

HVAC GENERAL NOTES															
ARCHITECTURAL								DUCTWORK							
1. DO NOT SCALE DRAWINGS. REFER TO ARCHITECTURAL DRAWINGS AND REFLECTED CEILING PLANS FOR EXACT LOCATION OF DOORS, WINDOWS, CEILING DIFFUSERS, ETC.								1. RUN ALL DUCTWORK AS TIGHT TO BOTTOM OF STEEL AS POSSIBLE.							
2. LIGHT FIXTURE LOCATIONS TAKE PRECEDENCE OVER DIFFUSER AND GRILLE LOCATIONS. LOCATE DIFFUSERS AND GRILLES TO ACCOMMODATE LIGHTING LAYOUT.								A. COORDINATE EXACT LOCATIONS (HEIGHT, ROUTING, ETC.) OF EXPOSED DUCTWORK IN THE FIELD WITH THE ARCHITECT PRIOR TO FABRICATING AND INSTALLING DUCTWORK.							
3. REFER TO ARCHITECTURAL FLOOR PLANS FOR LOCATION AND RATING OF ALL FIRE RATED WALLS AND CEILINGS.								2. DUCTWORK SHALL NOT BE SUPPORTED FROM BRIDGING, CONDUIT, PIPING, ETC. OF ANY KIND. DO NOT USE FASTENERS THAT PENETRATE ROOF DECKS.							
GENERAL								3. ASPECT RATIO SHALL NOT EXCEED 3:1.							
1. 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 CONDITIONS.								4. ALL DUCTWORK INSTALLATION SHALL RUN CONTINUOUSLY THROUGH PARTITIONS.							
2. 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 IN THE FIELD.								5. LOCATE ALL DUCT BALANCING DAMPERS AND CONTROL DAMPERS ABOVE ACCESSIBLE CEILINGS OR PROVIDE CEILING AND / OR WALL ACCESS DOORS.							
3. 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.								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.							
4. 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.								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.							
5. COORDINATE INSTALLATION AND LOCATIONS OF DUCTWORK WITH BUILDING STRUCTURE, PLUMBING PIPING, ELECTRICAL CONDUIT, LIGHTING, ETC. PRIOR TO PURCHASING OR INSTALLING EQUIPMENT AND MATERIALS.								8. ALL DUCTWORK SHALL BE CONSTRUCTED AND INSTALLED IN ACCORDANCE WITH SMACNA STANDARDS.							
6. RELOCATE EXISTING DUCTWORK, PIPING AND / OR EQUIPMENT IN EXISTING CEILING SPACES TO ACCOMMODATE ALL RENOVATIONS AND ADDITIONS.								9. ALL DUCTWORK SHALL BE GALVANIZED SHEET METAL IN AREAS WITH FINISHED CEILINGS.							
7. ALL PIPING, DUCTS, VENTS, ETC. EXTENDING THROUGH WALLS SHALL BE FLASHED AND COUNTERFLASHED IN A WATERPROOF MANNER.								A. ALL CONCEALED DUCTWORK AND FITTINGS SHALL BE CONSTRUCTED OF MINIMUM 26-GAUGE STEEL (GALVANIZED) AND 24-GAUGE (ALUMINIUM).							
8. MAINTAIN MINIMUM OF TEN (10) FEET BETWEEN OUTDOOR AIR INTAKES AND EXHAUST FAN DISCHARGE, PLUMBING VENTS, ETC.								B. ALL EXPOSED DUCTWORK AND FITTINGS SHALL BE CONSTRUCTED OF MINIMUM 24-GAUGE STEEL (GALVANIZED) AND 24-GAUGE (ALUMINIUM).							
9. REFER TO PLUMBING DRAWINGS FOR LOCATION AND ROUTING OF WATER HEATER COMBUSTION / EXHAUST AIR DUCTWORK.								C. ALL EXPOSED SUPPLY AIR DUCTWORK AND FITTINGS SHALL BE INTERNALLY-LINED RECTANGULAR (SUITABLE FOR PAINTING, COLOR AS SELECTED BY ARCHITECT).							
10. DIVISION 23 SHALL BE LICENSED TO PERFORM MECHANICAL WORK IN THE MUNICIPALITY IN WHICH THE PROJECT IS LOCATED.								1). IF APPROVED BY THE OWNER, INSULATION CAN BE REMOVED FROM THE DUCTWORK LOCATED WITHIN THE BUILDING THERMAL ENVELOPE (I.E. ENCLOSED CEILINGS) PROVIDED THAT ALL JOINTS AND SEAMS ARE SEALED AIRTIGHT BY MEANS OF TAPES, MASTICS, AND / OR GASKETING.							
11. 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.								D. ALL EXPOSED EXHAUST AIR DUCTWORK AND FITTINGS SHALL BE RECTANGULAR (SUITABLE FOR PAINTING, COLOR AS SELECTED BY ARCHITECT).							
12. WORK SHALL COMPLY WITH THE LATEST REVISIONS OF INTERNATIONAL BUILDING CODE, INTERNATIONAL MECHANICAL CODE, INTERNATIONAL FIRE CODE, INTERNATIONAL ENERGY CONSERVATION CODE, AND ANY STATE AND LOCAL CODES OR REGULATIONS THAT APPLY.								2). 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"ø, 10x6 = 10"ø).							
A. IN CASE OF CONFLICTS BETWEEN DRAWINGS, SPECIFICATIONS, AND INTERPRETATION OF CODES BY LOCAL AUTHORITY, LATER SHALL GOVERN.								11. 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.							
EQUIPMENT								12. ALL SQUARE ELBOWS SHALL HAVE AIRFOIL TYPE TURNING VANES.							
1. ALL HVAC EQUIPMENT SHALL BE INSTALLED PER MANUFACTURER'S REQUIREMENTS AS SHOWN. UTILIZE FACTORY FILTERS DURING CONSTRUCTION AND REPLACE (IN KIND) JUST PRIOR TO TESTING AND BALANCING. ALL FILTERS SHALL BE 2-INCHES THICK. PROVIDE ONE (1) SET OF EXTRA FILTERS FOR EACH UNIT INSTALLED.								13. FLEXIBLE DUCTWORK IS NOT PERMITTED IN EXPOSED AREAS AND EXHAUST AIR GRILLE CONNECTIONS).							
2. ALL EQUIPMENT SHALL HAVE A ONE (1) YEAR WARRANTY; PROVIDE WRITTEN GUARANTEE.								CONTROLS							
3. GENERAL CONTRACTOR SHALL STORE ALL HVAC EQUIPMENT (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.								1. ALL CONTROL WIRING AND CONDUIT SHALL COMPLY WITH THE NATIONAL ELECTRIC CODE (NEC) AND NFPA 70.							
4. FLEXIBLE CONNECTORS SHALL BE INSTALLED ON SUPPLY AND EXHAUST AIR DUCTS AT ALL EQUIPMENT CONNECTIONS.								2. ALL CONTROL WIRING AND POWER CONDUCTOR INSULATION SHALL BE PLENUM RATED.							
5. 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.								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							
								1. MECHANICAL CONTRACTOR, WHO IS CERTIFIED BY EITHER 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.							
								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 INTERNATIONAL 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.							

