



ISSUE	07/06/2022
JOB	30860.00
DRAWN	Author
SCALE	1/2" = 1'-0"
REVISIONS	

DIVISION 23: HEATING, VENTILATING AND AIR CONDITIONING REQUIREMENTS

1. GENERAL REQUIREMENTS:

1. THE WORK REQUIREMENTS DESCRIBED WITHIN DIVISION 20 SPECIFICATION SECTION "COMMON MECHANICAL / ELECTRICAL REQUIREMENTS" FORM COMPLEMENTARY REQUIREMENTS TO THE SCOPE OF WORK CONTAINED WITHIN DIVISION 23. REFER TO DRAWING H0 3 FOR SAID DIVISION 20 REQUIREMENTS.
2. CONTRACTOR SHALL PROVIDE MEANS OF SECURING AND ATTACHMENT TO ROOF FOR ALL ROOF-MOUNTED EQUIPMENT IN ACCORDANCE WITH STATE BUILDING CODE AND ALL OTHER APPLICABLE CODES. CONTRACTOR SHALL SUBMIT TO ARCHITECT THE PROPOSED MEANS OF EQUIPMENT SECURING AND ATTACHMENT TO ROOF, STAMPED AND SIGNED BY A REGISTERED STRUCTURAL PROFESSIONAL ENGINEER.
3. PRIOR TO ANY DEMOLITION OR NEW WORK, TESTING AND BALANCING CONTRACTOR SHALL TAKE CFM AND STATIC PRESSURE READINGS AT ALL LOCATIONS WHERE NEW SYSTEMS ARE TO CONNECT TO EXISTING, AND ELSEWHERE AS NOTED ON PLANS. SUBMIT TO ARCHITECT AND ENGINEER PRIOR TO STARTING NEW WORK.
4. THIS CONTRACTOR SHALL CONNECT HIS WORK TO VARIOUS EXISTING SYSTEMS AS INDICATED ON THE DRAWINGS. THE NEW WORK SHALL BE COMPATIBLE WITH THE EXISTING SYSTEM CONDITIONS.
 - a) ALL WORK SHALL BE COORDINATED WITH ALL TRADES INVOLVED AS WELL AS WITH EXISTING SYSTEMS, THE STRUCTURE, AND OTHER OBSTRUCTIONS.
 - b) SHUTDOWN OF EXISTING SYSTEMS FOR CONNECTION OF NEW WORK SHALL BE COORDINATED IN ADVANCE WITH THE CONSTRUCTION MANAGER AND BUILDING OWNER.
5. REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATIONS OF AIR TERMINAL DEVICES.
6. ALL MATERIALS AND EQUIPMENT SHALL BE UNUSED AND OF NEW MANUFACTURE, EXCEPT FOR EXISTING COMPONENTS INDICATED TO REMAIN AND BE REUSED.
7. ACCESS PANELS SHALL BE PROVIDED IN WALLS AND GYPSUM WALL BOARD CEILINGS TO FACILITATE CLEANING, ACCESS AND SERVICE TO DAMPERS, HEATERS, VALVES, VARIABLE AIR VOLUME BOXES, FAN BOXES AND ALL CONCEALED MECHANICAL EQUIPMENT. ACCESS PANELS ARE NOT INDICATED WITHIN THE PLANS. THE BIDDING CONTRACTOR SHALL REVIEW ARCHITECTURAL AND MECHANICAL PLANS TO DETERMINE THE LOCATION AND QUANTITY OF ACCESS PANELS REQUIRED. WITHIN THE MECHANICAL BID ALL ACCESS PANELS SHALL BE CLEARLY ENUMERATED AND PRICING SHALL BE ALLOCATED FOR ACCESS PANELS. AN ALTERNATE PRICE SHALL BE INDICATED FOR AN INCREASE IN QUALITY FROM STANDARD ACCESS PANELS TO DECORATIVE ACCESS PANELS.
8. INSTALL THERMOSTATS AT MOUNTING HEIGHTS ABOVE FINISHED FLOOR IN ACCORDANCE WITH "ADA" REQUIREMENTS, OR AS DIRECTED OTHERWISE BY ARCHITECT.
9. CONTRACTOR SHALL PROVIDE THE FOLLOWING SERVICES ON ALL EXISTING HVAC EQUIPMENT INDICATED TO REMAIN:
 - a) CLEAN CONDENSATE PAN AND TRAP
 - b) CALIBRATE CONTROLS
 - c) FILTER CHANGES
 - d) VERIFY FAN ROTATION AND OPERATION
 - e) BALANCING
 - f) VERIFY PITCH OF CONDENSATE DRAIN PIPES AND DRAIN PAN
 - g) VERIFY EQUIPMENT CONTROL OPERATION
 - h) LUBRICATION OF FANS, MOTORS, ETC.
 - i) CLEAN HEATING/COOLING COILS
10. EXISTING TO BE REUSED/RELOCATED EQUIPMENT: CONTRACTOR SHALL REPORT ANY EQUIPMENT DEFICIENCIES FOUND TO THE OWNER AND THE ARCHITECT AND/OR ENGINEER.
11. WORK SHALL CONFORM TO THE CURRENT IN-FORCE EDITIONS OF THE FOLLOWING:
 - a) SHEET METAL SMACNA STANDARDS (2005 - 3RD EDITION)
 - b) MASSACHUSETTS STATE BUILDING CODE (CMR-780, NINTH EDITION)
 - c) INTERNATIONAL MECHANICAL CODE (IMC-2015)
 - d) INTERNATIONAL ENERGY CONSERVATION CODE (IECC-2015)
 - e) INTERNATIONAL EXISTING BUILDING CODE (2015)
 - f) ALL OTHER APPLICABLE STATE AND LOCAL CODES AND ORDINANCES
 - g) WORK SHALL ALSO CONFORM TO BASE BUILDING SPECIFICATIONS AND STANDARDS.
12. SUBMITTALS:

