# MECHANICAL SPECIFICATION CONTINUED

3.03 CLOSED SYSTEM TREATMENT

A. PROVIDE ONE SHOT FEEDER ON EACH SYSTEM. INSTALL ISOLATING AND DRAIN VALVES AND INTERCONNECTING PIPING. INSTALL AROUND BALANCING VALVE DOWNSTREAM OF CIRCULATING PUMPS AS INDICATED ON DRAWINGS.
B. INTRODUCE CLOSED SYSTEM TREATMENT THROUGH SHOT FEEDER WHEN REQUIRED OR INDICATED BY TEST.
C. INSTALL 3/4 INCH WATER COUPON RACK AROUND CIRCULATING PUMPS WITH SPACE FOR 12 TEST SPECIMENS.

## SECTION 23 30 00

## HVAC AIR DISTRIBUTION:

1.0 GENERAL

1.01 SCOPE: PROVIDE ALL AIR DISTRIBUTION DEVICES AS INDICATED ON THE DRAWINGS AND AS SPECIFIED HEREIN FOR A COMPLETE AND OPERABLE SYSTEM.

1.02 RELATION TO OTHER WORK: COORDINATE WITH WORK OF THE CEILING, DRYWALL, AND PLASTERING TRADES AS REQUIRED TO INSURE AN ORDERLY PROGRESSION OF WORK AND A FIRST CLASS FINISHED SYSTEM WITH RESPECT TO PLACEMENT, ALIGNMENT, FINISH, GENERAL FIT, AND ABSENCE OF CONFLICT WITH LIGHTING SYSTEMS AND FIRE PROTECTION SYSTEMS.

1.03 DESIGN CONDITIONS:

A. ACOUSTICAL: NOISE PRODUCED AT EACH DIFFUSER, REGISTER, GRILLE, OR OTHER AIR DISTRIBUTION DEVICE SHALL NOT EXCEED A NOISE CRITERIA LEVEL OF 25 NC.

B. PRESSURE DROP ACROSS ANY AIR DISTRIBUTION DEVICE SHALL NOT EXCEED 0.10 IN W.G. STATIC.

C. GUARANTEE: AIR DISTRIBUTION EQUIPMENT SHALL BE GUARANTEED BY THE MANUFACTURER TO OPERATE WITHOUT EXCESSIVE NOISE AND WITH VELOCITIES IN THE FIVE FOOT OCCUPANCY ZONE, WHEN HANDLING AIR WITH TEMPERATURE DIFFERENTIALS AS HIGH AS 25 DEGREES, NOT TO EXCEED 30 FPM AT 2 DEGREE DIFFERENCE, 50 FPM AT 1–1/2 DEGREE DIFFERENCE, OR 75 FPM AT A 1 DEGREE DIFFERENCE WHEN OPERATING WITH AN AVERAGE 75 DEGREE ROOM TEMPERATURE AND MEASURED NO CLOSER THAN 6 INCHES FROM A WALL SURFACE.

1.04 MANUFACTURER: TITUS, PRICE, METAL AIRE, OR OTHER APPROVED PRIOR TO BID. MANUFACTURERS STYLE AND SERIES NUMBERS INDICATED ARE EXAMPLES OF PRODUCTS TO BE PROVIDED.

1.05 APPEARANCE: EACH AIR DISTRIBUTION DEVICE WHICH HAS A PORTION THEREOF (FRAME, CORE, ETC.) EXPOSED TO VIEW IN THE FINISHED AREA SHALL HAVE A FACTORY APPLIED FINISH WHICH MATCHES AND IS COMPATIBLE WITH THE COLOR OF THE SURROUNDING SURFACE ON WHICH THE DEVICE IS INSTALLED. COLORS MUST BE APPROVED BY ARCHITECT PRIOR TO DEVICE FABRICATION.

2.0 PRODUCTS

2.01 CEILING & WALL MOUNTED CONDITIONED AIR SUPPLY DIFFUSERS, RETURN AIR AND EXHAUST AIR REGISTERS.

A. DESIGNATED ON DRAWINGS BY THE MANNER OF INDICATED SYSTEM FUNCTION FOR THE DEVICE.

B. SPONGE RUBBER GASKETS.

C. ALUMINUM OR STEEL, AS SPECIFIED.

D. COMPANION ADJUSTABLE VOLUME DAMPERS.

E. PROVIDED WITH INSULATED BACKS.

3.0 EXECUTION

3.01 GENERAL:

A. INSTALL NEATLY WHERE INDICATED IN ACCORD WITH MANUFACTURER'S RECOMMENDATIONS AND IN ACCORD WITH SMACNA RECOMMENDATIONS AND AS OTHERWISE INDICATED.

