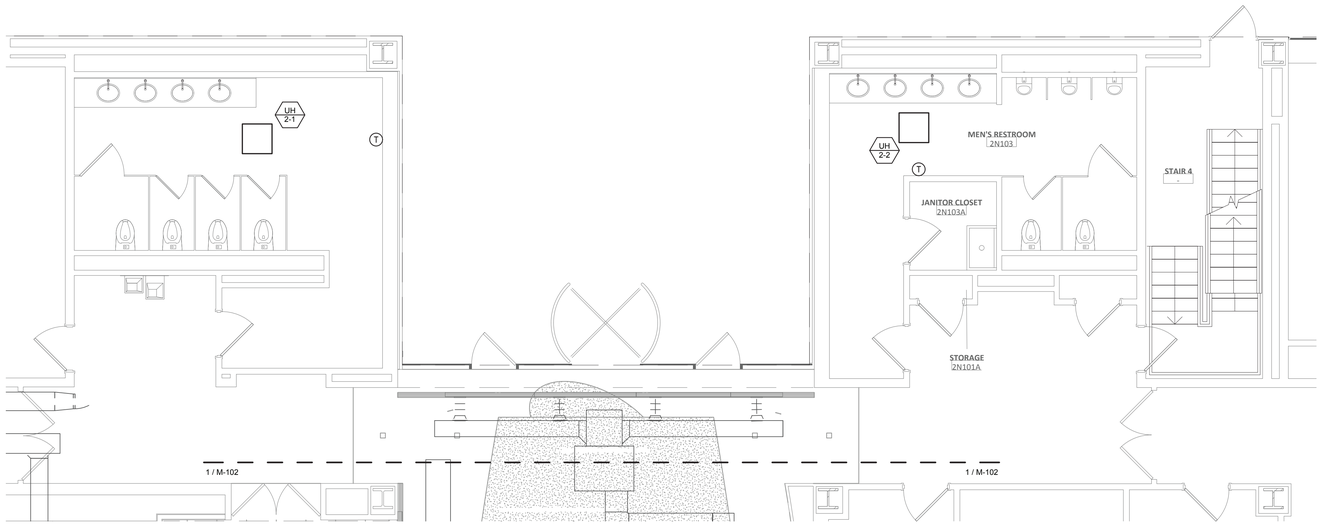
2ND FLOOR - ADD ALTERNATES

SCALE: As indicated FLOOR:

M-102A

PRINTED: FILE:



1 LEVEL 2 MECHANICAL CONSTRUCTION PART PLAN - RESTROOM
M-103 SCALE: 1/4" = 1'-0"

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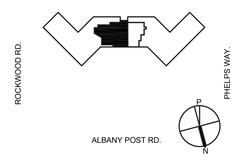

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FCA Project: 20-7168 Author
ARCHITECTURE

Drawing:
2ND FLOOR
MECHANICAL PART
PLAN - RESTROOMS

SCALE: As indicated FLOOR:

M-103

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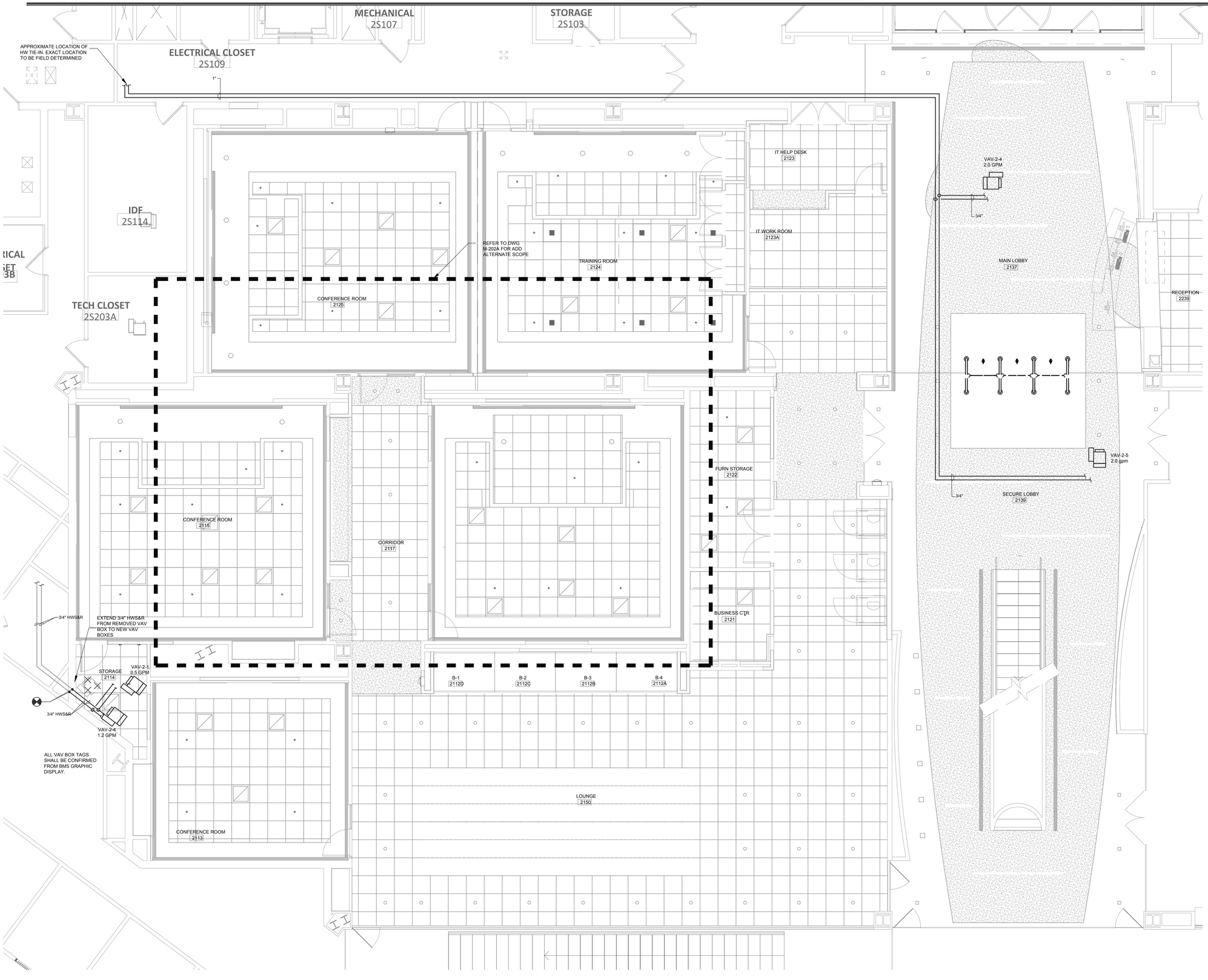

1 LEVEL 2 MECHANICAL PIPING PLAN

M-202 SCALE: 1/4" = 1'-0"

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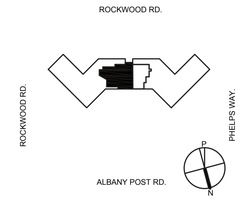

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FCA Project: 20-7168 Author
ARCHITECTURE

