

- NEMA 1: INDOOR APPLICATION NO WATER, FACTORY STANDARD.
  - POSITIVE ELECTRICAL SHUT-OFF
  - WIRED FROM FAN MOTOR TO JUNCTION BOX INSTALLED WITHIN MOTOR COMPARTMENT
- VIII. DUCT COLLARS:
- SQUARE DUCT MOUNTING COLLAR
  - INLET AND DISCHARGE COLLARS PROVIDE EASY SLIP FIT DUCT CONNECTION
  - SQUARE DESIGN TO PROVIDE A LARGE DISCHARGE AREA
- IX. ACCESS PANEL:
- TWO SIDED ACCESS PANELS, PERMIT EASY ACCESS TO ALL INTERNAL COMPONENTS
- X. LOCATED PERPENDICULAR TO THE MOTOR MOUNTING PANEL
- XI. DAMPER:
- TYPE: GRAVITY
  - GALVANIZED FRAMES WITH PREPUNCHED MOUNTING HOLES
  - BALANCED FOR MINIMAL RESISTANCE TO FLOW
  - HOT WATER FINNED TUBE RADIATORS (FTR):
- I. MANUFACTURER:
- SLANT FIN
  - VULCAN
  - STERLING HEAT
- II. COVER ASSEMBLY:
- ONE-PIECE BOTTOM, BACK AND TOP PANEL, AND ONE-PIECE FRONT PANEL, FORMED OF COLD ROLLED STEEL.
  - BOTTOM AND TOP EDGES OF BACK PANEL SHALL BE FORMED TO PROVIDE CHANNELS ALONG ENTIRE LENGTH, TO RECEIVE FULL-HEIGHT SUPPORT BRACKETS.
  - BRACKETS SHALL BE DIE-FORMED OF ELECTRO GALVANIZED COLD ROLLED STEEL, FOR RIGID BRACING AND SPRING LOCKING.
  - SLIDE-ACTION EXPANSION CRADLES, FORMED OF POLYPROPYLENE, SHALL BE INSERTED BETWEEN HEATING ELEMENT AND SUPPORT BRACKET.
  - CRADLES SHALL PROTECT ELEMENT BOTTOM AND SIDES FROM CONTACT WITH BRACKETS OR COVER, CONFINING ELEMENT TO FREE LATERAL EXPANSION FOR NOISELESS OPERATION.
  - ALL COVER COMPONENTS WITH A 19-GAUGE FRONT COVER SHALL BE PAINTED IN NU-WHITE THERMOSETTING POLYESTER ENAMEL, AND ALL COVER COMPONENTS WITH A 16-GAUGE FRONT COVER SHALL HAVE AN ELECTROGALVANIZED FINISH.
- III. OPTIONS:
- FINNED TUBE ENCLOSURE ACCESS DOORS FOR PIPING TRIM.
  - CONTRACTOR SHALL COORDINATE QUANTITIES WITH MECHANICAL PLANS & FLOW DIAGRAMS.
  - ALL FINNED TUBE ENCLOSURES SHALL EXTEND WALL TO WALL UNLESS OTHERWISE NOTED.
- M. ELECTRONIC RADIANT FLOOR HEATING:
- I. MANUFACTURER:
- THERMOSOFT
  - SIMILAR
- II. GENERAL:
- THE ELECTRONIC HEATING CABLE SHALL BE A TWIN CONDUCTOR CABLE AND SHALL EMIT ZERO EMF.
  - CABLE SHALL BE RATED FOR A MAXIMUM OF 220V AND A MINIMUM OF 40F.
  - CABLE DIAMETER SHALL BE 1/4" IN THICKNESS
- III. INSULATION:
- CABLE SHALL BE INSULATED WITH FLUOROPOLYMER AND XLPE.
- IV. CONTROLS:
- FURNISH WALL-MOUNTED LINE VOLTAGE THERMOSTAT
  - FURNISH NECESSARY RELAYS AS REQUIRED TO SUPPORT SINGLE THERMOSTAT OPERATION.
- N. HOT WATER UNIT HEATER (HWHU-A.B&C):
- I. MANUFACTURER:
- REZNOR
  - MODINE
  - TRANE
- II. GENERAL:
- THE HEAT EXCHANGER SHALL BE MADE OF ONE OR TWO ROW STEEL COILS WITH ALUMINUM FINS WITH APPROXIMATELY 10-1/2 FINS PER INCH.
  - THE SPACING BETWEEN THE FINS SHALL ALLOW FOR EASY CLEANING AND MAINTENANCE.
  - THE COPPER TUBING USED FOR THE HEATING COIL SHALL BE A MINIMUM OF (0.03", 0.75 MM) THICK.
  - THE COPPER TUBE DIAMETER SHALL BE 0.867" (22 MM) O.D. OR LARGER.
  - THE HEAT EXCHANGER ASSEMBLY SHALL HAVE AN EPOXY-POLYESTER POWDER COATING.
- III. FAN MOTOR ASSEMBLY:
- THE FAN/MOTOR ASSEMBLY SHALL BE MADE UP OF THREE COMPONENTS: THE FAN, THE MOTOR AND THE FAN GUARD, WHICH ALSO ACT AS THE MAIN SUPPORT FOR THE FAN.
  - THIS FAN GUARD SHALL BE GALVANIZED FOR PROTECTION AGAINST CORROSION, AND SHALL BE MOUNTED ONTO THE MAIN CASING WITH ANTI-VIBRATION RUBBER MOUNTINGS.