B. PROPERLY TEST, BALANCE AND ADJUST TO PRODUCE QUIET, DRAFTLESS OPERATING TO BEST DEGREE POSSIBLE.

3.02 SQUARE AIR DEVICES: WHERE DIFFUSERS ARE IN LAY–IN TYPE, THEY SHALL BE SUPPORTED BY THE INVERTED T–BAR SUSPENSION SYSTEM, BUT ALL DUCTS CONNECTED THERETO SHALL BE SUPPORTED INDEPENDENTLY OF THE CEILING AS SPECIFIED UNDER SECTION ENTITLED "DUCTWORK". SURFACE MOUNTED DIFFUSERS SHALL BE SUPPORTED BY THE DUCT RUNOUTS OR DROPS WHERE SHEET METAL DUCTS ARE INDICATED AND BY SEPARATE HANGERS WHERE FLEX RUNOUTS ARE INDICATED. ALL RECTANGULAR CEILING DIFFUSERS SHALL BE INSTALLED WITH THEIR LINES PARALLEL AND PERPENDICULAR TO THE BUILDING LINE AND PROPERLY ALIGNED WITH CEILING.

## SECTION 23 31 00

## HVAC DUCTS AND CASINGS:

1.0 GENERAL

1.01 SCOPE: PROVIDE COMPLETE DUCT SYSTEMS AS INDICATED. SYSTEMS SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING: OUTSIDE AIR, EXHAUST AIR, AND AIR CONDITIONING SUPPLY AND RETURN AIR DUCT SYSTEMS AS SHOWN ON DRAWINGS. DRAWING SCALES PROHIBIT THE INDICATION OF ALL OFFSETS, FITTINGS, AND LIKE ITEMS; HOWEVER, THESE ITEMS SHALL BE INSTALLED AS REQUIRED FOR THE ACTUAL PROJECT CONDITIONS AT NO CHANGE IN CONTRACT PRICE.

A. ITEMS INCLUDED: THIS SECTION GENERALLY INCLUDES, BUT IS NOT LIMITED TO, THE FOLLOWING MAJOR ITEMS:

1. SHEET METAL DUCTWORK.

2. DUCT SYSTEM ACCESSORIES.

A. FLEXIBLE DUCT CONNECTIONS.

B. TURNING VANES.

C. MANUAL VOLUME DAMPERS.

D. ACCESS DOORS.

1.02 SHOP DRAWINGS: REFER TO SECTION ENTITLED "COMMON REQUIREMENTS FOR MECHANICAL WORK". INCLUDE COMPLETE DATA FOR: FLEXIBLE DUCT, FLEXIBLE CONNECTORS, TURNING VANES, MANUAL VOLUME DAMPERS, ACCESS DOORS; FLEXIBLE CONNECTORS; MANUAL VOLUME DAMPERS AND ADHESIVES.

1.03 DEFINITIONS:

A. "SMACNA" MEANS "SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC."

B. LOW PRESSURE DUCTWORK: ANY AND ALL DUCTWORK CONVEYING AIR OR OTHER GASES AT VELOCITIES LESS THAN 2000 FPM AND STATIC PRESSURE LESS THAN 2.0 INCHES W.G. THE DUCTWORK MAY ALSO BE REFERRED TO IN THESE SPECIFICATIONS AS "LOW VELOCITY DUCTWORK". SMACNA "HVAC DUCT CONSTRUCTION STANDARDS, METAL AND FLEXIBLE," THIRD EDITION, 2005, SHALL GOVERN CONSTRUCTION OF THIS DUCTWORK UNLESS OTHERWISE SPECIFIED; CONSTRUCT DUCT IN ACCORD THEREWITH.

2.0 PRODUCTS

2.01 LOW PRESSURE SHEET METAL DUCTWORK: SYSTEMS OPERATING AT TWO INCHES OF WATER STATIC PRESSURE OR LESS, SHALL, UNLESS SPECIFICALLY SPECIFIED OTHERWISE, CONFORM TO THE FOLLOWING REQUIREMENTS:

A. MATERIAL: PRIME QUALITY FORTY–EIGHT INCH WIDE, TIGHT COAT GALVANIZED STEEL CONFORMING TO THE REQUIREMENTS OF ASTM A–526.

