

MECHANICAL SPECIFICATIONS

1. PROVIDE A COMPLETE HVAC SYSTEM AS SHOWN ON THE DRAWINGS AND AS SPECIFIED HEREIN. WORK INCLUDES, BUT IS NOT NECESSARILY LIMITED TO, THE FOLLOWING PRINCIPAL CATEGORIES:
- A. AIR DISTRIBUTION SYSTEM CONSISTING OF SUPPLY, RETURN AND EXHAUST DUCTWORK AND ASSOCIATED AIR DISTRIBUTION AND TERMINAL DEVICES.
 - B. HYDRONIC HEATING AND COOLING SYSTEMS AND ALL DEVICES AND EQUIPMENT.
 - C. ALTERATION WORK IN THE EXISTING BUILDING.

2. OBTAIN AND PAY FOR ALL PERMITS. UPON COMPLETION, PROVIDE A CERTIFICATE OF APPROVAL FROM THE GOVERNING INSPECTION AUTHORITY.

3. DURING THE BIDDING PERIOD INSPECT THE SITE AND PREMISES OF THE PROPOSED WORK. REPORT IMMEDIATELY ANY SIGNIFICANT OBSERVED DISCREPANCIES AS RELATED TO THE PLANS OR THE REQUIRED WORK. ALL WORK SHALL COMPLY WITH OHIO BUILDING CODE, OHIO MECHANICAL CODE AND ALL OTHER APPLICABLE CODES, LAWS AND ORDINANCES.

4. THIS CONTRACTOR SHALL GUARANTEE ALL WORKMANSHIP, EQUIPMENT, AND MATERIAL ENTERING INTO THIS CONTRACT FOR A PERIOD OF ONE (1) YEAR FROM THE DATE OF ACCEPTANCE. ANY WORK PROVEN TO BE DEFECTIVE DURING THIS PERIOD SHALL BE MADE GOOD BY THIS CONTRACTOR WITHOUT EXPENSE TO THE OWNER.

5. EQUIPMENT CONTROL PANELS CONTAINING POWER CONTROL COMPONENTS SHALL BE MARKED WITH THE MINIMUM SCOR RATING. THE RATING SHALL NOT BE LESS THAN THE AVAILABLE FAULT CURRENT. REFER TO THE ELECTRICAL DRAWINGS FOR THE CALCULATED AVAILABLE FAULT AT THE DISTRIBUTION PANEL, MCC OR PANELBOARD SERVING THE EQUIPMENT. INCLUDE CONFIRMATION OF BEING PROTECTED FROM THE FAULT CURRENT IN THE EQUIPMENT SHOP DRAWING SUBMITTAL.

6. WHERE TRADE NAMES, BRANDS OR MANUFACTURERS ARE LISTED, ANY ONE OF THE SEVERAL NAMED ARE CONSIDERED EQUALLY ACCEPTABLE. NO UNNAMED PRODUCT OR MATERIAL SHALL BE USED UNLESS APPROVED IN WRITING BY THE ENGINEER. SUBMIT ELECTRONIC SHOP DRAWINGS ON MAJOR ITEMS OF EQUIPMENT AND MATERIALS.

7. PLAN WORK AS TO PROVIDE REASONABLE CONTINUOUS SERVICE OF EXISTING SYSTEMS. SHUTDOWN OF SYSTEMS SHALL BE BID OUTSIDE OF NORMAL WORKING HOURS.

8. WORKMANSHIP SHALL BE FIRST CLASS. THE ARCHITECT'S OR ENGINEER'S JUDGMENT SHALL PREVAIL IF THE QUALITY IS SUSPECT.

9. PROTECT MATERIALS AND EQUIPMENT AFTER DELIVERY TO THE JOB SITE. RESPECT OTHER TRADES AS RELATED TO PROTECTING THEIR WORK AND TO AVOID CONSTRUCTION INTERFERENCES. CALL ATTENTION TO PROBLEMS RELATING TO SPACE REQUIREMENTS SO EARLY RESOLUTION MAY BE OBTAINED. RESPECT OWNER'S PROPERTY AT ALL TIMES. TEMPORARILY REMOVE, STORE AND RE-INSTALL CEILINGS WHEN REQUIRED TO PREFORM WORK.

10. CUT AND PATCH TO INSTALL WORK OR PAY OTHERS TO PERFORM SUCH WORK. CONCRETE SHALL BE SAW CUT OR CORE DRILLED. WORKMANSHIP SHALL BE FIRST CLASS. THE ARCHITECT'S OR ENGINEER'S JUDGMENT SHALL PREVAIL IF THE QUALITY IS SUSPECT.

11. IN ALTERATION AND REMODELING WORK, PERFORM ALL REMOVAL AND RELOCATION WORK KINDRED TO THE HVAC WORK. LEAVE ALL EXISTING SYSTEMS CONTINUOUS AND FUNCTIONAL. REMOVE EXTRANEOUS PIPING AND EQUIPMENT. NO REMOVED MATERIAL SHALL BE REUSED UNLESS EXPRESSLY SHOWN.