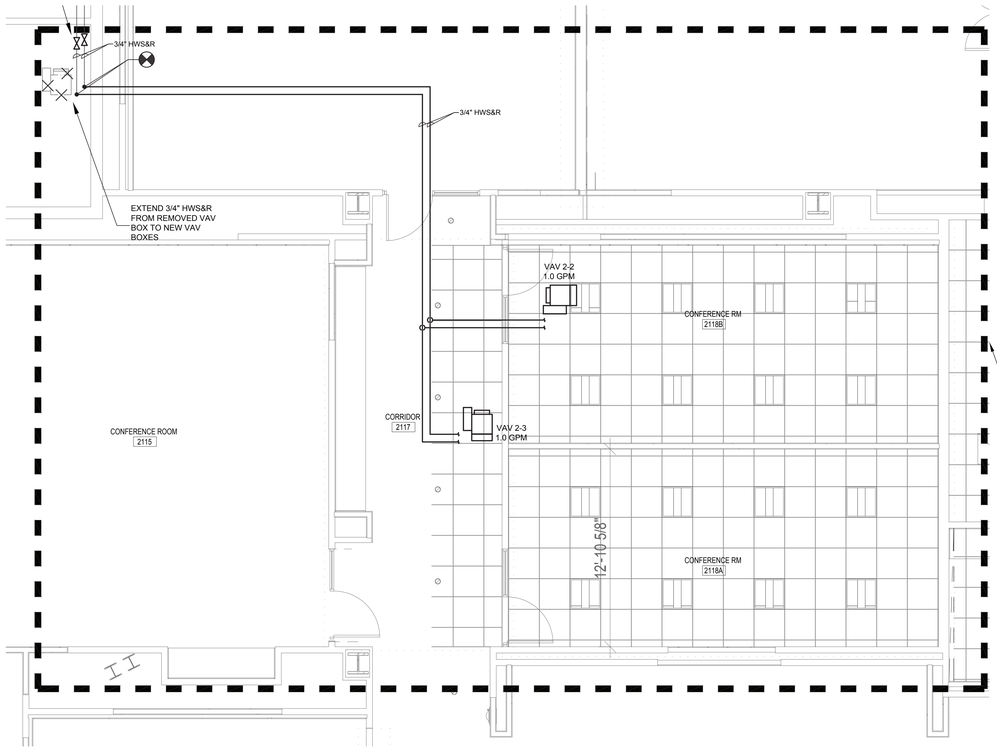
Drawing:

2ND FLOOR MECHANICAL PIPING PLAN

SCALE: As indicated FLOOR:

M-202

PRINTED: FILE:



NOTES

1. EXTEND EXISTING 3/4" HWS&R PIPING FROM REHEAT COIL TO NEW VAV BOX REHEAT COILS SERVING CONFERENCE ROOMS.
2. THE SCOPE OF THIS DRAWING IS IN ADDITION TO M-202.

1 LEVEL 2 MECHANICAL PIPING PLAN - ADD ALTERNATE

M-202A SCALE: 1/4" = 1'-0"

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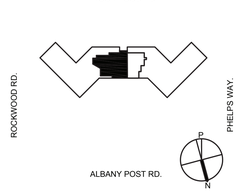
Key Plan:



Project Address: 1 ROCKWOOD ROAD SLEEPY HOLLOW NY 10591

Revision	Date	Description
	04/07/21	ISSUE FOR BID
	05/13/21	**ISSUE FOR BID**
	05/25/21	ISSUE FOR PERMIT
	06/01/21	ISSUE FOR BID

Plot Date::

Professional Seal and Signature:

FCA FRANCIS CAUFFMAN ARCHITECTS
FCA Project: 20-7168 Author
ARCHITECTURE

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SCALE: As indicated FLOOR:

M-202A

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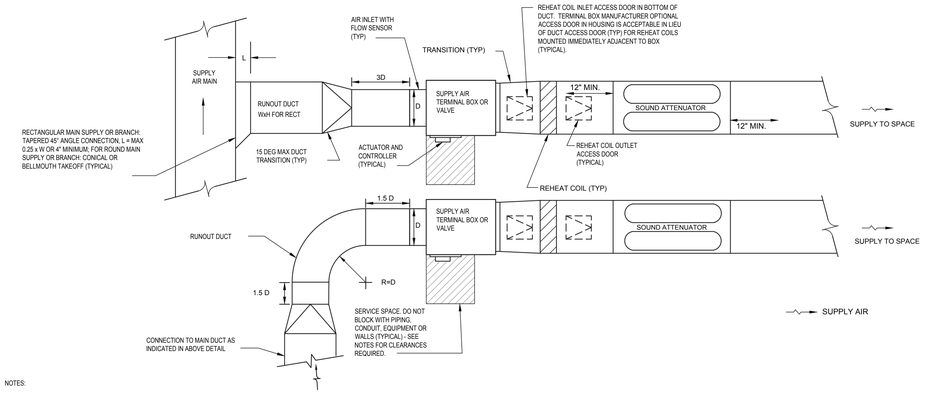
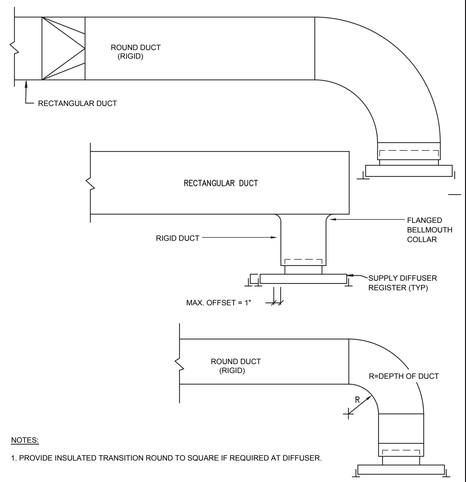


NOTES:

1. CONNECTIONS APPLY TO ALL TERMINAL BOXES INCLUDING THOSE WITHOUT REHEAT COILS OR WITHOUT SOUND ATTENUATORS. REFER TO PLANS AND SCHEDULES FOR REHEAT COIL AND SOUND ATTENUATOR REQUIREMENTS.
2. IF STRAIGHT RUN CANNOT BE MADE PROVIDE FLOW STRAIGHTENER AT BOX INLET.
3. PROVIDE RECTANGULAR OR ROUND TO OVAL TRANSITIONS WHEN BOX INLET IS OVAL.
4. FOR CONTROLLERS WITH INSULATED ELECTRICAL CONNECTORS (NO EXPOSED LIVE PARTS), ACCESS DEPTH SHALL BE 24 INCHES MINIMUM. FOR CONTROLLERS WITH EXPOSED CONNECTORS/TERMINAL STRIPS, ACCESS DEPTH SHALL BE 36 INCHES MINIMUM PER THE NEC. WIDTH OF ACCESS ZONE SHALL MATCH WIDTH OF CONTROLLER PANEL COVER OR 24 INCH MINIMUM.