HVAC ABBREVIATIONS	
AFF	ABOVE FINISHED FLOOR
BHP	BRAKE HORSEPOWER
BTU	BRITISH THERMAL UNITS
CFM	CUBIC FEET PER MINUTE
DB	DRY BULB
EAT	ENTERING AIR TEMPERATURE
ERV	ENERGY RECOVERY VENTILATOR
F	FAHRENHEIT
HP	HORSEPOWER
HVAC	HEATING, VENTILATING, AIR CONDITIONING
IN	INCHES
INT	INTERNAL
KW	KILOWATT
L	LOUVER
LAT	LEAVING AIR TEMPERATURE
LBS	POUNDS
MBH	1,000 BRITISH THERMAL UNITS
MCA	MINIMUM CIRCUIT AMPACITY
MOCOP	MAXIMUM OVERCURRENT PROTECTION
RPM	REVOLUTIONS PER MINUTE
SP	STATIC PRESSURE
W/	WITH
WB	WET BULB

HVAC DUCTWORK SYMBOLS	
SYMBOL	DESCRIPTION
	AIRFOIL TURNING VANES
	FLEXIBLE DUCT
	INTERNALLY LINED DUCTWORK
	MANUAL VOLUME DAMPERS
	DIRECTION OF SLOPE
	ROUND
	SUPPLY AIR DEVICE – FIRST NO. CFM, SECOND NO. TYPE THIRD NO. NECK SIZE (REFER TO SCHEDULE FOR DEVICE SIZE)
	EXHAUST AIR DEVICE – FIRST NO. CFM, SECOND NO. TYPE THIRD NO. NECK SIZE (IF REQUIRED) (REFER TO SCHEDULE FOR DEVICE SIZE)

HVAC CONTROL SYMBOLS	
SYMBOL	DESCRIPTION
	SPACE TEMPERATURE SENSOR WITH OVERRIDE
	CONTROL WIRING (PLENUM RATED)

HVAC DRAWING LIST	
M-1	HVAC SCHEDULES, LEGENDS AND ABBREVIATIONS
M-2	HVAC SPECIFICATIONS
M-3	HVAC SPECIFICATIONS
M-4	FLOOR PLAN – HVAC DUCTWORK
M-5	HVAC DETAILS

AIR DISTRIBUTION DEVICE SCHEDULE						
SYMBOL	STYLE & DEVICE SIZE	MOUNTING	DESCRIPTION	MANUFACTURER	MODEL NO.	MAXIMUM NC
SUPPLY						
	SUPPLY 14"W x 10"H 12x8 NECK	SURFACE	LOUVERED FACE, STEEL CONSTRUCTION, HEAVY DUTY, 3/4" BLADES, OPPOSED BLADE VOLUME DAMPERS, 22" DOUBLE DEFLECTION, COLOR AS SELECTED BY ARCHITECT	TITUS	300RL-HD	---
EXHAUST						
	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	---
	EXHAUST 18"W x 10"H 16x8 NECK	SURFACE	LOUVERED FACE, STEEL CONSTRUCTION, HEAVY DUTY, 1/2" BLADES, OPPOSED BLADE VOLUME DAMPERS, 38" FIXED DEFLECTION, COLOR AS SELECTED BY ARCHITECT	TITUS	33 RL	---
	EXHAUST 20"W x 12"H 18x10 NECK	SURFACE	LOUVERED FACE, STEEL CONSTRUCTION, HEAVY DUTY, 1/2" BLADES, OPPOSED BLADE VOLUME DAMPERS, 38" FIXED DEFLECTION, COLOR AS SELECTED BY ARCHITECT	TITUS	33 RL	15
AIR DISTRIBUTION DEVICE NOTES:						
1. ALL DEVICES SHALL BE FROM A SINGLE MANUFACTURER.						
2. ALL DEVICES SHALL HAVE MATCHING MATTE, WHITE FINISH (UNLESS OTHERWISE NOTED IN DESCRIPTION ABOVE).						
3. MAXIMUM NC OF 20.						
4. COORDINATE EXACT MOUNTING HEIGHT OF SURFACE MOUNTED DIFFUSERS / GRILLES WITH ARCHITECT IN FIELD PRIOR TO INSTALLING DIFFUSERS / GRILLES.						
5. ACCESSORIES:						
A. OPERATING KEYS: TOOLS DESIGNED TO FIT THROUGH DIFFUSER FACE AND OPERATE VOLUME CONTROL DEVICE AND / OR PATTERN ADJUSTMENT						
6. ALL NEW DIFFUSERS / GRILLES SHALL MATCH EXISTING BUILDING STANDARD (VERIFY EXISTING DIFFUSER / GRILLE MANUFACTURER AND MODEL NUMBER PRIOR TO PURCHASING AND INSTALLING DIFFUSERS / GRILLES).						
7. ACCEPTABLE MANUFACTURER'S – TITUS, PRICE.						
NOTE: SUBMITTALS SHALL INCLUDE DIFFUSER AND GRILLE SCHEDULE INDICATING ROOM LOCATION, NOISE CRITERIA (NC) AND PERFORMANCE DATA FOR EACH TYPE OF DIFFUSER AND GRILLES INDICATED.						

LOUVER SCHEDULE									
MARK	AREA SERVED	MANUFACTURER	MODEL NO.	SIZE	CFM	FREE AREA (SQ. FT.)	FPM	TOP OF LOUVER ± AFF	
L-1	ERV-1 (OUTSIDE AIR)	RUSKIN	ELF6375DX	30"W x 30"H	1,500	3.18	472	---	
L-2	ERV-1 (EXHAUST AIR)	RUSKIN	ELF6375DX	30"W x 30"H	1,500	3.18	472	---	
OUTSIDE AIR LOUVER NOTES:									
1. EXTRUDED ALUMINUM, DRAINABLE BLADES.									
2. FLANGED FRAME.									
3. MINIMUM 57% FREE AREA.									
4. MAXIMUM FPM OF 500 (INTAKE AND EXHAUST AIR).									
5. COORDINATE EXACT MOUNTING HEIGHT WITH ARCHITECT PRIOR TO INSTALLATION.									
6. ACCESSORIES:									
A. ALUMINUM BIRDSCREEN IN REMOVABLE FRAME.									
B. MOTORIZED, OPPOSED BLADE, LOW LEAKAGE ALUMINUM CONTROL DAMPERS (24V ACTUATOR).									
7. COLOR (AND / OR CUSTOM COLOR) AS SELECTED BY ARCHITECT.									
8. INTERLOCK LOUVERS ACTUATOR WITH ASSOCIATED ENERGY RECOVERY VENTILATOR (ERV-1) OPERATION.									
9. ACCEPTABLE MANUFACTURER'S – RUSKIN, GREENHECK.									