12. EACH CONTRACTOR SHALL MAINTAIN A SEPARATE SET OF AS-BUILT PRINTS OF THE CONTRACT DOCUMENTS AND SHALL SHOW ANY SIGNIFICANT CHANGES OR VARIATIONS WHICH ARE MADE DURING CONSTRUCTION. UPON COMPLETION OF THE WORK, THESE DRAWINGS SHALL BE TURNED OVER TO THE ARCHITECT.

13. MARK ALL DUCT SYSTEMS AND PIPING SYSTEMS AND TAG ALL VALVES. ANY EXISTING DUCTWORK AND PIPING ENCOUNTERED SHALL ALSO BE MARKED. VALVE TAGS SHALL BE NON-FERROUS METAL, 1" DIAMETER AND ATTACHED BY COPPER LOOP HOOKS. PIPE MARKERS SHALL BE 1" HIGH LETTERS IN COLOR BAND AND ARROW. MARKERS SHALL BE AT EACH VALVE AND AT LEAST ONE IN EACH ROOM, BUT NO MORE THAN 20 FT. INTERVALS. COLOR BAND SHALL MATCH EXISTING OR AS DICTATED BY OWNER. TURN OVER VALVE TAG SCHEDULE TO ARCHITECT.

14. FIRESTOPPING ASSEMBLIES SHALL BE PROVIDED AT PENETRATIONS OF PIPING AND NON-FIRE DAMPERED DUCTS THRU FIRE RATED FLOORS, FIRE RATED FLOOR-CEILING AND ROOF CEILING ASSEMBLIES, FIRE & SMOKE RATED WALLS AND PARTITIONS AND FIRE & SMOKE RATED SHAFT WALLS AND PARTITIONS. IN ADDITION, FIRESTOPPING ASSEMBLIES SHALL BE PROVIDED AT PENETRATIONS THRU G-ROUR RATED FLOORS. REFER TO THE ARCHITECTURAL DRAWINGS FOR FIRE AND SMOKE RATED BUILDING ELEMENTS AND HVAC DRAWINGS FOR PIPE AND DUCT LAYOUTS.

15. SUPPORT EQUIPMENT, DUCTWORK AND PIPING FROM STRUCTURAL STEEL MEMBERS OR CONCRETE ONLY, NOT FROM METAL DECKS. PIPE HANGERS SHALL BE CLEVIS TYPE.

16. PROVIDE 18" X 18" SIZE ACCESS DOORS WITH CONCEALED HINGE, SCREWDRIVER LOCK, TYPE M BY MILCOR, OR APPROVED EQUIVALENT, WHERE REQUIRED FOR DEVICE OR EQUIPMENT ACCESS.

17. PAINT ALL UNPAINTED OR RUSTY SURFACES ON SUPPORTS, HANGERS, PIPING AND EQUIPMENT WITH ONE (1) COAT BLACK RUSTOLEUM WHERE THE ITEM WILL BE EXPOSED TO VIEW IN ITS FINAL STATE.

18. TOUCH-UP OR REFINISH EQUIPMENT WHERE FACTORY FINISH HAS DETERIORATED DUE TO EXPOSURE.

19. PAINT DULL BLACK ALL VISIBLE METAL BEHIND GRILLES AND REGISTERS.

20. INSTALL SLEEVES IN ALL FLOORS, WALLS AND CEILINGS WHERE PIPES PASS THRU. SLEEVES SHALL BE SIZED TO PROVIDE A MINIMUM CLEARANCE OF 1/4" ON ALL SIDES FROM PIPE INSULATION AND 1/2" FROM PIPES NOT REQUIRING INSULATION. PIPE INSULATION SHALL EXTEND CONTINUOUS THRU SLEEVES.

- SLEEVES MAY BE RIGID STEEL OR SHEET METAL. EXTEND SLEEVES AT LEAST 1/2" ABOVE FLOOR IN UPPER LEVEL EQUIPMENT ROOMS.

21. PATCH ALL DUCTWORK THAT IS ALTERED DURING CONSTRUCTION

DUCTWORK SHALL BE MINIMUM 26 GAUGE GALVANIZED SHEET METAL, RECTANGULAR, FLAT OVAL AND ROUND AS SHOWN ON THE DRAWINGS.

RECTANGULAR DUCTWORK: ELBOWS SHALL HAVE AN INSIDE RADIUS EQUAL TO THE DUCT WIDTH, WHERE 90° ELBOWS ARE SHOWN TO BE SQUARE ON THE DRAWINGS, THEY SHALL BE SQUARE (MITERED) WITH TURNING VANES, SINGLE VANE TYPE IN LENGTHS 32" AND LESS. DOUBLE WALL IN LONGER VANES, INSTALLED AND SUPPORTED PER SMACNA. ELBOWS LESS THAN 90° SHALL BE RADIUSOD. NON-RADIUSOD ELBOWS LESS THAN 90°, WITH OR WITHOUT TURNING VANES, ARE NOT PERMITTED.