B. REINFORCING, CROSS BREAKING, SEAMS, JOINTS: BE IN ACCORDANCE WITH LATEST SMACNA CONSTRUCTION STANDARD FOR LOW PRESSURE SHEET METAL DUCT.

2.02 LOW PRESSURE ROUND DUCTWORK: DUCT SHALL BE MADE USING GALVANIZED STEEL AS PER ASTM A–527 G–90 WITH LONGITUDINAL SNAP–LOCK.

2.03 INSULATED FLEXIBLE DUCTS: FLEXIBLE DUCT SHALL CONSIST OF SPIRAL WOUND HELIX COIL WITH TRILAMINATE INNER FABRIC. CORE SHALL BE COVERED WITH FACTORY APPLIED ONE INCH, ONE POUND PER CUBIC FOOT FIBERGLASS INSULATION OF 0.23 THERMAL CONDUCTANCE SHEATHED IN A SEAMLESS EXTERIOR CLASS 1 VAPOR BARRIER JACKET REINFORCED ALUMINUM FOIL METALIZED JACKET. CONNECTIONS SHALL BE MADE USING QUADRANT DAMPERED TWIST_IN TYPE FITTINGS WITH EXTRACTOR SCOOPS AND VOLUME DAMPER. DUCT SHALL BE NFPA 90A, CLASS 1 (UL 181). FLAME SPREAD LESS THAN 25 AND SMOKE DEVELOPED LESS THAN 50. PROVIDE IN FACTORY FINISHED LENGTHS NOT IN EXCESS OF 6'–0" TO MAKE SUITABLE CONNECTIONS WITH MINIMUM PRESSURE DROP WITH "SPIN–IN" FITTING WITH INTEGRAL DAMPER AT CONNECTION TO MAIN DUCT BRANCH.

2.04 KITCHEN HOOD EXHAUST DUCT: 16 GAUGE CARBON STEEL WITH CONTINUOUS LIQUID TIGHT EXTERNALLY WELDED SEAMS AND JOINTS.

2.05 DUCT SYSTEM ACCESSORIES:

A. GENERAL:

1. PROVIDE ALL NECESSARY DUCT SYSTEM ACCESSORIES TO ASSURE PROPER BALANCE, QUIET AND DRAFTLESS DISTRIBUTION AND CONVEYANCE, AND MINIMIZATION OF TURBULENCE, NOISE AND PRESSURE DROP FOR ALL SUPPLY, RETURN, EXHAUST, AND VENTILATION AIR QUANTITIES INDICATED.

B. FLEXIBLE DUCT CONNECTIONS:

1. PROVIDED WHERE AIR HANDLERS, FANS AND BLOWERS CONNECT TO DUCTWORK WHEN NOT INTERNALLY ISOLATED.

2. AT LEAST 4 INCHES LONG.

3. CONNECTED ON EACH SIDE TO METAL (METAL DUCTWORK, AIR HANDLING APPARATUS, OR HEAVY GAUGE STEEL SLEEVES).

4. FOR USE IN LOW PRESSURE DUCT SYSTEMS.

C. LOW PRESSURE METAL TURNING VANES: PROVIDE IN ALL ELBOWS, BENDS AND TEES OF ALL LOW VELOCITY SUPPLY AIR DUCTS WHETHER OR NOT SHOWN IN DETAIL; PROVIDE IN ALL ELBOWS, BENDS AND TEES OF ALL OTHER LOW VELOCITY DUCTS WHERE PORTIONS OF SUCH DUCTS CONVEY AIR AT GREATER THAN 700 FPM AVERAGE VELOCITY. ADEQUATE RIGIDITY AND STRENGTH TO BE COMPLETE FLUTTER–PROOF; PROPERLY DESIGNED; PERMANENTLY FIXED TYPE. ALUMINUM, STEEL WITH CORROSION RESISTANT COATING, OR GALVANIZED STEEL. AIR FOIL TYPE IN ALL MITERED ELBOWS, MITERED BENDS AND MITERED TEES. AIR FOIL TYPE MUST BE MANUFACTURED BY TITUS, TUTTLE & BAILEY, ANEMOSTAT, WATERLOO, METAL–AIRE, BARBER–COLMAN, "AIRTURNS", TUTTLE & BAILEY "DUCTURNS", OR DURA–DYNE "VR" WITH 24 GAUGE RAILS AND HOLLOW VANES.

