#### HVAC GENERAL NOTES

#### <u>ARCHITECTURAL</u>

- DO NOT SCALE DRAWINGS. REFER TO ARCHITECTURAL DRAWINGS AND REFLECTED CEILING PLANS FOR EXACT LOCATION OF DOORS, WINDOWS, CEILING DIFFUSERS,
- LIGHT FIXTURE LOCATIONS TAKE PRECEDENCE OVER DIFFUSER AND GRILLE LOCATIONS. LOCATE DIFFUSERS AND GRILLES TO ACCOMMODATE LIGHTING LAYOUT.
- REFER TO ARCHITECTURAL FLOOR PLANS FOR LOCATION AND RATING OF ALL FIRE RATED WALLS AND CEILINGS.

#### <u>ENERAL</u>

- THE HVAC CONTRACTOR SHALL VISIT THE JOB SITE AND BE FAMILIAR WITH ALL PROJECT CONDITIONS PRIOR TO FABRICATING DUCTWORK, EQUIPMENT, ETC. NO ALLOWANCES WILL BE MADE FOR CONTRACTOR'S UNFAMILIARITY WITH PROJECT
- DUCTWORK ROUTING SHOWN IS SCHEMATIC. HVAC CONTRACTOR SHALL PROVIDE ANY ADDITIONAL OFFSETS AND FITTINGS, INCLUDING DIVIDED DUCTS, REQUIRED FOR PROPER INSTALLATION AND TO MAINTAIN CLEARANCES AS ENCOUNTERED
- FURNISH ALL LABOR, MATERIAL AND EQUIPMENT REQUIRED FOR THE COMPLETE INSTALLATION AND OPERATION OF ALL SYSTEMS IN THIS SECTION OF WORK IN ACCORDANCE WITH ALL APPLICABLE CODES, ASHRAE, SMACNA, NFPA, EPA, ETC.
- PRIOR TO INSTALLATION OF ASSOCIATED WORK; INSTALLER SHALL MEET AT PROJECT SITE WITH GENERAL CONTRACTOR, INSTALLER OF EACH COMPONENT OF ASSOCIATED WORK. INSPECTION AND TESTING AGENCY REPRESENTATIVES (IF ANY). INSTALLERS OF OTHER WORK REQUIRING COORDINATION WITH WORK OF THIS SECTION AND ARCHITECT / OWNER FOR PURPOSE OF COORDINATING LOCATIONS OF PROPOSED SYSTEMS, REVIEWING MATERIAL SELECTIONS, AND PROCEDURES TO BE FOLLOWED IN PERFORMING THE WORK IN COMPLIANCE WITH REQUIREMENTS SPECIFIED.
- THE HVAC CONTRACTOR SHALL VERIFY THE ENTIRE SCOPE OF THE DEMOLITION AND NEW WORK PRIOR TO BID. ADDITIONAL DEMOLITION AND / OR RELOCATION OF EXISTING SYSTEMS THAT MAY NOT BE REPRESENTED ON THESE DRAWINGS SHALL HAVE ADDITIONAL FUNDS ALLOCATED FOR A 100% COMPLETE AND OPERATIONAL SYSTEM AND WILL REPRESENT THE CONTRACTOR'S KNOWLEDGE OF THE PROJECT / SITE AND ON-SITE INSPECTION PRIOR TO BID.
- 1). COORDINATE THE DEMOLITION AND / OR RELOCATION OF EXISTING SYSTEMS WITH THE OWNER AND / OR OWNERS REPRESENTATIVE PRIOR TO PROCEEDING WITH ANY WORK.
- COORDINATE SCHEDULE FOR HOOK-UPS TO EXISTING SYSTEMS AND EQUIPMENT REMOVAL OR RELOCATIONS WITH THE OWNER AND PERFORM THIS WORK AT SUCH TIMES TO ENSURE THAT PERIODS OF SHUTDOWN WILL BE ACCEPTABLE TO THE
- COORDINATE INSTALLATION AND LOCATIONS OF NEW DUCTWORK WITH BUILDING STRUCTURE. PLUMBING PIPING, ELECTRICAL CONDUIT, LIGHTING, ETC. PRIOR TO PURCHASING OR INSTALLING EQUIPMENT AND MATERIALS.
- VERIFY EXACT SIZES OF EXISTING DUCTWORK IN FIELD PRIOR TO MAKING NEW CONNECTION.
- VERIFY EXACT LOCATION OF CONNECTION POINTS (NEW TO EXISTING) IN FIELD PRIOR TO CONSTRUCTION.
- RELOCATE EXISTING DUCTWORK, PIPING AND / OR EQUIPMENT IN EXISTING CEILING SPACES TO ACCOMMODATE ALL RENOVATIONS AND ADDITIONS.
- . ALL PIPING, DUCTS, VENTS, ETC. EXTENDING THROUGH WALLS AND ROOF SHALL BE FLASHED AND COUNTERFLASHED IN A WATERPROOF MANNER.
- MAINTAIN MINIMUM OF TEN (10) FEET BETWEEN OUTDOOR AIR INTAKES AND EXHAUST FAN DISCHARGE, PLUMBING VENTS, ETC.
- MAINTAIN A MINIMUM OF TEN (10) FEET BETWEEN EDGE OF HVAC EQUIPMENT / ROOF CURBS AND EDGE OF ROOF / PÁRAPET.
- 5. REFER TO PLUMBING DRAWINGS FOR LOCATION AND ROUTING OF ALL GAS PIPING.
- 14. DIVISION 23 SHALL BE LICENSED TO PERFORM MECHANICAL WORK IN THE MUNICIPALITY IN WHICH THE PROJECT IS LOCATED.
- DIVISION 23 SHALL GUARANTEE ALL WORK PERFORMED AND MATERIALS FURNISHED UNDER THIS CONTRACT AGAINST DEFECTS IN MATERIALS AND WORKMANSHIP FOR A PERIOD OF ONE (1) YEAR FROM THE DATE OF THE OWNER'S FINAL ACCEPTANCE OF THE WORK. ANY DEFECTS SHALL BE RECTIFIED BY DIVISION 23 WITHOUT ANY
- WORK SHALL COMPLY WITH THE LATEST REVISIONS OF NEW YORK STATE BUILDING CODE, NEW YORK STATE MECHANICAL CODE, NEW YORK STATE UNIFORM FIRE PROTECTION AND CONSTRUCTION CODE, NEW YORK STATE ENERGY CONSERVATION CODE, AND ANY STATE AND LOCAL CODES OR REGULATIONS THAT APPLY.
- A. IN CASE OF CONFLICTS BETWEEN DRAWINGS, SPECIFICATIONS, AND INTERPRETATION OF CODES BY LOCAL AUTHORITY, LATER SHALL GOVERN.

#### <u>EQUIPMENT</u>

ADDITIONAL COST TO THE OWNER.

- ALL HVAC EQUIPMENT SHALL BE INSTALLED PER MANUFACTURER'S REQUIREMENTS AS SHOWN. UTILIZE FACTORY FILTERS DURING CONSTRUCTION AND REPLACE WITH NEW FILTERS JUST PRIOR TO TESTING AND BALANCING. PROVIDE ONE (1) SET OF EXTRA FILTERS FOR EACH UNIT INSTALLED.
- EXSTING AND NEW ROOFTOP UNIT FILTERS SHALL BE REPLACED WITH MINIMUM MERV-11 FILTERS PRIOR TO TESTING AND BALANCING.
- ALL EQUIPMENT SHALL HAVE A ONE (1) YEAR WARRANTY: COMPRESSORS SHALL HAVE AN ADDITIONAL FIVE (5) YEAR EXTENDED WARRANTY, ROOFOTP UNIT HEAT EXCHANGERS SHALL HAVE AN ADDITIONAL TEN (10) YEAR EXTENDED WARRANTY; PROVIDE WRITTEN GUARANTEE.
- GENERAL CONTRACTOR SHALL STORE ALL HVAC EQUIPMENT (ROOFTOP UNITS, DUCTWORK, ETC.) THAT ARRIVES AT THE PROJECT SITE. STORE ALL EQUIPMENT IN A DRY PLACE, PROTECTING ALL EQUIPMENT FROM THE WEATHER, CONSTRUCTION TRAFFIC AND THEFT.
- ROOF CURBS SHALL HAVE A BASE THAT FITS SLOPE OF ROOF AS REQUIRED. TOP OF ROOF CURB SHALL BE LEVEL.
- FLEXIBLE CONNECTORS SHALL BE INSTALLED ON SUPPLY, RETURN, AND EXHAUST AIR DUCTS AT ALL EQUIPMENT CONNECTIONS.
- THE BIDDER MUST SUBMIT IN WRITING TO THE ARCHITECT / OWNER, WHO WILL FORWARD TO THE ENGINEER, ANY REQUEST FOR A PROPOSED DEVIATION, MODIFICATION, OR SUBSTITUTION TO THESE DRAWINGS AND SPECIFICATIONS FOR EVALUATION NO LATER THAN TEN (10) DAYS PRIOR TO THE BID DATE, AND SHALL BE ACCOMPANIED BY TECHNICAL DATA, DRAWINGS, AND COMPLETE DATA SUBSTANTIATING COMPLIANCE OF PROPOSED SUBSTITUTION WITH THESE DRAWINGS AND SPECIFICATIONS.

#### <u>DUCTWORK</u>

- 1. RUN ALL DUCTWORK AS TIGHT TO BOTTOM OF STEEL AS POSSIBLE OR RUN THRU OPEN JOIST WEBBING (IF APPLICABLE).
- 2. DUCTWORK SHALL NOT BE SUPPORTED FROM BRIDGING, CONDUIT, PIPING, ETC. OF ANY KIND. DO NOT USE FASTENERS THAT PENETRATE ROOF DECKS.
- 3. ASPECT RATIO SHALL NOT EXCEED 3:1.
- 4. ALL DUCTWORK INSTALLATIONS SHALL RUN CONTINUOUSLY THROUGH PARTITIONS.
- 5. LOCATE ALL DUCT BALANCING DAMPERS AND FIRE DAMPERS ABOVE ACCESSIBLE CEILINGS OR PROVIDE CEILING AND / OR WALL ACCESS DOORS.
- 6. PROVIDE VOLUME CONTROL DAMPERS WITH QUADRANT AND LOCK AND STANDOFF COLLAR AT ALL BRANCH DUCTS TO DIFFUSERS. INSTALL AT A MINIMUM OF TWO DUCT WIDTHS FROM BRANCH TAKEOFF.
- 7. DUCTWORK SIZES INDICATED ON DRAWINGS ARE INSIDE, FREE AND CLEAR DIMENSIONS. INCREASE DUCT OUTSIDE DIMENSION SIZE BY TWO (2) TIMES THE THICKNESS OF THE INSULATION.
- 8. ALL DUCTWORK SHALL BE CONSTRUCTED AND INSTALLED IN ACCORDANCE WITH SMACNA STANDARDS.
- 9. ALL DUCTWORK SHALL BE GALVANIZED SHEET METAL IN AREAS WITH FINISHED CEILINGS.
- A. ALL NEW DUCTWORK AND FITTINGS SHALL BE CONSTRUCTED OF MINIMUM 26-GAUGE STEEL (GALVANIZED).
- 10. WHERE RECTANGULAR DUCTWORK IS INDICATED, AND AT INSTALLERS OPTION, SPIRAL AND ROUND DUCTWORK MAY BE SUBSTITUTED FOR RECTANGULAR DUCTWORK PROVIDED THEY ARE EQUIVALENT TO THE RECTANGULAR DIMENSIONS INDICATED ON THE DRAWINGS (i.e.:  $8x4 = 8^{\circ}\phi$ ,  $10x6 = 10^{\circ}\phi$ ).
- 11. ALL NEW SUPPLY AIR DUCTWORK AND FITTINGS SHALL BE EXTERNALLY INSULATED WITH MINIMUM 2" THICK, 1.00 LB DENSITY, FOIL-BACK INSULATION WITH VAPOR BARRIER AND A MINIMUM R-VALUE OF R-6, FLAME SPREAD RATING OF 25 OR

LESS. AND SMOKE-DEVELOPED RATING OF 50 OR LESS.

- A. ALL EXISTING DUCTWORK AND FITTINGS FROM NEW DUCTWORK CONNECTION TO EXISTING MAIN DUCTWORK SHALL BE EXTERNALLY INSULATED WITH MINIMUM 'THICK. 1.00 LB DENSITY, FOIL-BACK INSULATION WITH VAPOR BARRIER AND A MINIMUM R-VALUE OF R-6, FLAME SPREAD RATING OF 25 OR LESS, AND SMOKE-DEVELOPED RATING OF 50 OR LESS.
- 12. ALL RETURN AIR AND TRANSFER AIR DUCTWORK AND FITTINGS SHALL BE INTERNALLY
- 13. ALL DUCT LINERS SHALL BE MINIMUM 1-1/2" THICK, COATED TO PREVENT ELEMENTS FROM ENTERING THE AIRSTREAM (COATING SHALL MEET ASHRAE 62 -LATEST EDITION), AND ENVIRONMENTALLY FRIENDLY WITH A MINIMUM R-VALUE OF R-6. LINER SHALL BE BLACK IN COLOR SO IT IS NOT NOTICEABLE FROM THE INSIDE OF REGISTERS AND GRILLES.
- 14. ALL SQUARE ELBOWS SHALL HAVE AIRFOIL TYPE TURNING VANES.
- 15. MAXIMUM FLEXIBLE DUCT LENGTH SHALL BE 5'-0". ALL FLEXIBLE DUCT SHALL CONFORM TO THE REQUIREMENTS OF U.L. 181 FOR CLASS 1 FLEXIBLE AIR DUCTS, WITH A MINIMUM R-VALUE OF R-6. SUPPORT FLEXIBLE DUCT TO ELIMINATE KINKING AND SAGGING. (FLEXIBLE DUCT IS NOT PERMITTED ON RETURN / EXHAUST AIR DUCTWORK, AND RETURN / EXHAUST AIR GRILLE CONNECTIONS).

- ALL CONDENSATE DRAIN PIPING SHALL BE FULLY INSULATED WITH MINIMUM 1-1/2" THICK, 0.75 LB DENSITY, INSULATION WITH VAPOR BARRIER, FLAME SPREAD RATING OF 25 OR LESS, AND SMOKE-DEVELOPED RATING OF 50 OR LESS.
- 2. CONDENSATE PIPING FROM AIR CONDITIONING EQUIPMENT SHALL BE PITCHED A MINIMUM OF 1/4" PER FOOT, IN THE DIRECTION OF FLOW.
- CONDENSATE DRAIN PIPES SHALL HAVE CLEANOUTS AT EVERY CHANGE IN DIRECTION, DISTANCES GREATER THAN 3 FEET, AND AT THE BEGINNING OF LONG

STRAIGHT RUNS.

CODE (NEC) AND NFPA 70.

- 1. ALL CONTROL WIRING AND CONDUIT SHALL COMPLY WITH THE NATIONAL ELECTRIC
- 2. ALL CONTROL WIRING AND POWER CONDUCTOR INSULATION SHALL BE PLENUM
- 3. ALL EXPOSED CONTROL WIRING SHALL BE INSTALLED IN 3/4" EMT CONDUIT.
- 4. PROVIDE ALL RELAYS, CONTACTORS, ETC. REQUIRED TO ACHIEVE INTERLOCK OPERATION OF EQUIPMENT.
- 5. CONTROLS SHALL BE COMPATIBLE TO AND INTERFACE WITH EXISTING ENERGY MANAGEMENT SYSTEM (IF APPLICABLE).

#### **BALANCING**

- MECHANICAL CONTRACTOR, WHO IS CERTIFIED BY FITHER THE ASSOCIATED AIR BALANCE COUNCIL (AABC) OR NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB); UPON COMPLETION OF THE PROJECT, SHALL PERFORM A COMPLETE TESTING AND BALANCING OF ALL EQUIPMENT. BALANCE SYSTEM TO WITHIN ±5% OF AIR QUANTITIES INDICATED ON PLANS AND SCHEDULES AND PROVIDE THE OWNER WITH A COMPLETE, SIGNED AND SEALED BALANCE REPORT.
- A. WHERE CFM'S ARE NOT INDICATED, PRIOR TO REMOVING EXISTING DIFFUSERS / GRILLES, MEASURE AND RECORD EXISTING AIR DEVICES CFM'S.

#### **DUCTWORK PRESSURE (TIGHTNESS) TESTING**

- 1. ALL DUCTWORK AND PLENUM SYSTEMS SHALL BE SEALED AND PRESSURE TESTED USING INSTRUMENTS AND PROCEDURES SPECIFIED IN ANSI / ASHRAE 152 AND ASTM E1554 TEST METHOD "A", AND NEW YORK STATE ENERGY CONSERVATION CODE
- A. <u>EXCEPTION:</u> DUCT TIGHTNESS TEST IS NOT REQUIRED IF THE AIR HANDLER AND ALL DUCTS ARE LOCATED WITHIN THE CONDITIONED SPACE.