MECHANICAL CONTRACTOR SHALL SUBMIT FOR REVIEW, SHOP DRAWINGS FOR ALL MATERIAL AND EQUIPMENT, CONTRACTOR SHALL POINT OUT ANY DEVIATIONS OF THE SHOP DRAWINGS FROM THE DESIGN SCHEDULE AT LEAST TEN WORKING DAYS EXCLUSIVE OF TRANSMITTAL TIME. FOR SUBMITTAL REVIEW, SHOP DRAWINGS MAY BE PAPER OR ELECTRONIC. ELECTRONIC SHOP DRAWINGS SHALL BE IN SEARCHABLE PDF FORMAT. IN ADDITION TO THE FOREGOING, SUBMIT PAPER SHOP DRAWINGS SHOWING THE FOLLOWING:

 - a) DUCTWORK SHOP DRAWINGS AND DETAILS. THE ROUTING OF DUCTWORK ON VANDERWEIL'S DRAWINGS IS SHOWN DIAGRAMMATICALLY AND APPROXIMATELY, AS ARE THE POSITIONS OF NEW VAV BOXES AND OTHER ABOVE-THE-CEILING COMPONENTS. THE CONTRACTOR SHALL DETERMINE EXACT ROUTING AND LOCATIONS, PROVIDING PROPER CLEARANCES, MAKING PROVISIONS FOR MAINTENANCE ACCESS, AND COORDINATING WITH EXISTING AND NEW COMPONENTS OF OTHER TRADES, THE STRUCTURE, AND OTHER OBSTRUCTIONS. THE DUCTWORK SHOP DRAWING SUBMITTAL SHALL BE BASED ON THIS COORDINATION EFFORT AND SHALL SHOW ALL AIR DISTRIBUTION COMPONENTS. DUCTWORK AND COMPONENTS SHALL BE DRAWN TO SCALE, AND DUCT SIZES SHALL BE INDICATED.
 - b) PIPING SHOP DRAWINGS SHOWING LAYOUT, COMPONENTS, AND DETAILS.
 - c) CONTROLS SHOP DRAWINGS, INCLUDING EQUIPMENT AND SYSTEM CONTROL SCHEMATICS, SEQUENCES OF OPERATIONS, LOGIC DIAGRAMS AND SYSTEM COMPONENTS INCLUDING DETAILS OF TIE-IN TO EXISTING BUILDING CONTROL MANAGEMENT SYSTEM. SUBMIT A POINT BY POINT STATEMENT OF COMPLIANCE WITH THE SPECIFICATIONS, SEQUENCE OF OPERATIONS AND DRAWING PAID'S. THIS STATEMENT SHALL CONSIST OF A LIST OF ALL NUMBERED PARAGRAPHS, WHERE THE SYSTEM COMPLIES FULLY, SUCH SHALL BE INDICATED BY PLACING THE WORD "COMPLY" OPPOSITE THE PARAGRAPH NUMBER, WHERE THE SYSTEM DOES NOT COMPLY, OR ACCOMPLISHES THE STATED FUNCTION IN A MANNER DIFFERENT FROM THAT DESCRIBED, A FULL DESCRIPTION OF THE DEVIATION SHALL BE PROVIDED.
13. MOTORS AND STARTERS:

PROVIDE MOTORS AND CONTROLS, AND FURNISH STARTERS FOR HVAC EQUIPMENT, EXCEPT FOR UNITS SERVED BY MCC WHICH ARE PROVIDED UNDER ELECTRIC WORK. PROVIDE CONTROL AND OTHER RELATED WIRING INCLUDING INTERLOCKS. ALL MOTORS SHALL TO BE PREMIUM EFFICIENCY. ALL THREE PHASE MOTORS SHALL BE RATED FOR INVERTER DUTY SERVICE.
14. VIBRATION ISOLATION:

PROVIDE VIBRATION ISOLATION FOR EACH PIECE OF ROTATING OR RECIPROCATING HVAC EQUIPMENT SHOWN ON THE DRAWINGS. ALL ISOLATION COMPONENTS SHALL BE SUPPLIED BY A SINGLE MANUFACTURER - MASON INDUSTRIES OR AMBER BOOTH. TYPES OF ISOLATORS, REQUIRED DEFLECTIONS, AND INSTALLATION PRACTICES SHALL BE IN STRICT ACCORDANCE WITH THE RECOMMENDATIONS OF THE VIBRATION ISOLATION MANUFACTURER.
15. SEISMIC RESTRAINTS:

PROVIDE RESTRAINTS AS REQUIRED BY CODE. FOR EACH SEISMIC RESTRAINT, PROVIDE CERTIFIED CALCULATIONS TO VERIFY ADEQUACY TO MEET THE FOLLOWING DESIGN REQUIREMENTS: ABILITY TO ACCOMMODATE RELATIVE SEISMIC DISPLACEMENTS OF SUPPORTED ITEM BETWEEN POINTS OF SUPPORT, ABILITY TO ACCOMMODATE THE REQUIRED SEISMIC FORCES. FOR EACH RESPECTIVE SET OF ANCHOR BOLTS PROVIDE CALCULATIONS TO VERIFY ADEQUACY TO MEET COMBINED SEISMIC-INDUCED SHEAR AND TENSION FORCES. FOR EACH WELDMENT BETWEEN STRUCTURE AND ITEM SUBJECT TO SEISMIC FORCE, PROVIDE CALCULATIONS TO VERIFY ADEQUACY. CALCULATIONS SHALL BE STAMPED BY A PROFESSIONAL ENGINEER WHO IS REGISTERED IN THE STATE WHERE THE WORK IS BEING PERFORMED AND HAS SPECIFIC EXPERIENCE IN SEISMIC CALCULATIONS. RESTRAINTS SHALL MAINTAIN THE RESTRAINED ITEM IN A CAPTIVE POSITION WITHOUT SHORT CIRCUITING THE VIBRATION ISOLATION.
16. HANGERS AND SUPPORTS:
 - a) STRUCTURAL STEEL SUPPORTS, HANGERS, ETC. SHALL BE ANGLE IRON, STEEL CHANNEL OR STEEL ROD USED WITH APPROVED CLAMPS, INSERTS, ETC. ALL SUPPORTS, HANGERS, BRACKETS, ETC., SHALL BE AS APPROVED BY THE ENGINEER. ALL HANGERS SHALL BE GALVANIZED OR PAINTED WITH TWO COATS OF RUSTOLEUM PAINT BEFORE THEIR INSTALLATION.
 - b) ATTACH HANGERS AND SUPPORTS DIRECTLY ONTO THE STRUCTURE BY FIRST REMOVING EXISTING FIRE PROOFING AND AFTER SECURING THE ATTACHMENT, REPAIRING THE FIRE PROOFING TO ITS ORIGINAL CONDITION, CONTINUOUSLY OVER THE ATTACHMENT.