OFFSETS AND TRANSITIONS SHALL CONFORM TO SMACNA. TRANSITION ANGLES SHALL BE LIMITED TO 30 DEGREES ON CONVERGING TRANSITIONS AND 20 DEGREES ON DIVERGING TRANSITIONS.

BRANCH TAKE-OFFS, WHERE NOT DETAILED OTHERWISE, SHALL BE WITH A STATIC BOOT (45° CLINCH COLLAR) PER SMACNA. STRAIGHT TAP TAKE-OFFS ARE NOT PERMITTED.

DIVIDED FLOW BRANCHES SHALL CONFORM TO SMACNA. BULL HEAD TEES WITHOUT VANES ARE NOT PERMITTED.

MANUFACTURED DUCT CONNECTORS EQUAL TO DUCTMATE INDUSTRIES "25," "35" AND "45" MAY BE USED ON RECTANGULAR DUCTWORK EXCEPT WHERE WELDING OR BRAZING IS SPECIFICALLY REQUIRED. ADHERE STRICTLY TO MANUFACTURER'S INSTRUCTIONS. SMACNA DUCT GALLIE THICKNESS SHALL BE MAINTAINED WHEN USING THIS JOINING METHOD OR ADDITIONAL CROSS BRACING AND STIFFENERS SHALL BE UTILIZED TO PREVENT DUCT "OIL CANNING". CONNECTOR COMPONENTS SHALL BE CONSTRUCTED FROM SAME MATERIAL AS THE DUCT SECTION BEING CONNECTED.

LOW PRESSURE, ROUND, SINGLE WALL. FOLLOW SMACNA STANDARDS.

ROUND AND FLAT OVAL DUCT: SHALL BE FACTORY OR SHOP FORMED SPIRAL LOCK SEAM, UNITED MCGILL AIR PRODUCTS "UNI SEAL" OR "UNI RIB" OR EQUAL BY SEMCO, TANGENT AIR OR APPROVED EQUAL.

ACOUSTICALLY LINED ROUND AND FLAT OVAL DUCT SHALL BE DOUBLE WALL SPIRAL LOCK SEAM DUCT EQUAL TO UNITED MCGILL AIR PRODUCTS "ACOUSTIC K27" WITH SOLID-PERFORATED LINER AND MINIMUM R-3.7 FIBERGLASS INSULATION. MYLAR FILM SHALL BE INCLUDED BETWEEN INSULATION AND PERFORATED LINER. FITTINGS SHALL BE DOUBLE WALL INSULATED WITH SOLID LINER. OF CONSTRUCTION SIMILAR TO SINGLE WALL FITTINGS. DUCT SIZES LIST ON THE DRAWINGS ARE INSIDE CLEAR DIMENSIONS.

IN LIEU OF THE ABOVE, ROUND DUCT, FITTINGS AND CONNECTORS MAY BE LINDAB "SAFE" (SINGLE WALL) OR "ISOL" (DOUBLE WALL) DUCT SYSTEMS WITH FITTING ENDS FACTORY EQUIPPED WITH DOUBLE LIPPED "U" PROFILE EPDM GASKET. SPIRAL DUCTS SHALL CONFORM TO LINDAB STANDARDS AND SHALL BE CALIBRATED TO PUBLISHED DIMENSIONAL TOLERANCES OF LINDAB. INSULATION R-VALVES AND LINER TYPES SHALL BE AS SPECIFIED ABOVE.

ELBOWS AND FITTINGS FOR SPIRAL LOCK SEAM ROUND AND FLAT OVAL DUCTWORK SHALL BE FACTORY SOLID WELDED, EQUAL TO UNITED MCGILL AIR PRODUCTS "UNI SEAL" AND "ACOUST-K27" WITH BEADED SLEEVE TRANSVERSE JOINT CONNECTORS. ELBOWS SHALL BE LONG RADIUS TYPE AND, WHERE SHOWN, MITERED WITH TURNING VANES. BRANCH TAKE OFFS SHALL BE STREAMLINED CONICAL TYPE WITH T OR Y BRANCHES TO MINIMIZE PRESSURE LOSSES. OFFSETS AND TRANSITIONS SHALL CONFORM TO SMACNA. TRANSITION ANGLES SHALL BE LIMITED TO 30 DEGREES ON CONVERGING TRANSITIONS AND 20 DEGREES ON DIVERGING TRANSITIONS. DIVIDED FLOW BRANCHES SHALL CONFORM TO SMACNA. BULL HEAD TEES WITHOUT VANES ARE NOT PERMITTED.