ENERGY RECOVERY VENTILATOR SCHEDULE																																								
MARK	AREA SERVED	SUPPLY AIR CFM	EXHAUST AIR CFM	SUPPLY STATIC PRESS. IN. WG EXT.	EXHAUST STATIC PRESS. IN. WG EXT.	MANUFACTURER	MODEL NO.	EFFICIENCY – SUMMER MODE								COOLING LOAD REDUCTION	OUTDOOR/OUTDOOR				EFFICIENCY – WINTER MODE								SUPPLY AIR FAN MOTOR				EXHAUST AIR FAN MOTOR				PRE-HEATER KW	MCA	MOCP	OPERATING WEIGHT (LBS.)
								OUTDOOR AIR DB °F	OUTDOOR AIR WB °F	SUPPLY AIR DB °F	SUPPLY AIR WB °F	RETURN AIR DB °F	RETURN AIR WB °F	EXHAUST AIR DB °F	EXHAUST AIR WB °F		ENTHALPY RECOVERY RATIO	OUTDOOR AIR DB °F	OUTDOOR AIR WB °F	SUPPLY AIR DB °F	SUPPLY AIR WB °F	RETURN AIR DB °F	RETURN AIR WB °F	EXHAUST AIR DB °F	EXHAUST AIR WB °F	ENTHALPY RECOVERY RATIO	HEATING LOAD REDUCTION	RPM	BHP	HP	VOLTS / PH	RPM	BHP	HP	VOLTS / PH					
ERV-1	WEIGHT AREA 002, STORAGE 003, UTILITY ROOM 006	1,500	1,500	0.50	0.50	GREENHECK	ERV-20-15L	95	75	79	66	75	62	91	72	77.3	4.5 TONS	-1	-2.5	56	46	72	56	15	14	76.3	93,437 BTU	1341	0.89	1	460/3/60	1318	0.84	1	460/3/60	5.0	13.5	15	800	
HEAT RECOVERY VENTILATOR NOTES:																																								
1. MINIMUM 18-GAUGE, DOUBLE-WALL GALVANIZED STEEL CABINET WITH MINIMUM 24-GAUGE STEEL LINER AND FACTORY APPLIED POWDER COAT FINISH.										6. UNIT SHALL HAVE:										7. ACCESSORIES:																				
2. UNIT CABINET SHALL BE INSULATED WITH MINIMUM 1" THICK FOIL-FACED, HIGH-DENSITY FIBERGLASS INSULATION										A. FLANGE DUCTWORK CONNECTIONS.										A. FACTORY INSTALLED SENSORS (EXHAUST AIR AND SUPPLY AIR DISCHARGE TEMPERATURE, OUTSIDE AIR AND RETURN AIR INLET TEMPERATURE).																				
3. PREMIUM EFFICIENCY, TOTALLY ENCLOSED (TEFC) MOTORS WITH FORWARD CURVED BLADES AND THERMAL OVERLOAD PROTECTION.										C. HINGED ACCESS DOORS.										B. REMOTE MOUNTED CONTROL PANEL (MOUNT REMOTE PANEL IN UTILITY ROOM 006 – COORDINATE EXACT LOCATIONS WITH OWNER PRIOR TO INSTALLATION).																				
4. MOTORS WITH PERMANENTLY LUBRICATED BEARINGS.										C. PREHEATER DEFROST CONTROL.										C. REMOTE MOUNTED TEMPERATURE SENSOR WITH OVERRIDE CONTROL.																				
5. ADJUSTABLE PITCH MOTOR SHEAVES AND MOTOR PULLEYS.										D. 2" THICK, MERV 8 OUTSIDE AIR AND EXHAUST AIR FILTERS.										D. BACNET INTERFACE WITH CONTROL INTERLOCKS.																				
										E. UNIT MOUNTED CONTROL PANEL.										E. FACTORY MOUNTED AND WIRED NON-FUSED DISCONNECT SWITCH.																				
										F. SINGLE-POINT POWER CONNECTION.										F. SPRING ISOLATION HANGERS.																				
																				8. CONTROLS SHALL BE COMPATIBLE TO AND INTERFACE WITH EXISTING ENERGY MANAGEMENT SYSTEM (IF APPLICABLE).																				
																				9. ACCEPTABLE MANUFACTURER’S – GREENHECK, RENEWAIRE, CARRIER.																				

HVAC SPECIFICATIONS

PART 1 – GENERAL

1.1 QUALITY ASSURANCE

- A. MATERIALS AND EQUIPMENT SHALL BE PROVIDED BY ONE OF THE MANUFACTURERS LISTED IN PART 2 – PRODUCTS.
1. 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.
4. 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. *PHONE CALLS, EMAILS, ETC. MADE THE DAY BEFORE AND / OR THE DAY THE BIDS ARE DUE ARE NOT ACCEPTABLE.
- 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.
- 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 IN WRITING THROUGH THE ARCHITECT / OWNER TO ALL BIDDERS PRIOR TO THE BID DATE.
- 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.
- 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 INTERNATIONAL BUILDING CODE, INTERNATIONAL MECHANICAL CODE, INTERNATIONAL FIRE CODE, INTERNATIONAL 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.
- 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).

- 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.
1. 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 PROPOSED REQUEST.

- 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.
1. 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.
3. 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.
1. DETAIL MAJOR ELEMENTS, COMPONENTS AND SYSTEMS OF MECHANICAL EQUIPMENT AND MATERIALS IN RELATIONSHIP WITH OTHER SYSTEMS, INSTALLATIONS, AND BUILDING COMPONENTS. 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. EXTERIOR 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 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.

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 BY THE OWNER.

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:
1. SUPPLY AND EXHAUST SYSTEMS INCLUDING DUCTS, FANS, GRILLES AND OUTLETS.
2. INSULATION FOR DUCTS, ETC.
3. MISCELLANEOUS EQUIPMENT REQUIRED FOR SYSTEMS.
4. TEMPERATURE CONTROLS.

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:
1. 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 INSPECTION OF MECHANICAL ITEMS.
- 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:
- 1). GREEN: RETURN AIR.
- 2). BLUE: EXHAUST AIR.
- 3). 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.

2.3 SHEET METAL MATERIALS

- A. 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.
1. LOCK–FORMING QUALITY: COMPLYING WITH ASTM A653/A653M AND HAVING G90 ZINC COATING DESIGNATION; DUCTS SHALL HAVE MILL–PHOSPHATIZED FINISH FOR SURFACES EXPOSED TO VIEW.
- C. ALUMINUM SHEETS.
1. ASTM B 209, ALLOY 3003, TEMPER H14; WITH MILL FINISH FOR CONCEALED DUCTS AND STANDARD, 1–SIDE BRIGHT FINISH FOR EXPOSED DUCTS.

2.4 SHEET METAL SEALANT MATERIALS

- A. 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.
- C. SOLVENT–BASED JOINT AND SEAM SEALANT: ONE–PART, NONSAG, SOLVENT–RELEASE–CURING, POLYMERIZED BUTYL SEALANT FORMULATED WITH A MINIMUM OF 75 PERCENT SOLIDS.

2.5 DUCTWORK INSULATION

- A. FIRE–TEST RESPONSE CHARACTERISTICS.
1. FLAME–SPREAD RATING OF 25 OR LESS, AND SMOKE–DEVELOPED RATING OF 50 OR LESS; COMPLYING WITH ASTM E–84.

2.6 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.
- b. ROLL–FORMED STEEL BLADES: 0.064" THICK, GALVANIZED SHEET STEEL.
- c. BLADE AXLES: 1/2", GALVANIZED STEEL.
- d. BEARINGS: TWO–PIECE MOLDED SYNTHETIC THRUST OR BALL.
- e. BLADE SEALS: FELT OR NEOPRENE.
- f. JAMB SEALS: CAMBERED STAINLESS STEEL.
- g. TIE BARS AND BRACKETS: GALVANIZED STEEL.
- h. FINISH: MILL.
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 ASSEMBLIES.
3. 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.
- a. INCLUDE CENTER HOLE TO SUIT DAMPER OPERATING–ROD SIZE. INCLUDE ELEVATED PLATFORM FOR INSULATED DUCT MOUNTING.
4. DUCT ACCESSORY HARDWARE.
- 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 OVER 12".
- 1). 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.
5. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE VOLUME DAMPERS OF ONE OF THE FOLLOWING:
- a. AIR BALANCE, INC.
- b. GREENHECK.
- c. MCGILL AIRFLOW CORPORATION.
- d. RUSKIN COMPANY.