  - THE FAN GUARD MEETS OSHA REQUIREMENTS.
- IV. MOTOR:
- THE STANDARD 2-SPEED MOTOR SHALL BE HERMETICALLY SEALED.
  - THE MOTOR SHALL BE WIRED FOR 120/180 VOLTS.
  - THE MOTOR SPEED SHALL BE FIELD ADJUSTABLE FOR HIGH OR LOW SPEDD.
  - MOTOR WHICH IS MAINTENANCE FREE. THE MOTOR IS WIRED FOR
- V. UNIT CABINET:
- THE UNIT CABINET SHALL BE 0.032" THICK GALVANIZED PRE-PAINTED STEEL IN DOVE GRAY.
  - HELPS PROTECT THE CABINET AGAINST OXIDATION.
  - THE CABINET SHALL BE HELD TOGETHER BY SHAKE-PROOF SCREWS AND MOLDED CORNER SECTIONS TO ADD ADDITIONAL STRENGTH AND DURABILITY.
- VI. CONTROLS:
- FURNISH LINE-VOLTAGE WALL-MOUNT THERMOSTAT CAPABLE OF FAN AND HOT WATER CONTROL VALVE OPERATION.
- O. ROOF-MOUNTED EXHAUST FAN (TXF-1-1):
- I. MANUFACTURER:
- GREENHECK
  - PENN BARRY
  - COOK
- II. GENERAL:
- DISCHARGE AIR DIRECTLY AWAY FROM THE MOUNTING SURFACE
- III. WHEEL:
- MATERIAL TYPE: ALUMINUM
  - NON-OVERLOADING, BACKWARD INCLINED CENTRIFUGAL
  - STATICALLY AND DYNAMICALLY BALANCED IN ACCORDANCE TO AMCA STANDARD 204-05
  - THE WHEEL CONE AND FAN INLET WILL BE MATCHED AND SHALL HAVE PRECISE RUNNING TOLERANCES FOR MAXIMUM PERFORMANCE AND OPERATING EFFICIENCY.
- IV. MOTORS:
- ELECTRONICALLY COMMUTATED MOTOR
  - MOTOR ENCLOSURES: OPEN TYPE
  - MOTOR TO BE A DC ELECTRONIC COMMUTATION TYPE DESIGNED FOR FAN APPLICATIONS. AC INDUCTION TYPE MOTORS ARE NOT ACCEPTABLE. EXAMPLES OF UNACCEPTABLE MOTORS ARE: SHADED POLE, PERMANENT SPLIT CAPACITOR (PSC), SPLIT PHASE, CAPACITOR START AND 3 PHASE INDUCTION TYPE MOTORS.
  - MOTORS ARE PERMANENTLY LUBRICATED, HEAVY DUTY BALL BEARING TYPE TO MATCH WITH THE FAN LOAD AND PRE-WIRED TO THE SPECIFIC VOLTAGE AND PHASE.

- INTERNAL MOTOR CIRCUITRY TO CONVERT AC POWER SUPPLIED TO THE FAN TO DC POWER TO OPERATE THE MOTOR
  - MOTOR SHALL BE SPEED CONTROLLABLE DOWN TO 20% OF FULL SPEED (80% TURNDOWN). SPEED SHALL BE CONTROLLED BY EITHER A POTENTIOMETER DIAL MOUNTED AT THE MOTOR OR BY A 0-10 VDC SIGNAL.
  - MOTOR SHALL BE A MINIMUM OF 85% EFFICIENT AT ALL SPEEDS.
- V. HOUSING:
- CONSTRUCTED OF HEAVY GAUGE ALUMINUM INCLUDES EXTERIOR HOUSING, CURB CAP, WINDBAND, AND MOTOR COMPARTMENT HOUSING. GALVANIZED MATERIAL IS NOT ACCEPTABLE.
  - HOUSING SHALL HAVE A RIGID INTERNAL SUPPORT STRUCTURE. WINDBAND TO BE ONE PIECE UNIQUELY SPUN ALUMINUM CONSTRUCTION AND MAINTAIN ORIGINAL MATERIAL THICKNESS THROUGHOUT THE HOUSING WINDBAND TO INCLUDE AN INTEGRAL ROLLED BEAD FOR STRENGTH.
  - CURB CAP BASE TO BE FULLY WELDED TO WINDBAND TO ENSURE A LEAK PROOF CONSTRUCTION. TACK WELDING, BOLTING, AND CAULKING ARE NOT ACCEPTABLE.
  - CURB CAP TO HAVE INTEGRAL DEEP SPUN INLET VENTURI AND PRE-PUNCHED MOUNTING HOLES TO ENSURE CORRECT ATTACHMENT TO CURB.
  - DRIVE FRAME ASSEMBLIES SHALL BE CONSTRUCTED OF HEAVY GAUGE STEEL AND MOUNTED ON VIBRATION ISOLATORS.
  - BREATHING TUBE SHALL BE 10 SQUARE INCHES IN SIZE FOR FRESH AIR MOTOR COOLING, AND DESIGNED TO ALLOW WIRING TO BE RUN THROUGH IT.