CONSTRUCTION, RE-ENFORCING, SUPPORTS, ETC. SHALL EITHER CONFORM TO SMACNA OR TO THE DUCT MANUFACTURER'S STANDARDS, WHICHEVER IS MORE STRINGENT.

ROUND DUCT OF 1" AND LESS (POSITIVE AND NEGATIVE) STATIC PRESSURE CONSTRUCTION CLASS MAY BE LONGITUDINAL SEAM. ELBOWS FOR LONGITUDINAL SEAM ROUND DUCTWORK SHALL BE FACTORY OR SHOP FORMED SEGMENTED STANDING SEAM OR PLEATED. OTHER FITTINGS SHALL BE COMPARABLE TO THE ELBOWS.

JOINTS SHALL BE HELD IN PLACE BY THE USE OF SCREWS OR SPOT WELDING. SOCKET TYPE, OVERLAPPING JOINTS SHALL BE USED. DUCT SEALER SHALL BEAR UL LABEL EQUAL TO CHEM-CON "HARDCAST" MINERAL FIBER TAPE.

AIR DEVICE DUCT CONNECTIONS FOR ROUND DUCT BRANCH CONNECTIONS TO RECTANGULAR SHEET METAL DUCTS SHALL BE 24 GAUGE SHEET METAL, EQUAL TO FLEXMASTER SERIES FL, STRAIGHT SIDE, WITH AND WITHOUT MANUAL DAMPER, AS DESCRIBED ON THE DRAWINGS. AIR TERMINAL UNIT DUCT CONNECTIONS FOR ROUND DUCT BRANCH CONNECTIONS TO RECTANGULAR SHEET METAL DUCTS SHALL BE 24 GAUGE SHEET METAL CONICAL TYPE EQUAL TO FLEXMASTER SERIES CB. CONNECTORS INSTALLED ON INTERIOR LINED RECTANGULAR DUCT SHALL HAVE AN INTEGRAL INSULATION GUARD SLEEVE. RECTANGULAR TAP-TO-ROUND BRANCH CONNECTION WITH STATIC BOOT CONFIGURATION SHALL BE EQUAL TO FLEXMASTER TYPE STO. BUCKLEY "AIR-TITE" FITTINGS OR SIMILAR BY "SNAP RITE", EQUAL TO THE SPECIFIED FLEXMASTER FITTINGS, WITH NEOPRENE GASKET AND ADHESIVE FACING. ADDITIONALLY SECURED WITH MINIMUM FOUR SHEETMETAL SCREWS. MAY BE USED FOR AIR DEVICE DUCT TAPS TO RECTANGULAR SHEET METAL DUCT WHICH IS NOT INTERNALLY LINED.

SOLVENT BASED SEALERS ARE PROHIBITED, AS ARE DUCT SEALANTS CONTAINING ASBESTOS. DUCT SEALANT MATERIALS SHALL BE ONE OR MORE OF THE FOLLOWING (COMPATIBLE WITH THE APPLICATION):

WATER BASE DUCT SEALERS AND MASTICS EQUAL TO UNITED MCGILL, WHEN THE INSTALLATION ENVIRONMENT IS ABOVE 40°F.

ACETONE BASED DUCT SEALERS AND MASTICS, EQUAL TO PRECISION ADHESIVES, WHEN THE INSTALLATION ENVIRONMENT IS BETWEEN 0°F AND 40°F, ZERO REPORTABLE V.O.C.'S.

MINERAL IMPREGNATED FIBER TAPE WITH LIQUID SEALANT DUCT JOINT SEALER EQUAL TO THAT MANUFACTURED BY HARDCAST, INC., TWO PART II SEALING SYSTEM, MAXIMUM V.O.C. OF 135 GL.

22. AIR DISTRIBUTION DEVICES ARE SPECIFIED ON THE DRAWINGS. MANUFACTURER LISTED IS INTENDED AS A STANDARD TO SUPPLEMENT THE DEVICE DESCRIPTION. DEVICES EQUAL TO THOSE CATALOG NUMBERS, AS MANUFACTURED BY TITUS, PRICE OR KRUEGER ARE ACCEPTABLE.

23. BALANCING DAMPERS, IN ADDITION TO THOSE INCORPORATED IN AIR DISTRIBUTION DEVICES, SHALL BE SINGLE CROSS-BLADE UP TO 12" BLADE WIDTH AND MULTI-BLADE IN LARGER SIZES. DAMPERS MOUNTED IN DUCTS SHALL BE CONTROLLED BY A LOCKING QUADRANT POSITIONER WITH HANDLE. FOR DUCTS WITH EXTERIOR INSULATION, PROVIDE SUITABLE EXTENSIONS FOR POSITIONERS EQUAL TO VENTLOCK 637. MULTI-BLADE DAMPERS SHALL BE OPPOSED BLADE TYPE WITH ADEQUATE LOCKING MEANS FOR STABLE POSITIONING. FURNISH ACCESS PANELS WHERE REQUIRED FOR ACCESS TO DAMPERS.