#### HVAC DUCTWORK SYMBOLS **HVAC ABBREVIATIONS** ANNUAL FUEL UTILIZATION EFFICIENCY BRAKE HORSEPOWER CUBIC FEET PER MINUTE CARBON DIOXIDE DRY BULB ENTERING AIR TEMPERATURE ENERGY EFFICIENCY RATIO EXHAUST FAN FIRE DAMPER HORSEPOWER

	<del> </del>	<b>  </b>
SYMBOL	DESCRIPTION	
	SUPPLY DUCT RISER	
	RETURN DUCT RISER	
	EXHAUST DUCT RISER	
	EXISTING DUCTWORK TO REMAIN	
	EXISTING DUCTWORK TO BE REMOVED	
	DUCT RISE OR DROP	$\prod_{M}$
Car	AIRFOIL TURNING VANES	<sup> </sup>
	FLEXIBLE DUCT	<sup>  </sup>
	INTERNALLY LINED DUCTWORK	$\prod_{M}$
+	MANUAL VOLUME DAMPERS	<sub>M</sub>
Ø	ROUND	l II m
-200-1 8"ø	SUPPLY AIR DEVICE — FIRST NO. CFM, SECOND NO. TYPE THIRD NO. NECK SIZE (REFER TO SCHEDULE FOR DEVICE SIZE)	M
200−3 8"ø - C	RETURN / EXHAUST AIR DEVICE — FIRST NO. CFM, SECOND NO. TYPE THIRD NO. NECK SIZE (IF REQUIRED) (REFER TO SCHEDULE FOR DEVICE SIZE)	M
		М

$\  \ $	HVAC CONTROL SYMBOLS								
	SYMBOL	DESCRIPTION							
Ш	T	MANUAL, PROGRAMMABLE, 7-DAY, 24-HOUR DIGITAL THERMOSTAT WITH BACKLIT DISPLAY AND BATTERY BACKUP							
Ш		CONTROL WIRING (PLENUM RATED)							
יו									

## HVAC DRAWING LIST

HVAC SCHEDULES, LEGENDS AND DETAILS

HVAC SCHEDULES AND SEQUENCE OF OPERATIONS

HVAC SPECIFICATIONS

HVAC SPECIFICATIONS

PARTIAL FLOOR PLAN - HVAC DUCTWORK DEMOLITION

PARTIAL FLOOR PLAN - HVAC DUCTWORK DEMOLITION PARTIAL FLOOR PLAN - HVAC DUCTWORK

PARTIAL FLOOR PLAN - HVAC DUCTWORK

PARTIAL ROOF PLAN - HVAC DUCTWORK 10 PARTIAL ROOF PLAN — HVAC DUCTWORK

11 HVAC DETAILS

#### AIR DISTRIBUTION DEVICE SCHEDULE

SYMBOL	STYLE & DEVICE SIZE	MOUNTING	DESCRIPTION	MANUFACTURER	MODEL NO.	MAXIMUM NC	THROW (MINIMUN FEET)
			SUPPLY				
TYPE 1	SUPPLY 24x24	LAY-IN	3-CONE FACE, STEEL CONSTRUCTION, OPPOSED BLADE VOLUME DAMPERS, 360° ADJUSTABLE PATTERN THROW, WHITE FINISH	TITUS	TMSA	16	4'-0"
TYPE 2	SUPPLY 24x24	SURFACE	3-CONE FACE, STEEL CONSTRUCTION, OPPOSED BLADE VOLUME DAMPERS, 360° ADJUSTABLE PATTERN THROW, WHITE FINISH	TITUS	TMSA		6'-0"
			RETURN				
TYPE 3	RETURN 24×24	LAY-IN	PERFORATED FACE, STEEL CONSTRUCTION, OPPOSED BLADE VOLUME DAMPERS, PROVIDE 22"x22" BACKPAN FOR FULL PANEL LAY—IN APPLICATION, WHITE FINISH	TITUS	PAR	14	
			EXHAUST	_			
TYPE 4	EXHAUST 24x24	LAY-IN	PERFORATED FACE, STEEL CONSTRUCTION, OPPOSED BLADE VOLUME DAMPERS, PROVIDE 22"x22" BACKPAN FOR FULL PANEL LAY—IN APPLICATION, WHITE FINISH	TITUS	PAR	16	

#### AIR DISTRIBUTION DEVICE NOTES:

ALL DEVICES SHALL BE FROM A SINGLE MANUFACTURER.

HEATING, VENTILATING, AIR CONDITIONING

LEAVING AIR TEMPERATURE

MINIMUM CIRCUIT AMPACITY

REVOLUTIONS PER MINUTE

1,000 BRITISH THERMAL UNITS

MAXIMUM OVERCURRENT PROTECTION

SEASONAL ENERGY EFFICIENCY RATIO

INTERNAL

POUNDS

ROOFTOP UNIT

WET BULB

STATIC PRESSURE

LBS

RPM

SEER

- ALL DEVICES SHALL HAVE MATCHING MATTE, WHITE FINISH (UNLESS OTHERWISE NOTED IN DESCRIPTION ABOVE).
- MAXIMUM NC OF 20.
- ACCESSORIES:
- A. PLASTER FRAME: FOR INSTALLATION IN GYPBOARD CEILING.
- OPERATING KEYS: TOOLS DESIGNED TO FIT THROUGH DIFFUSER FACE AND OPERATE VOLUME CONTROL DEVICE AND / OR PATTERN ADJUSTMENT
- ALL NEW DIFFUSERS / GRILLES SHALL MATCH EXISTING BUILDING STANDARD (VERIFY EXISTING DIFFUSER / GRILLE MANUFACUTRER AND MODEL NUMBER PRIOR TO PURCHASING AND INSTALLING DIFFUSERS / GRILLES)
- ACCEPTABLE MANUFACTURER'S TITUS, PRICE.

SUBMITTALS SHALL INCLUDE DIFFUSER AND GRILLE SCHEDULE INDICATING ROOM LOCATION. NOISE CRITERIA (NC), THROW AND PERFORMANCE DATA FOR EACH TYPE OF DIFFUSER AND GRILLES INDICATED.

ROOF EXHAUST FAN SCHEDULE													
			STATIC			FAN			MOTOR		ROOF	OPERATING	
MARK	AREA SERVED	CFM	PRESS. IN. WG EXT.	MANUFACTURER	MODEL NO.	FAN TYPE	DRIVE TYPE	RPM	SONES	HP	VOLTS / PH		WEIGHT (LBS.)
E/F-1	EXISTING WOMENS 123, EXISTING MENS 124	775	0.25	GREENHECK	LB-14-4	CENTRIFUGAL	BELT	661	4.2	1/4	120/1/60	GPI=26/16-A12	150

#### ROOF EXHAUST FAN NOTES:

- HOUSING "LOW PROFILE" ANODIZED ALUMINUM WITH HINGED HOOD AND ALUMINUM BIRDSCREEN.
- FAN BACKWARD INCLINED ANODIZED ALUMINUM.
- BUILT-IN POWER DISCONNECT.
- MOTORS SHALL HAVE BUILT-IN THERMAL OVERLOAD PROTECTION.
- UNITS SHALL HAVE ADJUSTABLE MOTOR PULLEYS.
- ROOF CURBS:
- A. EACH EXHAUST FAN SHALL BE EQUIPPED WITH AN INSULATED. ANODIZED ALUMINUM ROOF CURB (0.080" MINIMUM THICKNESS), ALL WELDED JOINT CONSTRUCTION.
  - 1). ROOF CURBS SHALL HAVE A BASE THAT FITS SLOPE OF ROOF AS REQUIRED. TOP OF ROOF CURB SHALL BE LEVEL.
- B. ALL CURBS SHALL BE MINIMUM 1'-0" HIGH.

- 7. ACCESSORIES:
- A. MOTORIZED, OPPOSED BLADE, LOW LEAKAGE ALUMINUM CONTROL DAMPERS (120V ACTUATOR).
- B. 1" THICK FAN HOUSING INSULATION.
- 8. INTERLOCK EXHAUST FAN'S WITH ASSOCIATED EXISTING ROOFTOP UNIT OPERATION.
- 9. MAXIMUM SONES TO BE 4.2 OR LESS, UNLESS OTHERWISE INDICATED.
- 10. ACCEPTABLE MANUFACTURER'S GREENHECK, COOK, TWIN CITY FAN.

1. UNITS SHALL BE INSTALLED TO RESIST THE WIND PRESSURES DETERMINED IN ACCORDANCE WITH THE NEW YORK STATE BUILDING CODE.

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2021-06-29: BID/PERMIT SET

\_\_\_ INTERIORS <u>N.Catuzza</u>

SA PROJECT TEAM: PRINCIPAL P.Silvestri PROJ. ARCH. <u>S.Hunt</u> DRAFTER

JOB CAPT.

HVAC SCHEDULES,

LEGENDS AND

ABBREVIATIONS

SILVESTRI

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ARCHITECTS - PC

SA JOB #:

DRAWING #:

M-1

6-29-2021

DATE:

MARK  AREA SERVED  AREA SERVED  AREA SERVED  TONS  SUPPLY RETURN OUTS AIR AIR CFM CFM CFM CFM	N OUTSIDE STATIC PRESS. MANUFACTURER MOI	DX COOLING	10.0011			
	CFM   IN. WG	ODEL NO. MBH (OUTSIDE (OUDS) NB)	CAT °C	S HEATING SECTION  MBH AFUE EAT 'F LAT 'F F	SUPPLY AIR FAN   MOTOR   SHP	SEER / EER MCA (HACR WEIG BREAKER) (LB
RTU-1 EXISTING SPACES 8.5 3,400 3,050 35	) 350 CARRIER 48H		120.0 98 70 4 (1ST STAGE) (1ST S	18.0   02%   03   93   0	867 1.72 2 208/3/60 -	/ 12.0 41.0 50 1,6
RTU-2 EXISTING SPACES 8.5 3,400 3,050 35	) 350 CARRIER 48H	-8HCE-09 97.0 95	70 4 120.0 98 (1ST STAGE) (1ST S 180.0 14 (2ND STAGE) (2ND	8.0 STAGE) 82% 65 95 8 48.0 STAGE)	867 1.72 2 208/3/60 -	/ 12.0 41.0 50 1,6
RTU-3 EXISTING SPACES 10.0 4,000 3,600 40	0 400 CARRIER 48H	8HCE-12 115.0 95	70 4 (1ST STAGE) (1ST S 224.0 18 (2ND STAGE) (2ND	34.0 65 95 STAGE)	942 2.41 3 208/3/60 -	/ 11.5 53.0 60 1,8
RTU-4 EXISTING SPACES 5.0 2,000 1,800 20	200 CARRIER 480	-8GCE-06 60.0 95	70 4 (1ST STAGE) (1ST S 110.0 88 (2ND STAGE) (2ND	8.0 80% 85 2 STAGE)	2133 1.02 2 208/3/60 1	16.0 / 12.0 31.0 45 1,1
RTU-5 EXISTING SPACES 8.5 3,400 3,050 35	) 350 CARRIER 48H	8HCE-09 97.0 95	70 4 (1ST STAGE) (1ST STAGE) (1ST STAGE) (2ND STAGE) (2ND	18.0   02%   03   93   0	867 1.72 2 208/3/60 -	/ 12.0 41.0 50 1,6
RTU-6 EXISTING SPACES 3.0 1,200 1,075 12	5 125 CARRIER 480	8GCD-04 35.2 95	70 2 (1ST STAGE) (1ST S 67.0 54 (2ND STAGE) (2ND	4.0   61%   65   55   1	1874 0.46 1 208/3/60 1	16.0 / 12.0 21.0 30 95
RTU-7 EXISTING SPACES 4.0 1,600 1,450 15	0 150 CARRIER 48H	8HCE-05 47.0 95	70 4 (1ST STAGE) (1ST S	8.0   60%   65   95   1	1993 0.84 1 208/3/60 1	16.0 / 12.0   26.0   30   1,0
RTU-8 EXISTING SPACES 12.5 5,000 4,500 50	0 500 CARRIER 48H	8HCF-14 146.0 95	70 4 192.0 15 (1ST STAGE) (1ST S 240.0 19 (2ND STAGE) (2ND 82.0 65	56.0 STAGE) 81% 65 95 5 STAGE)	718 2.39 3 208/3/60 -	/ 12.2 60.0 70 2,2
RTU-9 EXISTING SPACES 5.0 2,000 1,800 20	200 CARRIER 480	8GCE-06 60.0 95	70	STAGE) 80% 65 95 2	2133 1.02 2 208/3/60 1	16.0 / 12.0 31.0 45 1,1
RTU-10 EXISTING SPACES 5.0 2,000 1,800 20	200 CARRIER 480	8GCE-06 60.0 95	70 4 (1ST STAGE) (1ST STAGE) (1ST STAGE) (2ND STAGE) (2ND	5.0 STAGE) 80% 65 95 2 8.0 STAGE)	2133 1.02 2 208/3/60 1	16.0 / 12.0 31.0 45 1,1

#### ROOFTOP UNIT NOTES:

- FACTORY ASSEMBLED, PACKAGED UNIT WITH ROOF CURB AND ALL STANDARD ACCESSORIES.
- UNIT SHALL BE SINGLE-WALL CONSTRUCTION.
- UNIT SHALL BE U.L. OR AGA APPROVED.
- UNIT SHALL BE OF DOWNFLOW DESIGN AND SHALL HAVE 100% ECONOMIZER FUNCTION.
- A. UNIT SHALL HAVE 100% ECONOMIZER FUNCTION WITH DIFFERENTIAL ENTHALPY CONTROL AND MINIMUM OUTSIDE AIR SETTING, AND BAROMETRIC RELIEF.
- COMPRESSORS SHALL BE HIGH EFFICIENCY DESIGN.
- UNIT SHALL HAVE:
- A. R410A REFRIGERANT.
- B. ALL SECTIONS SHALL HAVE HINGED ACCESS DOORS.
- C. MOTORS SHALL HAVE BUILT-IN OVERLOAD PROTECTION.
- D. RTU-1, 2, 3, 5, 8: UNIT SHALL HAVE ADJUSTABLE PITCH MOTOR SHEAVES AND MOTOR PULLEYS.
- RTU-4, 6, 7, 9, 10: UNIT SHALL HAVE DIRECT DRIVE, VANE AXIAL ECM SUPPLY FAN (FIELD ADJUSTABLE FAN SPEED CONTROL).
- F. 2-STAGE GAS HEATING AND 2-STAGE COOLING.
- G. 30% PLEATED FILTERS.
- H. ALUMINIZED STEEL HEAT EXCHANGER.
- I. FACTORY INSTALLED REMOTE SHUTDOWN TERMINALS.
- J. DOUBLE-SLOPE DRAIN PAN WITH P-TRAP ASSEMBLY. K. UNIT MOUNTED CONTROLS WITH FACTORY MOUNTED CONTROL BOARD.

#### 7. ACCESSORIES:

- A. OUTSIDE AIR INTAKE HOOD AND RELIEF / EXHAUST HOOD.
- B. MOTORIZED, LOW-LEAKAGE, OPPOSED BLADE OUTSIDE AIR DAMPERS.
- C. CARBON DIOXIDE (CO2) SENSOR FOR OUTSIDE AIR CONTROL OVERRIDE (MOUNT IN RETURN AIR DUCTWORK).
- D. DISCHARGE AIR SENSOR MOUNTED IN SUPPLY AIR DUCTWORK.
- E. HUMIDI-MIZER DEHUMIDIFICATION CONTROL.
- F. MERV-11 FILTERS.
- G. STAINLESS STEEL, DOUBLE-SLOPE DRAIN PAN WITH P-TRAP ASSEMBLY.
- H. FACTORY-AUTHORIZED SERVICE REPRESENTATIVE TO PERFORM STARTUP SERVICE.

## 8. INSTALLATION:

- A. UNITS SHALL BE ON MANUFACTURER PROVIDED, FULL PERIMETER, INSULATED ROOF CURB SUITABLE FOR THE ROOF DECK, INSULATION AND MEMBRANE (REFER TO ARCHITECTURAL DRAWINGS FOR ROOF CONSTRUCTION).
- 1). ROOF CURBS SHALL HAVE A BASE THAT FITS SLOPE OF ROOF AS REQUIRED. TOP OF ROOF CURB SHALL BE LEVEL.
- B. ALL SERVICES TO THE UNIT SHALL ENTER WITHIN THE ROOF CURB. NO SEPARATE ROOF PENETRATIONS ARE ALLOWED.
- 9. ACCEPTABLE MANUFACTURER'S CARRIER, AAON, MCQUAY.

1. UNITS SHALL BE INSTALLED TO RESIST THE WIND PRESSURES DETERMINED IN ACCORDANCE WITH THE NEW YORK STATE BUILDING CODE.

- 2. CARRIER'S FAN MOTOR BRAKE HORSEPOWER (BHP) LISTED IS THE "MAXIMUM CONTINUOUS BHP RATING" (FAN POWER). MINIMUM ALLOWABLE FAN MOTOR HORSEPOWER IS 1 HP.
  - A. FAN HORSEPOWER'S (HP) INDICATED ARE FOR LISTED MANUFACTURER'S COMPARISON MOTOR HORSEPOWER RATING.
- 3. UNITS SUPPLY FAN RPM'S AND BHP'S ARE BASED ON 0.80" EXTERNAL STATIC PRESSURE (DUCTWORK ONLY). DIVISION 23 SHALL VERIFY UNITS ACTUAL STATIC PRESSURE (VIA AIRFLOW MEASUREMENTS OR EXISTING BALANCE REPORTS) AND COORDINATE WITH UNIT MANUFACTURER THE SUPPLY FANS EXACT RPM AND BHP PRIOR TO PURCHASING AND INSTALLING UNITS.