- VI. MOTOR COVER:
- CONSTRUCTED OF ALUMINUM
- VII. VIBRATION ISOLATION:
- DOUBLE STUDDED TRUE ISOLATORS
  - NO METAL TO METAL CONTACT
  - SIZED TO MATCH THE WEIGHT OF EACH FAN
- VIII. DISCONNECT SWITCHES:
- NEMA RATED: 3R
  - POSITIVE ELECTRICAL SHUT-OFF
  - WIRED FROM FAN MOTOR TO JUNCTION BOX INSTALLED WITHIN MOTOR COMPARTMENT
- IX. DRAIN TROUGH:
- ALLOWS FOR ONE-POINT DRAINAGE OF WATER, GREASE, AND OTHER RESIDUES
- X. OPTIONS/ACCESSORIES:
- BIRDSCREEN:
  - CONSTRUCTION OF GALVANIZED STEEL
  - PROTECTS FAN DISCHARGE
- XI. CLEAN OUT PORT:
- REMOVABLE GREASE REPELLENT COMPRESSION RUBBER PLUG ALLOWS ACCESS FOR CLEANING WHEEL THROUGH WINDBAND.
- XII. ROOF CURBS:
- MOUNTED ONTO ROOF WITH FAN
  - MATERIAL: ALUMINUM
  - INSULATION THICKNESS: 1 INCH
  - COATING TYPE: MACROPOXY WITH UV TOP COAT
- XIII. DAMPERS:
- TYPE: MOTORIZED
  - PREVENTS OUTSIDE AIR FROM ENTERING BACK INTO THE BUILDING WHEN FAN IS OFF
  - BALANCED FOR MINIMAL RESISTANCE TO FLOW
  - GALVANIZED FRAMES WITH PRE-PUNCHED MOUNTING HOLES
- XIV. HINGE KIT:
- ALUMINUM HINGES
  - ALLOWS THE FAN TO TILT AWAY FOR ACCESS TO WHEEL AND DUCTWORK FOR INSPECTION AND CLEANING
- P. ROOFTOP AIR CONDITIONING UNIT (RTAC-R-1&2):
- I. MANUFACTURERS:
- TRANE
  - RAPID ENGINEERING
  - YORK
- II. SUBMITTALS:
- SUBMIT DRAWINGS INDICATING COMPONENTS, DIMENSIONS, WEIGHTS AND LOADINGS, REQUIRED CLEARANCES, AND LOCATION AND SIZE OF FIELD CONNECTIONS.
  - SUBMIT PRODUCT DATA INDICATING RATED CAPACITIES, WEIGHTS, ACCESSORIES, SERVICE CLEARANCES AND ELECTRICAL REQUIREMENTS.
  - SUBMIT MANUFACTURER'S INSTALLATION INSTRUCTIONS.
- III. OPERATION AND MAINTENANCE DATA:
- SUBMIT OPERATION AND MAINTENANCE DATA.
  - INCLUDE MANUFACTURER'S DESCRIPTIVE LITERATURE, START-UP AND OPERATING INSTRUCTIONS, INSTALLATION INSTRUCTIONS, AND MAINTENANCE PROCEDURES.
- IV. HANDLING:
- COMPLY WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS FOR RIGGING, UNLOADING, AND TRANSPORTING UNITS.
  - PROTECT UNITS FROM PHYSICAL DAMAGE. LEAVE FACTORY SHIPPING COVERS IN PLACE UNTIL INSTALLATION.
- V. WARRANTY:
- PROVIDE A FULL PARTS WARRANTY FOR ONE YEAR FROM START-UP OR 18 MONTHS FROM SHIPMENT, WHICHEVER OCCURS FIRST.
  - PROVIDE FIVE YEAR EXTENDED PARTS WARRANTY FOR COMPRESSORS.
  - PROVIDE FIVE YEAR LIMITED PARTS WARRANTY FOR HEAT EXCHANGER.
- VI. REGULATORY REQUIREMENTS:
- UNIT SHALL CONFORM TO CULUS FOR CONSTRUCTION OF PACKAGED AIR CONDITIONER AND SHALL HAVE CULUS LABEL AFFIXED TO ROOFTOP PACKAGE.
  - IN THE EVENT THE UNIT IS NOT CULUS APPROVED, THE MANUFACTURER SHALL, AT HIS EXPENSE, PROVIDE FOR A FIELD INSPECTION BY A CULUS REPRESENTATIVE TO VERIFY CONFORMANCE TO CULUS STANDARDS. IF NECESSARY, CONTRACTOR SHALL PERFORM REQUIRED MODIFICATIONS TO THE UNIT TO COMPLY WITH CULUS, AS DIRECTED BY THE CULUS REPRESENTATIVE, AT NO ADDITIONAL EXPENSE TO THE OWNER.
  - GAS-FIRED HEATING ROOFTOP UNITS WITH LESS THAN 400,000 BTU HEATING INPUT SHALL CONFORM TO ANSI Z21.47/CANADIAN STANDARDS ASSOCIATION (CAN/CSA-2.3) FOR CONSTRUCTION OF PACKAGED AIR CONDITIONER. GAS-FIRED HEATING ROOFTOP UNITS WITH MORE THAN 400,000 BTU HEATING INPUT SHALL CONFORM TO UL 795/CANADIAN STANDARDS ASSOCIATION (CAN/CSA-3.2) FOR CONSTRUCTION OF PACKAGED AIR CONDITIONER.
  - IN THE EVENT THE UNIT IS NOT CSA APPROVED, THE MANUFACTURER MUST, AT HIS EXPENSE, PROVIDE FOR A FIELD INSPECTION BY A CSA REPRESENTATIVE TO VERIFY CONFORMANCE TO CSA STANDARDS. IF NECESSARY, CONTRACTOR SHALL PERFORM MODIFICATIONS TO THE UNIT TO COMPLY WITH CSA, AS DIRECTED BY THE CSA REPRESENTATIVE, AT NO ADDITIONAL EXPENSE TO THE OWNER.