17. CLEANING:
 - a) CONTRACTOR WILL CLEAN THE ENTIRE INSTALLATION AND ALL WORK AREAS SHALL BE LEFT AS CLEAN AS NEW. CLEAN INTERNALS OF ALL DUCTWORK AND AIR HANDLING UNITS, AND REPLACE FILTERS AFTERWARDS.
 - b) DUCTWORK: DUCTS SHALL BE THOROUGHLY CLEANED SO THAT NO DIRT OR DUST SHALL BE DISCHARGED FROM DIFFUSERS, REGISTERS, OR GRILLES, WHEN SYSTEM IS OPERATED.
 - c) PIPING: AFTER CHILLED WATER, CONDENSER WATER OR CONDENSATE PIPING HAVE BEEN PRESSURE TESTED AND APPROVED FOR TIGHTNESS, CLEAN AND FLUSH PIPING.
 - d) EQUIPMENT: AFTER COMPLETION OF PROJECT, CLEAN THE EXTERIOR SURFACE OF EQUIPMENT INCLUDED IN THIS SECTION, INCLUDING REMOVAL OF CONCRETE RESIDUE.
 - e) WORK AREA: AFTER COMPLETION OF PROJECT, REMOVE ALL CONSTRUCTION DEBRIS, TEMPORARY FACILITIES AND EQUIPMENT FROM WORK AREA. CLEAN WORK AREA TO PERMIT OCCUPATION.
18. START UP, TESTING AND BALANCING:
 - a) START UP ALL SYSTEMS, PRESSURE TEST DUCTWORK AND PIPING, AND BALANCE SYSTEMS INCLUDING, BUT NOT LIMITED TO, ALL NEW AND EXISTING REGISTERS, GRILLES, DIFFUSERS, VAV BOXES, FAN POWERED BOXES, HEAT PUMPS, FANS, ETC WITHIN THE AREA OF WORK TO PERFORMANCE DATA SHOWN ON PLANS, SCHEDULES, AND AS SPECIFIED.
 - b) DO NOT COVER OR CONCEAL WORK BEFORE TESTING AND INSPECTION AND OBTAINING APPROVAL.
 - c) LEAKS, DAMAGE AND DEFECTS DISCOVERED OR RESULTING FROM STARTUP, TESTING, AND BALANCING SHALL BE REPAIRED OR REPLACED TO LIKE-NEW CONDITION WITH ACCEPTABLE MATERIALS. TEST SHALL BE CONTINUED UNTIL SYSTEM OPERATES WITHOUT ADJUSTMENT OR REPAIR.
 - d) REPORT ON REPORTING FORMS, SUBMITTED TO ARCHITECT FOR APPROVAL IN ADVANCE.
 - e) SUBMIT ELECTRONIC COPY OF TESTING AND BALANCING REPORTS TO ARCHITECT FOR APPROVAL.
 - f) THIS CONTRACTOR SHALL FURNISH ALL TEST MEDIUMS AND DISPOSE OF ALL TEST MEDIUMS AT AN APPROVED OFF SITE LOCATION AFTER TESTING IS COMPLETE.
 - g) NOTE REQUIREMENT ABOVE FOR CFM AND STATIC PRESSURE READINGS PRIOR TO DEMOLITION.
 - h) THE BALANCING CONTRACTOR SHALL BE RESPONSIBLE FOR FINAL DIRECTIONAL ADJUSTMENT OF ALL LINEAR DIFFUSERS AS INDICATED ON PLANS. IF NO DIRECTIONAL FLOW IS INDICATED INTERIOR LINEAR DIFFUSERS SHALL BE DIRECTED HORIZONTALLY AND PERIMETER LINEAR DIFFUSER SHALL BE DIRECTED VERTICALLY, IF PERIMETER LINEAR DIFFUSERS HAVE MULTIPLE SLOTS THE PERIMETER SLOT DIRECTED VERTICALLY AND THE INTERIOR SLOT DIRECTED HORIZONTALLY TOWARDS THE INTERIOR SPACE.
19. WARRANTY:
 - a) WARRANT WORK OF THIS SECTION IN WRITING FOR ONE YEAR FROM DATE OF OWNERS ACCEPTANCE OF SUBSTANTIAL COMPLETION. REPAIR OR REPLACE DEFECTIVE MATERIALS, EQUIPMENT, WORKMANSHIP AND INSTALLATION THAT DEVELOP WITHIN THIS PERIOD, PROMPTLY AND TO OWNER'S SATISFACTION AND CORRECT DAMAGE CAUSED IN MAKING NECESSARY REPAIRS AND REPLACEMENTS UNDER WARRANTY WITHIN CONTRACT PRICE.