## HVAC SEQUENCE OF OPERATIONS

- 1.1 SEQUENCE OF OPERATIONS HVAC DUCTWORK
- A. ROOFTOP UNITS (RTU-1 THRU RTU-10).
- GENERAL.
  - a. CONFIGURATION: CONSTANT-VOLUME MIXED-AIR SINGLE PATH.
- SYSTEM RUN.
- a. OCCUPIED MODE.
- 1). SUPPLY FAN: SUPPLY FAN SHALL RUN CONTINUOUSLY. 2). ECONOMIZER (WITH CO2 SENSOR).
  - a). THE CONTROL SYSTEM SHALL SENSE THE INCREASED OCCUPANTS / CARBON DIOXIDE AND INCREASE THE OUTSIDE AIR QUANTITY ON THE EQUIPMENT SERVING THAT AREA SUCH THAT THE CARBON DIOXIDE SHALL BE CONTROLLED SO AS NOT TO EXCEED 500 PPM (ADJUSTABLE) ABOVE THE OUTSIDE AIR CARBON DIOXIDE CONCENTRATION.
  - b). MINIMUM OUTSIDE AIR IS SUPPLIED TO ALL AREAS AT ALL TIMES DURING OCCUPIED MODE.
  - c). CARBON DIOXIDE SENSOR OVERRIDES MINIMUM OUTSIDE AIR SETPOINT TO INCREASE OUTSIDE AIR SHOULD THE CONDITIONS IN THE SPACE DEVIATE FROM DESIGN CONDITIONS.
- 3). GAS VALVE: CYCLE IN SEQUENCE WITH THE ECONOMIZER DAMPERS TO MAINTAIN THE DISCHARGE AIR TEMPERATURE AT SETPOINT AS RESET FROM SPACE TEMPERATURE.
- a). BELOW 50° F (ADJUSTABLE) DISCHARGE AIR TEMPERATURE (FOR A PERIOD OF 5-MINUTES) AS SENSED BY THE DISCHARGE AIR TEMPERATURE SENSOR, THE SYSTEM SHALL BE DISABLED.
- 1). THE OUTSIDE AIR DAMPER SHALL CLOSE, THE SUPPLY FAN SHALL STOP AND THE GAS VALVE SHALL BE DISABLED.
- b). ABOVE 115° F (ADJUSTABLE) DISCHARGE AIR TEMPERATURE (FOR A PERIOD OF 5-MINUTES) AS SENSED BY THE DISCHARGE AIR TEMPERATURE SENSOR, THE GAS VALVE SHALL CLOSE.
- 1). IF THE DISCHARGE AIR TEMPERATURE DOES NOT DROP BELOW 115° F, THE UNIT SHALL SHUT DOWN. 2). THE OUTSIDE AIR DAMPER SHALL CLOSE AND THE SUPPLY FAN SHALL STOP.
- 4). DX COOLING: CYCLE WHEN OUTSIDE AIR TEMPERATURE IS ABOVE THE DX COOLING SYSTEM ENABLE SETPOINT TO MAINTAIN SUPPLY AIR TEMPERATURE AT SETPOINT AS RESET FROM DISCHARGE AIR TEMPERATURE.

- b. UNOCCUPIED HEATING MODE.
- 1). SUPPLY FAN: SUPPLY FAN SHALL CYCLE TO MAINTAIN DISCHARGE AIR TEMPERAURE
- AT THE UNOCCUPIED HEATING SETPOINT (55° F. ADJUSTABLE). 2). ECONOMIZER DAMPERS: OUTSIDE AIR DAMPERS ARE FULLY CLOSED AND RETURN
- AIR DAMPER IS FULLY OPEN. 3). GAS VALVE: CYCLE AS FOLLOWS WHEN THE SUPPLY FAN IS ON:
- a). BELOW 55° F (ADJUSTABLE) DISCHARGE AIR TEMPERATURE, FULLY OPEN GAS VALVE TO MAINTAIN SUPPLÝ AIR TEMPERATURE AT 90° F (ADJUSTABLE). ABOVE 55° F (ADJUSTABLE) DISCHARGE AIR TEMPERATURE, CYCLE THÉ GAS

VALVE TO MAINTAIN SUPPLY AIR TEMPERATURE AT 90° F (ADJUSTABLE).

- 4). DX COOLING: OFF.
- c. UNOCCUPIED COOLING MODE.
- 1). SUPPLY FAN: SUPPLY FAN SHALL CYCLE TO MAINTAIN DISCHARGE AIR TEMPERATURE AT THE UNOCCUPIED COOLING SETPOINT (85° F, ADJUSTABLE).
- 2). ECONOMIZER DAMPERS: ECONOMIZER DAMPERS SHALL BE ENABLED TO PROVIDE FREE COOLING WHEN THE OUTSIDE AIR TEMPERATURE IS BELOW THE DRY BULB ECONOMIZER SETPOINT.
- a). ECONOMIZER AVAILABLE: OUTSIDE AIR AND EXHAUST AIR DAMPERS ARE FULLY OPEN AND RETURN AIR DAMPER IS FULLY CLOSED WHEN THE SUPPLY FAN IS
- b). ECONOMIZER NOT AVAILABLE: OUTSIDE AIR AND EXHAUST DAMPERS ARE FULLY CLOSED AND RETURN AIR DAMPER IS FULLY OPEN.
- S). GAS VALVE: CLOSED. 4). DX COOLING: CYCLE WHEN OUTSIDE AIR TEMPERATURE IS ABOVE THE DX COOLING SYSTEM ENABLE SETPOINT TO MAINTAIN SUPPLY AIR TEMPERATURE AT 55° F (ADJUSTABLE).

- SYSTEM OFF.
- THE SUPPLY FAN SHALL BE OFF.
- THE OUTSIDE AIR DAMPERS SHALL BE CLOSED. THE RETURN AIR DAMPER SHALL BE OPEN.
- d. THE GAS VALVE SHALL CYCLE TO MAINTAIN THE MIXED AIR PLENUM TEMPERATURE AT
- 50° F (ADJUSTABLE). e. THE DX COOLING SHALL BE OFF
- 4. SAFETIES AND ALARMS.
- a. DISPLAY OFF-NORMAL ALARM WHENEVER SUPPLY FAN STATUS DOES NOT EQUAL COMMAND. b. LOW LIMIT: MANUAL RESET LOW LIMIT THERMOSTAT SHALL STOP THE SUPPLY FAN AND DISPLAY AN ALARM SHOULD THE COIL DISCHARGE AIR TEMPERATURE FALL BELOW 38° F (ADJUSTABLE).
- 1). HEATING COIL VALVE SHALL OPEN FULLY, AND DAMPERS AND DX COOLING CONTROL VALVE SHALL BE INDEXED TO THEIR "SYSTEM OFF" CONDITIONS.
- c. HIGH LIMIT: MANUAL RESET HIGH LIMIT THERMOSTAT LOCATED IN THE RETURN AIR SHALL STOP THE SUPPLY FAN AND DISPLAY AN ALARM SHOULD THE RETURN AIR TEMPERATURE RISE ABOVE 125° F (ADJUSTABLE).
- 1). DAMPERS AND CONTROL VALVES SHALL BE INDEXED TO THEIR "SYSTEM OFF" CONDITIONS.
- d. SMOKE CONTROL.
- 1). DUCT SMOKE DETECTOR(S) SHALL STOP THE SUPPLY FAN AND DISPLAY ALARM WHEN PRODUCTS OF COMBUSTION ARE DETECTED IN THE AIR STREAM.
- a). DAMPERS AND CONTROL VALVE SHALL BE INDEXED TO THEIR "SYSTEM OFF"

ADJUSTABLE DELAY TO PROVIDE A STAGGERED START OF ALL BUILDING LOADS.

2). THE SUPPLY FAN SHALL BE INTERLOCKED TO SHUT DOWN UPON A COMMAND FROM THE BUILDING FIRE ALARM SYSTEM.

3). UPON A RETURN TO NORMAL, THE SUPPLY FAN SHALL START AFTER AN

e. FILTER CONDITION: MONITOR DIFFERENTIAL PRESSURE ACROSS FILTER AND DISPLAY AN ALARM WHEN DIFFERENTIAL PRESSURE SETPOINT IS EXCEEDED.

#### FAILURE MODES.

- a. FAN FAILURE: IF THE SUPPLY FAN FAILS TO OPERATE, THE SUPPLY FAN SHALL SHUT DOWN AND ALARM SHALL BE DISPLAYED.
- 1). DAMPERS AND CONTROL VALVE SHALL BE INDEXED TO THEIR "SYSTEM OFF" CONDITIONS.
- b. SENSOR FAILURE: UPON THE FAILURE OF AN ANALOG SENSOR, ASSOCIATED DAMPERS AND CONTROL VALVES SHALL REMAIN AT THEIR LAST POSITION AND ALARM SHALL BE c. POWER FAILURE.
- 1). FANS: UPON RESTORATION OF POWER, THE SUPPLY FANS SHALL START AFTER AN ADJUSTABLE DELAY TO PROVIDE A STAGGERED START OF ALL BUILDING LOADS.
- ACTUATORS TO FAIL TO THEIR "SYSTEM OFF" POSITIONS.
- 3). VALVES: GAS VALVE SHALL BE PROVIDED WITH SPRING RETURN ACTUATOR TO FAIL OPEN TO THE COIL.

# 2). DAMPERS: ECONOMIZER DAMPERS SHALL BE PROVIDED WITH SPRING RETURN

**SILVESTRI** 

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HVAC

SCHEDULES

AND SEQUENCE

OF OPERATIONS

INTERIORS <u>N.Catuzza</u>

PROJ. ARCH. <u>S.Hunt</u> DRAFTER \_\_\_\_\_

JOB CAPT.

2021-06-29: BID/PERMIT SET

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SA JOB #:

DATE: 6-29-2021

DRAWING #:

#### HVAC SPECIFICATIONS

#### <u>PART 1 – GENERAL</u>

1.1 QUALITY ASSURANCE

- A. MATERIALS AND EQUIPMENT SHALL BE PROVIDED BY ONE OF THE MANUFACTURERS LISTED IN PART 2 – PRODUCTS.
- DIVISION 23 BIDS SHALL BE BASED ON THE MATERIAL MENTIONED OR SPECIFIED, AND ANY PROPOSALS FOR A SUBSTITUTION SHALL BE MADE IN WRITING TO THE ARCHITECT / ENGINEER ALLOWING ADEQUATE TIME FOR APPROPRIATE ACTION.
  - a. REFER TO DIVISION 1 REQUIREMENTS FOR SUBSTITUTION PROCEDURES.
- 2. MATERIALS AND EQUIPMENT FROM OTHER MANUFACTURERS MAY BE ACCEPTED IF PROVEN EQUAL TO THOSE SPECIFIED.
- a. EQUIPMENT SELECTION OF HIGHER ELECTRICAL CHARACTERISTICS, PHYSICAL DIMENSIONS, CAPACITIES, AND RATINGS MAY BE FURNISHED PROVIDED SUCH PROPOSED EQUIPMENT IS APPROVED IN WRITING AND CONNECTING MECHANICAL AND ELECTRICAL SERVICES, CIRCUIT BREAKERS, CONDUIT, MOTOR, BASES, AND EQUIPMENT SPACES ARE INCREASED.
- 1). DIVISION 23 ALSO IS LIABLE FOR ALL COSTS AND CHANGES IN THE WORK REQUIRED BY SUBSTITUTE EQUIPMENT.
- a). NO ADDITIONAL COSTS WILL BE APPROVED FOR THESE INCREASES, IF LARGER EQUIPMENT IS APPROVED.
- 2). IF MINIMUM ENERGY RATINGS OR EFFICIENCIES OF EQUIPMENT ARE SPECIFIED, EQUIPMENT MUST MEET DESIGN AND COMMISSIONING REQUIREMENTS.
- 3. DIVISION 23 IS LIABLE FOR AND SHALL PAY FOR, ALL ARCHITECTURAL AND ENGINEERING REVIEWS AND REDESIGN COSTS FOR SUBSTITUTE MATERIALS AND EQUIPMENT. THE BIDDER MUST SUBMIT IN WRITING TO THE ARCHITECT / OWNER. WHO WILL FORWARD TO THE ENGINEER, ANY REQUEST FOR A PROPOSED DEVIATION, MODIFICATION, OR SUBSTITUTION TO THESE DRAWINGS AND SPECIFICATIONS FOR EVALUATION NO LATER THAN TEN (10) DAYS
- a. A REQUEST FOR ANY SUBSTITUTION SHALL BE ACCOMPANIED BY TECHNICAL DATA, DRAWINGS, PRODUCT SAMPLES, AND COMPLETE DATA SUBSTANTIATING COMPLIANCE OF PROPOSED SUBSTITUTION WITH THESE SPECIFICATIONS AND DRAWINGS.

PRIOR TO THE BID DATE. PHONE CALLS, EMAILS, ETC. MADE THE DAY BEFORE AND / OR

- 1). REQUESTS FOR SUBSTITUTION SHALL BE MADE ONLY BY THE BIDDER; REQUESTS FOR SUBSTITUTION FROM SALES REPRESENTATIVES, VENDORS, OR SUPPLIERS ARE NOT **ACCEPTABLE**
- b. NO MATERIALS SHALL BE DEEMED ACCEPTABLE IF NOT IN STRICT AND FULL COMPLIANCE WITH THESE DRAWINGS AND SPECIFICATIONS.
- c. ALL BIDDERS MUST BID SOLELY ON THE SPECIFIED MATERIALS UNLESS ACCEPTANCE BY THE ENGINEER OF A DEVIATION, OMISSION, MODIFICATION, OR SUBSTITUTION IS GRANTED
- 1). FAILURE TO SUBMIT PROPOSED SUBSTITUTED EQUIPMENT / MATERIALS PRIOR TO THE BID EVALUATION DATE, AND IS INCLUDED IN THE BIDDERS PRICE / SUBMITTAL REVIEW DRAWINGS (AFTER THE PROJECT IS AWARDED); WILL RESULT IN A "REJECTED" SUBMITTAL PACKAGE.

IN WRITING THROUGH THE ARCHITECT / OWNER TO ALL BIDDERS PRIOR TO THE BID DATE.

B. THE LENGTH OF TIME THE MANUFACTURER HAS BEEN IN BUSINESS, THE LOCATION AND CAPABILITY OF COMPLETE REPAIR FACILITIES, AVAILABILITY OF REPAIR PARTS AND ANNUAL MAINTENANCE CONTRACTS ALL WILL BE CONSIDERED IN DETERMINING EQUALITY.

#### 1.2 LAWS, PERMITS, INSPECTIONS

- A. WORK SHALL COMPLY WITH THE LATEST REVISIONS OF NEW YORK STATE BUILDING CODE, NEW YORK STATE MECHANICAL CODE, NEW YORK STATE UNIFORM FIRE PROTECTION AND CONSTRUCTION CODE, NEW YORK STATE ENERGY CONSERVATION CODE, AND ANY STATE AND LOCAL CODES OR REGULATIONS THAT APPLY.
- B. COMPLY WITH NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) CODES AS APPLICABLE.
- C. COMPLY TO REQUIREMENTS OF DRAWINGS AND SPECIFICATIONS THAT ARE IN EXCESS OF GOVERNING CODES.
- D. DO NOT INSTALL WORK AS SPECIFIED OR SHOWN IF IN CONFLICT WITH GOVERNING CODES.
- 1. NOTIFY ENGINEER IN WRITING AND REQUEST DIRECTION.

THE DAY THE BIDS ARE DUE ARE NOT ACCEPTABLE.

- E. PAY ALL INSPECTION AND PERMIT FEES.
- F. PROVIDE CERTIFICATE OF INSPECTION FROM ALL GOVERNING AUTHORITIES.

#### 1.3 INSTALLERS QUALIFICATIONS

- A. SKILLED MECHANICS WHO HAVE SUCCESSFULLY COMPLETED AN APPRENTICESHIP PROGRAM OR ANOTHER CRAFT TRAINING PROGRAM CERTIFIED BY THE U.S. DEPARTMENT OF LABOR, BUREAU OF APPRENTICESHIP AND TRAINING.
- B. THE MECHANICAL CONTRACTOR SHALL BE LICENSED TO PERFORM MECHANICAL WORK IN THE MUNICIPALITY IN WHICH THE PROJECT IS LOCATED.

#### 1.4 OMISSIONS.

A. OMISSIONS. DISCREPANCIES OR POINTS OF QUESTION FOUND BY A BIDDER IN THE PLANS OR SPECIFICATIONS SHALL BE REFERRED TO THE ARCHITECT, WHO WILL FORWARD TO THE ENGINEER TO MAKE ANY CLARIFICATIONS IN WRITING.

#### 1.5 REQUEST FOR INFORMATION (RFI).

PROPOSED REQUEST.

- A. PRIOR TO, AND DURING THE CONSTRUCTION OF THE PROJECT, QUESTIONS FROM THE HVAC CONTRACTOR REGARDING OMISSIONS, DISCREPANCIES, COORDINATION ITEMS, AND ANY OTHER CONDITIONS THAT RESULT IN CHANGES TO THE HVAC LAYOUT SHALL BE REFERRED TO THE ARCHITECT, WHO WILL MAKE ANY CLARIFICATIONS IN WRITING.
- THE HVAC CONTRACTOR SHALL PROVIDE A DETAILED DESCRIPTION OF THE INFORMATION BEING REQUESTED ALONG WITH A DRAWING SHOWING THE AREA AND ITEMS WHERE THE CONFLICTS OCCUR AS WELL AS A PROPOSED SOLUTION TO RESOLVE THE CONFLICTS.
- 2. FAILURE TO PROVIDE A DETAILED DESCRIPTION AND PROPOSED SOLUTION TO THE INFORMATION BEING REQUESTED WILL RESULT IN THE ARCHITECT / ENGINEER RETURNING THE REQUEST AND REQUIRING THAT THIS BE PROVIDED BEFORE REVIEWING, ACCEPTING OR MODIFYING THE
- B. THE ENGINEER SHALL HAVE 5 (FIVE) WORKING BUSINESS DAYS (NOT INCLUDING HOLIDAYS AND VACATIONS) FROM THE DATE THAT THE ENGINEER HAS RECEIVED THEM TO REVIEW AND ISSUE A RESPONSE THE CONTRACTOR.