- VII. EXTRA MATERIALS
- PROVIDE ONE SPARE SET OF FILTERS.
  - FURNISH ONE SPARE SET OF FAN BELTS.
- VIII. SUMMARY:
- THE CONTRACTOR SHALL FURNISH AND INSTALL PACKAGED ROOFTOP AIR CONDITIONING UNIT(S) AS SHOWN AND AS SCHEDULED ON THE CONTRACT DOCUMENTS. THE UNIT(S) SHALL BE INSTALLED IN ACCORDANCE WITH THIS SPECIFICATION AND PERFORM AT THE CONDITIONS SPECIFIED, SCHEDULED OR AS SHOWN ON THE CONTRACT DRAWINGS.
- IX. GENERAL:
- MANUFACTURER OF PACKAGED UNITARY ROOFTOP PRODUCTS SHALL HAVE HAD A MINIMUM OF FIVE YEARS SUCCESSFUL EXPERIENCE IN THE MANUFACTURE AND SERVICE SUPPORT OF THE ROOFTOP PACKAGES SPECIFIED HEREIN. MANUFACTURERS WITH LESS THAN FIVE YEARS EXPERIENCE IN THE PRODUCTION OF ROOFTOP UNITS OF THE SIZES AND TYPES SPECIFIED SHALL NOT BE ACCEPTABLE.

- X. SUBSTITUTIONS:
- PRIOR APPROVAL REQUIRED AS INDICATED UNDER THE GENERAL AND/OR SUPPLEMENTAL CONDITIONS OF THESE SPECIFICATIONS. SUBSTITUTIONS MUST STILL COMPLY WITH THE PERFORMANCE AND FEATURES AS SPECIFIED HEREIN AND AS INDICATED ON THE DESIGN DOCUMENTS. JOB WILL BE AWARDED ON BASIS OF SPECIFIED PRODUCT. SUBSTITUTIONS MUST BE SELECTED AND APPROVED WITHIN 14 CALENDAR DAYS AFTER AWARD OF CONTRACT.
- XI. GENERAL UNIT DESCRIPTION:
- UNIT(S) FURNISHED AND INSTALLED SHALL BE PACKAGED ROOFTOPS AS SPECIFIED ON THE CONTRACT DOCUMENTS AND WITHIN THESE SPECIFICATIONS. COOLING CAPACITY RATINGS SHALL BE BASED UPON AHRI STANDARD 360. UNIT(S) SHALL CONSIST OF INSULATED WEATHERTIGHT CASING WITH COMPRESSORS, AIR COOLED CONDENSER COIL, CONDENSER FANS, EVAPORATOR COIL, FILTERS, SUPPLY AND/OR EXHAUST FAN MOTORS AND DRIVES, AND UNIT CONTROLS.
  - UNIT(S) SHALL BE SINGLE PIECE CONSTRUCTION AS MANUFACTURED AT THE FACTORY. (SITE ASSEMBLED SUB-ASSEMBLIES WILL NOT BE ALLOWED.) PACKAGE UNITS SHALL BE CONSTRUCTED FOR INSTALLATION ON A ROOF CURB PROVIDING FULL PERIMETER SUPPORT UNDER AIR HANDLER SECTION AND PEDESTAL SUPPORT UNDER CONDENSER SECTION.
  - UNIT(S) SHALL BE FACTORY RUN TESTED TO INCLUDE THE OPERATION OF ALL FANS, COMPRESSORS, HEAT EXCHANGERS, AND CONTROL SEQUENCES.
  - UNIT(S) SHALL HAVE LABELS, DECALS, AND/OR TAGS TO AID IN THE SERVICE OF THE UNIT AND INDICATE CAUTION AREAS.
- XII. UNIT CASING:
- CABINET: GALVANIZED STEEL, PHOSPHATIZED, AND FINISHED WITH AN AIR-DRY PAINT COATING DURABLE ENOUGH TO WITHSTAND A MINIMUM OF 600 CONSECUTIVE-HOUR SALT SPRAY APPLICATION IN ACCORDANCE WITH STANDARD ASTM B 117. STRUCTURAL MEMBERS SHALL BE HEAVY GAUGE WITH ACCESS DOORS AND REMOVABLE PANELS OF HEAVY GAUGE STEEL. ROOF PANELS SHALL BE SLOPED TO PROVIDE POSITIVE DRAINAGE OF RAIN WATER / MELTING SNOW AWAY FROM THE CABINET.
  - PROVIDE CUSTOM EXTERIOR PAINT COLORS TO MEET ARCHITECT/OWNERS SPECIFICATION.
  - ACCESS DOORS: FULLY GASKETED HINGED DOORS WITH FLUTED KNOB FASTENERS AND CHAINED "TIE-BACKS" TO PROVIDE ACCESS TO FILTERS, HEATING SECTION, RETURN/EXHAUST AIR FAN SECTION, SUPPLY AIR FAN SECTION AND EVAPORATOR COIL SECTION.
  - CONTROL PANEL: THE UNIT CONTROL PANEL SECTION SHALL BE COMPARTMENTED TO SEPARATE HIGH AND LOW VOLTAGE COMPONENTS. THE CONTROL PANELS SHALL ALSO BE FULLY GASKETED, HINGED AND PROVIDED WITH QUICK RELEASE LATCHES FOR EASY ACCESS.