II. DUCTWORK AND AIR DISTRIBUTION EQUIPMENT:

1. ROUTING AND SIZING OF DUCTWORK: THIS PROJECT INVOLVES CONSTRUCTION INSIDE AN EXISTING STRUCTURE. REFER TO GENERAL NOTE "SUBMITTALS", FOR ROUTING, WHERE DUCT SIZES ARE NOT INDICATED, CONTRACTOR SHALL SELECT SIZES BASED ON THE CFM USING THE "LOW PRESSURE DUCT SIZING TABLE."

LOW PRESSURE DUCT SIZING TABLE

Airflow (cfm)	Round Duct Size (inches)	FLAT OVAL Size (inches)	Equivalent Rectangular Duct Sizes (inches x inches)			
80-100	6	4x10	4x8	6x6		
100-150	8	6x8	4x12	6x8		
150-200	8	6x10	6x10	8x8		
200-300	10	6x14	6x12	8x10		
300-400	10	6x17	6x16	8x12	10x10	
400-500	12	6x20	6x20	8x14	10x10	
500-600	12	8x16	6x24	8x16	10x12	
600-750	14	8x19	8x18	10x14	12x12	
750-1000	14	8x25	8x24	10x16	12x14	
1000-1200	16	8x30	8x26	10x20	12x16	14x14
1200-1400	16	10x26	8x30	10x24	12x18	14x16
1200-1700	18	10x32	10x26	12x22	14x18	16x16
1700-1900	18	12x26	10x28	12x24	14x20	16x18
1900-2200	20	12x28	12x26	14x24	16x20	18x18
2200-2500	20	12x34	12x30	14x26	16x22	18x20
2500-2800	22	12x37	12x36	14x30	16x26	18x24

2. SPECIAL DUCTWORK REQUIREMENTS:
 - a) NEW ROUND DUCT IN EXPOSED AREAS SHALL BE SPIRAL, DOUBLE WALL, FLANGED, AND GASKETED. DIMENSIONS ON PLAN REPRESENT INTERNAL AIR FLOW DIMENSIONS. CONTRACTOR SHALL INCREASE SIZE FOR LINER WHERE APPLICABLE. NEW RECTANGULAR DUCT IN EXPOSED AREAS SHALL BE DOUBLE WALL. EXISTING RECTANGULAR DUCT SHALL HAVE NEW RIGID INSULATION APPLIED THAT IS FIELD PAINTABLE.
 - b) DIFFUSER SIZES SHOWN ARE NECK SIZES; REGISTER AND GRILLE SIZES ARE NOMINAL.
 - c) PROVIDE FLEXIBLE CONNECTIONS ON ALL DUCTS CONNECTED TO EQUIPMENT AND COMPONENTS WITH ROTATING OR VIBRATING PARTS. ALL DUCTS SHALL BE GROUNDED ACROSS FLEXIBLE CONNECTION WITH FLEXIBLE COPPER GROUNDING STRAPS.
 - d) ALL DUCTS PENETRATING RATED FIRE WALLS SHALL BE PROVIDED WITH FIRE DAMPERS AND ACCESS DOORS.
 - e) DUCTWORK SHALL NOT RUN ALONG FULL HEIGHT PARTITIONS.
 - f) PATCH AND SEAL ALL EXISTING OPENINGS IN DUCTWORK NOT UTILIZED FOR NEW LAYOUT.
 - g) THE INSIDE OF ALL UNLINED DUCTWORK VISIBLE THROUGH A GRILLE OR DIFFUSER SHALL BE PAINTED FLAT BLACK.
 - h) WHEN SECTION OF DUCTWORK IS NOT LABELED FOR SIZE, THE LARGER SIZE INDICATED ON THE CONNECTED DUCT SHALL PREVAIL. SIZE OF DUCT RUN-OUTS TO DIFFUSER SHALL EQUAL DIFFUSER NECK SIZE.
 - i) DUCT BRANCH CONNECTIONS AND TAKE OFFS SHALL BE MADE WITH 45° CONNECTION, BELLMOUTH OR CONICAL ONLY. SPIN IN COLLARS AND STRAIGHT TAPS SHALL NOT BE USED.
 - j) ELBOWS AND BENDS FOR RECTANGULAR DUCTS SHALL HAVE CENTER LINE RADIUS OF 1.5 TIMES DUCT WIDTH WHEREVER POSSIBLE. WHERE CENTERLINE RADIUS IS LESS THAN 1.5 TIMES DUCT WITH, ELBOWS SHALL BE RADIUS THROAT WITH RADIUS HEEL AND FULL LENGTH SPLITTER VANES.