#### 1.6 SHOP DRAWINGS

- A. DIVISION 23 SUBMITTALS SHALL BE SUBMITTED ELECTRONICALLY VIA EMAIL IN PDF FORMAT TO THE ARCHITECT WHO WILL THEN FORWARD THEM TO THE ENGINEER.
- DIVISION 23 SHALL CHECK, SIGN, STAMP AND DATE ALL SUBMITTALS BEFORE SENDING THEM TO THE ENGINEER FOR REVIEW.
- 2. THE ENGINEER SHALL HAVE 10-WORKING BUSINESS DAYS (NOT INCLUDING HOLIDAYS AND
- VACATIONS) AFTER THE DATE THAT THE ENGINEER HAS RECEIVED THEM TO REVIEW, SIGN AND STAMP THE SUBMITTALS BEFORE RETURNING THEM TO THE ARCHITECT.
- EACH PIECE OF EQUIPMENT SHALL BE SUBMITTED IN A SEPARATE PDF FILE, COMBINING THE EQUIPMENT INTO ONE (1) PDF FILE WILL NOT BE ACCEPTED.
- B. PREPARE COORDINATION DRAWINGS ACCORDING TO 1/4-INCH EQUALS 1'-0" SCALE OR LARGER.
- DETAIL MAJOR ELEMENTS, COMPONENTS AND SYSTEMS OF MECHANICAL EQUIPMENT AND MATERIALS IN RELATIONSHIP WITH OTHER SYSTEMS, INSTALLATIONS, AND BUILDING COMPONENTS. 2. INCLUDE THE FOLLOWING:
  - a. PROPOSED LOCATIONS AND SIZES OF DUCTWORK, EQUIPMENT, DUCTWORK ACCESSORIES
  - AND MATERIALS b. CLEARANCES FOR SERVICING AND MAINTAINING EQUIPMENT, INCLUDING SPACE FOR
  - EQUIPMENT DISASSEMBLY REQUIRED FOR PERIODIC MAINTENANCE.
  - c. EQUIPMENT SERVICE CONNECTIONS AND SUPPORT DETAILS. d. FIRE-RATED WALL PENETRATIONS.
  - e. FLOOR PLANS, ELEVATIONS AND DETAILS TO INDICATE PENETRATIONS IN FLOORS, WALLS AND CEILINGS AND THEIR RELATIONSHIP TO OTHER PENETRATIONS AND INSTALLATIONS.
  - f. REFLECTED CEILING PLANS TO COORDINATE AND INTEGRATE INSTALLATIONS. AIR OUTLETS AND INLETS, LIGHT FIXTURES, AND OTHER CEILING MOUNTED ITEMS.

#### 1.7 RECORD (AS-BUILT) DRAWINGS

- A. DURING THE PROGRESS OF CONSTRUCTION, THE RECORD DRAWINGS SHALL BE CORRECTED BY DIVISION 23 TO INDICATE ACTUAL INSTALLATIONS.
- B. UPON COMPLETION OF THE PROJECT, 3-SETS OF FINAL RECORD DRAWINGS SHALL PRODUCED, WITH 1-SET EACH BEING DELIVERED TO THE OWNER, ARCHITECT AND ENGINEER.

#### 1.8 PROTECTION

- A. CLOSE AND WATERPROOF BETWEEN OPENINGS, PIPES AND VOIDS IN WALLS TO PREVENT ENTRANCE OF WATER OR MOISTURE.
- B. SEAL ALL DUCTWORK, INCLUDING OPEN-ENDED DUCTWORK, AT THE END OF EACH DAY TO PREVENT DUST, DEBRIS, ETC. FROM ENTERING THE DUCTWORK AND PIPING.

#### 1.9 OPERATION DURING CONSTRUCTION

A. DIVISION 23 IS RESPONSIBLE FOR THE INSTALLATION AND OPERATION, SERVICE AND MAINTENANCE OF ALL NEW EQUIPMENT DURING CONSTRUCTION AND PRIOR TO ACCEPTANCE BY THE OWNER OF THE COMPLETED PROJECT. WARRANTY PERIODS SHALL NOT COMMENCE UNTIL FINAL ACCEPTANCE

#### 1.10 PROJECT COMPLETION.

A. AT THE COMPLETION OF THE PROJECT, DIVISION 23 SHALL PROVIDE, TO THE OWNER, THREE (3) HARD BOUND VOLUMES OF MANUALS CONTAINING OPERATING SERVICE AND LUBRICATION INSTRUCTIONS, AND PARTS LISTS FOR ALL MAJOR EQUIPMENT AND MANUFACTURERS GUARANTIES OR WARRANTIES.

#### 1.11 HVAC SCOPE OF WORK.

- A. THE WORK INCLUDED UNDER THIS CONTRACT CONSISTS OF THE PROVIDING OF ALL LABOR, MATERIALS, TOOLS, TRANSPORTATION, SERVICES, ETC., NECESSARY TO COMPLETE THE INSTALLATION THE HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS, AND OTHER ITEMS HEREIN LISTED, AND AS DESCRIBED IN THESE SPECIFICATIONS, AS ILLUSTRATED IN THE ACCOMPANYING DRAWINGS. OR AS DIRECTED BY THE OWNERS AUTHORIZED REPRESENTATIVE. HVAC WORK IS COMPRISED OF, BUT NOT LIMITED TO THE FOLLOWING PRINCIPAL ITEMS:
- SUPPLY AND RETURN SYSTEMS INCLUDING DUCTS, GRILLES AND OUTLETS.
- EXHAUST SYSTEMS INCLUDING DUCTS, ETC. INSULATION FOR DUCTS, ETC.
- MISCELLANEOUS EQUIPMENT REQUIRED FOR SYSTEMS. TEMPERATURE CONTROLS.

INSPECTION OF MECHANICAL ITEMS.

#### 1.12 GUARANTEES.

A. DIVISION 23 SHALL GUARANTEE ALL WORK PERFORMED AND MATERIALS FURNISHED UNDER THIS CONTRACT AGAINST DEFECTS IN MATERIALS AND WORKMANSHIP FOR A PERIOD OF ONE (1) YEAR FROM THE DATE OF THE OWNER'S FINAL ACCEPTANCE OF THE WORK. ANY DEFECTS SHALL BE RECTIFIED BY DIVISION 23 WITHOUT ANY ADDITIONAL COST TO THE OWNER.

#### 1.13 PUNCH LIST.

- A. DIVISION 23 SHALL SCHEDULE, THROUGH THE ARCHITECT WITH A MINIMUM OF 7-DAYS NOTICE, THE ENGINEER TO PERFORM THE FOLLOWING:
- PRE-PUNCH LIST: VERIFICATION OF MECHANICAL ITEMS SUCH AS, BUT NOT LIMITED TO, DUCTWORK SIZES, LOCATIONS, METHODS OF ASSEMBLY / INSTALLATION, BEFORE ITEMS ARE ENCLOSED BY CEILINGS, WALLS, ETC.
- a. DIVISION 23 SHALL DELIVER TO BOTH THE ARCHITECT AND ENGINEER, A LETTER STATING THAT ALL ITEMS IN THE PRE-PUNCH LIST HAVE BEEN CORRECTED OR ADJUSTED ACCORDING TO THE GENERAL CONDITIONS OF THE CONTRACT BEFORE ANY CEILINGS, WALLS, ETC. CAN BE INSTALLED TO ENCLOSE MECHANICAL ITEMS.
- 2. FINAL PUNCH LIST: VERIFICATION OF MECHANICAL ITEMS SUCH AS, BUT NOT LIMITED TO, UNIT OPERATION, SENSOR LOCATIONS, COLORS SELECTED BY ARCHITECT.
- a. BEFORE PROCEEDING WITH THE FINAL PUNCH LIST, DIVISION 23 SHALL PROVIDE THE ENGINEER WITH A COMPLETE SIGNED AND SEALED BALANCE REPORT.
- 1). THE ENGINEER SHALL NOT PERFORM A FINAL PUNCH LIST UNTIL A COMPLETED
- BALANCE REPORT IS RECEIVED. b. DIVISION 23 SHALL, AT THE REQUEST OF THE ENGINEER, PROVIDE A LADDER AND ONE EMPLOYEE TO REMOVE AND REPLACE CEILING TILES, OPEN ACCESS DOORS, ETC. FOR
- 1). THE EMPLOYEE SHALL BE MADE IMMEDIATELY AVAILABLE TO REMOVE ITEMS THAT
- ARE REQUESTED BY THE ENGINEER. 2). ANY CEILING TILE THAT IS DAMAGED SHALL BE REPLACED WITH NEW (TO MATCH EXISTING) AT DIVISION 23's EXPENSE.
- c. DIVISION 23 SHALL DELIVER TO BOTH THE ARCHITECT AND ENGINEER, A LETTER STATING THAT ALL ITEMS IN THE FINAL PUNCH LIST HAVE BEEN CORRECTED OR ADJUSTED ACCORDING TO THE GENERAL CONDITIONS OF THE CONTRACT.

#### PART 2 - PRODUCTS

#### 2.1 FIRESTOPPING

- A. PROVIDE UL LISTED AND TESTED FIRESTOPPING MATERIAL, SILICONE ELASTOMER SPECIFICALLY FORMULATED FOR USE IN HORIZONTAL AND VERTICAL APPLICATIONS.
- 1. THE MATERIAL SHALL POSSESS INTUMESCENT CHARACTERISTICS, AND UPON EXPOSURE TO HEAT ABOVE 250° F, SHALL EXPAND TO NOT LESS THAN FIVE TIMES ITS ORIGINAL VOLUME TO FORM A FIREPROOF ENVELOPE UL RATED FOR 2 AND 3-HOURS PROTECTION, WHEN APPLIED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
- B. UNUSED SLOTS AND OTHER PENETRATIONS IN WALLS OR OTHER GENERAL CONSTRUCTION SHALL BE CLOSED AND SEALED WITH AN APPROVED FIRESTOPPING MATERIAL.
- 1. DUCT OPENINGS IN WALLS SHALL BE CLOSED WITH 16-GAUGE GALVANIZED STEEL SHEET SECURELY ATTACHED AT THE MIDPOINT OF THE WALL THICKNESS AND FIRESTOPPED ON BOTH SIDES OF THE STEEL SHEET WITH NOT LESS THAN 1/8-INCH THICK LAYER OF NON-SAGGING SILICONE ELASTOMER TO FULLY COVER THE OPENING.
- C. DUCTS: THE ANNULUS BETWEEN DUCTWORK AND WALLS IN FINISHED SPACES SHALL BE FILLED, SEALED, AND PAINTED TO MATCH ADJACENT SURFACES.
- 1. WHERE DUCTWORK PASSES THROUGH A FIRE-RATED WALL ASSEMBLY, AND THERE ARE NO FIRE DAMPERS SHOWN ON THE PLANS (DUCTWORK SIZE IS LESS THAN 100 SQUARE INCHES), PROVIDE THE FOLLOWING, MINIMUM:
- a. A MINIMUM OF 12-INCH LONG BY 0.060-INCH THICK STEEL SLEEVE SHALL BE
- CENTERED IN EACH DUCT OPENING. b. THE SLEEVE SHALL BE SECURED TO BOTH SIDES OF THE WALL / CEILING AND ALL FOUR SIDES OF THE SLEEVE WITH A MINIMUM OF 1-1/2" x 1-1/2" x 0.060" STEEL RETAINING ANGLES.
- c. THE RETAINING ANGLES SHALL BE SECURED TO THE SLEEVES AND THE WALL / CEILING WITH NO. 10 (M5) SCREWS.
- d. THE ANNULAR SPACE BETWEEN THE STEEL SLEEVE AND WALL / CEILING SHALL BE FILLED WITH SILICONE ELASTOMER TO PROVIDE A MINIMUM 2-HOUR RATED FIRESTOP

#### 2.2 MECHANICAL IDENTIFICATION

- A. DUCT IDENTIFICATION DEVICES.
  - 1. PLASTIC DUCT MARKERS: MANUFACTURERS STANDARD LAMINATED PLASTIC, COLOR CODED, CONTACT-TYPE, PERMANENT ADHESIVE.
  - a. LETTER SIZE: MINIMUM 1/4" FOR NAME OF UNITS IF VIEWING DISTANCE IS LESS THAN 2'-0", 1/2" FOR VIEWING DISTANCES UP TO 6'-0", AND PROPORTIONALLY
  - LARGER LETTERING FOR GREATER VIEWING DISTANCES. b. CONFORM TO THE FOLLOWING COLOR CODE:
  - GREEN: RETURN AIR.
  - YELLOW: SUPPLY AIR.
  - BLUE: EXHAUST AIR. NOMENCLATURE: INCLUDE THE FOLLOWING, AS A MINIMUM:
  - a). DIRECTION OF AIRFLOW.
  - b). DUCT SERVICE (SUPPLY, RETURN, EXHAUST, ETC.).
  - 2. LOCATE DUCT MARKERS NEAT POINTS WHERE DUCTS ENTER INTO CONCEALED SPACES AND AT MAXIMUM INTERVALS OF 25'-0" IN EACH SPACE WHERE DUCTS ARE EXPOSED OR CONCEALED BY REMOVABLE CEILING SYSTEMS.

#### B. EQUIPMENT IDENTIFICATION DEVICES.

- 1. EQUIPMENT NAMEPLATES: METAL NAMEPLATE WITH OPERATIONAL DATA ENGRAVED OR STAMPED, PERMANENTLY ATTACHED TO EQUIPMENT.
- a. DATA: MANUFACTURER, PRODUCT NAME, MODEL NUMBER, SERIAL NUMBER, CAPACITY, OPERATING AND POWER CHARACTERISTICS, LABELS OF TESTED COMPLIANCES, AND SIMILAR ESSENTIAL DATA.
  - 1). ENGRAVING: MANUFACTURER'S STANDARD LETTER STYLE, OF SIZES AND WITH TERMS TO MATCH EQUIPMENT IDENTIFICATION.
  - 2). THICKNESS: 1/16 INCH FOR UNITS UP TO 20 SQUARE INCHES OR 8-INCHES IN LENGTH, AND 1/8 INCH FOR LARGER UNITS.
- b. LOCATION: AN ACCESSIBLE AND VISIBLE LOCATION. c. FASTENERS: AS REQUIRED TO MOUNT ON EQUIPMENT.
- 2. DUCT ACCESS DOOR MARKERS: 1/16-INCH THICK, ENGRAVED LAMINATED PLASTIC, WITH ABBREVIATED TERMS AND NUMBERS CORRESPONDING TO IDENTIFICATION.
- a. PROVIDE 1/8-INCH CENTER HOLE FOR ATTACHMENT.
- b. FASTENERS: SELF-TAPPING, STAINLESS-STEEL SCREWS OR CONTACT-TYPE, PERMANENT

#### 2.3 PIPING MATERIALS

- A. CONDENSATE PIPING: TYPE L DRAWN-TEMPER COPPER, ASTM B-88. WITH CRIMPED SOLDERED
- B. FITTINGS: WROUGHT COPPER COMPLYING WITH ASME B16.22.

#### 2.4 PIPING INSULATION

A. FIRE-TEST RESPONSE CHARACTERISTICS: FLAME-SPREAD RATING OF 25 OR LESS, AND

SMOKE-DEVELOPED RATING OF 50 OR LESS; COMPLYING WITH ASTM E-84.

- B. INSULATION MATERIALS.
- MINERAL-FIBER INSULATION: PREFORMED PIPE INSULATION WITH GLASS FIBERS BONDED WITH A THERMOSETTING RESIN; WITH FACTORY-APPLIED, ALL PURPOSE, VAPOR-RETARDER PVC JACKET. 2. CLOSED-CELL PHENOLIC FOAM INSULATION: PREFORMED PIPE INSULATION OF RIGID, EXPANDED CLOSED CELL STRUCTURE, WITH VAPOR BARRIER AND ALL SERVICE JACKET; COMPLYING WITH
- C. ALL PIPING EXPOSED ON THE ROOF SHALL BE PROVIDED WITH A HIGH IMPACT, UV-RESISTANT PVC JACKET, MINIMUM 30 MIL (AS MANUFACTURED BY JOHNS MANVILLE).
- D. SCHEDULE OF PIPING INSULATION THICKNESSES.

ASTM C-1126, TYPE III, GRADE 1.

#### MINIMUM PIPE INSULATION

	MIN THE STATE OF THE	E INSOBATION	
SYSTEM TYPE	TEMPERATURE <u>RANGE (° F)</u>	PIPE <u>DIAMETER</u>	INSULATION <u>THICKNESS</u>
CONDENSATE	ALL	≤1" TO 8"	1-1/2"

#### 2.5 SHEET METAL MATERIALS

- COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS-METAL AND FLEXIBLE" FOR ACCEPTABLE MATERIALS, MATERIAL THICKNESSES, AND DUCT CONSTRUCTION METHODS, UNLESS OTHERWISE INDICATED.
- 1. SHEET METAL MATERIALS SHALL BE FREE FROM VISUAL IMPERFECTIONS INCLUDING PITTING, SEAM MARKS, ROLLER MARKS, OIL CANNING, STAINS, DISCOLORATIONS, AND OTHER IMPERFECTIONS, INCLUDING THOSE WHICH WOULD IMPAIR PAINTING.

## B. GALVANIZED SHEET STEEL.

LOCK-FORMING QUALITY; COMPLYING WITH ASTM A653/A653M AND HAVING G90 ZINC COATING DESIGNATION; DUCTS SHALL HAVE MILL-PHOSPHATIZED FINISH FOR SURFACES EXPOSED TO

## 2.6 SHEET METAL SEALANT MATERIALS

- MASTIC: NON-HARDENING, NON-MIGRATING MASTIC ELASTIC SEALANT SPECIFICALLY FOR SEALING JOINTS AND SEAMS IN DUCTWORK.
- B. WATER-BASED JOINT AND SEAM SEALANT: FLEXIBLE. ADHESIVE SEALANT, RESISTANT TO UV LIGHT WHEN CURED, UL 723 LISTED, AND COMPLYING WITH NFPA REQUIREMENTS FOR CLASS 1 DUCTS.
- SOLVENT-BASED JOINT AND SEAM SEALANT: ONE-PART, NONSAG, SOLVENT-RELEASE-CURING, POLYMERIZED BUTYL SEALANT FORMULATED WITH A MINIMUM OF 75 PERCENT SOLIDS.
- 2.7 DUCTWORK INSULATION A. FIRE-TEST RESPONSE CHARACTERISTICS.
  - 1. INDOOR APPLICATIONS: FLAME-SPREAD RATING OF 25 OR LESS, AND SMOKE-DEVELOPED RATING OF 50 OR LESS: COMPLYING WITH ASTM E-84.

## B. INSULATION MATERIALS.

1. MINERAL-FIBER BLANKET THERMAL INSULATION: GLASS FIBERS BONDED WITH A THERMOSETTING RESIN, WITHOUT FACING AND WITH ALL SERVICE JACKET MANUFACTURED FROM KRAFT PAPER, REINFORCING SCRIM, ALUMINUM FOIL, AND VINYL FILM.