B. FLEXIBLE CONNECTORS.

1. 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.
2. 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.
- C. MOTORIZED CONTROL DAMPERS.
1. 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 CONSTRUCTION.
- 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 BEARINGS 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.
2. MANUFACTURER: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE MOTORIZED CONTROL DAMPERS OF ONE OF THE FOLLOWING:
- a. AIR BALANCE, INC.
- b. GREENHECK.
- c. RUSKIN COMPANY.
- 2.7 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. WALL COMPATIBILITY: PROVIDE REGISTERS AND GRILLES WITH BORDER STYLES THAT ARE COMPATIBLE WITH ADJACENT WALL SYSTEMS, AND THAT ARE SPECIFICALLY MANUFACTURED TO FIT INTO WALL CONSTRUCTION WITH ACCURATE FIT AND ADEQUATE SUPPORT.
- C. PERFORMANCE: PROVIDE CEILING AND WALL DIFFUSERS / 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.
- D. CEILING EXHAUST GRILLES.
1. MATERIAL: STEEL.
2. FINISH: BAKED ENAMEL, WHITE.
3. 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).
5. MOUNTING: T–BAR (LAY–IN).
6. DAMPERS: ADJUSTABLE, OPPOSED–BLADE, KEY OPERATED FROM FACE OF DIFFUSER.
7. ACCESSORIES.
- a. SQUARE TO ROUND NECK ADAPTOR.
- E. SURFACE MOUNTED SUPPLY AND EXHAUST REGISTERS AND GRILLES.

1. ADJUSTABLE BAR GRILLE – SUPPLY (HEAVY–DUTY).
- a. MATERIAL: STEEL, FITTED WITH FELT OR NEOPRENE GASKET AND ADJUSTABLE BLADES.
- b. FINISH: BAKED ENAMEL, COLOR AS SELECTED BY ARCHITECT.
- c. BLADES: MINIMUM 14–GAUGE.
- d. FRAME: MINIMUM 18–GAUGE, 1–1/4" WIDE.
- e. FACE BLADE ARRANGEMENT: MINIMUM 14–GAUGE, SPACED 3/4" APART, INDIVIDUALLY ADJUSTABLE HORIZONTAL BLADES.
- f. GRILLE PATTERN: LOUVERED FACE, DOUBLE–DEFLECTION, TWO SETS OF BLADES IN FACE. 22" DEFLECTION.
- g. REAR BLADE ARRANGEMENT: SET AT 90–DEGREES TO FACE AND SPACED 3/4" APART.
- h. MOUNTING: SURFACE WITH COUNTERSUNK PHILLIPS SCREWS.
- i. DAMPERS: ADJUSTABLE, OPPOSED–BLADE, FORMED STEEL, CADMIUM PLATED, GANG KEY OPERATED, AND ARRANGED SO THAT THE OPERATING MECHANISM DOES NOT PROJECT THROUGH ANY PART OF THE GRILLE FACE.
2. FIXED FACED REGISTER – EXHAUST (HEAVY–DUTY).
- a. MATERIAL: STEEL, FITTED WITH FELT OR NEOPRENE GASKET AND FIXED BLADES.
- b. FINISH: BAKED ENAMEL, COLOR AS SELECTED BY ARCHITECT.
- c. BLADES: MINIMUM 14–GAUGE.
- d. FRAME: MINIMUM 16–GAUGE, 1–1/4" WIDE.
- e. FACE BLADE ARRANGEMENT: SPACED 1/2" APART, BLADES PARALLEL TO HORIZONTAL DIMENSION, 38–DEGREE DEFLECTION.
- f. MOUNTING: SURFACE WITH COUNTERSUNK PHILLIPS SCREWS.
- g. DAMPERS: ADJUSTABLE, OPPOSED–BLADE, FORMED STEEL, CADMIUM PLATED, GANG KEY OPERATED, AND ARRANGED SO THAT THE OPERATING MECHANISM DOES NOT PROJECT THROUGH ANY PART OF THE GRILLE FACE.
- F. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE DIFFUSERS, REGISTERS AND GRILLES OF ONE OF THE FOLLOWING:
1. PRICE INDUSTRIES.
2. TITUS.

REVISION RECORD

NO.	DATE	REMARKS

IT IS A VIOLATION OF STATE LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A NEW YORK STATE ARCHITECT OR ENGINEER, TO ALTER ANY ITEM ON THIS DOCUMENT IN ANY WAY. IF ANY ITEM ON THIS DOCUMENT IS ALTERED, THE ALTERING ARCHITECT OR ENGINEER SHALL AFFIX TO HIS ITEM HIS SEAL AND THE NOTATION "ALTERED BY FOLLOWED BY HIS SIGNATURE, THE DATE OF SUCH ALTERATION AND A SPECIFIC DESCRIPTION OF SUCH ALTERATION."



Bryant and Stratton

College

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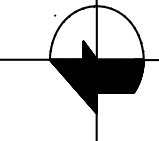
COLLEGE

LOWER LEVEL RENOVATIONS

10950 W Potter Rd
Wauwatosa, WI 53226

GREGORY A. TOMSIC

REGISTERED ARCHITECT



145 BATHURST DR., TONAWANDA, N.Y. 14150
716-433-0617

SCALE	JOB NO.
DRAWN	DWG. NO.
CHECKED	M-2
DATE 04.10.2020	CONTRACT NO.

HVAC SPECIFICATIONS (cont'd)

PART 3 – TESTING, ADJUSTING AND BALANCING

3.1 TESTING, ADJUSTING AND BALANCING

- A. 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.
- B. AIR BALANCING CONTRACTOR SHALL INCLUDE, IN THEIR PRICING, ONE SHEAVE CHANGE FOR EACH ENERGY RECOVERY VENTILATOR 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".
- E. 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.
- F. 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 DEGREE 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 ESTABLISHED.
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.
- G. TOLERANCES.
1. SUPPLY AND EXHAUST FANS: 0% TO PLUS 5%.
2. AIR OUTLETS AND INLETS: 0% TO PLUS 5%.
- H. FINAL REPORT.
1. 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.
- a. TITLE PAGE.
- b. NAME AND ADDRESS OF TAB FIRM.
- c. PROJECT NAME AND LOCATION.
- d. ARCHITECTS NAME AND ADDRESS.
- e. ENGINEERS NAME AND ADDRESS.
- f. MECHANICAL CONTRACTORS NAME AND ADDRESS.
- g. REPORT DATE.
- h. TABLE OF CONTENTS WITH THE TOTAL NUMBER OF PAGES (NUMBER EACH PAGE IN REPORT) DEFINED FOR EACH SECTION OF THE REPORT.
- i. SUMMARY OF CONTENTS INCLUDING THE FOLLOWING:
- 1). INDICATED VERSUS FINAL PERFORMANCE.
- 2). NOTABLE CHARACTERISTICS OF SYSTEMS.
- 3). DESCRIPTION OF SYSTEM OPERATION SEQUENCE IF IT VARIES FROM THE CONTRACT DOCUMENTS.
- I. INSPECTIONS.
1. 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:
- a). MEASURE AIRFLOW OF AT LEAST 10% OF AIR OUTLETS.
- b). MEASURE ROOM TEMPERATURE AT EACH THERMOSTAT.
- c). MEASURE SPACE PRESSURE OF AT LEAST 10% OF LOCATIONS.
- d). 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 OWNER.
- 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 DOCUMENTED IN THE FINAL REPORT BY MORE THAN THE TOLERANCES ALLOWED, THE 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 LISTINGS, THE TESTING AND BALANCING SHALL BE CONSIDERED INCOMPLETE 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 COST.
- d. TAB FIRM SHALL RECHECK ALL MEASUREMENTS AND MAKE READJUSTMENTS.
- 1). 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 FIRM.