3. MATERIALS AND PRESSURE RATINGS:
 - a) SHEET METAL DUCTS SHALL BE CONSTRUCTED OF HOT DIPPED G90 GALVANIZED SHEET METAL UNLESS OTHERWISE SPECIFIED.
 - b) KITCHEN HOOD EXHAUST DUCTS SHALL BE 16 GA. ALL WELDED CARBON STEEL AND WILL BE INSTALLED IN ACCORDANCE WITH NFPA-96.
 - c) SHOWER EXHAUST DUCTWORK SHALL BE (ALUMINUM WITH WELDED SEAMS), DUCTWORK SHALL PITCH TOWARDS SHOWERS.
 - d) ALL MEDIUM PRESSURE DUCTWORK BETWEEN MAIN SYSTEM FAN AND AIR TERMINAL DEVICE SHALL BE MINIMUM 4"(wg) PRESSURE CLASS, SEAL CLASS A, LEAKAGE CLASS 6. ALL LOW PRESSURE DUCTWORK BETWEEN TERMINAL DEVICE AND AIR OUTLETS SHALL BE MINIMUM 2"(wg) PRESSURE CLASS, SEAL CLASS B, LEAKAGE CLASS 12.
 - e) DOUBLE WALLED DUCTWORK:
 - 1) DOUBLE WALLED DUCTWORK SHALL BE SUITABLE TO SUSTAIN INTERNAL PRESSURES STATED BELOW. THE OUTER CASING SHALL BE SOLID GALVANIZED STEEL AND THE INNER CASING SHALL BE PERFORATED GALVANIZED STEEL. THE DUCT ASSEMBLY SHALL HAVE AN R-VALUE OF NOT LESS THAN 6. THE INSULATION SHALL BE ENCAPSULATED TO ENSURE IT DOES NOT TOUCH THE AIR STREAM. DOUBLE WALLED DUCTS SHALL BE BY MCGILL, SHEET METAL CONNECTORS INC. OR APPROVED EQUAL. PROVIDE INSULATED DOUBLE WALL DUCTWORK FOR THE FOLLOWING SYSTEMS.
 - i) ALL EXPOSED ROUND, RECTANGULAR AND FLAT OVAL DUCTWORK.

4. FLEXIBLE DUCTWORK:
 - a) FLEXIBLE DUCTWORK, CONNECTING TO UNINSULATED OR UNLINED DUCT, SHALL BE VINYL COATED FIBERGLASS CLOTH 0.0257" MINIMUM THICKNESS, 25 STRANDS PER INCH MINIMUM THREAD COUNT WITH CORROSION-RESISTANT HELICAL WIRE REINFORCEMENT. FLEX DUCT SHALL BE UL RATED FOR 1/2" W.C. POSITIVE PRESSURE, 2" W.C. NEGATIVE PRESSURE WITH A MAXIMUM VELOCITY OF 4000 FPM. FLEXDUCT MUST BE LISTED AS A CLASS 1 CONNECTOR ACCORDING TO UL 181 AND SHALL MEET THE REQUIREMENTS OF NFPA 90A - MAXIMUM ASTM E-84 FIRE HAZARD RATING SHALL BE 25 FLAME SPREAD, 50 FUEL CONTRIBUTED AND 50 SMOKE DEVELOPED. UNINSULATED FLEXIBLE DUCT SHALL BE EQUIVALENT TO FLEXMASTER TYPE 4.
 - b) FLEXIBLE DUCT CONNECTED TO INSULATED OR LINED DUCT SHALL BE INSULATED WITH 1-1/2", 1/2 LB. DENSITY FIBERGLASS INSULATION AND FLAME RETARDANT (UL LISTED) VAPOR BARRIER, MEETING ASTM E-84 RATING AS REFERENCED ABOVE.
 - c) SUBMITTALS SHALL INCLUDE DATA ON CORE, IN ADDITION TO OTHER DATA LISTED ABOVE REQUIRED TO ENSURE THAT SUBMITTED PRODUCT MEETS THE REQUIREMENTS OF THESE SPECIFICATIONS.
 - d) PROVIDE SEALING COMPOUND FOR INSTALLATION. SEE FURTHER PARAGRAPHS IN THIS SPECIFICATION, AND DETAILS FOR OTHER INSTALLATION REQUIREMENTS.
 - e) FLEXIBLE DUCTWORK SHALL BE A 5'-0" LONG. FLEXIBLE DUCTS SHALL BE INSTALLED WITH MINIMUM SAG OF 1/2" PER 1'-0". MORE THAN ONE (1) 90 DEGREE TURNS/BENDS OF FLEXIBLE DUCT ARE PROHIBITED.