D. MANUAL VOLUME DAMPERS: (OTHER THAN THOSE SPECIFIED AS BEING INTEGRAL WITH EACH REGISTER, DIFFUSER AND OTHER AIR OUTLET OR INLET):

1. PROVIDE WHERE INDICATED IN THE COMPLETE AIR DISTRIBUTION SYSTEM(S) (INCLUDING DUCTWORK, RETURN AIR PLENUMS, ETC.) TO ALLOW COMPLETE BALANCING OF THE AIR SUPPLY, RETURN, VENTILATION AND EXHAUST SYSTEM(S).

2. OPPOSED BLADE TYPE.

3. AN 8" MAXIMUM BLADE WIDTH.

4. MADE OF GALVANIZED STEEL OR STEEL WITH A SPRAYED OR DIPPED ALUMINUM RUST RESISTANT FINISH; FLUTTER–PROOF.

5. PROVIDED SO THAT ALL DAMPER ADJUSTMENTS CAN BE MADE FROM OUTSIDE THE COMPLETED DUCTWORK WITHOUT NECESSITY FOR PUNCTURING OR OTHERWISE PENETRATING DUCTWORK AND/OR ITS VAPOR BARRIER.

6. FULLY ADJUSTABLE AND WITH LOCKING DEVICE.

7. PROVIDED AT A POINT IN THE DUCTWORK WHICH IS A SUFFICIENT DISTANCE UPSTREAM FROM AN OUTLET (OR DOWNSTREAM FROM AN INLET) TO ATTENUATE OBJECTIONABLE NOISE DUE TO DAMPER THROTTLING AND TO PRECLUDE ADVERSE AFFECTS ON THE DISTRIBUTION CHARACTERISTICS (THROW, DROP, PATTERN, ETC.) OF THE AIR DISTRIBUTION DEVICE.

E. LOW PRESSURE DUCT ACCESS DOORS:

1. PROVIDED FOR: FIRE DAMPER AND WHERE ACCESS IS OTHERWISE SPECIFIED.

2. FACTORY PREFABRICATED DOUBLE WALL INSULATED TYPE OF 22 GAUGE GALVANIZED STEEL (OF SAME OR THICKER GAUGE THAN DUCTWORK PANEL IN WHICH INSTALLED, WHICHEVER IS GREATER).

3. MINIMUM SIZE SHALL BE AS SMALL AS IS COMPATIBLE WITH DOOR SIZE

4. DOORS SHALL BE PROVIDED WITH HAND OPERATED ADJUSTABLE TENSION CATCHES AND SHALL BE COMPLETELY GASKETED AROUND THEIR PERIMETERS. DOORS SHALL BE VENTLOCK 226 ACCESS DOORS, INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS USING VENTLOCK 1360 SEALANT.

3.0 EXECUTION

3.01 GENERAL:

A. CONSTRUCT ALL DUCTWORK AND ACCESSORIES IN ACCORDANCE WITH THE LATEST INDICATED EDITIONS OF APPLICABLE SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION CONSTRUCTION STANDARDS.

B. STREAMLINE ALL DUCTWORK TO THE FULL EXTENT PRACTICAL AND EQUIP WITH PROPER AND ADEQUATE DEVICES TO ASSURE PROPER BALANCE AND QUIET DRAFT LESS DISTRIBUTION OF INDICATED AIR QUANTITIES.

C. PROTECT ALL DUCTWORK AND SYSTEM ACCESSORIES FROM DAMAGE DURING CONSTRUCTION UNTIL ARCHITECT'S FINAL ACCEPTANCE OF PROJECT.

D. PRIOR TO DUCTWORK FABRICATION, VERIFY IF ALL DUCTWORK AS DIMENSIONED AND GENERALLY SHOWN WILL SATISFACTORILY FIT ALLOCATED SPACES. TAKE PRECAUTIONS TO AVOID SPACE INTERFERENCES WITH BEAMS, COLUMNS, JOISTS, PIPES, LIGHTS, CONDUIT, OTHER DUCTS, EQUIPMENT, ETC. NOTIFY ARCHITECT IF ANY SPATIAL CONFLICTS EXIST, AND THEN OBTAIN ARCHITECT'S APPROVAL OF NECESSARY ROUTING. MAKE ANY SUCH NECESSARY REVISIONS WHICH ARE MINOR AT NO ADDITIONAL COST.

E. CAREFULLY CORRELATE ALL DUCT CONNECTIONS TO AIR HANDLING UNITS AND FANS TO PROVIDE PROPER CONNECTIONS, ELBOWS AND BENDS WHICH MINIMIZE NOISE AND PRESSURE DROP.