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.
1. ENERGY RECOVERY VENTILATORS.
- a. TOTAL AIRFLOW RATE IN CFM.
- b. TOTAL SUPPLY AND EXHAUST AIRFLOW RATE IN CFM.
- c. TOTAL SUPPLY FAN AND EXHAUST FAN STATIC PRESSURE IN INCHES WG.
- d. DISCHARGE STATIC PRESSURE IN INCHES WG.
- e. FILTER STATIC PRESSURE DIFFERENTIAL IN INCHES WG.
- f. OUTSIDE AIRFLOW RATE IN CFM.
- g. OUTSIDE AIR DAMPER POSITION.
- h. EXHAUST ENTERING AND LEAVING AIR TEMPERATURE IN DEGREES F.
- i. OUTSIDE AIR ENTERING AND LEAVING AIR TEMPERATURE IN DEGREES F.
- j. MOTOR VOLTAGE AT EACH CONNECTION.
- k. MOTOR AMPERAGE FOR EACH PHASE.
2. AIR TERMINAL DEVICES.
- a. AIRFLOW RATE IN CFM.
- b. AIR VELOCITY IN FPM.
- c. PRELIMINARY AIRFLOW RATE AS NEEDED IN CFM.
- d. PRELIMINARY VELOCITY AS NEEDED IN FPM.
- e. FINAL AIRFLOW RATE IN CFM.
- f. FINAL VELOCITY IN FPM.
- g. SPACE TEMPERATURE IN DEGREES F.
3. RECTANGULAR AND ROUND DUCTWORK.
- a. SYSTEM AND FURNACE UNIT NUMBER.
- b. DUCT STATIC PRESSURE IN INCHES WG.
- c. DUCT SIZE IN INCHES.
- d. ACTUAL AIRFLOW RATE IN CFM.
- e. ACTUAL VELOCITY IN FPM.

3.3 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 INTERNATIONAL 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.

2.8 AIR DUCTWORK CLEANING

A. SCOPE OF WORK.

1. SUPPLY AND EXHAUST AIR DUCTWORK SYSTEMS.
2. 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.

1. ENGAGE A QUALIFIED AIR SYSTEM CLEANING SPECIALIST (ASCS) TO CLEAN THE SYSTEMS.
2. 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.
3. AIR VOLUME CONTROL DEVICES: DAMPERS AND ANY AIR DIRECTIONAL MECHANICAL DEVICES INSIDE 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 ENTRY 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 CONDENSATION ON SURFACES WITHIN THE SYSTEM.

5. CUTTING SERVICE OPENINGS INTO FLEXIBLE DUCTS AND FLEXIBLE CONNECTORS IS NOT PERMITTED.
6. 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 IS DAMAGED SHALL BE REPLACED WITH NEW (TO MATCH EXISTING) AT THE CONTRACTOR'S EXPENSE.
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.
- b. 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.

1. 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 COATINGS.
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 CONTRACTOR.

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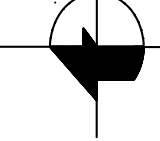
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HVAC SPECIFICATIONS