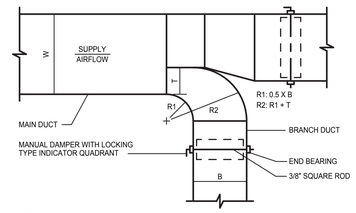
1 SUPPLY AIR BOX AND TERMINAL VALVE - DUCT CONNECTIONS
SCALE: NTS



NOTES:

1. PROVIDE INSULATED TRANSITION ROUND TO SQUARE IF REQUIRED AT DIFFUSER.

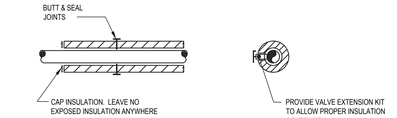
2 TYPICAL SUPPLY DIFFUSER/REGISTER DUCTWORK & CONNECTION
SCALE: NTS



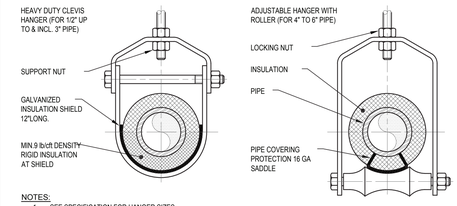
NOTES:

1. FURNISH THIS TYPE CONNECTION WHERE NOTED AND WHEN SINGLE LINE DUCTWORK IS INDICATED AS THIS ⊥. FOR LOW PRESSURE BRANCHES WITH MORE THAN 700 CFM AND MEDIUM PRESSURE BRANCHES WITH MORE THAN 1,000 CFM.
2. FURNISH THIS TYPE CONNECTION WITHOUT MANUAL DAMPER FOR ALL MEDIUM PRESSURE DUCTWORK BRANCHES.
3. MUST BE USED WHEN W ≥ 36".
4. T= $\frac{\text{CFM IN B}}{\text{CFM IN W}}$ x W, MINIMUM 4 INCHES.

3 RECTNGULAR DUCT BRANCH WITH THROAT & VOLUME DAMPER
SCALE: NTS



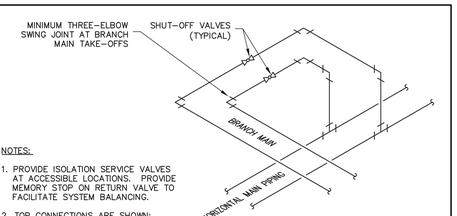
4 TYPICAL PIPE INSULATION & VALVE HANDLE EXTENSION
SCALE: NTS



NOTES:

1. SEE SPECIFICATION FOR HANGER SIZES.
2. PIPE 8" AND LARGER SHALL HAVE ROLLER SUPPORTED WITH DUAL RODS.
3. FOR CHW SERVICE OVER 3" REPLACE SADDLE WITH 12" LONG 14 GA SHIELD WITH RIGID INSULATION BETWEEN PIPE AND SHIELD.

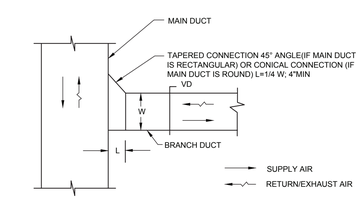
5 PIPE HANGER SUPPORT
SCALE: NTS



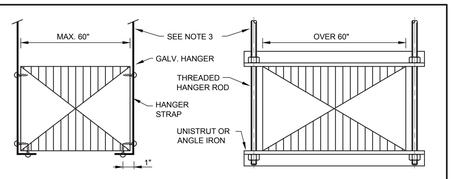
NOTES:

1. PROVIDE ISOLATION SERVICE VALVES AT ACCESSIBLE LOCATIONS. PROVIDE MEMORY STOP ON RETURN VALVE TO FACILITATE SYSTEM BALANCING.
2. TOP CONNECTIONS ARE SHOWN; BOTTOM CONNECTIONS SHALL BE SIMILAR.

9 HYDRONIC PIPING BRANCH TAKE-OFFS
SCALE: NTS



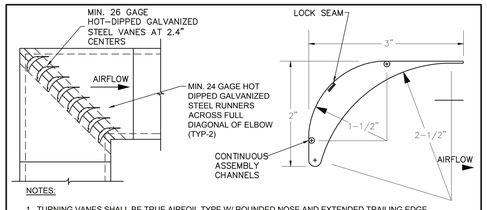
14 LOW PRESSURE BRANCH TAKE-OFFS
SCALE: NTS



NOTES:

1. ON DUCTS OVER 48" WIDE, BOTTOM SHALL BE BRACED BY ANGLE. FOR CROSS SECTION AREA MORE THAN 8 SQ FT, DUCT SHALL BE BRACED BY ANGLES ON ALL FOUR SIDES.
2. CUTTING AND PATCHING SHALL BE LIMITED TO A MINIMUM AS REQUIRED FOR PROPER INSTALLATION.
3. SUPPORTS SHALL BE SPACED AND SIZED AS PER SMACNA.

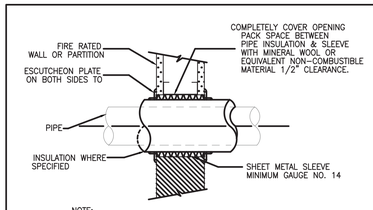
6 DUCT HANGER SUPPORT
SCALE: NTS



NOTES:

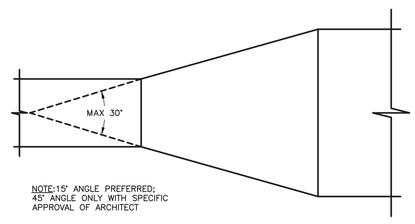
1. TURNING VANES SHALL BE TRUE AIRFOIL TYPE W/ ROUNDED NOSE AND EXTENDED TRAILING EDGE
2. PROVIDE HIGH EFFICIENCY PROFILE AS MANUFACTURED BY AERODYNE CO. OR EQUAL.
3. ASSEMBLIES SHALL INCLUDE SIDE RAILS BY THE SAME MANUFACTURER AND BE ATTACHED BY NAILS AT EACH END THAT CONNECT TO TWO CONTINUOUS ASSEMBLY CHANNELS.

7 DOUBLE THICKNESS TURNING VANES FOR SQUARE ELBOWS
SCALE: NTS



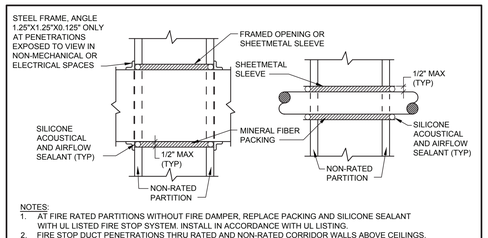
NOTE:
1.) THE INSTALLATION OF FIRE STOPPING MATERIALS SHALL BE SUBJECT TO CONTROLLED INSPECTION IN ACCORDANCE WITH C26-106.3.

10 PIPE SLEEVE THRU INTERIOR WALL
SCALE: NTS



NOTE:15° ANGLE PREFERRED; 45° ANGLE ONLY WITH SPECIFIC APPROVAL OF ARCHITECT

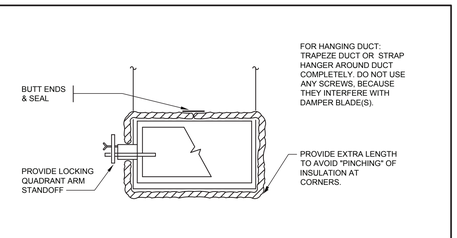
11 DUCT TRANSITION DETAIL
SCALE: NTS



NOTES:

1. AT FIRE RATED PARTITIONS WITHOUT FIRE DAMPER, REPLACE PACKING AND SILICONE SEALANT WITH UL LISTED FIRE STOP SYSTEM. INSTALL IN ACCORDANCE WITH UL LISTING.
2. FIRE STOP DUCT PENETRATIONS THRU RATED AND NON-RATED CORRIDOR WALLS ABOVE CEILINGS.