F. PROPERLY SUSPEND ALL DUCTWORK SO THAT NO OBJECTIONABLE CONDITIONS RESULT (SUCH AS VIBRATION, SAGGING, ETC.).

G. INSTALL HORIZONTAL RIGID DUCTWORK AS HIGH AS PRACTICAL ABOVE SUSPENDED CEILINGS SO THAT MOVABLE LIGHT FIXTURES MAY BE RELOCATED WITHOUT INTERFERENCE TO MEET ANY FUTURE PARTITION RELOCATION REQUIREMENTS.

H. INSTALL ALL FLEXIBLE ROUND DUCTS WITHOUT KINKS OR SIMILAR OBSTRUCTIONS SO THAT PRESSURE DROP IS MINIMIZED. CUT AND REMOVE EXCESS LENGTHS AS NECESSARY.

3.02 HANGERS AND SUPPORTS:

A. GENERAL: COMPLY WITH LATEST APPLICABLE SMACNA CONSTRUCTION STANDARDS.

B. SUPPORTS: VERTICAL RISERS AND OTHER DUCT RUNS WHERE THE METHOD OF SUPPORT SPECIFIED ABOVE IS NOT APPLICABLE SHALL BE SUPPORTED BY SUBSTANTIAL ANGLE BRACKETS DESIGNED TO MEET FIELD CONDITIONS AND INSTALLED TO ALLOW FOR DUCT EXPANSION.

C. FASTENERS: SECURE HANGERS TO STEEL BEAMS OR METAL DECK WITH BEAM CLAMPS TO DROP THROUGH CONNECTIONS FROM METAL OR CONCRETE DECK. REFER TO THE REQUIREMENTS OF THE SECTION ENTITLED "COMMON REQUIREMENTS FOR MECHANICAL WORK".

3.03 INSULATED DUCT: WHERE DUCTS WILL BE INSULATED, MAKE PROVISION FOR NEAT INSULATION FINISH AROUND DAMPER OPERATING QUADRANTS, SPLITTER ADJUSTMENT CLAMPS, ACCESS DOORS, AND SIMILAR OPERATING DEVICES. A METAL COLLAR EQUIVALENT IN DEPTH TO INSULATION THICKNESS AND OF SUITABLE SIZE TO WHICH INSULATION MAY BE FINISHED SHALL BE MOUNTED ON DUCT.

3.03 OTHER REQUIREMENTS:

A. IF DUCTWORK MATERIALS ARE INSTALLED WHICH DO NOT MEET THESE SPECIFICATIONS, CONTRACTOR SHALL REMOVE SUCH DUCTWORK MATERIALS AND REPLACE THEM WITH THE SPECIFIED MATERIALS. ANY DELAY IN JOB PROGRESS WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.

## SECTION 23 34 00

## HVAC FANS:

1.01 CEILING MOUNTED CABINET EXHAUST FANS:

A. MANUFACTURERS: GREENHECK CORP., LOREN COOK COMPANY, PENN VENTILATION OR OTHER APPROVED PRIOR TO BID.

B. CENTRIFUGAL FAN UNIT: DIRECT DRIVEN WITH INJECTION MOLDED RESIN GALVANIZED STEEL HOUSING LINED WITH 1/2 INCH ACOUSTIC INSULATION, RESILIENT MOUNTED MOTOR, GRAVITY BACKDRAFT DAMPER IN DISCHARGE OPENING, INTEGRAL OUTLET DUCT COLLAR. DISCHARGE POSITION CONVERTIBLE BY MOVING INTERCHANGEABLE PANELS.

1. DISCONNECT SWITCH: CORD AND PLUG IN HOUSING FAN MOUNTED TOGGLE SWITCH FOR THERMAL OVERLOAD PROTECTED MOTOR.

2. GRILLE: MOLDED WHITE PLASTIC ALUMINUM WITH BAKED WHITE ENAMEL FINISH PAINTED STEEL.

3. WHEEL: DWDI CENTRIFUGAL FORWARD CURVED TYPE CONSTRUCTED OF INJECTION MOLDED OR POLYPROPYLENE RESIN.

4. MOTOR: OPEN DRIP PROOF TYPE WITH PERMANENTLY LUBRICATED SEALED BEARINGS AND THERMAL OVERLOAD PROTECTION.

2.01 CENTRIFUGAL ROOF EXHAUST FANS:

A. MANUFACTURERS: GREENHECK CORP., LOREN COOK COMPANY, PENN VENTILATION OR APPROVED EQUAL.

B. DESCRIPTION

1. HOUSING: REMOVABLE SPUN ALUMINUM FAN STANDARD WITH STAINLESS STEEL HARDWARE.ALUMINUM CURB CAP AND BIRDBAND WITH ALUMINUM BIRDSCREEN.