24. FIRE DAMPERS SHALL BE PROVIDED WHERE NOTED ON THE DRAWINGS AND WHERE OTHERWISE REQUIRED TO CONFORM TO NATIONAL FIRE CODE REQUIREMENTS AND REQUIREMENTS OF THE GOVERNING AUTHORITY. CONSTRUCTION OF DAMPERS SHALL CONFORM TO NFPA 90A AND SHALL BE UL LABELED. DAMPERS SHALL BE INSTALLED IN STRICT ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND SMACNA STANDARDS, INCLUDING HEAVY GAUGE SLEEVES AND WALL FRAMES.

25. ACCESS DOORS SHALL BE PROVIDED WHERE REQUIRED FOR ACCESS TO FIRE DAMPERS OR OTHER DEVICES WITHIN DUCTS WHICH REQUIRE ACCESS. THESE SHALL BE 14" X 14" SIZE UNLESS DUCT SIZE LIMITS HEIGHT. DOORS IN UNINSULATED DUCTS SHALL HAVE HINGED DOOR, CAM LOCKS AND GASKET. DOORS IN INSULATED DUCTS SHALL BE INSULATED TYPE WITH HINGE AND CAM LOCK. WHERE FIRE DAMPER LINKS OCCUR, ACCESS DOORS SHALL HAVE A PLEXIGLASS VISION PORT.

26. LOCATE DAMPERS AND ACCESS DOORS TO BE ACCESSIBLE. DEMONSTRATE TO THE OWNER THE ACCESSIBILITY TO ALL FIRE DAMPER LINKS.

27. PREPARE SHEET METAL DRAWINGS FOR REVIEW, COORDINATE DUCT LAYOUT CAREFULLY WITH OTHER TRADES TO AVOID CONFLICT WITH STRUCTURAL ELEMENTS, LIGHTING AND PLUMBING/HEATING PIPING. HAVING DUCTWORK FABRICATED AND DELIVERED IN ADVANCE SHALL NOT BE JUSTIFICATION FOR INTERFERENCE WITH OTHER TRADES.

28. AIR TERMINAL UNITS SHALL BE PRESSURE INDEPENDENT HOT WATER REHEAT AND FULL SHUT-OFF VARIABLE AIR VOLUME UNITS WITH CONTROL DAMPER AND VELOCITY SENSORS. CONSTANT VOLUME UNITS SHALL BE SAME AS VARIABLE VOLUME UNITS EXCEPT WITH A SINGULAR SETPOINT. UNITS SHALL BE AS SPECIFIED BELOW AND SHOWN ON THE DRAWINGS.

UNIT SIZES (INLET DUCT SIZE) SHALL CONFORM TO THOSE LISTED ON THE DRAWINGS EXCEPT WHERE LARGER SIZE IS REQUIRED TO MEET NOISE OR OPERATIONAL REQUIREMENTS. RESULTANT NOISE LEVEL FROM THE CONTROL UNIT, DUCTWORK AND DIFFUSERS, AS A SYSTEM, SHALL NOT EXCEED A ROOM NC LEVEL OF 35 FROM BOTH AIRBORNE AND RADIATED NOISE, BASED ON AHRF 885 LATEST EDITION, WITH 3.0" S.P. DIFFERENTIAL ACROSS THE UNIT AT MAXIMUM CFM SETTING. ALLOWANCE FOR LINED DUCTWORK SHALL ONLY BE USED WHEN ACOUSTIC LINING IS SPECIFIED FOR DUCTWORK DOWNSTREAM OF AIR TERMINAL UNIT. WHEN THIS NOISE LEVEL CANNOT BE MET, A DOUBLEWALL SOUND ATTENUATOR, SHALL BE PROVIDED IN THE DISCHARGE DUCTWORK TO ATTAIN THE SPECIFIED NOISE LEVEL, MAXIMUM 0.05" S.P. DROP.

TERMINAL UNITS SHALL ALSO BE CERTIFIED TO COMPLY WITH AHRF STANDARD 880.

UNIT CASING SHALL BE 22 GAUGE MINIMUM GALVANIZED OR GALVANEALD SHEETMETAL WITH BEADED ROUND INLET DUCT CONNECTION. CASING SHALL BE LINED INTERNALLY WITH MINIMUM R-4.0 INSULATION, FIBER FREE OR FIBERGLASS WITH REINFORCED ALUMINUM FOIL FACING. LINING SHALL MEET UL 181 EROSION STANDARDS, NFPA 255 FIRE AND SMOKE REQUIREMENTS AND BIOLOGICAL STANDARDS OF ASTM C865. EDGES, JOINTS AND OTHER EXPOSURES SHALL BE ADDITIONALLY COATED OR PROTECTED WITH METAL EDGING. LINER SHALL BE COVERED WITH GALVANIZED SHEET METAL, MYLAR, TEDLAR OR SIMILAR FACING MATERIALS ARE NOT ACCEPTABLE. ACOUSTICAL CONSIDERATIONS MUST BE FULLY ADDRESSED.