12 DUCT PENETRATION OF FULL HEIGHT PARTITIONS
SCALE: NTS



13 TYPICAL DUCT INSULATION & SUPPORTS NEAR VOLUME DAMPERS
SCALE: NTS

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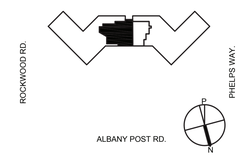

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FCA FRANCIS CAUFFMAN ARCHITECTS
FCA Project: 20-7168 Author
ARCHITECTURE

Drawing:

HVAC DETAILS
SHEET NO. 1

SCALE: As indicated FLOOR:

M-500

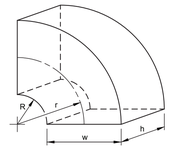
PRINTED: FILE:

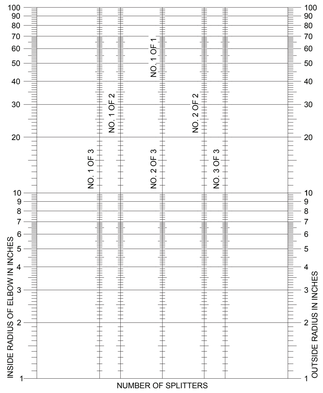
RADIUS ELBOW AND SPLITTER VANE REQUIREMENTS

r/w RATIO:	NO. OF VANES FOR 1 ELBOW:	NO. OF VANES WHEN 2 ELBOWS ARE WITHIN 2 EQUIV. DIA.:
r/w >= 1.50	0	1
1.5 > r/w >= 0.70	1	2
0.7 > r/w >= 0.60	2	3
0.6 > r/w >= 0.55	3	3

EQUIVALENT DIAMETER = (w+h)/2

NOTE:
r/w < 0.55 (SQUARE THROAT ELBOW) SHALL NOT BE USED.
MINIMUM INSIDE RADIUS R SHALL BE 2".





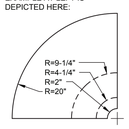
r = CENTERLINE RADIUS
R = INSIDE RADIUS
w = DUCT WIDTH
H = DUCT HEIGHT

TERMINOLOGY:

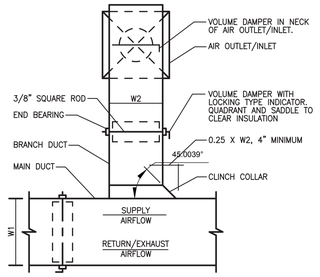
"NO. 1 OF 3" =
NO. 1 VANE OF A TOTAL OF 3 VANES.

"NO. 2 OF 3" =
NO. 2 VANE OF A TOTAL OF 3 VANES.

EXAMPLE AT LEFT IS DEPICTED HERE:



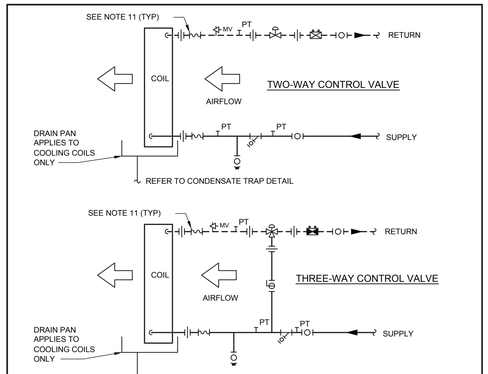
1 QUANTITY & SPACING OF DUCT SPLITTER VANES FOR SHORT RADIUS ELBOWS
SCALE: NTS



NOTES:

1. FURNISH THIS TYPE CONNECTION WHEN SINGLE LINE DUCTWORK IS INDICATED AS THIS: FOR LOW PRESSURE BRANCHES WITH LESS THAN 700 CFM.
2. NOT TO BE USED AS A SUBSTITUTE FOR AN ELBOW.
3. VOLUME DAMPER IN BRANCH RUN-OUT TO BE USED FOR BALANCING. VOLUME DAMPER IN NECK OF AIR OUTLET/INLET TO BE USED FOR FINAL ADJUSTMENT ONLY.

2 BRANCH RUN-OUT TO SINGLE AIR OUTLET/INLET
SCALE: NTS



NOTES:

1. DETAIL APPLIES TO SINGLE DUCT MOUNTED OR VAV BOX COILS, TERMINAL HEATING AND COOLING UNIT COILS INCLUDING FAN COIL UNITS, CABINET HEATERS, UNIT HEATERS, CRAC UNITS, ETC...
2. PIPING FOR MULTIPLE ROW COILS SHALL BE CONNECTED IN COUNTERFLOW ARRANGEMENT.
3. RELOCATE MANUAL AIR VENT TO COIL IF CONNECTION IS PROVIDED BY THE COIL MANUFACTURER.
4. SUBSTITUTE BUTTERFLY VALVES FOR BALL VALVES IF PIPING IS 2-1/2" NPS OR LARGER.
5. RELOCATE DRAIN OFF VALVE TO COIL IF CONNECTION IS PROVIDED BY THE COIL MANUFACTURER.
6. PROVIDE DRAIN OFF VALVES AND AIR VENTS IN PIPING SYSTEM.
7. REMOVE STRAINER BASKETS AFTER INITIAL STARTUP AND SYSTEM FLUSH IS COMPLETE.
8. WHERE COIL CONNECTIONS ARE IN SAME VERTICAL PLANE, PROVIDE COIL VENT AND DRAIN OFF CONNECTIONS.
9. WHERE COIL CONNECTIONS ARE NOT IN SAME VERTICAL PLANE, SUPPLY SHALL BE THROUGH THE BOTTOM CONNECTION.
10. WHERE WATER COIL IS INSTALLED IN A FLOOR MOUNTED CABINET TYPE UNITS, ALL VALVES SHALL FIT WITHIN CABINET. COOLING COIL PIPING AND VALVES NOT LOCATED OVER AN EXTENDED COIL DRAIN PAN SHALL BE INSULATED, INCLUDING WITHIN THE TERMINAL UNIT CABINET.
11. PROVIDE 12 INCH LONG SS BRAIDED HOSE ONLY ON FAN COILS, FAN POWERED TERMINAL BOXES, UNIT AND CABINET HEATERS, CRAC UNITS AND OTHER TERMINAL UNITS THAT INCLUDE FANS.

3 VAV MOUNTED COIL AND TERMINAL UNIT HYDRONIC PIPING
SCALE: NTS H12-23

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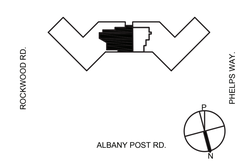

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ARCHITECTURE

Drawing:

HVAC DETAILS
SHEET NO. 2

SCALE: As indicated FLOOR:

M-501

PRINTED: FILE:

DIFFUSER, GRILLE & REGISTER SCHEDULE

TAG	SERVICE	TYPE	MATERIALS	FACE SIZE (INCHES)	MAXIMUM AIRFLOW (CFM)							MAX NC	MAX SP	MFR	MODEL	SERVICE	NOTES
					6" NECK	8" NECK	10" NECK	12" NECK	14" NECK	15" NECK	22x22						
A	SUPPLY	SQUARE PLAQUE DIFFUSER	ALUMINUM	24x24	100	175	275	400	535	615	-	20	0.15	TITUS	OMNI	OFFICE AREAS WHERE INDICATED ON PLANS	1,2,3,4
B	RETURN	SQUARE PLAQUE GRILLE	ALUMINUM	24x24	-	-	-	-	-	-	1,115	20	0.15	TITUS	350 RL	OFFICE AREAS WHERE INDICATED ON PLANS	1,2,3,4