#### 2.8 DUCTWORK ACCESSORIES

#### A. VOLUME DAMPERS.

- 1. LOW LEAKAGE VOLUME DAMPERS: MULTIPLE OR SINGLE-BLADE, OPPOSED BLADE DESIGN, LOW LEAKAGE RATING, LINKAGE OUTSIDE OF AIRSTREAM, AND SUITABLE FOR HORIZONTAL OR VERTICAL APPLICATIONS.
- a. STEEL FRAMES: HAT-SHAPED, GALVANIZED SHEET STEEL CHANNELS, MINIMUM OF 0.064"
  - THICK, WITH MITERED AND WELDED CORNERS; FRAMES WITH FLANGES FOR ATTACHING TO WALLS, FLANGELESS FRAMES FOR INSTALLATION IN DUCTS. ROLL-FORMED STEEL BLADES: 0.064" THICK, GALVANIZED SHEET STEEL.
  - BLADE AXLES: 1/2", GALVANIZED STEEL.
  - BEARINGS: TWO-PIECE MOLDED SYNTHETIC THRUST OR BALL
  - BLADE SEALS: FELT OR NEOPRENE. JAMB SEALS: CAMBERED STAINLESS STEEL
  - TIE BARS AND BRACKETS: GALVANIZED STEEL.
- 2. JACKSHAFT: 1" DIAMETER, GALVANIZED STEEL PIPE ROTATING WITHIN PIPE-BEARING ASSEMBLY MOUNTED ON SUPPORTS AT EACH MULLION AND AT EACH END OF MULTIPLE DAMPER
- DAMPER HARDWARE: ZINC-PLATED, DIE-CAST CORE WITH DIAL AND HANDLE MADE OF 3/32" THICK ZINC-PLATED STEEL, AND A 3/4" HEXAGON LOCKING NUT.
- INCLUDE CENTER HOLE TO SUIT DAMPER OPERATING-ROD SIZE

INCLUDE ELEVATED PLATFORM FOR INSULATED DUCT MOUNTING.

#### 4. DUCT ACCESSORY HARDWARE.

FINISH: MILL.

- a. QUADRANT LOCKS: PROVIDE FOR EACH VOLUME DAMPER, QUADRANT LOCK DEVICE ON ONE END OF SHAFT; AND END BEARING PLATE ON OTHER END FOR DAMPER LENGTHS
- PROVIDE EXTENDED QUADRANT LOCKS FOR EXTERNALLY INSULATED DUCTWORK. 2). MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE QUADRANT LOCKS OF ONE OF THE FOLLOWING:
  - a). VENT FABRICS, INC. b). YOUNG REGULATOR COMPANY.
- MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS. PROVIDE VOLUME DAMPERS OF ONE OF THE FOLLOWING:
- AIR BALANCE, INC.
- GREENHECK.
- McGILL AIRFLOW CORPORATION. RUSKIN COMPANY.

#### B. DUCT-MOUNTING ACCESS DOORS.

- 1. DESCRIPTION: FABRICATE DOORS AIRTIGHT AND SUITABLE FOR DUCT PRESSURE CLASS.
- a. PROVIDE ACCESS DOORS IN DUCTS FOR READY ACCESS TO OPERATING PARTS INCLUDING FIRE DAMPERS, ETC.
- 2. ACCESS DOORS IN DUCTS PROVIDE AND SIZE DOOR AS FOLLOWS:
- a. INSTALL THE FOLLOWING MINIMUM SIZES FOR DUCT-MOUNTING, RECTANGULAR ACCESS DOORS: 1). HEAD AND HAND ACCESS: 18 BY 10 INCHES.
- b. INSTALL THE FOLLOWING MINIMUM SIZES FOR DUCT-MOUNTING, ROUND ACCESS
- 1). HEAD AND HAND ACCESS: 12 INCHES IN DIAMETER. c. WHEN FIELD CONDITIONS REQUIRE AN ACCESS OPENING SMALLER THAN 18-INCH BY

10-INCH OR 12-INCHES IN DIAMETER, PROVIDE A 24-INCH LONG REMOVABLE SECTION

- OF CASING OR DUCT, SECURED WITH QUICK ACTING LOCKING DEVICES. 6 INCHES ON CENTERS. TO PERMIT READY ACCESS WITHOUT DISMANTLING OTHER EQUIPMENT. d. LABEL FIRE DAMPERS ACCESS DOORS IN ACCORDANCE WITH NFPA AND DRAWINGS.
- 3. RECTANGULAR DOORS: MINIMUM 22-GAUGE, DOUBLE-WALL, DUCT MOUNTING, FABRICATED OF GALVANIZED SHEET METAL (OR MATERIAL MATCHING ADJOINING DUCTWORK).
- . INCLUDE CONTINUOUS PIANO HINGE AND CAM LATCHES.
- FRAME: MINIMUM 22-GAUGE GALVANIZED SHEET STEEL, WITH BEND-OVER TABS AND FOAM GASKETS. 3). LOCKS: MINIMUM 16-GAUGE GALVANIZED STEEL CAM AND 20-GAUGE GALVANIZED
- STEEL LATCH. 4). ARRANGE DOORS SO THAT SYSTEM AIR PRESSURE WILL ASSIST CLOSURE AND PREVENT OPENING WHEN THE SYSTEM IS IN OPERATION.

MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE RECTANGULAR

- ACCESS DOORS OF ONE OF THE FOLLOWING:
- a). DUCTMATE INDUSTRIES, INC. McGILL AIRFLOW CORPORATION.
- RUSKIN COMPANY. 4. ROUND DOORS: MINIMUM 22-GAUGE, DOUBLE WALL, DUCT MOUNTING: FABRICATED OF
  - GALVANIZED SHEET METAL (OR MATERIAL MATCHING ADJOINING DUCTWORK).
- INCLUDE CAM LATCHES. FRAME: MINIMUM 22-GAUGE GALVANIZED SHEET STEEL, WITH SPIN-IN NOTCHED FRAME.
- ARRANGE DOORS SO THAT SYSTEM AIR PRESSURE WILL ASSIST CLOSURE AND PREVENT OPENING WHEN THE SYSTEM IS IN OPERATION. 4). MANUFACTURER: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE ROUND ACCESS
- DOORS BY ONE OF THE FOLLOWING:
- a). DUCTMATE INDUSTRIES, INC. b). FLEXMASTER U.S.A., INC.
- 5. SEAL AROUND FRAME ATTACHMENT TO DUCT AND DOOR TO FRAME WITH NEOPRENE OR FOAM RUBBER GASKET.

SIZE FOR INTENDED AND NECESSARY ACCESS.

#### 6. INSULATION: 1-INCH THICK, FIBROUS-GLASS OR POLYSTYRENE-FOAM BOARD.

- C. CEILING AND WALL ACCESS DOORS. 1. WHERE CEILINGS AND WALLS MUST BE PENETRATED FOR ACCESS TO MECHANICAL WORK,
  - PROVIDE TYPES OF ACCESS DOORS INDICATED. a. FURNISH SIZES INDICATED OR, WHERE NOT OTHERWISE INDICATED, FURNISH ADEQUATE
  - 1). HEAD AND HAND ACCESS MINIMUM SIZES FOR RECTANGULAR ACCESS DOORS: 20 INCHES BY 12 INCHES.

b. FURNISH MANUFACTURER'S COMPLETE UNITS, OF TYPE RECOMMENDED FOR APPLICATION

IN INDICATED SUBSTRATE CONSTRUCTION, IN EACH CASE, COMPLETE WITH ANCHORAGES AND HARDWARE. 2. CONSTRUCTION: EXCEPT AS OTHERWISE INDICATED, FABRICATE CEILING AND WALL DOOR UNITS OF WELDED STEEL CONSTRUCTION WITH WELDS GROUND SMOOTH, 16-GAUGE FRAMES AND

14-GAUGE FLUSH PANEL DOORS, 175 DEGREE SWING WITH CONCEALED SPRING HINGES, FLUSH SCREWDRIVER OPERATED CAM LOCKS, FACTORY APPLIED RUST-INHIBITIVE PRIME COAT

- PAINT FINISH (FINISH COLOR AS SELECTED BY ARCHITECT). MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE CEILING AND WALL
- a. MILCOR DIV., INRYCO INC. b. SMITH (JAY R.) MFG. CO.

ACCESS DOORS OF ONE OF THE FOLLOWING:

c. ZURN INDUSTRIES, INC.

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#### HVAC SPECIFICATIONS (cont'd)

#### D. FIRE DAMPERS.

- DESCRIPTION: LABELED ACCORDING TO UL 555, AND UL 555C (FIRE RATED CEILINGS WITH WOOD JOIST / TRUSS CONSTRUCTION), HORIZONTAL OR VERTICAL MOUNTING, MILL FINISH.
- a. FIRE RATING: 1-1/2 HOURS AND 2 HOURS.

STEEL BLADE CONNECTORS.

- b. FRAME: CURTAIN TYPE WITH BLADES OUTSIDE AIRSTREAM; FABRICATED WITH ROLL-FORMED, MINIMUM 20-GAUGE GALVANIZED STEEL; WITH MITERED AND
- INTERLOCKING CORNERS. c. MOUNTING SLEEVE: FACTORY FURNISHED, FIELD INSTALLED, MINIMUM 20-GAUGE GALVANIZED SHEET STEEL AND RETAINING ANGLES.
- ). MINIMUM THICKNESS: 0.138" THICK AND OF LENGTH TO SUIT APPLICATION. 2). FXCFPTIONS: OMIT SLEEVE WHERE DAMPER FRAME WIDTH PERMITS DIRECT ATTACHMENT OF PERIMETER MOUNTING ANGLES ON EACH SIDE OF WALL OR FLOOR, AND THICKNESS OF DAMPER FRAME COMPLIES WITH SLEEVE REQUIREMENTS.
- d. BLADES: ROLL-FORMED, INTERLOCKING, MINIMUM 24-GAUGE GALVANIZED SHEET STEEL 1). IN PLACE OF INTERLOCKING BLADES, USE FULL LENGTH, 0.034" THICK, GALVANIZED
- e. HORIZONTAL MOUNTING: INCLUDE BLADE LOCK AND 301 STAINLESS STEEL CONSTANT
- FORCE TYPE CLOSURE SPRING. FUSIBLE LINK: REPLACEABLE, 165° F, VIBRATION PROOF AND SECURED WITH CLINCHED "S" HOOKS OR STAINLESS STEEL BOLTS AND LOCK NUTS.
- 2. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE FIRE DAMPERS OF ONE OF THE FOLLOWING:
- a. AIR BALANCE, INC.
- GREENHECK. c. RUSKIN COMPANY.

#### E. FLEXIBLE CONNECTORS.

- DESCRIPTION: FLAME RETARDANT OR NON-COMBUSTIBLE FABRICS, COATINGS, AND ADHESIVES COMPLYING WITH UL 181, CLASS 1.
- a. FABRIC: GLASS FABRIC DOUBLE COATED WITH NEOPRENE.
- b. METAL EDGE CONNECTORS: FACTORY FABRICATED WITH A FABRIC STRIP 3-1/2" WIDE ATTACHED TO TWO STRIPS OF 2-3/4" WIDE, 0.028" THICK GALVANIZED SHEET STEEL OR 0.032" THICK ALUMINUM SHEETS.
- 1). SELECT METAL COMPATIBLE WITH DUCTS.
- ATTACHMENTS: ATTACH TO EQUIPMENT CONNECTIONS AS SPECIFIED BY MANUFACTURER AND AS SHOWN ON THE DRAWINGS.
- a. LENGTH: LIMIT FLEXIBLE CONNECTIONS TO 4" ACTIVE LENGTH IN DIRECTION OF AIRFLOW.
- 3. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE FLEXIBLE CONNECTORS OF ONE OF THE FOLLOWING:
- a. DUCTMATE INDUSTRIES, INC. b. DURO DYNE CORPORATION.
- c. VENTFABRICS, INC.

#### F. FLEXIBLE DUCTS.

- INSULATED FLEXIBLE DUCTS: UL 181, CLASS 1; BLACK POLYMER FILM SUPPORTED BY HELICALLY WOUND, SPRING-STEEL WIRE; 1" THICK FIBROUS-GLASS INSULATION; ALUMINUM
- VAPOR BARRIER FILM; MAXIMUM 5'-0" IN LENGTH. FLEXIBLE DUCT CLAMPS: STAINLESS STEEL BAND WITH CADMIUM-PLATED HEX SCREW TO TIGHTEN
- BAND WITH A WORM-GEAR ACTION, IN SIZES TO SUIT DUCT SIZE. 3. FLEXIBLE DUCT FITTINGS: FACTORY FABRICATED GALVANIZED STEEL FITTINGS.
- a. USE 45-DEGREE LATERALS, BALL MOUTH TEES, SPIN COLLARS, OR CONICAL TEES FOR DUCT TAPS.

b. 90-DEGREE TEES ARE NOT ALLOWED.

- 4. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE FLEXIBLE DUCTS OF ONE OF THE FOLLOWING:
  - FLEXMASTER U.S.A., INC. b. McGILL AIRFLOW CORPORATION.
- G. MOTORIZED CONTROL DAMPERS.
  - DESCRIPTION: OPPOSED-BLADE DESIGN WITH INFLATABLE SEAL BLADE EDGING, OR REPLACEABLE RUBBER SEALS, AMCA RATED AND TESTED TO AMCA 500D.
  - a. FRAME: 5"x1"x16-GAUGE GALVANIZED STEEL HAT CHANNEL REINFORCED WITH CORNER BRACES EQUAL TO 13-GAUGE CHANNEL FRAMES (3-1/2"x3/8"x16-GAUGE TOP AND
  - BOTTOM ON 12" HIGH OR LESS) AND HOLES FOR DUCT MOUNTING. b. BLADES: 6" WIDE, 14-GAUGE GALVANIZED STEEL AIRFOIL SHAPE, DOUBLE-SKIN
  - 1). SECURE BLADES TO 1/2" REMOVABLE DIAMETER, ZINC-PLATED AXLES USING ZINC-PLATED HARDWARE, WITH NYLON BLADE BEARINGS, BLADE-LINKAGE HARDWARE OF ZINC-PLATED STEEL AND BRASS (CONCEALED IN FRAME), ENDS SEALED AGAINST SPRING-STAINLESS STEEL BLADE BEARINGS, AND THRUST BÉARINGS AT EACH END OF EVERY BLADE.
  - c. LEAKAGE RATE: NOT GREATER THAN 4 CFM / FT2 OF DAMPER SURFACE AREA AT 1.0 INCH WATER GAUGE.
- MANUFACTURER: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE MOTORIZED CONTROL DAMPERS OF ONE OF THE FOLLOWING:
- a. AIR BALANCE, INC.
- GREENHECK. c. RUSKIN COMPANY.

#### 2.9 DIFFUSERS, REGISTERS AND GRILLES

- A. CEILING COMPATIBILITY: PROVIDE DIFFUSERS AND GRILLES WITH BORDER STYLES THAT ARE COMPATIBLE WITH ADJACENT CEILING SYSTEMS, AND THAT ARE SPECIFICALLY MANUFACTURED TO FIT INTO CEILING MODULE AND WITH ACCURATE FIT AND ADEQUATE SUPPORT.
- B. PERFORMANCE: PROVIDE CEILING DIFFUSERS AND GRILLES THAT HAVE, AS MINIMUM, TEMPERATURE AND VELOCITY TRAVERSES, THROW AND DROP, AND NOISE CRITERIA RATINGS FOR EACH SIZE DEVICE AS LISTED IN MANUFACTURERS CURRENT DATA.
- 1. NOISE LEVELS OF NC 20 OR LESS.
- C. SQUARE CEILING SUPPLY DIFFUSERS.
- LOUVERED FACE DIFFUSER.
  - MATERIAL: MINIMUM 18-GAUGE STEEL, CORE OF CONCENTRIC RINGS. b. FINISH: BAKED ENAMEL, COLOR SELECTED BY ARCHITECT.
  - FACE STYLE: THREE CONE.
  - d. PATTERN: FULLY ADJUSTABLE.
  - 1). MANUAL ADJUSTABLE CORES FROM HORIZONTAL TO VERTICAL BY EXTENDING OR RETRACTING THE INNER THREE CONES.
    - a). THESE THREE CONES SHALL BE CONSTRUCTED AS A SINGLE INNER ASSEMBLY AND MUST BE EASILY REMOVABLE USING A SPRING LOCK MECHANISM. A RETAINER CABLE SHALL BE PROVIDED TO ALLOW THE INNER CORE ASSEMBLY
  - e. MOUNTING: T-BAR (LAY-IN), SURFACE
  - DAMPERS: ADJUSTABLE. OPPOSED BLADE, KEY OPERATED FROM FACE OF DIFFUSER. ACCESS: PROVIDE REMOVABLE INTERNAL PARTS OF ROUND DIFFUSERS, INCLUDING VOLUME
  - REGULATORS, DIFFUSER FACE, DAMPERS AND EQUALIZING DEVICES. h. ACCESSORIES:

TO HANG DURING MAINTENANCE OF DIFFUSERS.

- 1). OPERATING KEYS: TOOLS DESIGNED TO FIT THROUGH DIFFUSER FACE AND OPERATE VOLUME CONTROL DEVICE AND / OR PATTERN ADJUSTMENT.
- 2). PLASTER RING.

#### D. CEILING RETURN / EXHAUST GRILLES.

- MATERIAL: STEEL.
- FINISH: BAKED ENAMEL, WHITE. FACE STYLE: FLUSH, HOUSING COVERED WITH REMOVABLE PERFORATED PANEL (PERFORATED SCREEN WITH 3/16" DIAMETER HOLES ON 1/4" STAGGERED CENTERS) IN FRAME, MINIMUM 51% FREE AREA.
- 4. FACE SIZE.
- a. 24"x24" SQUARE: MINIMUM 22-GAUGE STEEL, PROVIDE 22"x22" BACKPAN (NECK SIZE AS SHOWN ON DRAWINGS, STANDARD NECK SIZE WHERE NOT INDICATED).
- 1). MINIMUM 22-GAUGE STEEL BACKPAN (WELDED-IN INLETS AND CORNER JOINTS ARE NOT ACCEPTABLE).
- DAMPERS: ADJUSTABLE, OPPOSED-BLADE, KEY OPERATED FROM FACE OF DIFFUSER. ACCESSORIES.
- a. SQUARE TO ROUND NECK ADAPTOR.

