

2. ALL CONTROL WIRING TERMINATES AT TERMINAL STRIPS (SINGLE POINT CONNECTION) AND INCLUDE AN IDENTIFYING MARKER CORRESPONDING TO THE WIRING DIAGRAM. MOTOR AND CONTROL WIRING IS HARNESSSED WITH TERMINAL BLOCK CONNECTIONS. CASINGS ARE DIE FORMED, 18 GAUGE [1.3 MM] GALVANIZED STEEL AND FINISHED IN AIR DRY ENAMEL. SERVICE AND ACCESS PANELS ARE PROVIDED THROUGH EASILY REMOVABLE SIDE ACCESS PANELS WITH CAPTIVE FASTENERS. FAN SECTIONS AND SUPPLY PLENUMS (WHEN PROVIDED) ARE INSULATED WITH FIRE RESISTANT, ODDORLESS, MATTE FACED 1" [25 MM] GLASS FIBER MATERIAL. OUTSIDE AIR HOODS, WHEN PROVIDED, SHIP WITH A WIRE MESH INLET SCREEN. STANDARD HEAT EXCHANGER CONSTRUCTION CONSISTS OF 20 GAUGE [1.0 MM] ALUMINIZED STEEL TUBES AND 18 GAUGE [1.3 M] ALUMINIZED STEEL HEADERS. STANDARD DRIP PAN CONSTRUCTION IS CORROSION RESISTANT ALUMINIZED STEEL.
 3. STANDARD FINE COLLECTOR CONSTRUCTION IS CORROSION RESISTANT ALUMINIZED STEEL. BURNERS ARE DIE FORMED, CORROSION RESISTANT ALUMINIZED STEEL. STAMPED PORTING AND STAINLESS STEEL PORT PROTECTORS, PORT PROTECTORS PREVENT FOREIGN MATTER FROM OBSTRUCTING THE BURNER PORTS. BURNERS ARE INDIVIDUALLY REMOVABLE FOR EASE OF INSPECTION AND SERVICING. THE ENTIRE BURNER ASSEMBLY IS EASILY REMOVED WITH ITS SLIDE OUT DRAWER DESIGN. THE PILOT IS ACCESSIBLE THROUGH AN ACCESS PLATE WITHOUT REMOVING THE BURNER DRAWER ASSEMBLY.
 4. FILTER RACK IS CONSTRUCTED OF GALVANIZED STEEL WITH ACCESS THROUGH THE SIDE SERVICE PANEL. ELECTRICAL CABINET IS ISOLATED FROM THE AIR STREAM WITH A NON REMOVABLE ACCESS PANEL INTERIOR TO THE OUTER SERVICE PANEL. THERE IS PROVISION IN THIS CABINET FOR COMPONENT MOUNTING, WIRE ROUTING AND HIGH VOLTAGE ISOLATION. MOTOR AND CONTROL WIRING IS HARNESSSED WITH TERMINAL BLOCK CONNECTIONS. STANDARD UNITS ARE PROVIDED WITH 24 VOLT COMBINATION SINGLE STAGE AUTOMATIC GAS VALVES, INCLUDING MAIN OPERATING VALVE AND PILOT SAFETY SHUTOFF. PRESSURE REGULATOR, MANUAL MAIN AND PILOT SHUTOFF VALVE AND ADJUSTABLE PILOT VALVE. GAS VALVES ARE SUITABLE FOR NEC CLASS 2 USE FOR A MAXIMUM INLET GAS PRESSURE OF 0.5 PSI (14" W.C.) [3.4 KPA] ON NATURAL GAS. ALL ROOFTOP UNITS ARE PROVIDED WITH A LOW VOLTAGE CIRCUIT BREAKER RATED FOR 150% OF THE UNITS NORMAL 24 VOLT OPERATING LOAD.
 5. EACH DUCT FURNACE IS PROVIDED WITH A 24 VOLT HIGH TEMPERATURE LIMIT SWITCH, A (REDUANT) COMBINATION GAS VALVE AND A FAN TIME DELAY RELAY. THE FAN TIME DELAY RELAY DELAYS THE FAN START UNTIL THE HEAT EXCHANGER REACHES A PREDETERMINED TEMPERATURE. MAIN AND PILOT SHUTOFF VALVE AND PILOT SAFETY SHUTDOWN REMOVING RESIDUAL HEAT FROM THE HEAT EXCHANGER. DOUBLE AND TRIPLE FURNACE UNITS CONTAIN A REVERSE AIRFLOW INTERLOCK SWITCH. THE NORMALLY CLOSED SWITCH, WHEN ACTIVATED, CAUSES THE GAS VALVES TO CLOSE AND CONTINUE BLOWER OPERATION. ALL UNITS PROVIDED WITH A SOLID STATE IGNITION CONTROL SYSTEM WHICH IGNITES THE INTERMITTENT PILOT BY SPARK DURING EACH CYCLE OF OPERATION. WHEN PILOT FLAME IS PROVEN, MAIN BURNER VALVE OPENS TO ALLOW GAS FLOW TO THE BURNERS. PILOT AND BURNERS ARE EXTINGUISHED DURING THE OFF CYCLE.