NOTES:
1. PROVIDE REQUIRED SHEET METAL TRANSITION FROM SQUARE DIFFUSER CONNECTION SIZE LISTED TO ROUND DIAMETER INDICATED BY DIFFUSER DESIGNATION ON PLANS.
2. COORDINATE MOUNTINGS WITH ADJACENT TYPE OF CONSTRUCTION - REFER TO ARCHITECTURAL DRAWINGS. PROVIDE CONCEALED MOUNTINGS WHEN AVAILABLE
3. PROVIDE SECTORIZING BAFFLES OR BLANK-OFFS FOR DIRECTIONAL THROW CONTROL WHERE INDICATED ON PLANS
4. ADJUST THROW PATTERNS IN FIELD AFTER BALANCING TO AVOID DRAFTS IN OCCUPIED ZONE.
5. ARCHITECT TO COORDINATE EDGE STYLE, COLOR AND FINISH TYPES

VAV BOX SCHEDULE & HOT WATER REHEAT

UNIT NO.	PRIMARY CFM (RANGE)	LOWEST TURN DOWN CFM	PRIMARY INLET COLLAR SIZE	DISCHARGE COLLAR SIZE (IN. x IN.)	MIN. INLET SP (IN. WG)	NC RATING @ 1" INLET S.P.		SOUND POWER LEVELS @ 1.0" INLET PRESSURE (IN. WG)							HOT WATER REHEAT COIL										MANUFACTURER MODEL NUMBER (OR APPROVED EQUAL)	NOTES
						RADIATED	DISCHARGE	OCTAVE BAND / REFERENCE	2	3	4	5	6	7	MBH	ROWS	EAT (°F)	LAT (°F)	EWT (°F)	LWT (°F)	WPD (FT. WG)	APD (FT. WG)	COIL GPM	BRANCH PIPE RUNOUT SIZE		
VAV-2-1	200-400	120	6"	8.75x8.75	0.18	15	19	DISCHARGE RADIATED	59 55	60 52	56 44	52 37	47 31	48 29	8.4	1	55	84.5	180	140	0.2	0.10	PER PLAN	3/4"	TITUS DESV	(1) (2)
VAV-2-2 VAV-2-3	401-680	200	8"	10.75x8.75	0.38	15	15	DISCHARGE RADIATED	59 58	59 51	56 45	53 39	49 35	47 31	12.6	1	55	82.2	180	140	0.5	0.36	PER PLAN	3/4"	TITUS DESV	(1) (2)
VAV-2-4	1101-1400	420	12"	14.75x13.75	0.21	19	15	DISCHARGE RADIATED	60 56	61 52	60 50	56 43	54 39	52 34	29.3	1	55	84.3	180	140	3.0	0.19	PER PLAN	3/4"	TITUS DESV	(1) (2)
VAV-2-5	TBD	TBD	TBD																							
VAV-2-6	TBD	TBD	TBD																							

(1) DDC CONTROLLER TO BE PROVIDED BY THE CONTROLS CONTRACTOR.
(2) UNIT SHALL BE PROVIDED WITH NON-FUSED DISCONNECT, SWITCH AND 120/24 VOLT TRANSFORMER.
(3) ALL VAV BOX TAAGS SHALL BE CONFIRMED FROM BMS GRAPHIC DISPLAY.
(4) VAV-2-5 AND 2-6 SIZE TO BE CONFIRMED BY PRE-CONSTRUCTION AIRFLOW.

UNIT HEATER SCHEDULE (ELECTRIC)

UNIT NO.	LOCATION	TYPE	INPUT (KW)	MBH	AIR			MOTOR		ELEC. DATA			MANUFACTURER MODEL NUMBER (AS STANDARD)	REMARKS
					CFM	EAT (°F)	LAT (°F)	HP	RPM	VOLTS	PHASE	HZ		
UH-02-1	SECOND FLOOR RESTROOM	ELECTRIC	3.0	--	300	72	103	--	--	208	3	60	DAYTON 2YU39	WITH CEILING TRIM KIT
UH-02-2	SECOND FLOOR RESTROOM	ELECTRIC	3.0	--	300	72	103	--	--	208	3	60	DAYTON 2YU39	WITH CEILING TRIM KIT

NOTES:
1. RECESSED MOUNTING IN T-BAR CEILING
2. 208/24 VOLT TRANSFORMER
3. TIME DELAY RELAY (24V)
4. WALL MOUNTED THERMOSTAT

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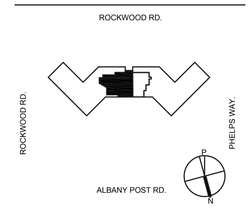

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	06/01/21	ISSUE FOR BID

Plot Date::

Professional Seal and Signature:

FCA FRANCIS CAUFFMAN ARCHITECTS
FCA Project: 20-7168 Author
ARCHITECTURE

Drawing:

HVAC SCHEDULE

SCALE: As indicated FLOOR:

M-600

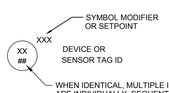
PRINTED: FILE:

FIRST LETTER(S)			SUCCEEDING LETTERS		
	PROCESS OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER FLAME		USERS CHOICE(*)	USERS CHOICE(*)	USERS CHOICE(*)
C	CARBON DIOXIDE			CONTROL	
D	DEWPOINT	DIFFERENTIAL		DAMPER	
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO			
G	GAS		GLASS	GATE	
H	HAND (MANUAL)				HIGH
I	CURRENT		INDICATE		
J	POWER	SCAN			
K	TIME OR SCHEDULE	RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOISTURE	MOMENTARY			
N	USERS CHOICE(*)		USERS CHOICE(*)	USERS CHOICE(*)	USERS CHOICE(*)
O	USERS CHOICE(*)		ORIFICE, RESTRICTION		
P	PRESSURE (OR VACUUM)		POINT (TEST CONNECTION)		
Q	QUANTITY OR EVENT(*)	INTEGRATE	INTEGRATE		
R	RADIATION		RECORD OR PRINT		
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE(*)		MULTIFUNCTION(*)	MULTIFUNCTION(*)	MULTIFUNCTION(*)
V	VIBRATION, MECH ANALYSIS			VALVE	
W	WEIGHT OR FORCE		WELL		
X	SMOKE		UNCLASSIFIED(*)	TRANSFORMER	UNCLASSIFIED(*)
Y	EVENT (STATUS)			RELAY OR COMPUTE(*)	
Z	POSITION, DIMENSION			DRIVER, ACTUATOR OR UNCLASSIFIED FINAL CONTROL ELEMENT	

(*) WHEN USED, EXPLANATION IS SHOWN ADJACENT TO INSTRUMENT SYMBOL. SEE ABBREVIATIONS AND LETTER SYMBOLS.
EXAMPLE: PT=PRESSURE TRANSMITTER, HS=HAND SWITCH

INSTRUMENT IDENTIFICATION LETTERS

CONTROL DEVICE OR INSTRUMENT TAG



BAS INPUT/OUTPUT IDENTIFIER

X = ANALOG(A) OR DIGITAL(D)
Y = OUTPUT(O) OR INPUT(I)

NOTE:
INSTRUMENTATION IDENTIFICATION TAGS SHOWN ON THE ENCLOSED CONTROL DRAWINGS ARE INTENDED TO BE SPECIFIC FOR EACH SEQUENCE. NO ATTEMPT HAS BEEN MADE TO COORDINATE SEQUENTIAL TAGS IN ALL SEQUENCES AS THIS EFFORT WOULD NOT AID IN THE UNDERSTANDING OF THE DESIGN INTENT. THEREFORE THERE MAY BE INSTRUMENTS ON THE CONTROL DRAWINGS WHICH APPEAR TO HAVE THE SAME IDENTIFICATION NUMBER.