AIRFLOW CONTROL DAMPER OR VALVE SHALL HAVE LINEAR CONTROL CHARACTERISTICS AND SHALL BE 16 GAUGE GALVANIZED STEEL OR EXTRUDED OR CAST ALUMINUM WITH GASKETING AND NYLON BEARINGS.

VELOCITY SENSOR SHALL BE MULTI-POINT AVERAGING CROSSFLOW TYPE. THE VELOCITY SENSOR SHALL BE MOUNTED IN THE INLET AIR STREAM AND SHALL AMPLIFY THE AIRFLOW SIGNAL TO PROVIDE ACCURATE CONTROL AT LOW, AS WELL AS HIGH, INLET STATIC PRESSURE CONDITIONS. REQUIRED MINIMUM STATIC PRESSURE OF THE VOLUME REGULATOR SHALL NOT EXCEED 0.25 INCH W.G. FOR PROPER OPERATION.

AIRFLOW TAPS SHALL BE PROVIDED TO ENABLE DIRECT READING OF TOTAL AND STATIC PRESSURES. A CONVERSION CHART ATTACHED TO EACH UNIT TO CONVERT PRESSURE READINGS TO AIRFLOW QUANTITIES.

CASING LEAKAGE AND DAMPER LEAKAGE SHALL EACH NOT EXCEED 2% OF MAXIMUM AIRFLOW CFM AT 3.0" S.P. DIFFERENTIAL ACROSS THE UNIT.

UNITS SHALL HAVE A SHEET METAL HOUSING TO ENCLOSE CONTROL DEVICES AND WIRING WHICH ARE MOUNTED ON THE EXTERIOR OF THE UNIT CASING.

UNITS SHALL BE MANUFACTURED BY PRICE, KRUEGER, TITUS, NALOR OR TRANE.

29. DUCT INSULATION SHALL BE MANUFACTURED BY MANVILLE, OWENS-CORNING KNAUF, OR CERTAINTED, INSTALLED BY TRAINED INSTALLERS, IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. EACH COMPOSITE INSULATION ASSEMBLY SHALL MEET NFPA 255 REQUIREMENTS, NOT EXCEEDING A FLAME SPREAD RATING OF 25, OR A SMOKE DEVELOPMENT OF 50. CONFORM TO CODE REQUIRED SEGMENTS REGARDING LABELING OF INSULATION AT REGULAR INTERVALS, STATING MANUFACTURER, FIRE AND SMOKE RATINGS AND THICKNESS.

ALL SUPPLY AIR, FRESH AIR, AND MIXED AIR DUCTS SHALL BE INSULATED UNLESS OTHERWISE INDICATED ON THE DRAWINGS.

DUCT INSULATION R-VALUE SHALL BE IN ACCORDANCE WITH ASHRAE 90.1, LATEST PUBLISHED EDITION, BUT MINIMUM R-3.7 1-1/2" THICK, 34 LB. DENSITY FLEXIBLE FIBROUS GLASS BLANKET WITH ALUMINUM VAPOR BARRIER AND KRAFT PAPER JACKET, GREENGUARD CERTIFIED.

ADHERE INSULATION ON DUCTS WITH NON-ORGANIC HOT OR COLD ADHESIVE APPLIED TO THE BOTTOM SIDE ONLY OR IMPALING PINS. JOINTS SHALL BE TAPED TO OVERLAP FOR VAPOR BARRIER. VAPOR BARRIERS SHALL BE CONTINUOUS TO PREVENT CONDENSATION.

PATCH ALL DUCT INSULATION THAT IS REMOVED FOR ALTERATION OF DUCTWORK OR DAMAGED DURING CONSTRUCTION

30. AS EACH SYSTEM IS PUT INTO OPERATION, ALL ITEMS OF EQUIPMENT INCLUDED THEREN SHALL BE ADJUSTED TO PERFECT WORKING ORDER. THIS SHALL INCLUDE BALANCING AIR AND ADJUSTING FAN SPEEDS, BELTS, PULLEYS, TIGHTENING PACKING GLANDS, OILING AND ADJUSTING ALL OPERATING EQUIPMENT.