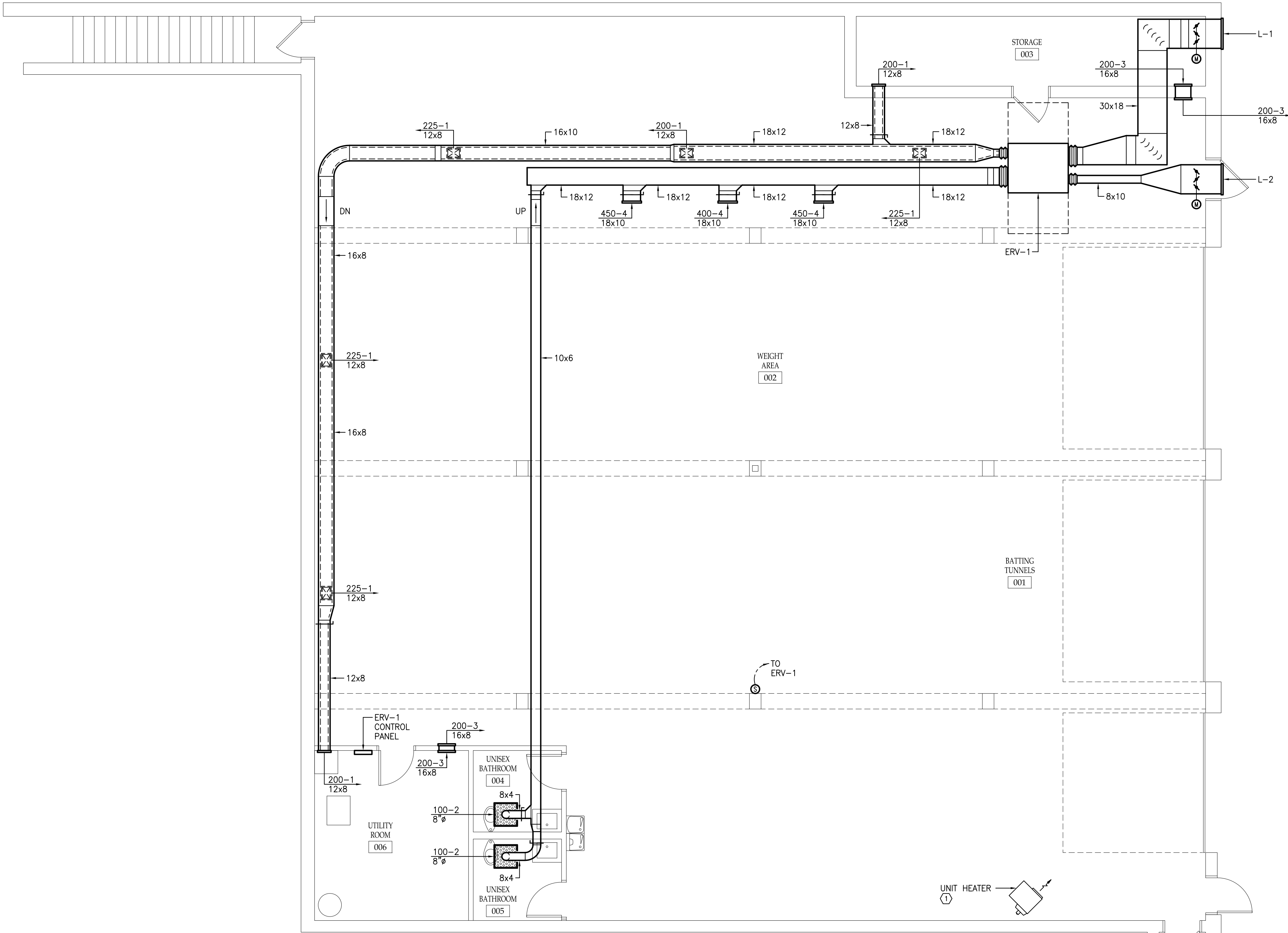


GREGORY A. TOMSIC

REGISTERED ARCHITECT

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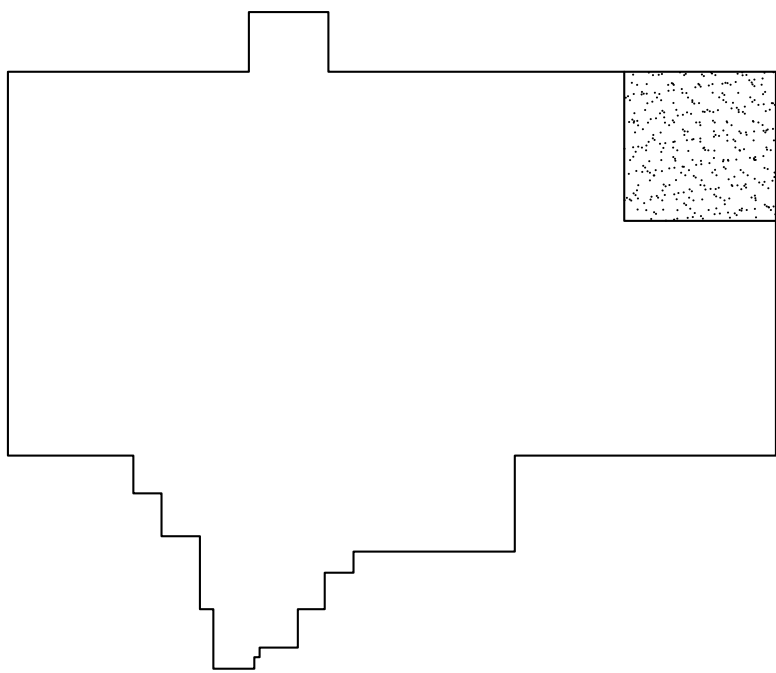
1
M-4 **FLOOR PLAN - HVAC DUCTWORK**
SCALE: 3/16" = 1'-0"

2
M-4 **HVAC NOTES:**

- EXISTING TO REMAIN.

3
M-4 **HVAC GENERAL NOTES:**

- PROVIDE VOLUME DAMPERS AT ALL BRANCH DUCTWORK TAPS.
- COORDINATE LOCATION AND SPACING OF INTERIOR WALL FRAMING WITH THE ARCHITECT FOR SUPPLY AIR DUCTWORK AND EXHAUST AIR DUCTWORK PENETRATIONS PRIOR TO FRAMING THE WALLS, ADJUSTING THE SPACING TO ALLOW FOR A MINIMUM OF 1" CLEAR (ALL SIDES) AROUND THE DUCTWORK PENETRATIONS.
- COORDINATE EXACT LOCATIONS (HEIGHT, ROUTING, ETC.) OF EXPOSED DUCTWORK, DIFFUSERS AND ENERGY RECOVERY UNIT IN THE FIELD WITH THE ARCHITECT AND OWNER FABRICATING AND INSTALLING DUCTWORK AND EQUIPMENT.
- PAINTING OF MECHANICAL WORK.
 - SCOPE: THE SCOPE OF PAINTING TO BE APPLIED AS PART OF WORK UNDER DIVISION 23 SHALL CONSIST OF THE FOLLOWING:
 - PAINT EXPOSED MECHANICAL WORK THROUGHOUT ENTIRE PROJECT INCLUDING UNINSULATED AND INSULATED DUCTWORK, AND TERMINAL HVAC EQUIPMENT.
 - PAINT ALL DUCT HANGERS, SUPPORTING STEEL, AND EQUIPMENT HAVING NO PRIME OR ONLY A PRIME COAT FINISH.
 - GENERAL PAINTING PRODUCT REQUIREMENTS.
 - STEEL SURFACES.
 - FIRST COAT: RUST-OLEUM #769 RED PRIMER.
 - SECOND COAT: RUST-OLEUM #960 ZINC-CHROMATE RUST INHIBITIVE PRIMER.
 - THIRD COAT: RUST-OLEUM INDUSTRIAL ENAMEL, FINISH COLOR AS SELECTED BY ARCHITECT UNLESS OTHERWISE INDICATED.
 - PAINT INTERIORS OF METAL DUCTS THAT DO NOT HAVE DUCT LINER, FOR 24-INCHES UPSTREAM OF REGISTERS AND GRILLES.
 - APPLY ONE COAT OF FLAT BLACK, LATEX FINISH COAT OVER A COMPATIBLE GALVANIZED-STEEL PRIMER.
- COORDINATE EXACT LOCATIONS OF TEMPERATURE SENSORS IN FIELD WITH THE ARCHITECT AND OWNER PRIOR TO INSTALLATION TO AVOID CONFLICTS WITH WALL MOUNTED ARCHITECTURAL ITEMS.
- ALL TEMPERATURE SENSORS SHALL BE PROVIDED WITH A WITH A CLEAR, LOCKABLE, TAMPERPROOF COVER.



KEY PLAN

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SEAL:

**FLOOR
PLAN -
HVAC
DUCTWORK**

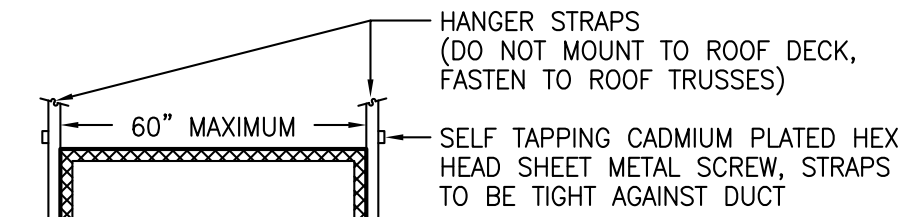
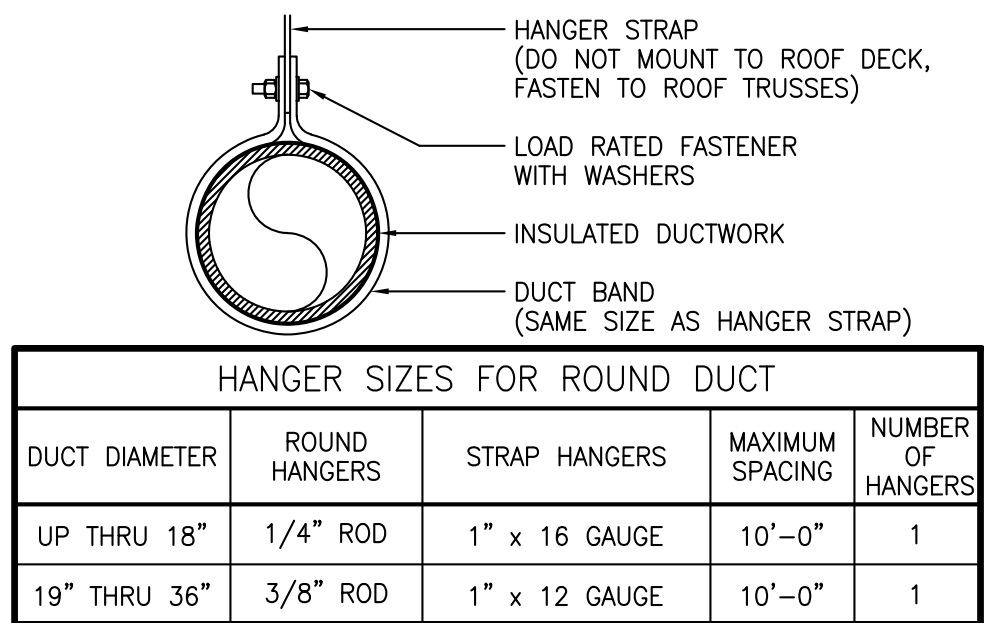
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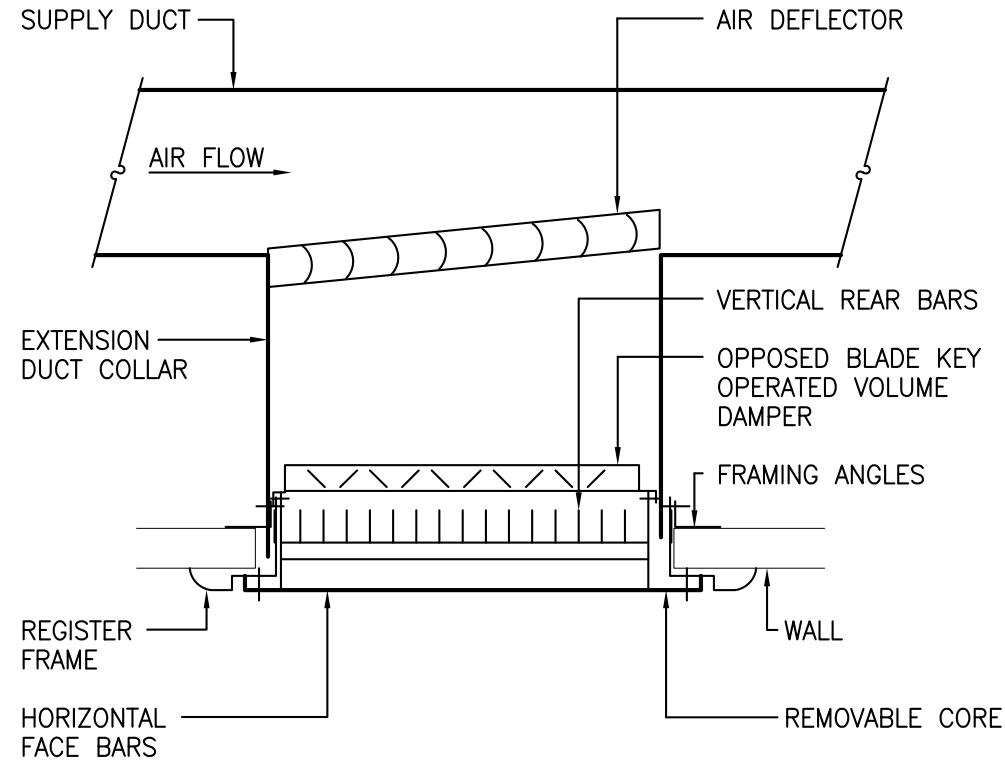
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HANGER SIZES FOR RECTANGULAR DUCT				
LONGEST DIMENSION OF DUCT	ROUND HANGERS	STRAP HANGERS	MAXIMUM SPACING	
UP THRU 18"	1/4" ROD	1" x 16 GAUGE	10'-0"	
19" THRU 42"	1/4" ROD	1" x 16 GAUGE	10'-0"	