  - THE HIGH VOLTAGE CONTROL PANEL SHALL BE PROVIDED WITH A DOOR HANDLE DISCONNECT SWITCH TO FACILITATE CONVENIENT, SAFE DISCONNECTION OF MAIN THREE PHASE POWER.
  - INSULATION: PROVIDE 1/2 INCH THICK COATED FIBERGLASS INTERNAL LINER ON ALL EXTERIOR PANELS IN CONTACT WITH THE CONDITIONED AIR STREAM.
- XIII. SUPPLY FAN:
- XIV. SUPPLY FAN SHALL BE ONE OR TWO SINGLE WIDTH, SINGLE INLET 9-BLADE PLENUM FAN(S). FAN BLADES SHALL BE AIR-DRY PAINTED. BACKWARD INCLINED AIR-DRY FANS SHALL BE DIRECT-DRIVEN. ENTIRE ASSEMBLY SHALL BE COMPLETELY ISOLATED FROM UNIT AND FAN BOARD BY 2" DEFLECTION SPRING ISOLATION. MULTIPLE FAN WIDTHS SHALL BE AVAILABLE TO OPTIMIZE EFFICIENCY. FAN SHALL NOT REQUIRE ROUTINE MAINTENANCE SUCH AS FAN BEARING LUBRICATION, BELT TENSIONING AND REPLACEMENT, SHEAVE ALIGNMENT, AND SETS CREW TORQUE CHECKS.
- MOUNT FAN MOTOR(S) AND FAN ON A COMMON BASE ASSEMBLY AND ISOLATED FROM UNIT. PROVIDE THRUST RESTRAINT ISOLATION ON THE FAN HOUSING/FAN BOARD TO ASSURE SMOOTH FAN STARTUP TRANSITION AND OPERATION.
  - FAN SHAFT SHALL BE MOUNTED ON GREASE LUBRICATED BALL BEARINGS.
  - MOTOR SHALL BE HIGH EFFICIENCY OPEN DRIP-PROOF. MOTOR SHALL HAVE A STANDARD T-FRAME AND A MINIMUM SERVICE FACTOR OF 1.15. ALL DRIVE COMPONENTS SHALL BE ACCESSIBLE WITHOUT THE USE OF SCAFFOLDS OR LADDERS, TO FACILITATE PERIODIC MAINTENANCE CHECKS AND FOR OPERATOR SAFETY.
  - INTERNAL SHAFT GROUNDING RING, OPTION-MOTORS HAVE INTERNAL BEARING PROTECTION FOR USE WITH VFDS TO PROVIDE A CONDUCTIVE DISCHARGE PATH AWAY FROM THE MOTOR BEARINGS TO GROUND. BEARING PROTECTION RINGS ARE CIRCUMFERENTIAL RINGS WITH CONDUCTIVE MICRO FIBERS WHICH PROVIDE THE PATH OF LEAST RESISTANCE AND DRAMATICALLY EXTEND MOTOR LIFE.
- XV. GAS FIRED HEATING SECTION:
- PROVIDE GAS-FIRED HEATING SECTION AS A COMPLETELY ASSEMBLED AND FACTORY-INSTALLED HEATING SYSTEM INTEGRAL TO UNIT, CULUS APPROVED SPECIFICALLY FOR OUTDOOR APPLICATIONS FOR USE DOWNSTREAM FROM REFRIGERANT COILING COILS. PROVIDE CAPABILITY FOR THREADED GAS PIPING CONNECTION THROUGH SIDE OR BOTTOM OF UNIT.
  - HEATING SECTION SHALL BE FACTORY FIRE-TESTED PRIOR TO SHIPMENT.
  - GAS BURNER: FORCED-DRAFT TYPE BURNER WITH ADJUSTABLE COMBUSTION AIR SUPPLY, GAS VALVE, MANUAL SHUT-OFF, DIRECT SPARK OR PILOT IGNITION, AND FLAME SENSING MONITORING ELECTRODE. PROVIDE AIR PROVING SWITCH TO PREVENT BURNER OPERATION WHEN BURNER IS OPEN FOR MAINTENANCE OR INSPECTION.
  - GAS BURNER SAFETY CONTROLS: PROVIDE ELECTRONIC FLAME SAFETY CONTROLS FOR THE PROVING OF COMBUSTION AIR PRIOR TO IGNITION SEQUENCE WITH PRE-PURGE CYCLE, CONTINUOUS ELECTRONIC FLAME SUPERVISION, AND SIXTY SECOND DELAY BETWEEN FIRST AND SECOND STAGE GAS VALVE OPERATION ON TWO-STAGE HEATERS.
  - COMBUSTION BLOWER: PROVIDE CENTRIFUGAL TYPE FAN WITH BUILT-IN THERMAL OVERLOAD PROTECTION ON FAN MOTOR.
  - HEAT EXCHANGER: PROVIDE FACTORY PRESSURE- AND LEAK-TESTED TUBULAR TWO PASS HEAT EXCHANGER OF FRICTION DESIGN MANUFACTURED OF 16-GAUGE STAINLESS STEEL PRIMARY SURFACE AND 18-GAUGE STAINLESS STEEL SECONDARY SURFACE.
  - GAS HEATERS SHALL BE CONSTRUCTED OF GRADES OF STAINLESS STEEL SUITABLE FOR CONDENSING ENVIRONMENTS. THE HEATER SHALL PROVIDE 2 STAGES OR MODULATING CONTROL OF AND CONTAIN A MODULATING GAS VALVE THAT RESPONDS TO USER SELECTABLE SETPOINTS.