PROVIDE AND COORDINATE A COMPLETE LIST OF INSTRUMENTATION, THE ASSOCIATED IDENTIFICATION TAGS AND A CROSS REFERENCE TO BE USED IN THE BAS (BUILDING AUTOMATION SYSTEM) PROGRAM CODE.

MODIFIER SYMBOLS AND DESCRIPTIONS SHOWN BELOW

OC	OPEN/CLOSE
OO	ON/OFF
SS	START/STOP
AUTO	AUTO
PAL	PRESSURE ALARM LOW LIMIT
PAH	PRESSURE ALARM HIGH LIMIT
TSL	TEMPERATURE ALARM LOW LIMIT
TSH	TEMPERATURE ALARM HIGH LIMIT
MAL	MOISTURE ALARM LOW LIMIT
MAH	MOISTURE ALARM HIGH LIMIT
R	MANUAL RESET

SAMPLE DEVICE TAGS

DUCT SMOKE DETECTOR WITH AUXILIARY CONTACTS AND MANUAL RESET

HIGH & LOW MOISTURE "OUT OF RANGE" LIMITS FOR FAULTY SENSOR ALARM

PILOT LIGHT

LINE TYPE LEGEND

PROCESS LINE

INSTRUMENT LINE

GENERAL INSTRUMENT / FUNCTION SYMBOLS

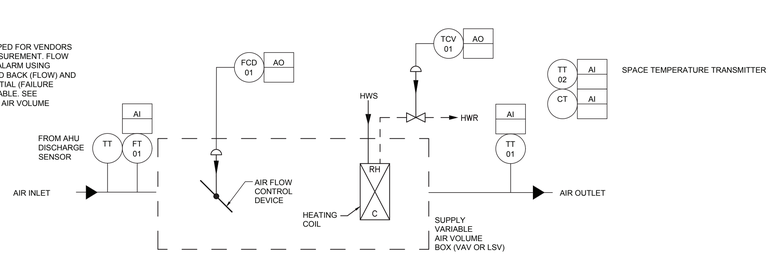
HVAC CONTROL SYSTEM GENERAL REQUIREMENTS:

1. UNLESS OTHERWISE NOTED, ALL CONTROLS SHALL BE DIRECT DIGITAL TYPE (DDC). SEQUENCES OUTLINED SHALL BE PERFORMED BY LOCALLY MOUNTED TERMINAL UNIT DIRECT DIGITAL CONTROLLERS AND DIRECT DIGITAL CONTROL FIELD PANELS (DDCFP). REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS. ALL SEQUENCES SHALL BE MONITORED BY THE CENTRAL BUILDING AUTOMATION SYSTEM (BAS) HEAD END COMPUTER WORKSTATION.
2. ALL MEASURED DATA, CONTROL SETPOINTS, FUNCTIONS AND TIME DELAYS SHALL BE ACCESSIBLE AND ADJUSTABLE AT THE BAS HEAD END COMPUTER WORKSTATION AND VIA A LAPTOP SERVICE TOOL CONNECTED TO ANY DDCFP WITHOUT ANY HARDWARE OR SOFTWARE REVISIONS.
3. BAS SHALL MONITOR GENERATOR SWITCHGEAR TO OBTAIN STATUS OF NORMAL (STREET) POWER. INPUT SHALL BE PROVIDED INDEPENDENTLY TO AT LEAST TWO DDCFP.
4. DEFINED OCCUPIED/UNOCCUPIED PERIODS SHALL BE ADJUSTABLE GLOBALLY (SO THAT ALL CAN BE ON THE SAME TIME FRAME) AND INDIVIDUALLY (SO THAT ANY ONE ZONE OR SYSTEM OPERATION CAN HAVE DIFFERENT TIME PERIODS).
5. ALL BAS COMPONENTS (E.G. CONTROL PANELS, WORKSTATION COMPUTER, ETC…) SHALL BE CONNECTED TO STANDBY POWER.
6. BAS SHALL MONITOR AND PROVIDE CONTROL SIGNALS TO MANUFACTURERS PACKAGED CONTROL PANELS. PROVIDE COMMUNICATION INTERFACE INCLUDING SOFTWARE BETWEEN EQUIPMENT MANUFACTURERS PACKAGED CONTROL PANELS AND THE BAS COMMUNICATION CONTROL PANELS. INTERFACE SHALL BE CAPABLE OF READING AND DISPLAYING ALL DATA USED BY THE MANUFACTURER CONTROL PANEL. SOFTWARE INTERFACE MAY BE THROUGH OPEN PROTOCOL INTERFACE CARDS. PROVIDE INTERFACE TO ACCESS AND CONTROL ALL SETPOINT, INPUTS AND OUTPUTS.
7. ALL DDCFPS AND LABORATORY ZONE CONTROLLERS SHALL BE CAPABLE OF INDEPENDENT OPERATION REGARDLESS OF THE STATUS OF THE BAS NETWORK COMMUNICATION.
8. ALL COMMON INFORMATION (OUTSIDE AIR TEMP & HUMIDITY, ETC…) SHALL BE MEASURED AND COMMUNICATED TO THE BAS IN AT LEAST (2) LOCATIONS.
9. ALL WALL MOUNTED TEMPERATURE OR HUMIDITY TRANSMITTERS SHALL HAVE ALL PENETRATIONS SEALED.
10. ALL INSTALLED CONTROL DEVICES SHALL BE INSTALLED IN SUCH A WAY TO BE ACCESSIBLE FOR MAINTENANCE AND REPAIR.
11. PROVIDE MENU DRIVEN CAPABILITY TO OVERRIDE AUTOMATED START/STOP OR OPERATING MODES FOR EACH PIECE OF EQUIPMENT (INCLUDING PUMPS, AIR HANDLING UNITS, VV BOXES, ETC…). IF A SEQUENCE IS DISABLED BY MANUAL INPUT AND THE BAS ATTEMPTS AN AUTOMATED CHANGE IN OPERATING MODE, AN ALARM SHALL BE INITIATED AT THE BAS STATING THAT THE SYSTEM WAS UNABLE TO CHANGE THE MODE DUE TO USER INPUT. WHERE APPLICABLE A MANUAL INPUT COMMAND WILL THEN BE REQUIRED FROM THE USER INSTRUCTING THE BAS TO START THE NEXT SEQUENTIAL PIECE OF EQUIPMENT.
12. THE DESIGN INTENT IS FOR THE BAS TO MONITOR PRESSURES, TEMPERATURES AND FLOWS AND TO CONTROL VALVES, VARIABLE FREQUENCY DRIVES (VFDS), AHUS, PUMPS, ETC.... MONITORED DATA WILL BE USED TO ENERGIZE OR DE-ENERGIZE EQUIPMENT IN ACCORDANCE WITH THE SEQUENCES OUTLINED.
13. ALL EQUIPMENT CONTROLLED BY THE BAS SHALL BE CAPABLE OF MANUAL OPERATION THROUGH HAND-OFF-AUTOMATIC (HOA) SWITCHES LOCATED IN THE MOTOR STARTERS OR VARIABLE SPEED DRIVES. POSITIONING OF ALL VALVES CONTROLLED BY THE BAS SHALL BE CAPABLE OF MANUAL POSITIONING (OPEN, CLOSED, MODULATED, AUTO) VIA LABELED POTENTIOMETERS AND SWITCHES. SAFETY DEVICES SHALL FUNCTION AND SHUT DOWN THE ASSOCIATED EQUIPMENT WHEN THE MANUAL SWITCHES ARE IN BOTH THE HAND AND AUTO POSITIONS.
14. COORDINATE ALL SENSOR INSTALLATION LOCATIONS AND SUBMIT PROPOSED POSITIONS ON PIPING AND DUCTWORK COORDINATION SUBMITTALS. COORDINATE AND ENSURE MANUFACTURER'S RECOMMENDED UPSTREAM AND DOWNSTREAM PIPE OR DUCT DIAMETERS ARE PROVIDED. SPECIAL ATTENTION REQUIRED FOR FLOW MEASUREMENT.
15. DAMPER END SWITCHES SHALL BE MOUNTED OUTSIDE CONTAMINATED AIRSTREAM FOR ALL LABORATORY EXHAUST SYSTEMS.
16. FAIL SAFE POSITIONS INDICATED ARE POSITIONS THAT DEVICES WILL GO TO WHEN THE ASSOCIATED EQUIPMENT IS DE-ENERGIZED.
17. PROVIDE DAMPING OF MODULATING CONTROL LOOPS TO PREVENT HUNTING. MAXIMUM RESPONSE TIME SHALL BE 30 SECONDS. TUNE CONTROL P&ID LOOPS TO OBTAIN STABLE OPERATION OF THE CONTROL DEVICE. P&ID LOOP TUNING MAY BE REQUIRED TO BE PERFORMED MULTIPLE TIMES (E.G. DURING MULTIPLE CONTROL SCENARIOS).
18. FOR ALARMS AND SAFETY SHUT DOWN OF A UNIT, BAS SHALL RETAIN IN MEMORY READINGS AND SETPOINTS TO HELP ISOLATE CAUSE OF THE ALARM OR SAFETY SHUT DOWN. BAS SHALL INCLUDE AN ON SCREEN MANUAL RESTART BUTTON FOR EACH SYSTEM AND PIECE OF EQUIPMENT TO ALLOW REMOTE RESTART AT HEAD END COMPUTER.
19. IF A DDCFP OR EQUIPMENT MANUFACTURER CONTROL PANEL LOSES COMMUNICATION WITH THE BAS NETWORK, AN ALARM SHALL BE INITIATED AT THE BAS INDICATING THE LOCATION OF THE FAULT.
20. WHENEVER A PIECE OF EQUIPMENT IS TAKEN OFFLINE FOR MAINTENANCE, ALARMS RELATED TO THIS PIECE OF EQUIPMENT SHALL BE INHIBITED.
21. WHERE CURRENT TRANSMITTERS ARE USED TO DETERMINE FAN OR EQUIPMENT STATUS, A BELT OFF TEST SHALL BE PERFORMED TO DETERMINE CURRENT LOW POINT FOR STATUS VERIFICATION.
22. OCCUPANCY SCHEDULES: OCCUPANCY SCHEDULING SHALL BE CAPABLE OF SCHEDULING BY AREA, ZONE, GROUPS OF ZONES, INDIVIDUALLY CONTROLLED EQUIPMENT AND GROUPS OF INDIVIDUALLY CONTROLLED EQUIPMENT. EACH SCHEDULE SHALL PROVIDE BEGINNING AND ENDING DATES AND TIMES (HOURS: MINUTES). A WEEKLY REPEATING SCHEDULE (E.G. BETWEEN 8:00 A.M. AND 6:00 P.M., MONDAY THROUGH FRIDAY) SHALL CONSTITUTE ONE SCHEDULE. NOT FIVE. DATED SCHEDULES MAY BE ENTERED IN ONE-YEAR ADVANCE. DATED SCHEDULES SHALL BE SELF-DELETING WHEN EFFECTIVE DATES HAVE PASSED. LEAP YEARS SHALL BE ADJUSTED AUTOMATICALLY WITHOUT OPERATOR INTERVENTION.
23. REFER TO ZONE SEQUENCES FOR INITIAL SETPOINTS AND SCHEDULES.