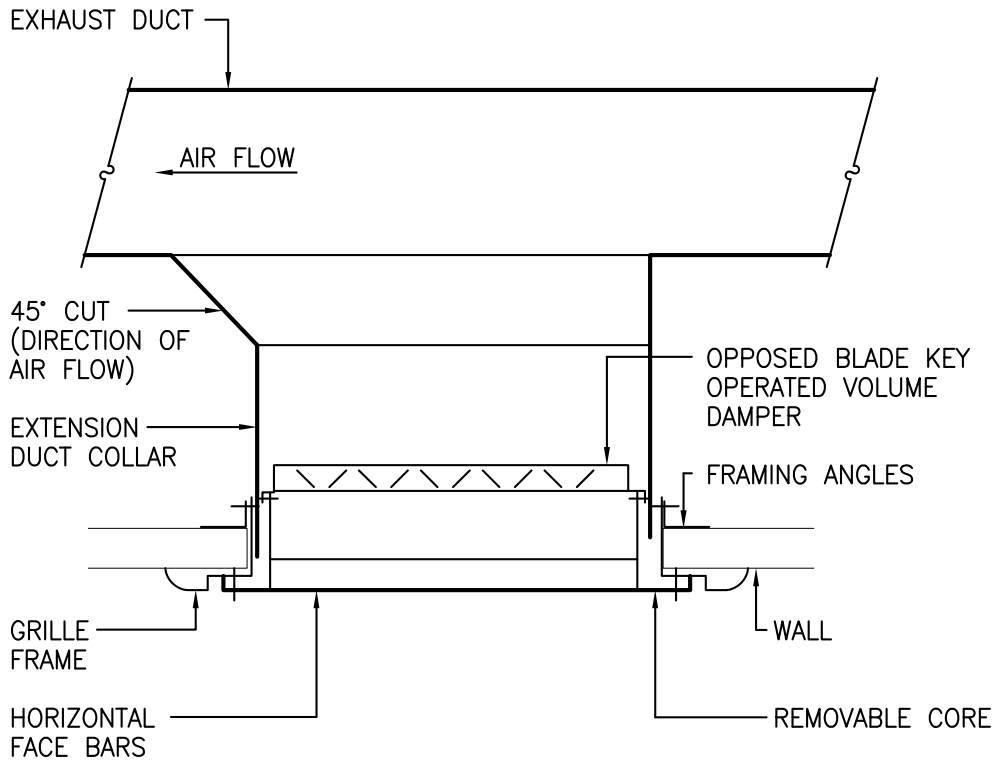
- NOTES:
- INSULATE ALL DUCTWORK AS PER SPECIFICATIONS.

DUCT HANGER DETAIL



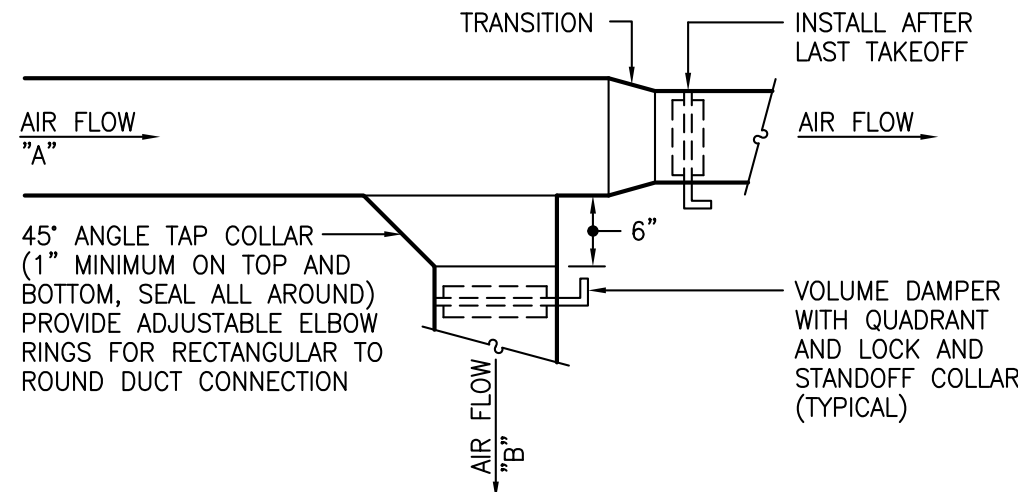
- INSTALLATION NOTES:
- FASTEN EXTENSION DUCT COLLAR TO DUCTWORK WITH SHEET METAL SCREWS. AFTER WALL IS INSTALLED, SECURE FRAME TO WALL FRAMING ANGLES AND TO EXTENSION DUCT COLLAR.
 - INSTALL REMOVABLE CORE DAMPER ASSEMBLY.