  - PROVIDE FACTORY-MOUNTED NON-FUSED DISCONNECT SWITCH.
- XVI. EVAPORATOR COIL SECTION:
- PROVIDE HEAVY DUTY ALUMINUM FINS MECHANICALLY BONDED TO COPPER TUBES. EVAPORATOR COIL SHALL BE INTER-CIRCUITED TO MAINTAIN ACTIVE COIL FACE AREA AT PART LOAD CONDITIONS. COIL SHALL ALSO UTILIZE INTERNALLY ENHANCED TUBING FOR MAXIMUM EFFICIENCY.
  - PROVIDE A THERMOSTATIC EXPANSION VALVE (TXV) FOR EACH REFRIGERANT CIRCUIT. FACTORY PRESSURE AND LEAK TEST COIL.
  - PROVIDE PITCHED STAINLESS STEEL DRAIN PAN TO ASSURE POSITIVE DRAINAGE OF CONDENSATE FROM THE UNIT CASING.
- XVII. AIR-COOLED CONDENSER SECTION:
- CONDENSER COILS SHALL HAVE ALL ALUMINUM MICROCHANNEL COILS. ALL COILS SHALL BE LEAK TESTED AT THE FACTORY TO ENSURE PRESSURE INTEGRITY. THE CONDENSER COIL IS PRESSURE TESTED TO 650 PSIG. SUBCOOLING CIRCUIT(S) SHALL BE PROVIDED AS STANDARD.
  - PROVIDE SUBCOOLING CIRCUIT(S) INTEGRAL WITH CONDENSER COILS TO MAXIMIZE EFFICIENCY AND PREVENT PREMATURE FLASHING OF LIQUID REFRIGERANT, TO A GASEOUS STATE, AHEAD OF THE EXPANSION VALVE.
  - PROVIDE VERTICAL DISCHARGE, DIRECT DRIVE FANS WITH STEEL BLADES, AND THREE PHASE MOTORS. FANS SHALL BE STATICALLY AND DYNAMICALLY BALANCED. MOTORS SHALL BE PERMANENTLY LUBRICATED, WITH BUILT-IN CURRENT AND THERMAL OVERLOAD PROTECTION AND WEATHERTIGHT SLINGER OVER MOTOR BEARINGS.
  - FURNISH UNIT WITH FACTORY-INSTALLED ELECTRONIC LOW AMBIENT OPTION TO ALLOW FOR OPERATION DOWN TO 0 DEGREES F.
  - PROVIDE FACTORY-INSTALLED LOUVERED STEEL COIL GUARDS AROUND PERIMETER OF CONDENSING SECTION TO PROTECT THE CONDENSER COILS, REFRIGERANT PIPING AND CONTROL COMPONENTS. LOUVERED PANELS SHALL BE FABRICATED FROM HEAVY GAUGE GALVANIZED STEEL AND BE RIGID ENOUGH TO PROVIDE PERMANENT PROTECTION FOR SHIPPING AND PRE-POST-INSTALLATION. COURSE WIRE MESH IS NOT AN ACCEPTABLE MATERIAL FOR COIL GUARDS.
- XVIII. REFRIGERATION SYSTEM:
- COMPRESSOR: SHALL BE INDUSTRIAL GRADE, ENERGY EFFICIENT DIRECT DRIVE 3600 RPM MAXIMUM SPEED RECIPROCATING OR SCROLL TYPE. THE MOTOR SHALL OF A SUCTION GAS COOLED HERMETIC DESIGN. COMPRESSOR SHALL HAVE CENTRIFUGAL OIL PUMP WITH DIRT

- SEPARATOR, OIL SIGHT GLASS, AND OIL CHARGING VALVE.
- PROVIDE WITH THERMOSTATIC MOTOR WINDING TEMPERATURE CONTROL TO PROTECT AGAINST EXCESSIVE MOTOR TEMPERATURES RESULTING FROM OVER-UNDER-VOLTAGE OR LOSS OF CHARGE. PROVIDE HIGH AND LOW PRESSURE CUTOUTS, AND RESET RELAY.
  - PROVIDE FACTORY-INSTALLED COMPRESSOR LOCKOUT THERMOSTAT TO PREVENT COMPRESSOR OPERATION AT LOW AMBIENT CONDITIONS.
  - PROVIDE COIL FROST PROTECTION COMPRESSOR UNLOADING BASED ON REFRIGERANT CIRCUIT SUCTION TEMPERATURE TO PREVENT COIL FROSTING WITH MINIMUM ENERGY USAGE.
  - PHASE AND VOLTAGE MONITOR - STANDARD ON 20-75 TON AIR-COOLED UNITS. PROTECTS 3-PHASE EQUIPMENT FROM PHASE LOSS, PHASE REVERSAL AND LOW VOLTAGE. ANY FAULT CONDITION WILL PRODUCE A FAILURE INDICATOR LED AND SEND THE UNIT INTO AN AUTO STOP CONDITION. CULUS APPROVED.
- XIX. OUTDOOR AIR SECTION:
- PROVIDE 100% MODULATING ENTHALPY-BASED ECONOMIZER SYSTEM FULLY INTEGRATED WITH UNIT RETURN AND EXHAUST AIR DAMPERS. UNIT OPERATION IS THROUGH PRIMARY TEMPERATURE CONTROLS THAT AUTOMATICALLY MODULATE DAMPERS TO MAINTAIN DESIRED SPACE TEMPERATURE CONDITIONS.
  - PROVIDE AUTOMATIC OUTDOOR ENTHALPY LOCKOUT SENSOR.