31. VERSE THE OWNER'S REPRESENTATIVES IN ALL MATTERS PERTAINING TO THE PROPER OPERATION AND MAINTENANCE OF EQUIPMENT WHICH IS FURNISHED UNDER THIS CONTRACT. INSTALLATION, MAINTENANCE AND OPERATING INSTRUCTION PAMPHLETS, OR BROCHURES AND WARRANTIES, SHALL BE OBTAINED FROM EACH MANUFACTURER OF THE PRINCIPAL ITEMS OF EQUIPMENT, AND THESE SHALL BE TURNED OVER TO THE ARCHITECT. IN ADDITION, THE CONTRACTOR SHALL PREPARE A CHART LISTING ALL ITEMS OF EQUIPMENT WHICH ARE FURNISHED UNDER THEIR CONTRACT AND INDICATING THE NATURE OF MAINTENANCE REQUIRED, THE RECOMMENDED FREQUENCY OF CHECKING THESE POINTS AND THE TYPE OF LUBRICATING MEDIA OR REPLACEMENT MATERIAL REQUIRED. THREE (3) SET OF OPERATING AND MAINTENANCE INSTRUCTIONS AND WIRING DIAGRAMS SHALL BE FURNISHED ON EACH PIECE OF EQUIPMENT.

32. AFTER ALL EQUIPMENT HAS BEEN ADJUSTED, THE CONTRACTOR SHALL MAKE A TRIAL RUN AND DEMONSTRATE TO THE ARCHITECT AND THE OWNER THAT THE REQUIREMENTS OF THE CONTRACT HAVE BEEN FULFILLED. DURING THIS RUN, THE CONTRACTOR SHALL EXPLAIN TO THE OWNER'S REPRESENTATIVE THE COMPLETE OPERATION OF THE SYSTEM AND THE FUNCTION OF ALL MAJOR ITEMS OF EQUIPMENT. A PERIOD OF 48 HOURS OF CONTINUOUS TROUBLE-FREE OPERATION ON ALL PARTS OF THE WORK SHALL BE CONSIDERED THE MINIMUM REQUIREMENT TO DEMONSTRATE THAT THE SYSTEM IS SATISFACTORY AND MEETS FULLY THE REQUIREMENTS OF THE CONTRACT.

33. AN AIR AND WATER BALANCE SHALL BE PERFORMED BY A SEPARATE SUBCONTRACTOR SPECIALIZING IN THIS FIELD. THE BALANCE CONTRACTOR SHALL BE AN ACTIVE, FULLY CERTIFIED MEMBER OF THE ASSOCIATED AIR BALANCE COUNCIL OR N.E.B.B. SYSTEMS SHALL BALANCED TO DELIVER THE QUANTITIES INDICATED (WITHIN PLUS OR MINUS 10 PERCENT).

DUCT CONSTRUCTION, SEALING, AND INSULATION

GENERAL NOTES:
A. REFER TO SPECIFICATIONS FOR DUCT CONSTRUCTION:
SHEET METAL DUCT; INTERIOR LINING; EXTERIOR INSULATION; FIBERGLASS DUCTBOARD; ETC.
B. DUCT CONSTRUCTION AND SEALING SHALL BE PER LATEST S.M.A.C.N.A. STANDARDS.

- NOTES:
1. ROUND SHEET METAL RUN-OUTS TO AIR DEVICES MAY BE 1" S.P. CLASS.
2. REFER TO DETAIL ON SHEET M002.

DUCT SYSTEM	S.M.A.C.N.A. CLASS.				INTERNALLY LINED	EXTERNAL INSULATION	DOUBLE WALL INSULATED	NOT INSULATED	SEE NOTE
	S.P. CON-STRUCT.	SEAL CLASS	LEAKAGE CLASS						
			RECT	RND					
SUPPLY DUCTWORK UPSTREAM OF VAV BOXES	+4"	A	4	2	-	●	-	-	-
SUPPLY DUCTWORK DOWNSTREAM OF VAV BOXES	+1"	A	16	8	-	●	-	-	-
RETURN DUCTWORK	-2"	A	16	8	-	-	-	●	1
TRANSFER / RETURN AIR SOUND BOOT	-1"	A	16	-	-	-	-	●	2
EXHAUST AIR DUCTWORK	-2"	A	16	8	-	-	-	●	1

AIR DISTRIBUTION DEVICES

GENERAL NOTES:
A. ALL LAY-IN AIR DEVICES SHALL FIT IN 24"x24" LAY-IN CLG SYSTEM. VERIFY GRID TYPE AND COORDINATE AIR DEVICE COMPATIBILITY.
B. FINISH KEY: "W.B.E." - WHITE BAKER ENAMEL; "E.C.L." - ETCHED CLEAR LACQUER OR ANODIZED; "C.C.B.A." - CUSTOM COLOR SELECTED BY ARCHITECT.
C. SUPPLY AIR DIFFUSERS SHALL BE 4-WAY BLOW, UNLESS INDICATED OTHERWISE ON DRAWINGS.
D. PROVIDE AUX. FRAMES FOR AIR DEVICES IN PLASTER, GYPSUM BOARD, TILE OR OTHER HARD SURFACES.