- III. STANDARD TEMPERATURE RISE FURNACE:
1. EACH DUCT FURNACE SHALL HAVE A LOWER PRESSURE DROP ACROSS THE HEAT EXCHANGER, ALLOWING HIGHER AIR FLOW CAPACITIES AND AN 80% EFF RATING WITH DELTA T OF 20-60 PER FURNACE.
- IV. AIR HANDLING (FANS):
1. CENTRIFUGAL FAN IS BELT DRIVEN, FORWARD CURVED WITH DOUBLE INLET, STATICALLY AND DYNAMICALLY BALANCED. THE BLOWER WHEEL IS FIXED ON A KEYED SHAFT, SUPPORTED WITH RUBBER GROMMET ON BEARING ONLY AND BALL BEARING SECURED. AN ACCESS INTERLOCK SWITCH IS INSTALLED IN THE BLOWER COMPARTMENT AND WILL DISENGAGE THE BLOWER UPON REMOVING THE SERVICE PANEL. AN OVERRIDE IS INCORPORATED INTO THE ACCESS INTERLOCK SWITCH FOR SERVICEABILITY.
- V. POWER VENT:
1. POWER VENT UNITS ARE PROVIDED WITH A VENT FAN, OUTSIDE AIR FOR COMBUSTION AND PRODUCTS OF COMBUSTION HAVE INDIVIDUAL AIR INLET AND DISCHARGE GRILLES LOCATED IN THE UPPER SECTION OF THE FURNACE SERVICE PANEL. AN AIR PROVING SWITCH IS INSTALLED AND DISENGAGES GAS FLOW IF FOR ANY REASON THE DRAFTER HAS FAILED TO OPERATE. (POWER VENTING AND 100% SHUTOFF IGNITION SYSTEMS ARE REQUIRED FOR COMPLIANCE WITH IRI (INDUSTRIAL RISK INSURERS)).
- VI. ELECTRONIC MODULATING DUCT STAT WITH ROOM OVERRIDE GAS CONTROL:
1. PROVIDE MODULATED HEAT OUTPUT. AN AUTOMATIC VALVE IN SERIES WITH THE MODULATING VALVE SHALL BE PROVIDED TO CYCLE THE UNIT. IGNITION IS AT FULL FIRE (100% INPUT) AND MODULATES THE GAS INPUT FROM 100% TO 40% RATED INPUT. AVAILABLE FOR USE WITH A DUCT THERMOSTAT WITH REMOTE SET POINT ADJUSTMENT. OVERRIDE ROOM THERMOSTAT CAUSES THE UNIT TO GO TO FULL FIRE WHEN THE ROOM TEMPERATURE FALLS BELOW THE OVERRIDE ROOM THERMOSTAT'S SET POINT.
- VII. TYPE 409 STAINLESS STEEL HEAT EXCHANGER:
1. HEAT EXCHANGER TUBES AND HEADERS SHALL BE 20 GAUGE [1.0 MM] TYPE 409 STAINLESS STEEL. BURNERS AND FLUE COLLECTOR SHALL BE 409 STAINLESS STEEL. 409 STAINLESS STEEL IS RECOMMENDED WHERE OUTSIDE AIR IS USED FOR MAKE UP AIR IN AREAS WHERE OUTSIDE TEMPERATURES ARE 40 F [4 C] OR BELOW.
- VIII. DAMPERS-GENERAL:
1. DAMPERS ARE OF THE OPPOSED BLADE TYPE, CONSTRUCTED OF GALVANIZED STEEL WITH NEOPRENE NYLON BUSHINGS, BLADES TO BE MECHANICALLY INTERLOCKED.
 2. TWO POSITION SPRING RETURN MOTOR WITH INTERLOCKED OUTSIDE AND RETURN AIR DAMPERS ARE PROVIDED. THE MOTOR POWERS EITHER THE OUTSIDE AIR DAMPER FULL OPEN AND THE RETURN AIR DAMPER FULL CLOSED OR THE OUTSIDE AIR DAMPER FULL CLOSED AND THE RETURN AIR DAMPER FULL OPEN IN RESPONSE TO AN OUTSIDE AIR TEMPERATURE SENSOR. WHEN THE UNIT IS OFF, THE MOTOR WILL DRIVE THE OUTSIDE AIR DAMPER FULL CLOSED AND THE RETURN AIR DAMPER FULL OPEN.