MOUNTING: LAY-IN (T-BAR).

- E. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE DIFFUSERS, REGISTERS AND GRILLES OF ONE OF THE FOLLOWING:
- PRICE INDUSTRIES. TITUS.

#### 2.10 AIR DUCTWORK CLEANING

#### A. SCOPE OF WORK.

- 1. EXTENT OF WORK INCLUDES THE FOLLOWING.
- a. EXISTING AND NEW SUPPLY, RETURN AND EXHAUST AIR DUCTWORK SYSTEMS.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF VISIBLE SURFACE CONTAMINANTS AND DEPOSITS FROM WITHIN THE HVAC SYSTEM IN STRICT ACCORDANCE WITH THESE SPECIFICATIONS.
- 3. THE HVAC SYSTEM INCLUDES ANY INTERIOR SURFACE OF THE FACILITY?S AIR DISTRIBUTION SYSTEM FOR CONDITIONED SPACES AND / OR OCCUPIED ZONES.
- a. THIS INCLUDES THE ENTIRE HEATING, AIR CONDITIONING AND VENTILATION SYSTEMS FROM THE POINTS WHERE THE AIR ENTERS THE SYSTEM TO THE POINTS WHERE THE AIR IS DISCHARGED FROM THE SYSTEM.

#### B. CLEANING REQUIREMENTS.

- ENGAGE A QUALIFIED AIR SYSTEM CLEANING SPECIALIST (ASCS) TO CLEAN THE SYSTEMS. COMPONENT CLEANING: CLEANING METHODS SHALL BE EMPLOYED SUCH THAT ALL HVAC
- YSTEM COMPONENTS MUST BE VISIBLY CLEAN AS DEFINED IN APPLICABLE STANDARDS; SEE NATIONAL AIR DUCT CLEANERS ASSOCIATION (NADCA) STANDARDS. AIR VOLUME CONTROL DEVICES: DAMPERS AND ANY AIR DIRECTIONAL MECHANICAL DEVICES NSIDE THE HVAC SYSTEM MUST HAVE THEIR POSITION MARKED PRIOR TO CLEANING AND,
- UPON COMPLETION, MUST BE RESTORED TO THEIR MARKED POSITION 4. SERVICE OPENINGS: THE CONTRACTOR SHALL UTILIZE SERVICE OPENINGS, AS REQUIRED FOR PROPER CLEANING, AT VARIOUS POINTS OF THE HVAC SYSTEM FOR PHYSICAL AND MECHANICAL
- FNTRY AND INSPECTION. a. OTHER OPENINGS SHALL BE CREATED WHERE NEEDED AND THEY MUST BE CREATED SO
- THEY CAN BE SEALED IN ACCORDANCE WITH INDUSTRY CODES AND STANDARDS. b. CLOSURES MUST NOT SIGNIFICANTLY HINDER, RESTRICT, OR ALTER THE AIRFLOW WITHIN

THE SYSTEM AND MUST BE PROPERLY INSULATED TO PREVENT HEAT LOSS / GAIN OR

5. CUTTING SERVICE OPENINGS INTO FLEXIBLE DUCTS AND FLEXIBLE CONNECTORS IS NOT

CONDENSATION ON SURFACES WITHIN THE SYSTEM.

- CEILING SECTIONS (TILE): THE CONTRACTOR MAY REMOVE AND REINSTALL CEILING SECTIONS TO GAIN ACCESS TO HVAC SYSTEMS DURING THE CLEANING PROCESS; ANY CEILING TILE THAT S DAMAGED SHALL BE REPLACED WITH NEW (TO MATCH EXISTING) AT THE CONTRACTOR'S
- 7. CLEAN THE FOLLOWING METAL DUCT SYSTEM COMPONENTS BY REMOVING VISIBLE SURFACE CONTAMINANTS AND DEPOSITS.
- a. AIR DISTRIBUTION DEVICES (REGISTERS, GRILLES AND DIFFUSERS. b. SUPPLY, RETURN AND EXHAUST AIR DUCTS, DAMPERS, ACTUATORS, AND TURNING VANES.

#### C. MECHANICAL CLEANING METHODOLOGY.

- 1. THE HVAC SYSTEM SHALL BE CLEANED USING SOURCE REMOVAL MECHANICAL CLEANING METHODS DESIGNED TO EXTRACT CONTAMINANTS FROM WITHIN THE HVAC SYSTEM AND SAFELY REMOVE CONTAMINANTS FROM THE FACILITY.
- a. IT IS THE CONTRACTOR'S RESPONSIBILITY TO SELECT SOURCE REMOVAL METHODS WHICH WILL RENDER THE HVAC SYSTEM VISIBLY CLEAN AND CAPABLE OF PASSING CLEANING VERIFICATION METHODS (SEE APPLICABLE NADCA STANDARDS).
- 1). NO CLEANING METHOD, OR COMBINATION OF METHODS, SHALL BE USED WHICH COULD POTENTIALLY DAMAGE COMPONENTS OF THE HVAC SYSTEM OR NEGATIVELY ALTER THE INTEGRITY OF THE SYSTEM.
- b. ALL METHODS USED SHALL INCORPORATE THE USE OF VACUUM COLLECTION DEVICES
- THAT ARE OPERATED CONTINUOUSLY DURING CLEANING. c. ALL VACUUM DEVICES EXHAUSTING AIR INSIDE THE BUILDING SHALL BE EQUIPPED WITH HEPA FILTERS (MINIMUM 99.97 PERCENT COLLECTION EFFICIENCY FOR 0.3-MICRON SIZE
- OR GREATER PARTICLES), INCLUDING HAND-HELD VACUUMS AND WET VACUUMS. d. ALL VACUUM DEVICES EXHAUSTING AIR OUTSIDE THE FACILITY SHALL BE EQUIPPED WITH PARTICULATE COLLECTION INCLUDING ADEQUATE FILTRATION TO CONTAIN DEBRIS REMOVED FROM THE HVAC SYSTEM AND SHALL BE LOCATED DOWN WIND AND AWAY FROM AIR INTAKES AND OTHER POINTS OF ENTRY INTO BUILDING.
- 1). RELEASE OF DEBRIS OUTDOORS MUST NOT VIOLATE ANY OUTDOOR ENVIRONMENTAL STANDARDS, CODES OR REGULATIONS.
- e. ALL METHODS REQUIRE MECHANICAL AGITATION DEVICES TO DISLODGE DEBRIS ADHERED TO INTERIOR HVAC SYSTEM SURFACES, SUCH THAT DEBRIS MAY BE SAFELY CONVEYED TO VACUUM COLLECTION DEVICES.
- 1). ACCEPTABLE METHODS WILL INCLUDE THOSE WHICH WILL NOT POTENTIALLY DAMAGE THE INTEGRITY OF THE DUCTWORK, NOR DAMAGE POROUS SURFACE MATERIALS SUCH AS LINERS INSIDE THE DUCTWORK OR SYSTEM COMPONENTS.
- 2. METHODS OF CLEANING FIBROUS GLASS INSULATED COMPONENTS.
- a. FIBROUS GLASS THERMAL OR ACOUSTICAL INSULATION ELEMENTS PRESENT IN ANY EQUIPMENT OR DUCTWORK SHALL BE THOROUGHLY CLEANED WITH HEPA VACUUMING EQUIPMENT, WHILE THE HVAC SYSTEM IS UNDER CONSTANT NEGATIVE PRESSURE, AND NOT PERMITTED TO GET WET IN ACCORDANCE WITH APPLICABLE NADCA AND NAIMA STANDARDS AND RECOMMENDATIONS.
- CLEANING METHODS USED SHALL NOT CAUSE DAMAGE TO FIBROUS GLASS COMPONENTS AND WILL RENDER THE SYSTEM CAPABLE OF PASSING CLEANING VERIFICATION TESTS (SEE NADCA STANDARDS).
- 1). IN THE EVENT FIBER GLASS MATERIALS MUST BE REPLACED, ALL MATERIALS SHALL CONFORM TO APPLICABLE INDUSTRY CODES AND STANDARDS, INCLUDING THOSE OF UL AND SMACNA.

#### 3. CLEANING OF COILS.

- a. ANY CLEANING METHOD MAY BE USED WHICH WILL RENDER THE COIL VISIBLY CLEAN AND CAPABLE OF PASSING COIL CLEANING VERIFICATION (SEE APPLICABLE NADCA STANDARDS). b. COIL DRAIN PANS SHALL BE SUBJECT TO NON-POROUS SURFACES CLEANING VERIFICATION
- (THE DRAIN FOR THE CONDENSATE DRAIN PAN SHALL BE OPERATIONAL) c. CLEANING METHODS SHALL NOT CAUSE ANY APPRECIABLE DAMAGE TO, DISPLACEMENT OF, INHIBIT HEAT TRANSFER. OR EROSION OF THE COIL SURFACE OR FINS, AND SHALL
- CONFORM TO COIL MANUFACTURER RECOMMENDATIONS. d. COILS SHALL BE THOROUGHLY RINSED WITH CLEAN WATER TO REMOVE ANY LATENT RESIDUES AND CLEANING MATERIALS: COMB AND STRAIGHTEN FINS.
- e. PROVIDE OPERATIVE DRAINAGE SYSTEM FOR WASHDOWN PROCEDURES.

#### D. CLEANLINESS VERIFICATION.

- VERIFICATION OF HVAC SYSTEM CLEANLINESS WILL BE DETERMINED AFTER MECHANICAL CLEANING AND BEFORE THE APPLICATION OF ANY TREATMENT OR INTRODUCTION OF ANY TREATMENT-RELATED SUBSTANCE TO THE HVAC SYSTEM, INCLUDING BIOCIDAL AGENTS AND
- 2. VISUAL INSPECTION: THE HVAC SYSTEM SHALL BE INSPECTED VISUALLY TO ENSURE THAT NO VISIBLE CONTAMINANTS ARE PRESENT.
- a. IF NO CONTAMINANTS ARE EVIDENT THROUGH VISUAL INSPECTION, THE HVAC SYSTEM SHALL BE CONSIDERED CLEAN: HOWEVER, THE OWNER RESERVES THE RIGHT TO FURTHER VERIFY SYSTEM CLEANLINESS THROUGH GRAVIMETRIC OR WIPE TESTING ANALYSIS TESTING AS SPECIFIED HEREIN.
- b. IF VISIBLE CONTAMINANTS ARE EVIDENT THROUGH VISUAL INSPECTION, THOSE PORTIONS OF THE SYSTEM WHERE CONTAMINANTS ARE VISIBLE SHALL BE RE-CLEANED AND SUBJECTED TO RE-INSPECTION FOR CLEANLINESS.
- 3. GRAVIMETRIC ANALYSIS: AT THE DISCRETION AND EXPENSE OF THE OWNER, SECTIONS OF THE HVAC SYSTEM MAY BE TESTED FOR CLEANLINESS USING THE NADCA VACUUM TEST (GRAVIMETRIC ANALYSIS) AS SPECIFIED IN APPLICABLE NADCA STANDARDS (LEVELS OF DEBRIS COLLECTED SHALL BE EQUAL TO OR LESS THAN ACCEPTABLE LEVELS DEFINED IN APPLICABLE NADCA STANDARDS).
- a. GRAVIMETRIC ANALYSIS SHALL BE PERFORMED BY A QUALIFIED THIRD-PARTY EXPERIENCED IN TESTING OF THIS NATURE.
- 1). IF GRAVIMETRIC ANALYSIS DETERMINES THAT LEVELS OF DEBRIS EXCEED THOSE SPECIFIED IN APPLICABLE NADCA STANDARDS. THE SYSTEM SHALL NOT BE CONSIDERED CLEAN AND THOSE SECTIONS OF THE SYSTEM WHICH FAILED CLEANLINESS VERIFICATION SHALL BE RE-CLEANED AT THE EXPENSE OF THE ORIGINAL HVAC SYSTEM CLEANING

#### PART 3 - TESTING, ADJUSTING AND BALANCING

#### 3.1 TESTING, ADJUSTING AND BALANCING

- GENERAL: MULTIPLE MOBILIZATIONS ARE REQUIRED PER EACH COMPLETED WORK AREA / PHASE (i.e. PRIOR TO OWNER'S OCCUPANCY SPACE).
- 1. HVAC PRIME CONTRACTOR SHALL REVIEW THE PHASING PLANS AND INCLUDE IN BASE BID, SEPARATE BALANCE REPORTS FOR EACH COMPLETED AREA OF WORK.
- AIR BALANCING CONTRACTOR SHALL INCLUDE, IN THEIR PRICING, ONE SHEAVE CHANGE FOR RROFTOP UNIT TO BE INSTALLED AT COMPLETION OF PROJECT, IF NECESSARY,
- 1. SHEAVES AND BELT ADJUSTMENTS SHALL BE SET IN ACCORDANCE WITH THE UNIT MANUFACTURER RECOMMENDATIONS AND WITH FACTORY-AUTHORIZED SERVICE REPRESENTATIVE PRESENT, IN ORDER TO MAINTAIN MAXIMUM BELT LIFE.
- C. TAB FIRM QUALIFICATIONS: ENGAGE A TAB FIRM CERTIFIED BY EITHER ASSOCIATED AIR BALANCE COUNCIL (AABC) OR NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB).
- 1. A SPECIALIST WITH AT LEAST 5-YEARS OF EXPERIENCE IN THOSE TESTING, ADJUSTING AND BALANCING REQUIREMENTS SIMILAR TO THOSE REQUIRED FOR THIS PROJECT.
- a. SUBMIT BIOGRAPHICAL DATA ON TAB SUPERVISOR WHO IS DIRECTLY SUPERVISING TESTING,
- ADJUSTING AND BALANCING WORK. b. SUBMIT THE INDIVIDUAL QUALIFICATIONS OF ALL PERSONS RESPONSIBLE FOR SUPERVISING AND PERFORMING THE ACTUAL WORK.
- D. TAB FORM REPORTS: USE STANDARD FORMS FROM AABC'S "NATIONAL STANDARDS FOR TESTING AND BALANCING HEATING, VENTILATING,, AND AIR CONDITIONING SYSTEMS" OR NEBB'S "PROCEDURAL
- STANDARDS FOR TESTING, ADJUSTING AND BALANCING OF ENVIRONMENTAL SYSTEMS". INSTRUMENTATION TYPE, QUANTITY AND ACCURACY: AS DESCRIBED IN AABC'S "NATIONAL STANDARDS FOR TESTING AND BALANCING HEATING, VENTILATING,, AND AIR CONDITIONING SYSTEMS" OR NEBB'S PROCEDURAL STANDARDS FOR TESTING, ADJUSTING AND BALANCING OF ENVIRONMENTAL SYSTEMS", SECTION II, "REQUIRED INSTRUMENTATION FOR NEBB CERTIFICATION".
  - CALIBRATE INSTRUMENTS AT LEAST EVERY 6-MONTHS OR MORE FREQUENTLY IF REQUIRED BY INSTRUMENT MANUFACTURER.
  - a. PROVIDE UPDATED RECORD OF INSTRUMENT CALIBRATION THAT INDICATES DATE OF CALIBRATION AND THE NAME OF THE PARTY PERFORMING INSTRUMENT CALIBRATION

#### F. PROJECT CONDITIONS.

- 1. GENERAL: DO NOT PROCEED WITH TESTING, ADJUSTING AND BALANCING WORK UNTIL THE FOLLOWING CONDITIONS HAVE BEEN MET.
  - a. WORK HAS BEEN COMPLETED AND IS OPERABLE.
- b. WORK SCHEDULED FOR TESTING, ADJUSTING AND BALANCING IS CLEAN AND FREE FROM DEBRIS, DIRT AND DISCARDED BUILDING MATERIALS. c. ALL ARCHITECTURAL OPENINGS (DOORS, WINDOWS, AND OTHER OPENINGS) WHICH MAY
- AFFECT THE OPERATION OF THE SYSTEM TO BE TESTED, ADJUSTED AND BALANCED SHALL BE AT THEIR NORMAL STATES. d. ALL RELATED MECHANICAL SYSTEMS. WHICH MAY AFFECT THE OPERATION OF THE SYSTEM
- TO BE TESTED, ADJUSTED AND BALANCED SHALL BE AT THEIR NORMAL OPERATING CONDITIONS; COORDINATE WITH CONTROLS CONTRACTOR. e. UNIT FILTERS ARE NOT "LOADED"; MECHANICAL CONTRACTOR SHALL REPLACE, IF REQUIRED, PRIOR TO BALANCING.

## G. GENERAL PROCEDURES FOR TESTING AND BALANCING.

- 1. PERFORM TESTING AND BALANCING PROCEDURES ON EACH SYSTEM ACCORDING TO THE PROCEDURES CONTAINED IN AABC'S "NATIONAL STANDARDS FOR TESTING AND BALANCING HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS" OR NEBB'S "PROCEDURAL
- STANDARDS FOR TESTING, ADJUSTING, AND BALANCING OF ENVIRONMENTAL SYSTEMS' 2. TEST, ADJUST AND BALANCE SYSTEMS DURING NEAR-PEAK SUMMER SEASON FOR AIR CONDITIONING SYSTEMS AND DURING NEAR-PEAK WINTER SEASON FOR HEATING SYSTEMS, INCLUDING AT LEAST A PERIOD OF OPERATION AT OUTSIDE CONDITIONS WITHIN 5 DEGREE F (3 DEGREE C) WET BULB TEMPERATURE OF MAXIMUM SUMMER DESIGN CONDITION, AND WITHIN 10 DÉGREE F (6 DEGREE C) DRY BULB TEMPERATURE OF MINIMUM WINTER DESIGN CONDITION. WHEN SEASONAL OPERATION DOES NOT PERMIT MEASURING FINAL TEMPERATURES,
- THEN TAKE FINAL TEMPERATURE READINGS WHEN SEASONAL OPERATION DOES PERMIT. a. TEST DURATION: OPERATING TESTS OF EQUIPMENT SHALL BE OF NOT LESS THAN FOUR (4) HOURS DURATION AFTER STABILIZED OPERATING CONDITIONS HAVE BEEN
- 3. MARK EQUIPMENT AND BALANCING DEVICE SETTINGS WITH PAINT OR OTHER SUITABLE, PERMANENT IDENTIFICATION MATERIAL, INCLUDING DAMPER-CONTROL POSITIONS, FAN-SPEED CONTROL LEVERS, AND SIMILAR CONTROL DEVICES, TO SHOW FINAL SETTINGS.