CONTROLS SYSTEM GENERAL REQUIREMENTS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	CENTRIFUGAL FAN		VARIABLE AIR VOLUME TERMINAL BOX OR VALVE WITH REHEAT COIL		MODULATING ACTUATOR WITHOUT INTEGRAL PILOT POSITIONER
	TUBULAR CENTRIFUGAL OR VANEAXIAL FAN		VARIABLE AIR VOLUME TERMINAL BOX OR VALVE		MODULATING ACTUATOR WITHOUT PILOT POSITIONER - FAILS OPEN
	PLUG FAN		PUMP		MODULATING ACTUATOR WITHOUT PILOT POSITIONER - FAILS CLOSED
	PROP FAN	MS	MOTOR STARTER		TWO POSITION ACTUATOR, FAILS OPEN
		VSD	VARIABLE SPEED DRIVE		TWO POSITION ACTUATOR, FAILS CLOSED
	DYNAMIC PLUG FAN (ARRAY)		AIR FLOW STATION		BACKPRESSURE REGULATOR, SELF CONTAINED
					PRESSURE REDUCING REGULATOR SELF CONTAINED
C H RH PH C C C C	COIL: CC - COOLING COIL HC - HEATING COIL RHC- REHEAT COIL PHC- PREHEAT COIL		HUMIDIFIER	HOA	HAND-OFF-AUTOMATIC CONTROL STATION REFER TO DIVISION 26 DWGS
			FILTER		TWO WAY VALVE ASSOCIATED WITH ACTUATOR - SEE DRAWINGS & SPECS FOR VALVE TYPE
					THREE WAY VALVE ASSOCIATED WITH ACTUATOR - SEE DRAWINGS & SPECS FOR VALVE TYPE
					OPPOSED BLADE DAMPER ASSOCIATED WITH ACTUATOR
					PARALLEL BLADE DAMPER ASSOCIATED WITH ACTUATOR

EQUIPMENT SYMBOLS



NOTES:

THIS DETAIL DEVELOPED FOR VENDORS THAT USE FLOW MEASUREMENT. FLOW CONFIRMATION AND ALARM USING POSITION BASED FEED BACK (FLOW) AND PRESSURE DIFFERENTIAL (FAILURE ALARM) ARE ACCEPTABLE. SEE SPECIFICATIONS FOR AIR VOLUME TERMINAL BOXES.

GENERAL

1. REQUIREMENTS OF "SEQUENCE OF CONTROLS - GENERAL", "SEQUENCE OF CONTROLS - STANDBY POWER" AND "CONTROL SYSTEM NOTES" ON DRAWING H701 APPLY TO ALL SEQUENCES.
2. VARIABLE AIR VOLUME BOX (LSV/VAV) SHALL BE CONTROLLED BY A LOCAL (BOX MOUNTED) DIRECT DIGITAL CONTROLLER COMMUNICATING WITH THE BAS. ALL BOXES SHALL BE CAPABLE OF VARIABLE, TWO POSITION AND CONSTANT AIR VOLUME OPERATION. PROVIDE INPUT/OUTPUT EXPANSION MODULES TO PERFORM SEQUENCES OUTLINED. SEE TYPICAL SPACE SEQUENCES FOR OPERATING REQUIREMENTS.
3. SETPOINTS AND OCCUPANCY SCHEDULING SHALL BE ADJUSTABLE FROM THE BAS. THE BAS SHALL BE CAPABLE OF ADJUSTING SETPOINTS AND STATUS GLOBALLY AS WELL AS ON AN INDIVIDUAL BOX BASIS.
4. LOCAL SPACE TEMPERATURE TRANSMITTER (TT-01) SHALL BE CAPABLE OF SETPOINT ADJUSTMENT WITHIN A 2F, ADJUSTABLE RANGE.
5. ALL SUPPLY BOXES SHALL BE NORMALLY CLOSED UNLESS NOTED OTHERWISE.
6. SV OR VV BOX AIR FLOW RATE SETPOINT AS MEASURED AT FT-01 (OR VIA POSITION FEEDBACK) SHALL BE MAINTAINED BY THE LOCAL CONTROLLER REGARDLESS OF UPSTREAM PRESSURE (PRESSURE INDEPENDENT OPERATION). THE BAS SHALL MONITOR AND DISPLAY (UPON REQUEST) THE FLOW RATE OF ANY LSV OR VAV BOX.