2. DISCONNECT SWITCH: NEMA 1 SWITCH FACTORY MOUNTED WITHIN THE MOTOR COMPARTMENT AND ACCESSIBLE THRU THE REMOVABLE FAN HOOD.

3. WHEEL: CENTRIFUGAL BACKWARD INCLINED CONSTRUCTED OF ALUMINUM. WHEEL SHALL BE STATICALLY AND DYNAMICALLY BALANCED.

4. MOTOR: OPEN DRIP PROOF TYPE WITH PERMANENTLY LUBRICATED SEALED BEARINGS AND THERMAL OVERLOAD PROTECTION.

C. ROOF CURBS

1. CONTRACTOR SHALL PROVIDE FACTORY SUPPLIED ROOF CURB, 16 GAUGE CONSTRUCTION MADE OF ZINC COATED STEEL WITH SUPPLY AND RETURN AIR GASKETING AND WATER SEALER STRIPS. SHIP KNOCKED DOWN AND PROVIDED WITH INSTRUCTIONS FOR EASY ASSEMBLY.

2. CURB SHALL BE MANUFACTURED IN ACCORDANCE WITH THE NATIONAL ROOFING CONTRACTORS ASSOCIATION GUIDELINES.

## SECTION 23 36 00

## AIR TERMINAL UNITS:

1.0 GENERAL

1.01 SCOPE: PROVIDE TERMINAL UNITS WHERE INDICATED ON DRAWINGS. UNIT CAPACITY AND OPERATING CONDITIONS SHALL BE AS SCHEDULED ON THE DRAWINGS.

1.03 MANUFACTURER: BASIS OF DESIGN IS CARRIER, ACCEPTABLE MANUFACTURER'S ARE ENVIRO–TEC, TITUS, AND PRICE OR OTHER APPROVED PRIOR TO BID.

1.04 NOISE CRITERIA: UNLESS OTHERWISE INDICATED ON DRAWINGS, THE MAXIMUM ALLOWABLE NC LEVEL IN ANY OCCUPIED SPACE (UNLESS OTHERWISE INDICATED) SHALL NOT EXCEED NC–30 AS A RESULT OF RADIATED OR DISCHARGED NOISE FROM ANY TERMINAL UNIT.

2.0 PRODUCTS

2.01 FRAME: COMPLETELY FACTORY ASSEMBLED.

2.02 CASING: CASING SHALL BE NOT LESS THAN 22 GAUGE GALVANIZED STEEL INTERNALLY INSULATED WITH FIBERGLASS MEETING REQUIREMENTS OF NFPA 90A.

2.03 FANS: DOUBLE WIDTH DOUBLE INLET FORWARD CURVED BLADE TYPE STATICALLY AND DYNAMICALLY BALANCED. FANS SHALL BE OF THE DIRECT DRIVE TYPE WITH PERMANENTLY LUBRICATED SPLIT CAPACITOR TYPE MOTOR SUITABLE FOR THE POWER SUPPLY SCHEDULED. FAN ASSEMBLY SHALL BE INTERNALLY ISOLATED USING RUBBER IN SHEAR ISOLATORS.

A. FAN PORTION OF THE ASSEMBLY SHALL BE CONFIGURED TO OPERATE IN A PARALLEL AIRFLOW MADE WITH THE PRIMARY AIR VOLUME DAMPER. FAN PORTION SHALL NOT BE IN SERIES WITH THE PRIMARY COLD AIR INLET VOLUME DAMPER DEVICE.

2.04 VOLUME DAMPER: SHALL BE A PRESSURE INDEPENDENT, VARIABLE CONSTANT VOLUME CONTROL DEVICE.

2.05 CONTROL REQUIREMENT:

A. FAN TERMINAL UNITS MUST BE INDEPENDENT OF INLET PRESSURE FLUCTUATION IN THE MAIN OR BRANCH DUCT SYSTEM. UNITS MUST HAVE CONTROLS WHICH ARE FACTORY INSTALLED, FACTORY CALIBRATED AND FACTORY TESTED TO BE PRESSURE–INDEPENDENT.