5. VOLUME DAMPERS:
 - a) GENERAL: FOR CLARITY PURPOSES; PLANS/DRAWINGS DO NOT INDICATE VOLUME DAMPERS TO DIFFUSERS, REGISTERS OR GRILLES. DAMPERS SHALL BE TAMCO.
 - b) PROVIDE MANUAL ADJUSTABLE VOLUME DAMPERS, WITH EXTENDED MOUNT INDICATING AND LOCKING QUADRANTS ON EACH SUPPLY, RETURN, EXHAUST DUCT TAKEOFF, AND AT EACH TAKEOFF TO A REGISTER, GRILLE, OR DIFFUSER (NOT ALL DAMPERS ARE SHOWN ON DRAWINGS). DAMPERS SHALL BE LOCATED AS FAR UPSTREAM AS POSSIBLE IN THE BRANCH DUCT OR TAKE OFF TO MINIMIZE DOWNSTREAM NOISE.
 - c) REMOTE ADJUSTABLE VOLUME DAMPERS: REMOTE ADJUSTABLE VOLUME DAMPERS ARE REQUIRED IN AREAS WHERE CEILING CAVITY ACCESS IS LIMITED BY HARD (SOLID) CEILINGS, EQUIPMENT OBSTRUCTIONS, ARCHITECTURAL FEATURES, ETC. CONTRACTOR SHALL COORDINATE BETWEEN MECHANICAL PLANS AND ARCHITECTURAL CEILING PLANS TO DETERMINE IF AND WHERE REMOTE ADJUSTABLE VOLUME DAMPERS ARE REQUIRED. CONTRACTOR SHALL CLEARLY IDENTIFY WITH THEIR BID THE QUANTITY OF REMOTE ADJUSTABLE VOLUME DAMPERS BEING PROVIDED AND A DESCRIPTION OF THEIR MOUNTING LOCATIONS.
 - i) MANUALLY ADJUSTED REMOTE VOLUME DAMPERS SHALL BE SIMILAR TO YOUNG REGULATOR MODEL 270. REFER TO FLOOR PLANS AND DETAILS FOR TYPES OF OPERATORS (CEILING MOUNTED OR CONCEALED).
 - ii) ELECTRONICALLY ADJUSTED REMOTE VOLUME DAMPERS SHALL BE SIMILAR TO YOUNG REGULATOR MODEL EBD. PROVIDE WITH RECESSED WALL-BOX TERMINATION PORT. REFER TO FLOOR PLANS FOR QUANTITY AND LOCATION OF PORTS REQUIRED AT EACH WALL-BOX. WIRING SHALL BE NON-SHEILED PLENUM RATED WIRE. LENGTHS SHALL BE BASED ON FLOOR PLAN REQUIREMENTS. PROVIDE WITH ONE HAND HELD BATTERY POWERED DAMPER ACTUATOR WITH LCD POSITION INDICATOR, SIMILAR TO YOUNG REGULATOR EBD-P.

6. DIFFUSERS, REGISTERS AND GRILLES (AIR INLETS AND OUTLETS):
 - a) GENERAL: PROVIDE DIFFUSERS, REGISTERS, AND GRILLES FOR SUPPLY, RETURN, AND EXHAUST OUTLETS, OF SIZE, TYPE, MATERIAL AND DESIGN SHOWN ON DRAWINGS. ACCEPTABLE MANUFACTURERS SHALL BE NAILOR, METALAIR, TITUS, OR PRICE. SOUND PRESSURE LEVELS SHALL NOT EXCEED NC 30. COLOR AND FINISH SHALL BE SELECTED BY THE ARCHITECT.
 - b) EXISTING TO REMAIN/BE REUSED DIFFUSERS/REGISTERS/GRILLES SHALL BE CLEANED, TOUCH-UP PAINTED AND RENDERED IN LIKE-NEW-CONDITION BY THE CONTRACTOR.