- IX. ROOF CURB:
1. ROOF CURB IS SHIPPED UNASSEMBLED WITH HARDWARE PACKAGE AND GASKET ATTACHED. CURB AND RAIL SHALL TOTAL 24" AND BE SUPPLIED WITH A GRS MEMBER WHICH ALLOWS THE ISOLATION OF THE RETURN AND SUPPLY AIR STREAMS (WHEN SUPPLIED).
- X. FACTORY INSTALLED VFD:
1. A VARIABLE FREQUENCY DRIVE (VFD) SHALL BE PROVIDED WHEN VARIABLE AIR VOLUME CONTROL IS REQUIRED FOR FAN OPERATION. THE VFD SHALL BE PROPERLY SIZED, FACTORY MOUNTED AND WIRED TO THE FAN MOTOR. THE VFD SHALL PROVIDE OVERLOAD PROTECTION AND SOFT START OPERATION. THE VFD SHALL BE COVERED BY UL 1995 STANDARDS AND MANUFACTURED WITH A NEMA 1 PLENUM RATED ENCLOSURE. IF OPERATING CONDITIONS ARE BELOW 14.0 F A SEPARATE VFD ENCLOSURE SHOULD BE SELECTED.
- XI. VFD ENCLOSURE:
1. THE VFD SHALL BE FACTORY INSTALLED IN A COLD WEATHER ENCLOSURE INSTALLED ON THE DOOR OF THE UNIT. ENCLOSURE SHALL BE NEMA 3R RATED AND SHALL PROTECT THE DRIVE IN AMBIENT TEMPERATURES FROM -30°F TO 115°F.
- XJ. AIR CURTAIN (ACUR-ABB):
- I. MANUFACTURER:
1. MARS AIR SYSTEMS
 2. SIMILAR
- II. AIR CURTAIN ASSEMBLIES:
1. MOTOR FAN ASSEMBLY: DESIGN FOR EASY REMOVAL, ASSEMBLY, REPAIR, AND MAINTENANCE.
- III. MOTOR:
1. TOTALLY ENCLOSED AIR OVER (TEAO) COOLED MOTOR WITH SEALED LIFETIME PRE-LUBRICATED BALL BEARINGS, MOTOR STARTER AND THERMAL OVERLOAD PROTECTION.
- IV. WIRED FOR SINGLE SPEED OPERATION.
- V. ELECTRICAL CHARACTERISTICS:
1. 460V AC, THREE-PHASE, 0.8 AMP FULL LOAD PER MOTOR/FAN.
 2. MEETS NEC, ETL LISTED TO CONFORM TO UL 507 (US) AND CSA22.2 (CANADA) STANDARDS. AMCA 211 CERTIFIED.
- VI. FANS:
1. FORWARD CURVED CENTRIFUGAL TYPE, DOUBLE WIDTH, AND DOUBLE INLET DESIGN, DIRECTLY DRIVEN TO AN ELECTRIC MOTOR.
- VII. PROVIDE RESILIENT ISOLATION DAMPENING MOUNTINGS BETWEEN MOTOR FRAME AND MOTOR MOUNTING PAN.
- VIII. FACTORY BALANCED BLOWER WHEEL ASSEMBLY STATICALLY AND DYNAMICALLY.
- IX. HOUSING:
1. SELF-CONTAINED ONE-PIECE TYPE WITH SUFFICIENT STRENGTH FOR MOUNTING FROM PRE-PUNCHED MOUNTING HOLES AT BOTH ENDS TO ADJACENT WALLS OR CEILING WITHOUT

- INTERMEDIATE SUPPORT.
- X. SIZE:
1. UNHEATED: 12-3/4 INCHES DEEP BY 10-5/8 INCHES HIGH (INCLUDING DISCHARGE NOZZLE) BY WIDTH OF UNIT.
- XI. MOUNTING:
1. UNHEATED INSIDE MOUNT.
- XII. MATERIAL:
1. PROVIDE 18- AND 20-GAUGE ELECTRO OR HOT DIPPED GALVANIZED STEEL SHEET HOUSING CONFORMING TO ASTM A 879 AND/OR ASTM A 653.
- XIII. AIR INLET GRILLE AND/OR FILTERS: PROVIDE AIR INLET GRILLE AND/OR FILTERS SPECIFIED.
- XIV. DISCHARGE: PROVIDE INTEGRAL DISCHARGE NOZZLE SPECIFIED.