ALARMS

1. THE FOLLOWING SHALL INITIATE A SPECIFIC ALARM NOTICE AT THE BAS:
   a. SPACE TEMPERATURE ABOVE 95 DEGREES F - TIME DELAY 10 MINUTES.
   b. SPACE TEMPERATURE BELOW 55 DEGREES F - TIME DELAY 10 MINUTES.
   c. AIRFLOW RATE 10% ABOVE SETPOINT FOR 5 CONSECUTIVE MINUTES.
   d. AIRFLOW RATE 10% BELOW SETPOINT FOR 5 CONSECUTIVE MINUTES.
   e. CO2 LEVEL ABOVE 1000 PPM FOR 5 CONSECUTIVE MINUTES.

MONITOR

1. THE DISCHARGE AIR TEMPERATURE SHALL BE PROVIDED FOR MONITORING ONLY.

OCCUPIED MODE

1. SV OR VV BOX SHALL OPERATE BETWEEN PRESET FLOW RATES (CFM) SHOWN ON THE PLANS (OCCUPIED MAXIMUM TO OCCUPIED MINIMUM). THE LOCAL CONTROLLER AND THE BAS SHALL MONITOR ROOM TEMPERATURE AT TT-01 AND AIR FLOW RATE AT FT-01 (OR VIA POSITION FEEDBACK). UPON A RISE IN SPACE TEMPERATURE FCD SHALL MODULATE OPEN TO MAINTAIN SPACE TEMPERATURE SET POINT. UPON A DROP IN SPACE TEMPERATURE, THE FCD SHALL MODULATE TO MINIMUM POSITION, AND UPON FURTHER DROP IN TEMPERATURE, THE REHEAT CONTROL VALVE TCV-01 SHALL MODULATE OPEN. ON A RISE IN TEMPERATURE, THE REVERSE SHALL OCCUR.
2. CARBON DIOXIDE SENSORS LOCATED IN EACH CONFERENCE ROOM SHALL MONITOR CO2 LEVELS IN THE SPACE. WHENEVER THE SPACE CO2 LEVEL EXCEEDS 800 PP.M, THE CO2 CONTROL LOOP WILL BE ACTIVATED. WHEN THE CO2 CONTROL LOOP IS ACTIVATED THE SPACE TEMPERATURE SENSOR SHALL BE OVERRIDDEN AND THE FCD-01 SHALL MODULATE OPEN. IF THE SPACE TEMPERATURE IS EXCEEDED, TCV-01 SHALL MODULATE OPEN TO MAINTAIN SPACE TEMPERATURE SET POINT. VAV BOXES SHALL RESUME NORMAL OPERATION WHEN CO2 LEVELS RETURN TO LESS THAN 700 PPM.

UNOCCUPIED MODE

1. SV BOX SHALL OPERATE WITHIN PRESET AIRFLOW RANGE (CFM) SHOWN ON THE PLANS (UNOCCUPIED SETPOINT). THE LOCAL CONTROLLER AND THE BAS SHALL MONITOR ROOM TEMPERATURE AT TRANSMITTER TT-01 AND AIR FLOW RATE AT FT-01. THE LOCAL CONTROLLER SHALL MODULATE AIR FLOW RATE VIA FCD-01 AND HOT WATER FLOW VIA TCV-01.
2. WHEN THE SPACE TEMPERATURE IS AT OR ABOVE THE UNOCCUPIED SETPOINT AT TT-01, HOT WATER VALVE TCV-02 SHALL BE FULLY CLOSED, AIRFLOW CONTROL DAMPER FCD-01 SHALL MODULATE TO MAINTAIN UNOCCUPIED FLOW SETPOINT AT FT-01. AS THE SPACE TEMPERATURE DROPS, HOT WATER VALVE TCV-01 SHALL BE MODULATED OPEN IN ORDER TO MAINTAIN UNOCCUPIED SETPOINT AT TT-01. UPON A RISE IN TEMPERATURE AT TT-01, TCV-02 SHALL MODULATE CLOSED.

HISTORIES/TRENDING & REPORTS

1. THE BAS SOFTWARE SHALL BE CAPABLE OF RECORDING AND PRODUCING REPORTS TO DOCUMENT ALL READINGS ASSOCIATED WITH EACH SUPPLY SV OR VV BOX. REFER TO TYPICAL ZONE SEQUENCES FOR ADDITIONAL REQUIREMENTS.

TYPICAL VARIABLE AIR VOLUME BOX (VAV) OR VALVE (LSV) CONTROL DETAIL

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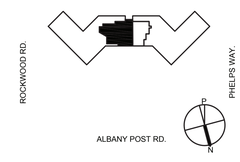
Key Plan:



Project Address: 1 ROCKWOOD ROAD SLEEPY HOLLOW NY 10591

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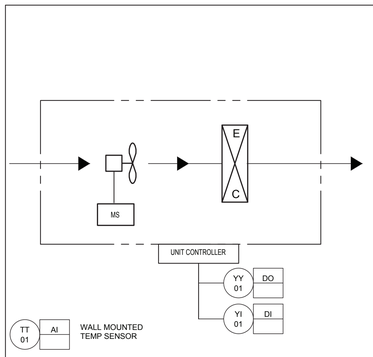

GENERAL

1. REQUIREMENTS OF "SEQUENCE OF CONTROLS - GENERAL" "SEQUENCE OF CONTROLS - STANDBY POWER" AND "CONTROL SYSTEM NOTES" ON DRAWING H801 APPLY TO ALL SEQUENCES.
2. THIS CONTROL SEQUENCE APPLIES TO UNIT HEATERS.
3. SEQUENCES SHALL BE PERFORMED BY A LOCAL CONTROL UNIT.

START/STOP SEQUENCE

1. NORMALLY ALL UNIT HEATERS SHALL BE AVAILABLE FOR OPERATION 24 HOURS PER DAY SEVEN DAYS PER WEEK.
2. UNIT SHALL START AND STOP IN ACCORDANCE WITH TEMPERATURE CONTROL SEQUENCE.

TEMPERATURE CONTROL SEQUENCE

1. WHEN THE TEMPERATURE AT TT-01 FALLS BELOW SETPOINT FAN SHALL START AT FIXED SPEED AND HOT WATER VALVE SHALL OPEN. AS TEMPERATURE RISES ABOVE SETPOINT REVERSE SHALL OCCUR.
2. ONCE THE TEMPERATURE SETPOINT AT TT-01 IS MET, THE REVERSE SHALL OCCUR

ELECTRIC UNIT HEATER CONTROLS

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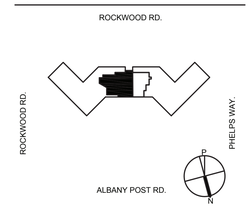

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