1. UNITS SHALL MAINTAIN CONSTANT DISCHARGE FLOW FOR ANY GIVEN SETPOINT WITH ANY VARIATION IN INLET STATIC PRESSURE BETWEEN 0.2 INCH W.G. AND 6.0 INCH W.G.

2. ALL FAN TERMINAL UNITS MUST BE FACTORY SET FOR DESIGN AIR FLOWS.

3. THE MAXIMUM AIR PRESSURE DROP ACROSS THE FAN TERMINAL UNIT AT MAXIMUM DESIGN COOLING AIR FLOW AND AT WHICH THE UNIT WILL OPERATE UNDER PROPER CONTROL SHALL NOT EXCEED STATIC PRESSURES AS INDICATED ON DRAWINGS.

B. UNIT MUST HAVE CAPABILITY FOR EASY FIELD ADJUSTMENT OF MAXIMUM AND MINIMUM AIR QUANTITIES BY RESETTING OF CONTROLLER ON TERMINAL UNIT.

C. DISCHARGE VOLUME SETTING CONTROLLED THROUGHOUT INDICATED VARIABLE OPERATING RANGE BY OPERATION UNDER THERMOSTATIC CONTROL.

D. DIRECT DIGITAL CONTROLLER FOR THE TERMINAL UNIT SHALL BE PROVIDED BY THE BUILDING CONTROLS MANUFACTURER.

E. CONTROLS MUST BE COMPLETELY COMPATIBLE IN ALL RESPECTS WITH THE RELATED COMPONENTS OF THE BUILDING TEMPERATURE CONTROL SYSTEM.

2.06 OPERATING SEQUENCE: TERMINAL UNITS SHALL HAVE ALL NECESSARY CONTROLS AND ACCESSORIES TO OPERATE AS FOLLOWS: TU SHALL FUNCTION AS A SINGLE INLET VAV TERMINAL UNIT SUCH THAT AT MAXIMUM COOLING DEMAND, TU PASSES MAXIMUM COLD AIR. AS COOLING DEMAND DECREASES, TU WILL THROTTLE DOWN DISCHARGE AIR TO SPACE IN RESPONSE TO ROOM THERMOSTAT UNTIL IT REACHES A PRESET MINIMUM. AS DEMAND FOR HEATING TAKES OVER IN RESPONSE TO THERMOSTAT SIGNAL, ELECTRIC HEATING COIL SHALL BE ACTUATED TO HEAT THE AIR BEING CONVEYED BY THE TU.

2.07 ACCESS: A GASKETED ACCESS PANEL SHALL BE PROVIDED IN THE UNIT CASING TO ALLOW REMOVAL OF THE FAN DRIVE MOTOR FOR SERVICE.

2.08 ELECTRIC HEATING COIL: EACH FAN TERMINAL UNIT SHALL BE PROVIDED WITH AN INTEGRAL, FACTORY MOUNTED ELECTRIC HEATING COIL. HEATING COIL SHALL HAVE ALL OPERATING CHARACTERISTICS AND INSULATION COMPLETELY COORDINATED TO FUNCTION SATISFACTORY AS AN INTEGRAL PART OF THE FAN TERMINAL UNIT.

A. OTHER REQUIREMENTS:

1. MEET ALL APPLICABLE REQUIREMENTS OF THE CURRENT NEC.

2. UL LISTED INCLUDING ALL BUILT–IN COMPONENTS.

3. COORDINATED WITH THE SPECIFIED REQUIREMENTS OF THE MECHANICAL SYSTEM CONTROL SYSTEM.

B. MATERIALS:

1. OPEN COIL TYPE.

2. WELL FINE BREAK MERCURY CONTACTORS WHICH WILL BREAK ALL UNGROUNDED CONDUCTORS (NOTE HORIZONTAL, VERTICAL OR OBLIQUE POSITION OF EACH HEATER ASSEMBLY AS SHOWN ON DRAWINGS).