SUPPLY SIDEWALL REGISTER DETAIL

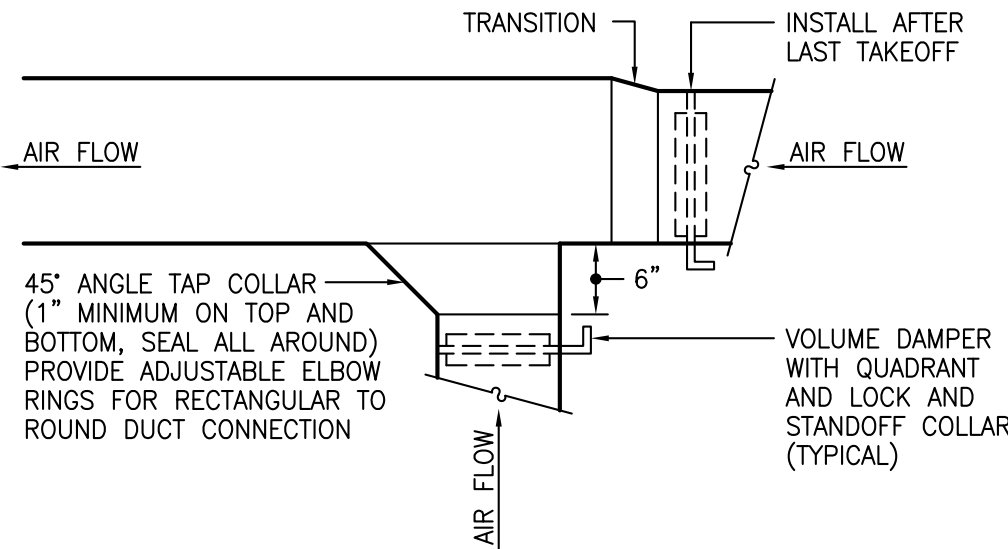


- INSTALLATION NOTES:
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 - INSTALL REMOVABLE CORE DAMPER ASSEMBLY.

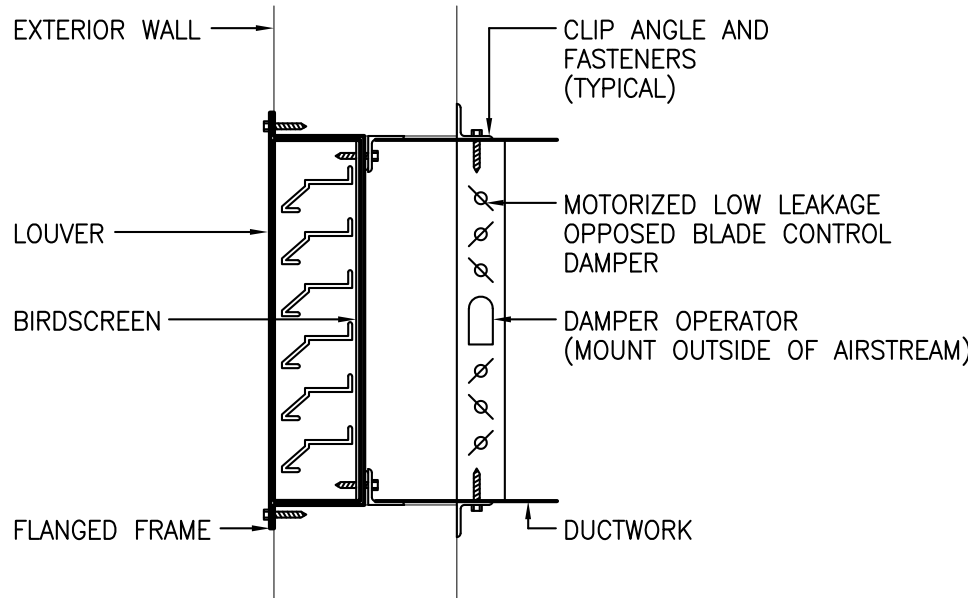
EXHAUST SIDEWALL GRILLE DETAIL



SUPPLY BRANCH TAKEOFF FITTING DETAIL

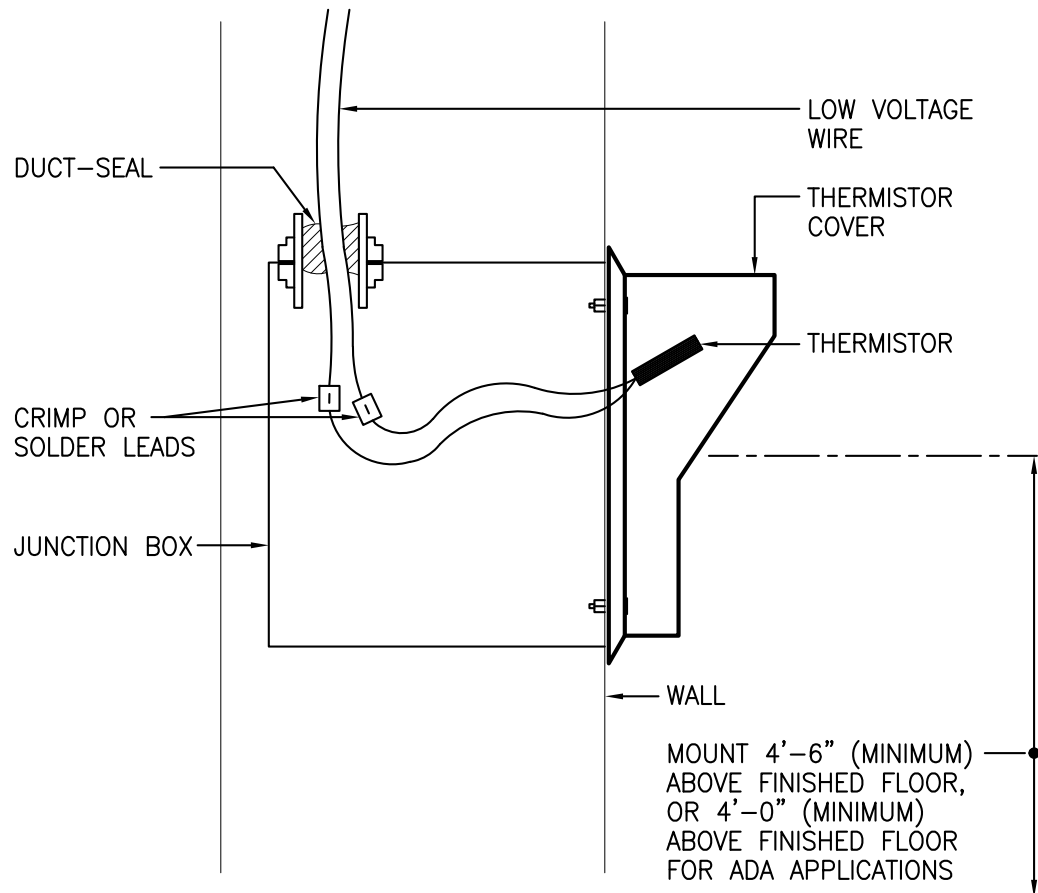


EXHAUST BRANCH TAKEOFF FITTING DETAIL



- NOTES:
- SEAL LOUVER PENETRATIONS AT EXTERIOR WALL WATERTIGHT.
 - WALL OPENINGS PROVIDED BY DIVISION 4 AND 8.
 - REFER TO ARCHITECTURAL DRAWINGS FOR WALL CONSTRUCTION DETAILS.

FLANGED FRAME LOUVER DETAIL



TEMPERATURE SENSOR MOUNTING DETAIL

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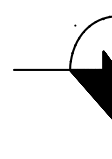
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SEAL:

HVAC DETAILS

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