NOTES:

MARK		DESCRIPTION	MOUNTING TYPE		MATERIAL	FINISH	SQ.-TO-RD NECK ADAPTOR	BASIS OF DESIGN		SEE NOTE
			LAY-IN	SURFACE				MANUFACTURER	MODEL	
A1		STANDARD SQ. PLAQUE CEILING DIFFUSER - ROUND NECK - 24 X 24	•		•	•		TITUS	OMNI	
J1		PERFORATED CEILING GRILLE, RETURN	•		•	•		TITUS	8F	

AIR TERMINAL UNITS - HOT WATER HEAT

GENERAL NOTES:
A. TYPES: "V.V.R." - VARIABLE VOLUME; "V.V.R." - VARIABLE VOLUME REHEAT; "C.V.R." - CONSTANT VOLUME REHEAT; "V.V.E." - VARIABLE VOLUME EXHAUST; "C.V.E." - CONSTANT VOLUME EXHAUST.
B. 0.35" MAX. S.P. DROP THRU UNIT & COIL AT MAX. CFM.
C. REHEAT COIL CAPACITIES BASED ON HEATING MAX. CFM, 55°F ENT. AIR & 140°F ENT. WATER, AND MAX. 5FT. HD. W.P.D.
D. AUTO VALVES SHALL BE 2-WAY TYPE UNLESS NOTED OTHERWISE.
E. WHEN APPLICABLE, REFER TO SPECIFICATIONS FOR SEISMIC RESTRAINT REQUIREMENTS.
F. WHEN PICV IS INDICATED, MINIMUM REQUIRED INLET PRESSURE SHALL NOT EXCEED 5 PSIG.
G. IF REHEAT COIL IS FURNISHED SEPARATELY FROM TERMINAL UNIT, PROVIDE DUCT TRANSITION AS REQUIRED BETWEEN TERMINAL UNIT AND COIL.

NOTES:
1. EXISTING VAV BOX. REBALANCE TO VALUES INDICATED.
2. NEW VAV BOX. COORDINATE BOX NUMBERING WITH FACILITIES.
3. ALTERNATE #1: REMOVE AND REPLACE VAV BOX CONTROLLER AND THERMOSTAT.
4. FIELD CONFIRM EXISTING CONTROLS. IF PNEUMATIC, REPLACE EXISTING VAV CONTROLLER, HOT WATER VALVE AND THERMOSTAT.
5. REPLACE EXISTING PNEUMATIC CONTROLS WITH DDC THERMOSTAT, CONTROLLER, AND HOT WATER VALVE/ACTUATOR.

MARK	TYPE	MINIMUM INLET SIZE		CFM			REHEAT COIL		AUTO CONTROL VALVE	SEISMIC RESTRAINTS	REFER TO NOTE
		DIAMETER	WIDTH	HEIGHT	COOLING MAXIMUM	DEAD BAND MINIMUM	HEATING MAXIMUM	MBH	GPM	PIPE RUNOUT SIZE	
15-3-1	V.V.R.	6"			345	100	175	6	0.8	0.75"	2
15-3-2	V.V.R.	12"			540	110	540	20	2.1	0.75"	1.3
15-3-3	V.V.R.	12"			540	110	540	20.6	2.1	0.75"	1.3
15-3-4	V.V.R.	10"			540	110	540	20.6	2.1	0.75"	1.3
15-3-5	V.V.R.	14"			1,345	395	675	18.4	1.9	0.75"	2
15-3-6	V.V.R.	14"			1,595	745	800	21.7	2.2	0.75"	2
15-3-7	V.V.R.	6"			300	85	150	4.1	0.5	0.75"	2
15-3-8	V.V.R.	10"			885	180	445	16.9	1.7	0.75"	1.5
15-3-9	V.V.R.	10"			790	165	395	10.8	1.1	0.75"	1.5
15-3-10	V.V.R.	10"			50	10	25	0.7	0.1	0.75"	1.5
16-3-12	V.V.R.	9"			250	50	250	9.5	1.0	0.75"	1.3
16-3-13	V.V.R.	10"			360	75	360	13.7	1.4	0.75"	1.3
16-3-14	V.V.R.	8"			180	40	180	6.9	0.7	0.75"	1.5
16-3-15	V.V.R.	8"			540	110	540	20.6	2.1	0.75"	1.5
16-3-16	V.V.R.	10"			360	75	360	13.7	1.4	0.75"	1.5
16-3-17	V.V.R.	8"			360	75	360	13.7	1.4	0.75"	1.5
16-3-18	V.V.R.	8"			180	40	180	6.9	0.7	0.75"	1.5
16-3-21	V.V.R.	6"			315	280	280	7.6	0.8	0.75"	2
16-3-22	V.V.R.	6"			300	60	150	4.1	0.5	0.75"	2
16-3-23	V.V.R.	6"			300	60	150	4.1	0.5	0.75"	2
16-3-24	V.V.R.	6"			285	85	145	4	0.4	0.75"	2
40-3-1	V.V.R.	10"			150	30	75	2.1	0.3	0.75"	1.4
40-3-27	V.V.R.	8"			360	75	360	11.9	1.2	0.75"	1.4



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