  - PROVIDE ADJUSTABLE MINIMUM POSITION CONTROL.
  - PROVIDE SPRING-RETURN MOTOR FOR OUTSIDE AIR DAMPER CLOSURE DURING UNIT SHUTDOWN OR POWER INTERRUPTION.
  - ECONOMIZER CONTROL WITH COMPARATIVE ENTHALPY - USED WITH THE OUTSIDE AIR ECONOMIZER, TWO ENTHALPY SENSORS ARE PROVIDED TO COMPARE TOTAL HEAT CONTENT OF THE INDOOR AIR AND OUTDOOR AIR TO DETERMINE THE MOST EFFICIENT AIR SOURCE WHEN ECONOMIZING.
  - OUTSIDE AIR MEASUREMENT (TRAQ™) - A FACTORY MOUNTED AIRFLOW MEASUREMENT STATION (TRAQ™) SHALL BE PROVIDED IN THE OUTSIDE AIR OPENING TO MEASURE AIRFLOW. THE AIRFLOW MEASUREMENT STATION SHALL MEASURE FROM 40 CFM/TON TO MAXIMUM AIRFLOW. THE AIRFLOW MEASUREMENT STATION SHALL ADJUST FOR TEMPERATURE VARIATIONS. MEASUREMENT ACCURACY SHALL MEET REQUIREMENTS OF LEED IE Q CREDIT 1 AS DEFINED BY ASHRAE 62.1-2007.
- XX. DAMPERS:
- LEAKAGE RATE SHALL BE DETERMINED IN ACCORDANCE WITH AMCA STANDARD 575.
- XXI. FILTERS:
- DIFFERENTIAL PRESSURE GAUGE - A FACTORY-INSTALLED, DIAL-TYPE, DIFFERENTIAL PRESSURE GAUGE SHALL BE PIPED TO BOTH SIDES OF THE FILTER TO INDICATE STATUS. GAUGE SHALL MAINTAIN A +/- 5 PERCENT ACCURACY WITHIN OPERATING TEMPERATURE LIMITS OF -20°F TO 120°F. GAUGE SHALL BE FLUSH-MOUNTED WITH CASING OUTER WALL. FILTER SECTIONS CONSISTING OF PRE- AND POST-FILTERS SHALL HAVE A GAUGE FOR EACH.
- XXII. PRE-EVAP FILTER:
- HIGH EFFICIENCY THROWAWAY OPTION, MERV 8 - SHALL BE TWO-INCH HIGH EFFICIENCY MEDIA FILTERS WITH AVERAGE DUST SPOT EFFICIENCY OF 25-35 PERCENT AND AN AVERAGE AERIAL RESISTANCE IN EXCESS OF 90 PERCENT WHEN TESTED IN ACCORDANCE WITH ASHRAE 52-76.
  - 90-95% BAG FILTER OPTION, MERV 14 - SHALL HAVE GLASS FIBER MEDIA MOUNTED IN A GALVANIZED STEEL FRAME. THESE CLASS 1 SINGLE PIECE DISPOSABLE BAG FILTERS SHALL HAVE A 90-95% DUST SPOT EFFICIENCY RATING PER ASHRAE 52-76. TO ENSURE MAXIMUM BAG FILTER LIFE TWO-INCH MERV8 PREFILTERS SHALL BE INCLUDED WITH THE BAG FILTERS.
- XXIII. DDC MICROPROCESSOR CONTROLS:
- GENERAL - EACH UNIT SHALL BE PROVIDED WITH A FACTORY-INSTALLED, PROGRAMMED AND RUN-TESTED, STAND-ALONE, MICROPROCESSOR CONTROL SYSTEM SUITABLE FOR CV OR VAV CONTROL AS REQUIRED. THIS SYSTEM SHALL CONSIST OF TEMPERATURE AND PRESSURE THERMISTOR AND TRANSDUCER SENSORS, PRINTED CIRCUIT BOARDS, AND A UNIT-MOUNTED HUMAN INTERFACE PANEL. THE MICROPROCESSOR SHALL BE EQUIPPED WITH ON-BOARD DIAGNOSTICS TO INDICATE THAT ALL HARDWARE, SOFTWARE, AND ALL INTERCONNECTED WIRING AND SENSORS ARE IN PROPER OPERATING CONDITION. THE MICROPROCESSOR'S MEMORY SHALL BE NON-VOLATILE EEPROM TYPE, THUS REQUIRING NO BATTERY OR CAPACITIVE BACKUP TO MAINTAIN ALL DATA DURING A POWER LOSS.
  - THE UNIT SHALL BE EQUIPPED WITH A BACNET IP & MS/TP COMMUNICATION PROTOCOL GATEWAY.
  - VENTILATION OVERRIDE MODULE (VOM) - SHALL BE PROVIDED WHICH WILL ALLOW THE USER TO FIELD RECONFIGURE AND ESTABLISH UP TO FIVE DIFFERENT PURGE, EXHAUST AND BUILDING PRESSURIZATION SEQUENCES. THESE SEQUENCES, FACTORY PRIORITIZED, SHALL BE RECONFIGURABLE THROUGH THE HUMAN INTERFACE PANEL AT THE ROOFTOP UNIT, THE REMOTE HUMAN INTERFACE OR THE TRACER BUILDING AUTOMATION SYSTEM.
  - ANTI-RECYCLE PROTECTION - SHALL BE PROVIDED TO PREVENT EXCESSIVE CYCLING, AND PREMATURE WEAR, OF THE COMPRESSORS, CONTACTORS AND RELATED COMPONENTS.