### H. TOLERANCES.

SUPPLY AND EXHAUST FANS: 0% TO PLUS 5%. 2. AIR OUTLETS AND INLETS: 0% TO PLUS 5%.

#### FINAL REPORT.

- GENERAL: PROVIDE TYPEWRITTEN OR COMPUTER PRINTOUT IN LETTER-QUALITY FONT. ON STANDARD BOND PAPER, IN THREE-RING BINDER, TABULATED AND DIVIDED INTO SECTIONS BY TESTED AND BALANCED SYSTEM.
- a. INCLUDE A CERTIFICATION SHEET IN FRONT OF BINDER, SEALED AND SIGNED BY THE
- TESTING AND BALANCING ENGINEER. b. INCLUDE A LIST OF INSTRUMENTS USED FOR PROCEDURES, ALONG WITH PROOF OF CALIBRATION.
- 2. GENERAL REPORT DATA: IN ADDITION TO FORM TITLES AND ENTRIES, INCLUDE THE FOLLOWING DATA IN THE FINAL REPORT, AS APPLICABLE.
  - NAME AND ADDRESS OF TAB FIRM.
  - PROJECT NAME AND LOCATION.
  - ARCHITECTS NAME AND ADDRESS

CONTRACT DOCUMENTS.

- ENGINEERS NAME AND ADDRESS MECHANICAL CONTRACTORS NAME AND ADDRESS.
- REPORT DATE. TABLE OF CONTENTS WITH THE TOTAL NUMBER OF PAGES (NUMBER EACH PAGE IN
- REPORT) DEFINED FOR EACH SECTION OF THE REPORT. SUMMARY OF CONTENTS INCLUDING THE FOLLOWING:
- INDICATED VERSUS FINAL PERFORMANCE
- NOTABLE CHARACTERISTICS OF SYSTEMS. DESCRIPTION OF SYSTEM OPERATION SEQUENCE IF IT VARIES FROM THE

#### J. INSPECTIONS.

#### INITIAL INSPECTION.

- a. AFTER TESTING AND BALANCING ARE COMPLETE, OPERATE EACH SYSTEM AND RANDOMLY CHECK MEASUREMENTS TO VERIFY THAT THE SYSTEM IS OPERATING ACCORDING TO THE FINAL TEST AND BALANCE READINGS DOCUMENTED IN THE FINAL REPORT
- 1). RANDOMLY CHECK THE FOLLOWING FOR EACH SYSTEM:
- MEASURE AIRFLOW OF AT LEAST 10% OF AIR OUTLETS.
- MEASURE ROOM TEMPERATURE AT EACH THERMOSTAT. MEASURE SPACE PRESSURE OF AT LEAST 10% OF LOCATIONS. BALANCING DEVICES ARE MARKED WITH FINAL BALANCE POSITION.

#### 2. FINAL INSPECTION.

- a. AFTER INITIAL INSPECTION IS COMPLETE AND EVIDENCE BY RANDOM CHECKS VERIFIES THAT TESTING AND BALANCING ARE COMPLETE AND ACCURATELY DOCUMENTED IN THE FINAL REPORT, REQUEST THAT A FINAL INSPECTION BE MADE BY THE ARCHITECT AND
- 1). TAB FIRM TEST AND BALANCE ENGINEER SHALL CONDUCT THE INSPECTION IN THE PRESENCE OF THE ARCHITECT AND OWNER.
- b. ARCHITECT AND OWNER SHALL RANDOMLY SELECT MEASUREMENTS DOCUMENTED IN THE FINAL REPORT TO BE RECHECKED.
- 1). THE RECHECKING SHALL BE LIMITED TO EITHER 10% OF THE TOTAL MEASUREMENTS RECORDED, OR THE EXTENT OF THE MEASUREMENTS THAT CAN BE ACCOMPLISHED IN A NORMAL 8-HOUR BUSINESS DAY.

c. IF THE RECHECKS YIELD MEASUREMENTS THAT DIFFER FROM THE MEASUREMENTS

MEASUREMENTS SHALL BE NOTED AS "FAILED". 1). IF THE NUMBER OF "FAILED" MEASUREMENTS IS GREATER THAN 10% OF THE TOTAL MEASUREMENTS CHECKED DURING THE FINAL INSPECTION, OR A SOUND LEVEL OF 2 db OR MORE GREATER THAN THAT RECORDED IN THE REPORT

DOCUMENTED IN THE FINAL REPORT BY MORE THAN THE TOLERANCES ALLOWED, THE

AND SHALL BE REJECTED. a). IN THE EVENT THE REPORT IS REJECTED, ALL SYSTEMS SHALL BE READJUSTED AND TESTED. NEW DATA RECORDED. NEW CERTIFIED REPORTS SUBMITTED, AND NEW INSPECTIONS TEST MADE, ALL AT NO ADDITIONAL

LISTINGS, THE TESTING AND BALANCING SHALL BE CONSIDERED INCOMPLETE

- d. TAB FIRM SHALL RECHECK ALL MEASUREMENTS AND MAKE READJUSTMENTS. REVISE THE FINAL REPORT AND BALANCE DEVICE SETTINGS TO INCLUDE ALL CHANGES AND RESUBMIT THE FINAL REPORT.
- e. REQUEST A SECOND FINAL INSPECTION.
- 1). IF THE SECOND FINAL INSPECTION ALSO FAILS, THE OWNER SHALL CONTRACT THE SERVICES OF ANOTHER QUALIFIED TAB FIRM TO COMPLETE THE TESTING AND BALANCING IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND DEDUCT THE COST OF THE SERVICES FROM THE FINAL PAYMENT OF THE ORIGINAL TAB

- 3.2 EQUIPMENT REPORT TEST DATA. A. TEST DATA REQUIREMENTS: PROVIDE THE FOLLOWING, AS A MINIMUM, INDICATED AND ACTUAL
  - VALUES PER EACH PIECE OF SYSTEM TESTED.
  - FXHAUST FANS.
  - TOTAL AIRFLOW RATE IN CFM.
  - b. TOTAL SYSTEM STATIC PRESSURE IN INCHES WG. FAN RPM.
  - d. DISCHARGE AND SUCTION STATIC PRESSURE IN INCHES WG.
  - 2. ROOFTOP UNITS.
  - TOTAL SUPPLY AND RETURN AIRFLOW RATE IN CFM. TOTAL SUPPLY FAN STATIC PRESSURE IN INCHES WG.

a. TOTAL AIRFLOW RATE IN CFM.

SUPPLY FAN RPM. DISCHARGE STATIC PRESSURE IN INCHES WG.

FILTER STATIC PRESSURE DIFFERENTIAL IN INCHES WG.

OUTSIDE AIR ENTERING AND LEAVING AIR TEMPERATURE IN DEGREES F.

OUTSIDE AIRFLOW RATE IN CFM. OUTSIDE AIR DAMPER POSITION.

#### MOTOR VOLTAGE AT EACH CONNECTION. MOTOR AMPERAGE FOR EACH PHASE.

- 3. AIR TERMINAL DEVICES.
- AIRFLOW RATE IN CFM. AIR VELOCITY IN FPM. PRELIMINARY AIRFLOW RATE AS NEEDED IN CFM.

PRELIMINARY VELOCITY AS NEEDED IN FPM.

- FINAL AIRFLOW RATE IN CFM. FINAL VELOCITY IN FPM. NOISE CRITERIA (NC).
- 4. RECTANGULAR AND ROUND DUCTWORK.

h. SPACE TEMPERATURÉ IN DEGREES I

- SYSTEM AND FURNACE UNIT NUMBER. DUCT STATIC PRESSURE IN INCHES WG.
- d. ACTUAL AIRFLOW RATE IN CFM. e. ACTUAL VELOCITY IN FPM.

3.3 DUCTWORK PRESSURE (TIGHTNESS) TESTING

DUCT SIZE IN INCHES.

- 1. ALL DUCTWORK AND PLENUM SYSTEMS SHALL BE SEALED AND PRESSURE TESTED USING INSTRUMENTS AND PROCEDURES SPECIFIED IN ANSI / ASHRAE 152 AND ASTM E1554 TEST METHOD "A", AND NEW YORK STATE ENERGY CONSERVATION CODE SECTION 403.
  - A. EXCEPTION: DUCT TIGHTNESS TEST IS NOT REQUIRED IF THE AIR HANDLER AND ALL DUCTS ARE LOCATED WITHIN THE CONDITIONED SPACE.

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SA PROJECT TEAM: PRINCIPAL P.Silvestri

INTERIORS N.Catuzza

JOB CAPT.

SEAL:

HVAC



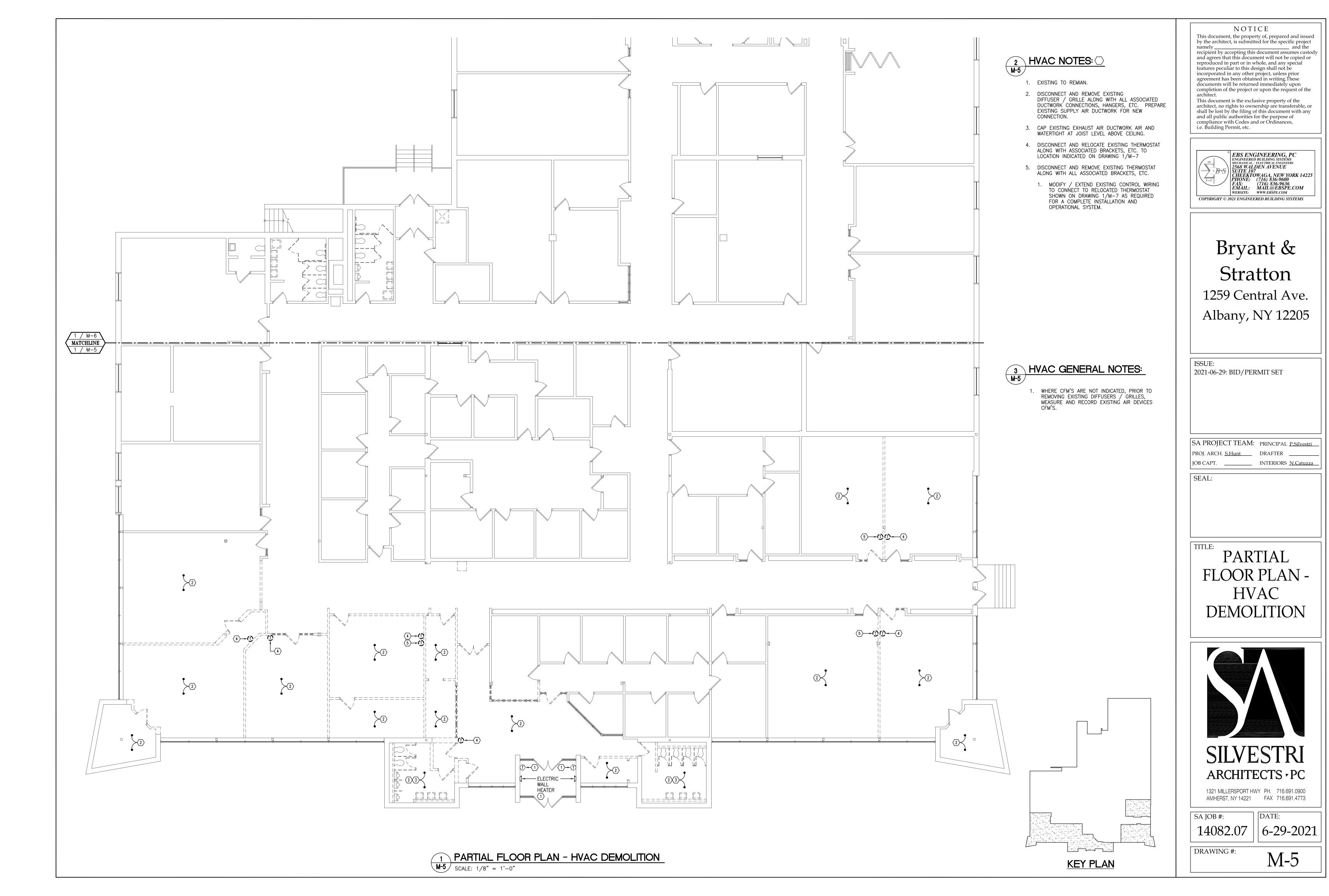
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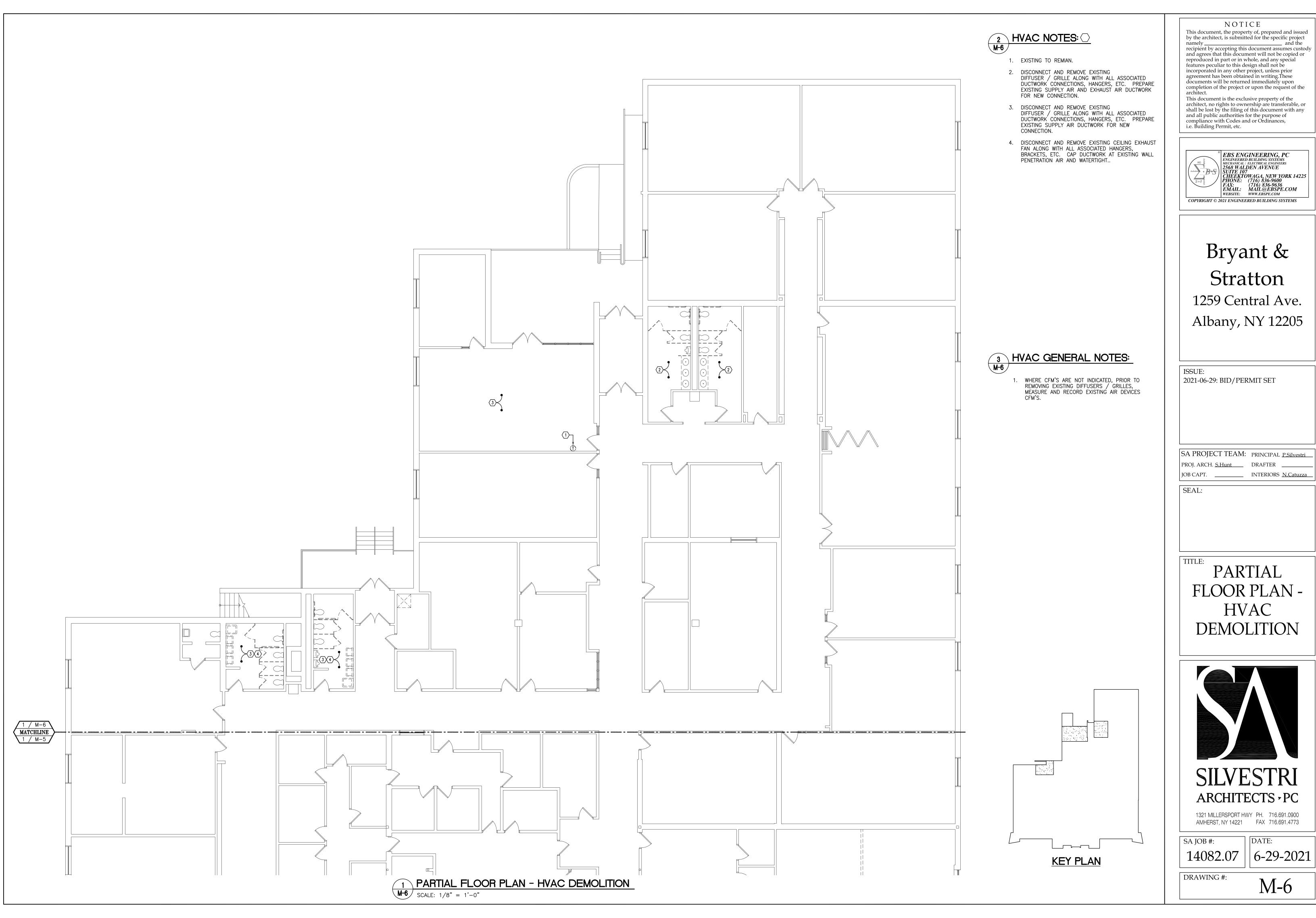
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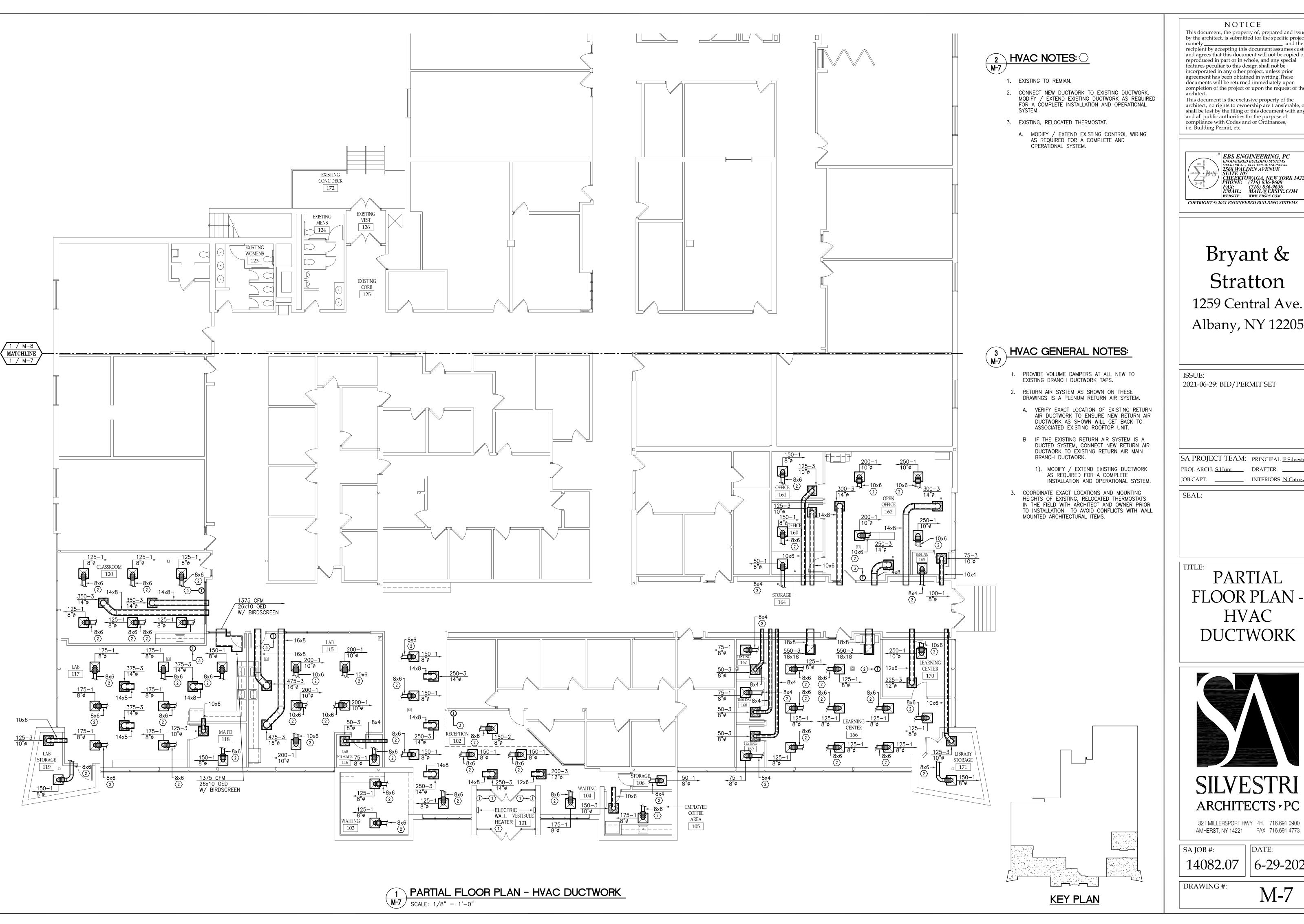
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PARTIAL FLOOR PLAN -HVAC **DUCTWORK** 