7. ACOUSTICAL DUCTWORK LINING: (LOW PRESSURE DUCTWORK ONLY)
 - a) PROVIDE ACOUSTICAL LINING BY CERTAIN-TEED, KNAUF, OWENS CORNING, OR MANVILLE TO ACHIEVE A MINIMUM INSULATORY VALUE OF R-4 (AS INSTALLED) FOR THE FOLLOWING DUCTWORK:
 - 1) SUPPLY AND RETURN AIR DUCTWORK, INCLUDING PLENUMS, FOR MINIMUM OF 20 FEET FROM CONNECTION OF AIR HANDLING UNITS.
 - 2) ALL LOW PRESSURE DUCTWORK DOWNSTREAM OF VARIABLE VOLUME, CONSTANT VOLUME BOXES, FAN BOXES, FAN COIL UNITS, AND HEAT PUMPS.
 - 3) EXHAUST DUCTWORK, INCLUDING PLENUMS, FOR MINIMUM OF 20 FEET FROM AIR HANDLERS AND EXHAUST FANS.
 - 4) ALL TRANSFER AIR DUCTS
 - 5) ALL OTHER DUCTWORK INDICATED AS LINED ON DRAWINGS.
 - b) MATERIALS AND INSTALLATION SHALL MEET THE FOLLOWING STANDARDS, AS APPLICABLE:
 - 1) NFPA-90A, UL723, NFPA-255, SMACNA DUCT LINER APPLICATIONS STANDARD; SMACNA MECHANICAL FASTENERS STANDARD; ADHESIVE AND SEALANT COUNCIL; ADHESIVES STANDARD FOR DUCT LINER - ASC-A-7001A; ASTM E-84 FIRE HAZARD CLASSIFICATIONS OF 25 FLAME SPREAD, 50 SMOKE DEVELOPED, AND 50 FUEL CONTRIBUTED.

8. DUCTWORK INSULATION (EXTERNAL)
 - a) INSULATION SHALL BE CERTAIN-TEED, KNAUF, MANVILLE, OR OWENS CORNING. MATERIALS SHALL MEET REQUIREMENTS OF ADHESIVE AND SEALANT COUNCIL STANDARDS AND SMACNA AND MUST BE NON-FORMALDEHYDE (FSK WRAP). INSULATE (EXISTING AND NEW) SUPPLY, FRESH AIR, AND RETURN DUCTS AND PLENUMS WITH A MINIMUM OF R-6 (AS INSTALLED) INSULATION WHEN LOCATED WITHIN UNCONDITIONED SPACES AND A MINIMUM OF R-8 (AS INSTALLED) INSULATION WHEN LOCATED OUTSIDE THE BUILDING ENVELOP. INSULATION SHALL BE FOLK-KRAFT FLAME RESISTANT VAPOR BARRIER. ASTM E-84 FIRE HAZARD RATINGS SHALL BE 25 FLAME SPREAD, 50 SMOKE DEVELOPED AND 50 FUEL CONTRIBUTED.
 - b) INSULATE STANDING SEAMS IN DUCTWORK WITH THE SAME MATERIAL AND THICKNESS AS DUCT.
 - c) ACOUSTICALLY LINED DUCTWORK SHALL NOT BE INSULATED.
 - d) INSULATION AND VAPOR BARRIER SHALL BE CONTINUOUS AROUND ENTIRE PERIMETER OF DUCTS. DUCTS SUPPORTED BY METAL STRAPS SHALL HAVE INSULATION ENCOMPASSING STRAPS, WHERE STRAPS PENETRATE AT TOP OF DUCT TIGHTLY SEAL AROUND STRAP WITH INSULATING TAPE. DUCTS SUPPORTED BY TRAPEZE TYPE HANGERS UNDER DUCTS SHALL HAVE 6 LB. DENSITY RIGID INSULATION PROVIDED BETWEEN DUCT AND HANGER. INSULATION SHALL BE SAME THICKNESS AND VAPOR BARRIER AS SPECIFIED FOR SPECIFIC DUCT TYPE. RIGID INSULATION SECTION SHALL BE FULL WIDTH OF DUCT AND MINIMUM 12" LONG. TAPE AND SEAL ALL SEAMS WHERE RIGID INSULATION MEETS OTHER INSULATION.