3. TRANSFORMER WITH PRIMARY FUSING IF CONTROL VOLTAGE IS DIFFERENT FROM SUPPLY VOLTAGE.

4. OVERCURRENT PROTECTION IN ACCORD WITH NEC REQUIREMENTS.

5. CONTROL TERMINALS AND POWER TERMINALS.

6. BUILT–IN OR REMOTE PRESSURE TYPE AIR FLOW SWITCH. INSTALL IN SERIES WITH AUTOMATIC RESET THERMAL CUTOUT.

C. WIRING DIAGRAMS: PROVIDE COMPLETE CONTROL WIRING DIAGRAMS FURNISHED BY THE HEATING COIL MANUFACTURER TO THE MECHANICAL SYSTEMS CONTROL MANUFACTURER AND THE ELECTRICAL CONTRACTOR. THIS WIRING DIAGRAM SHALL COMPLETELY INDICATE IN FULL DETAIL ALL ELECTRICAL AND CONTROL WIRING REQUIREMENTS, TERMINAL, ETC. NECESSARY TO ALLOW THE CONTROL MANUFACTURER AND ELECTRICAL CONTRACTOR TO COMPLETELY COORDINATE THEIR RESPECTIVE WIRING PORTIONS OF THE TERMINAL UNIT SYSTEM INSTALLATION.

3.0 EXECUTION

3.01 UNIT LOCATION: UNIT LOCATION SHALL ESSENTIALLY BE AS SHOWN ON THE DRAWINGS; HOWEVER, ACTUAL PLACEMENT OF THE UNIT SHALL BE VERIFIED USING FIELD MEASUREMENTS AND DATA RELATING TO THE EQUIPMENT APPROVED FOR ACTUAL INSTALLATION ON THIS PROJECT. COORDINATE LOCATION WITH ALL DUCTS, BEAMS, JOISTS, CONDUIT, LIGHTS, PIPING, AIR DISTRIBUTION DEVICES AND OTHER ITEMS IN IMMEDIATE VICINITY OF INDICATED LOCATIONS. MAKE MINOR ADJUSTMENTS IN EXACT LOCATIONS SHOWN TO BEST FIT AVAILABLE SPACE.

3.02 ADDITIONAL INSTALLATION REQUIREMENTS:

A. LOCATE BOXES SO THAT ACCESS FOR REPAIR, MAINTENANCE AND ADJUSTMENT IS EASILY FACILITATED WITHOUT REMOVAL OF OTHER PERMANENTLY LOCATED ITEMS WHICH ARE IN THE IMMEDIATE VICINITY OF BOXES (THIS EXCLUDES REMOVABLE CEILING PANELS, REMOVABLE AIR DISTRIBUTION DEVICES ATTACHED TO FLEXIBLE DUCTWORK AND OTHER SIMILAR ITEMS).

B. NO TERMINAL UNIT OUTLET SHALL BE NEARER THAN 60 INCHES FROM THE FIRST FLEXIBLE DUCT CONNECTION TAKE–OFF TO THE FIRST DOWNSTREAM AIR DISTRIBUTION DEVICE.

## SECTION 23 64 11

## PACKAGED WATER CHILLERS–RECIPROCATING, SCROLL, AND SCREW:

1.0 GENERAL

1.01 SUMMARY

A. SECTION INCLUDES DESIGN, PERFORMANCE CRITERIA, REFRIGERANTS, CONTROLS, AND INSTALLATION REQUIREMENTS FOR AIR–COOLED ROTARY SCREW PACKAGED CHILLERS

B. COMPLY WITH APPLICABLE STANDARDS/CODES OF ARI 550/590, ANSI/ASHRAE 15, ASHRAE 90.1 AND ASME SECTION VIII DIV 1.

1.03 SUBMITTALS

A. SUBMIT SHOP DRAWINGS AND PRODUCT DATA IN ACCORDANCE WITH SPECIFICATION REQUIREMENTS

B. SUBMITTALS SHALL INCLUDE THE FOLLOWING:

1. DIMENSIONED PLAN AND ELEVATION VIEW DRAWINGS, REQUIRED CLEARANCES, AND LOCATION OF ALL FIELD CONNECTIONS.

2. SUMMARY OF ALL AUXILIARY UTILITY REQUIREMENTS SUCH AS ELECTRICITY, WATER, COMPRESSED AIR, ETC. SUMMARY SHALL INDICATE QUALITY AND QUANTITY OF EACH REQUIRED UTILITY.

3. SINGLE LINE SCHEMATIC DRAWING OF THE POWER FIELD HOOKUP REQUIREMENTS, INDICATING ALL ITEMS THAT ARE FURNISHED.

4. SCHEMATIC DIAGRAM OF CONTROL SYSTEM INDICATING POINTS FOR FIELD CONNECTION. DIAGRAM SHALL FULLY DELINEATE FIELD AND FACTORY WIRING.

5. CERTIFICATION OF FACTORY RUN TEST OF CHILLER UNIT SIGNED BY COMPANY OFFICER.

6. INSTALLATION MANUALS.


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