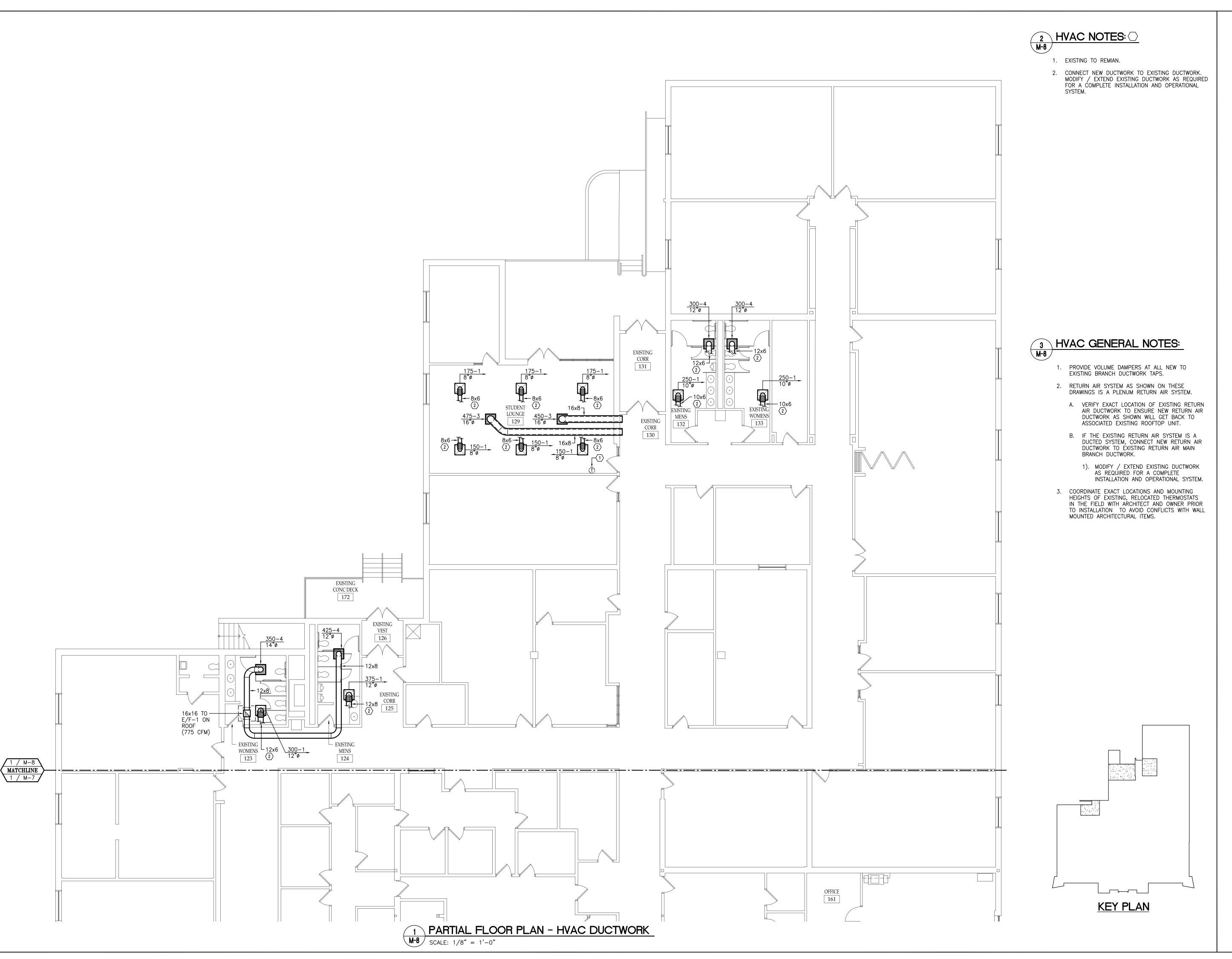


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JOB CAPT.

\_\_\_\_ INTERIORS <u>N.Catuzza</u>

PARTIAL FLOOR PLAN -HVAC **DUCTWORK** 



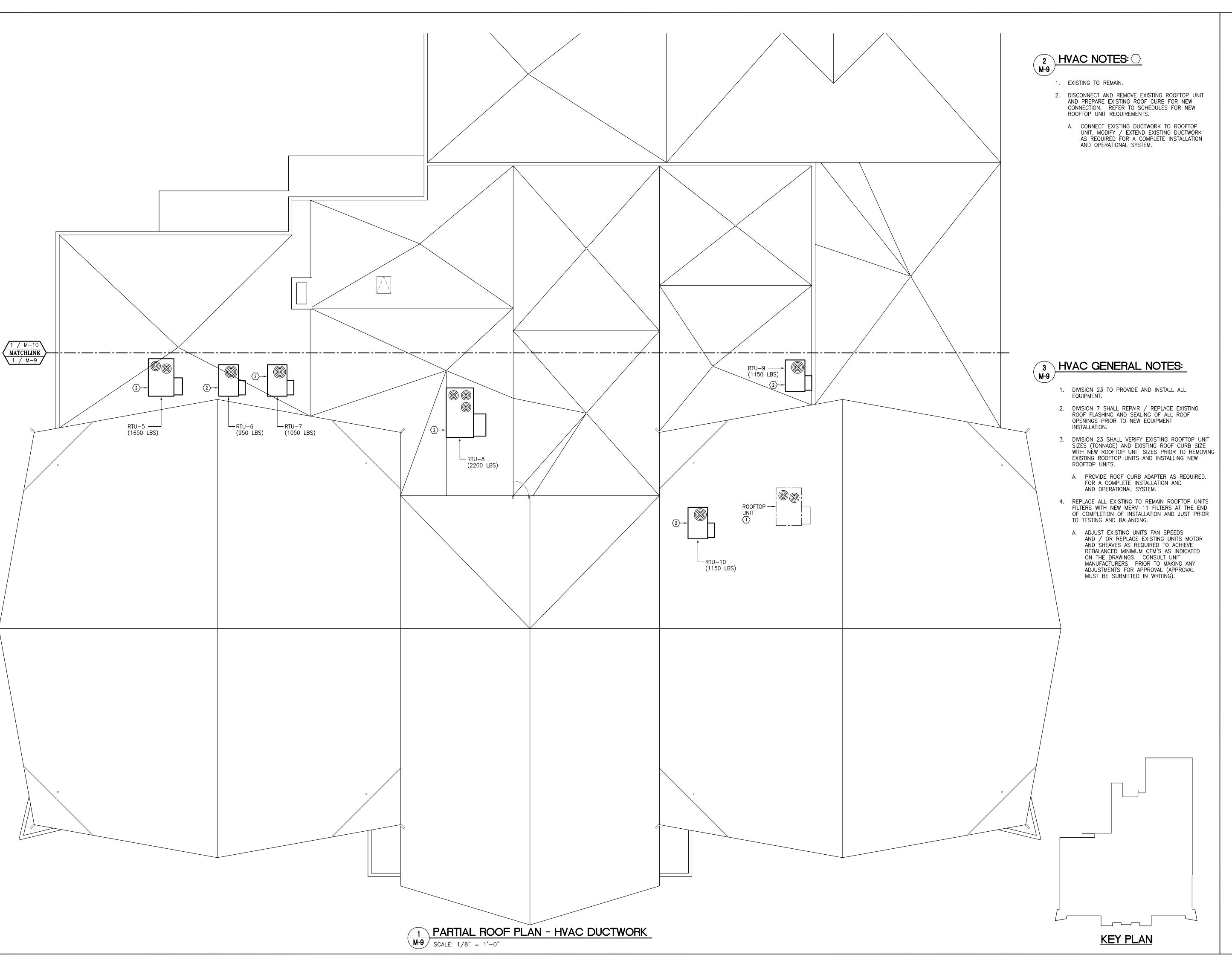
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PARTIAL ROOF PLAN -HVAC **DUCTWORK** 

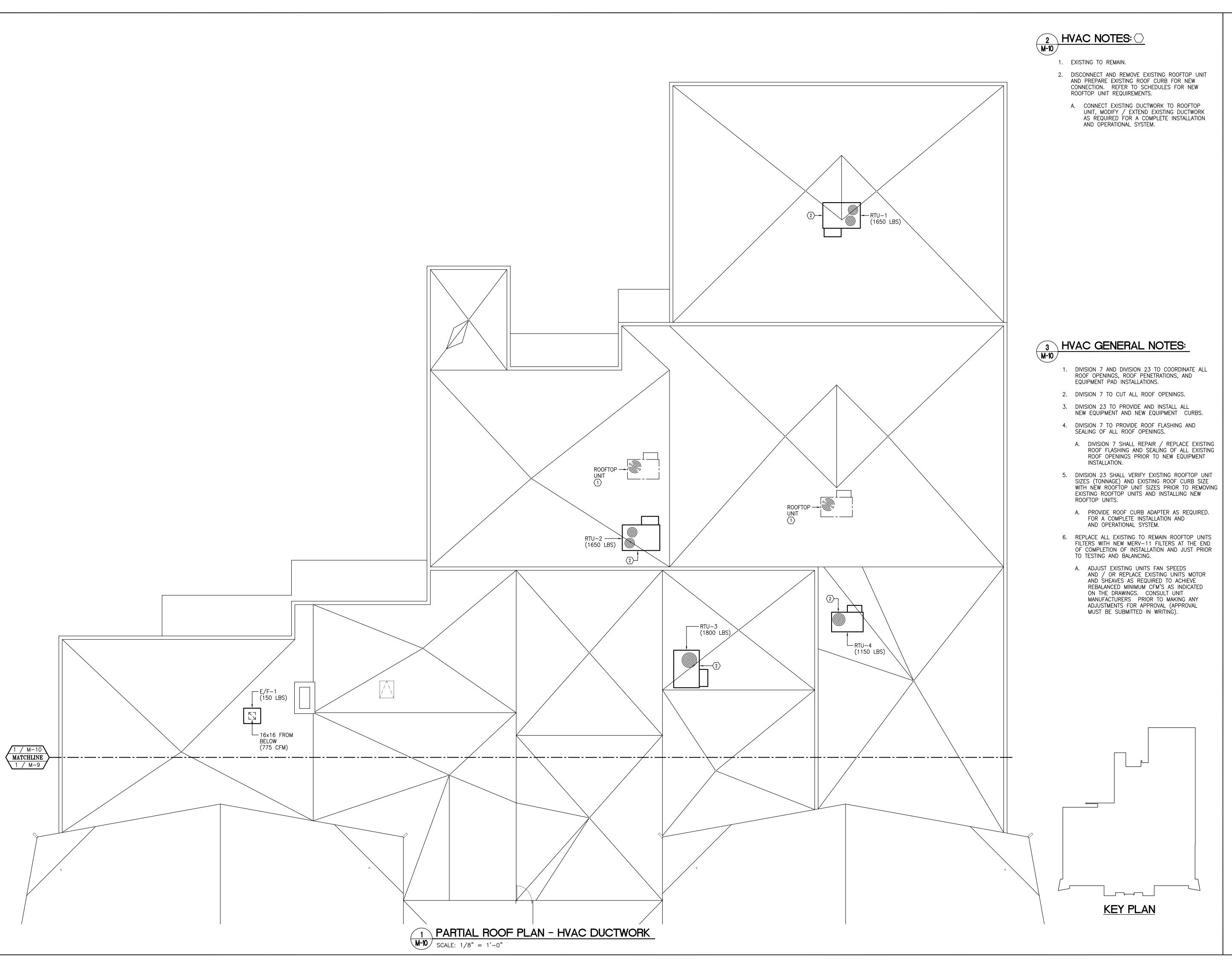


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SEAL:

PARTIAL ROOF PLAN -HVAC

**DUCTWORK** 

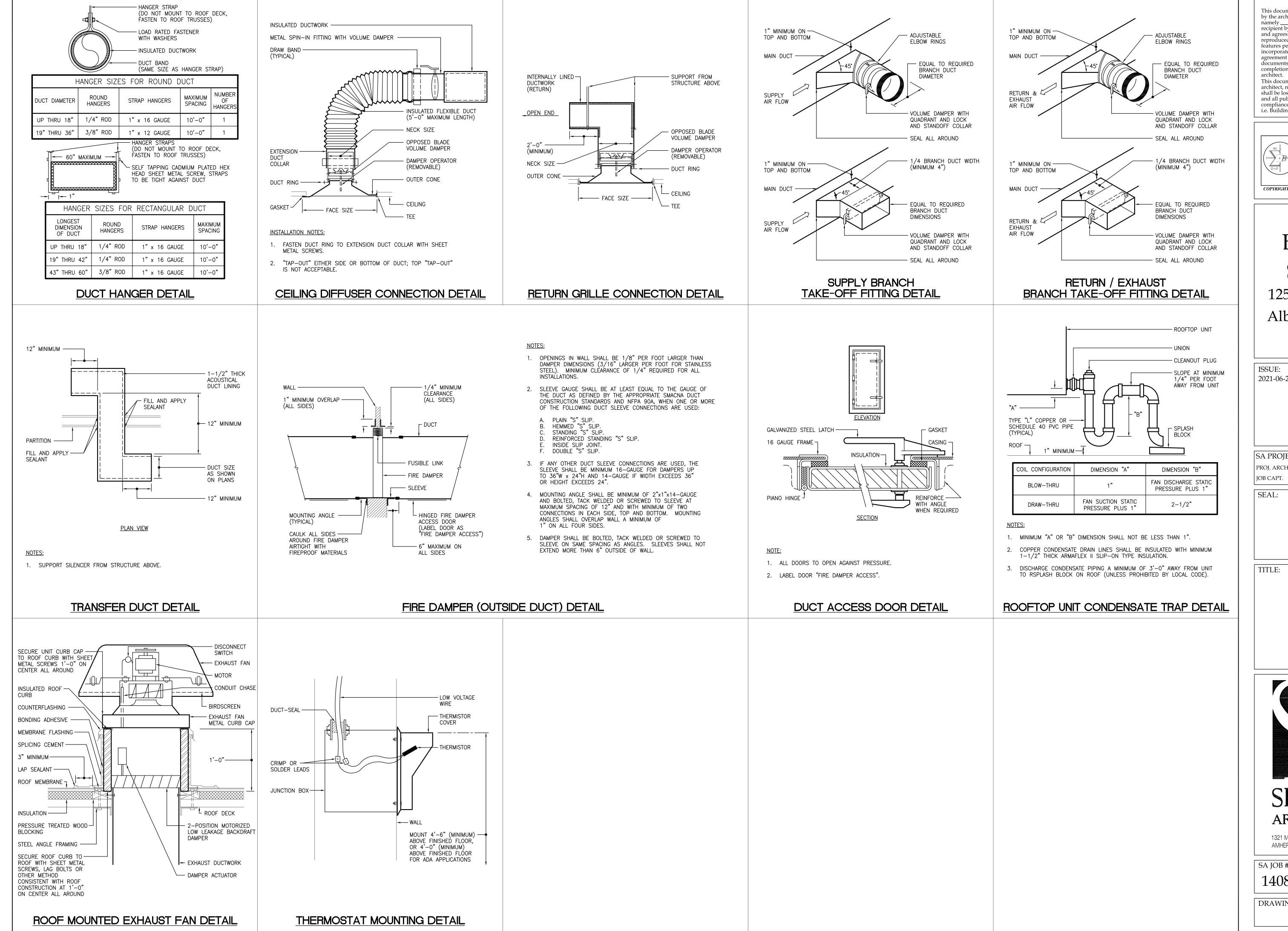


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INTERIORS N.Catuzza

TITLE: HVAC **DETAILS** 



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