  - AIRFLOW MODULATION SHALL BE PROVIDED BY A VARIABLE FREQUENCY DRIVE WITH BYPASS THAT IS FACTORY-MOUNTED, COMPLETELY WIRED, AND FUNCTIONALLY TESTED. ADJUSTABLE FREQUENCY INVERTER DRIVE SHALL SAFELY VARY THE SPEED OF THE FAN MOTOR ALLOWING THE MOTOR TO MEET THE DYNAMIC REQUIREMENTS AT THE SHAFT OF THE MOTOR AND MEET THE SYSTEM STATIC REQUIREMENTS. PROPERLY SIZED MOTOR PROTECTION SHALL BE PROVIDED IN BOTH DRIVE AND BYPASS MODES BY A MOTOR OVERLOAD RELAY AND FUSES. INVERTER CONTROLLER SHALL HAVE A DISPLAY THAT PROVIDES READOUT FUNCTIONS THAT INCLUDE: OUTPUT FREQUENCY, OUTPUT VOLTAGE, OUTPUT CURRENT, OUTPUT POWER, DC BUS VOLTAGE, INTERFACE TERMINAL STATUS, AND FAULT STATUS. IN THE BYPASS MODE, AN OUTPUT SIGNAL SHALL BE AVAILABLE FOR A BUILDING AUTOMATION SYSTEM TO MAKE SYSTEM ADJUSTMENTS TO PREPARE FOR AN ACROSS THE LINE START OF A FULLY LOADED FAN. A RUN COMMAND SIGNAL TO THE BYPASS MOTOR STARTER SHALL BE PROVIDED BY THE UNIT CONTROLLER.
  - INTERNAL SHAFT GROUNDING RING - MOTORS HAVE INTERNAL BEARING PROTECTION FOR USE WITH VFDS.
- XXIV. MISCELLANEOUS FEATURES:
- PROVIDE UNIT MOUNTED 115 VOLT CONVENIENCE OUTLET
  - PROVIDE UNIT MOUNTED & WIRED SERVICE LIGHTS.
  - PHASE AND VOLTAGE MONITOR - STANDARD ON 20-75T UNITS. PROTECTS 3-PHASE EQUIPMENT FROM PHASE LOSS, PHASE REVERSAL, AND LOW VOLTAGE. ANY FAULT CONDITION WILL PRODUCE A FAILURE INDICATOR LED, AND SEND THE UNIT INTO AN EMERGENCY STOP CONDITION. CULUS APPROVED.
- Q. DESTRATIFICATION FANS (DSF-4-1 THRU 43):
- I. MANUFACTURERS:
- AIRIUS
  - EQUIVALENT
- II. PERFORMANCE:
- COORDINATED DESIGN OF HOUSING, STATOR AND MOTOR SHALL PROVIDE COLUMNAR LAMINAR AIRFLOW TO PRODUCE A MINIMUM OF 100 FPM AT CENTER OF COLUMN AT GRADE LEVEL WHEN INSTALLED WITHIN 2'-0" OF CEILING.
- III. HOUSING:
- THE FAN HOUSING SHALL BE MADE OF PC/ABS RESIN, RATED 5VA FOR FLAME RESISTANCE.
- IV. HOUSING COLOR:
- BLACK
- V. SAFETY CABLE:
- MODELS 10 THROUGH 60 ARE SUPPLIED WITH 6'-0" STEEL CABLE FASTENED TO SEISMIC RESTRAINT POINT INTEGRATED INTO HOUSING.
- VI. MOTOR MOUNTING:
- ENCLOSED IN HOUSING, ABOVE STATOR.
- VII. STATOR:
- THE FAN SHALL BE EQUIPPED WITH A PATENTED MULTIPLE-VANE STATOR COORDINATED WITH FAN DESIGN FOR MAXIMIZING COLUMNAR LAMINAR FLOW.
- VIII. CERTIFICATION:
- UL STANDARD 507 FOR SAFETY ELECTRIC FANS, CAN/CSA C22.2#60335-1AND UL 94 5VA AS CERTIFIED BY NATIONALLY RECOGNIZED TESTING LABORATORY. ACCEPTABLE LABORATORIES INCLUDE ETL, UL OR OTHER NATIONALLY RECOGNIZED TESTING LABORATORIES.
- IX. IDENTIFICATION:
- PERMANENTLY AFFIXED MANUFACTURER'S NAMEPLATE INCLUDING THE FOLLOWING: MODEL NUMBER, SERIAL NUMBER, MOTOR POWER SPECIFICATIONS, COUNTRY OF MANUFACTURE AND SAFETY MARKS: ETL (US & CA) & CE (EU).

TO THE BEST KNOWLEDGE, BELIEF AND PROFESSIONAL JUDGEMENT, THESE PLANS AND SPECIFICATIONS ARE IN COMPLIANCE WITH THE 2020 ENERGY CONSERVATION CONSTRUCTION CODE OF NEW YORK STATE.

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KEY PLAN

REV	DESCRIPTION	DATE
	ISSUED FOR DOB SUBMISSION	09/10/2021
	ISSUED FOR BID	10/15/2021
	ISSUED FOR PROGRESS	01/18/2022

DRAWN BY :
CHECKED BY :
APPROVED BY :
DATE :
SCALE :
DRAWING TITLE :

**MECHANICAL SPECIFICATIONS SHEET #3**

DWG NUMBER :

**M-803**