- XV. FINISH AND COLOR:
1. PROVIDE WITH, NO VOC, CORROSION RESISTANT POLYURETHANE POWDER COATED FINISH FOR SHEET METAL HOUSINGS.
 2. UNIT TO BE OBSIDIAN BLACK.
- XVI. DISCHARGE NOZZLE:
1. WEDGE-SHAPED DISCHARGE OUTLET NOZZLE WITH ADJUSTABLE AIR FOIL VANES WITH A PLUS/MINUS 40-DEGREE SWEEP FRONT TO BACK.
- XVII. AIR VELOCITY AT NOZZLE:
1. STD2108-3: 108 INCH (2743 MM) WIDE UNITS: 2206 FEET/MIN (11.2 M/S) TWO 1/2HP MOTOR/FAN ASSEMBLIES.
 2. STD2120-3: 120 INCH (3050 MM) WIDE UNITS: 2084 FEET/MIN (10.6 M/S) THREE 1/2HP MOTOR/FAN ASSEMBLIES.
- XVIII. AIR SPEED AT FLOOR: MINIMUM OF 300 FPM (1.53 M/S) AT 3 FEET (914 MM) FROM THE FLOOR.
- XIX. AIR INLET GRILLE AND FILTERS:
1. LOCATION: FRONT.
 2. TYPE: FIXED AIR INTAKE GRILLE.
 3. FILTER: ALUMINUM MESH, 1/4 INCH (6.4 MM), WASHABLE.
- XX. MOTOR/FAN ASSEMBLY:
1. SOUND PRESSURE LEVEL AT 10 FEET (3 M) FROM NOZZLE:
 2. THREE MOTOR/FAN UNITS: 71 DBA.
- XXI. MOTOR CONTROL PANELS FOR UNHEATED UNITS:
1. RECOMMENDED FOR ALL THREE-PHASE UNITS AND SINGLE PHASE UNITS WITH COMBINED MOTOR CAPACITIES OF MORE THAN 1 HP WHENEVER A DOOR LIMIT SWITCH IS USED TO AUTOMATICALLY START AND STOP THE AIR CURTAIN.
 2. PROVIDE MOTOR CONTROL PANELS AS FOLLOWS:
1. MOUNTING: SHIPPED LOOSE TO BE FIELD MOUNTED.
 3. ELECTRICAL COMPONENTS UL/ULC LISTED.
 4. PANELS UL 508A LISTED.
- C. VERTICAL INLINE MULTISTAGE PUMP (HWP-1-1-82):
- I. MANUFACTURER:
1. BELL & GOSSETT
 2. ARMSTRONG
 3. GRUNDFOS
- II. PUMP:
1. THE PUMP SHALL BE A NON-SELF PRIMING VERTICAL MULTISTAGE PUMP COUPLED TO A MOTOR.
 2. THE LIQUID END, LOCATED BETWEEN THE UPPER COVER AND THE PUMP CASING, IS HELD IN PLACE BY THE RODS.
 3. THE PUMP CASING IS AVAILABLE WITH DIFFERENT CONFIGURATIONS AND CONNECTION TYPES.
 4. DIRECTION OF ROTATION: CLOCKWISE LOOKING AT THE PUMP FROM THE TOP DOWN MARKED WITH AN ARROW ON THE ADAPTER AND ON THE COUPLING.
- III. MOTOR:
1. STANDARD NEMA PREMIUM TC FRAME MOTORS IN TOTALLY ENCLOSED FAN COOLED (TEFC).
 2. 1750 RPM NOMINAL
- IV. STANDARD VOLTAGE:
1. THREE-PHASE VERSION, 2 POLE: 208-230/460 V, 60 HZ
- V. GENERAL:
1. VERTICAL MULTISTAGE CENTRIFUGAL PUMP WITH IMPELLERS, DIFFUSERS AND OUTER SLEEVE MADE ENTIRELY OF STAINLESS STEEL, AND WITH PUMP CASING AND MOTOR ADAPTER MADE OF CAST IRON IN THE STANDARD VERSION
 2. ROTATING COMPONENTS MADE ENTIRELY OF AISI 316 STAINLESS STEEL
 3. INNOVATIVE AXIAL LOAD COMPENSATION SYSTEM TO ENSURE REDUCED AXIAL THRUSTS
 4. BALANCED MECHANICAL SEAL ACCORDING TO EN 12756 (EX DIN 24960) AND ISO 3069, WHICH CAN BE REPLACED WITHOUT REMOVING THE MOTOR FROM THE PUMP
 5. SEAL HOUSING CHAMBER DESIGNED TO PREVENT THE ACCUMULATION OF AIR IN THE CRITICAL AREA NEXT TO THE MECHANICAL SEAL.
 6. ALLOWABLE TEMPERATURE RANGE: -20°F TO 250°F
 7. PUMP BODY FITTED WITH TAPS FOR INSTALLING PRESSURE GAUGES ON BOTH SUCTION AND DELIVERY FLANGES
- D. VARIABLE AIR VOLUME BOXES (VAV, CAV & VAV-HW):
- I. CASING:
1. 22 GAUGE GALVANIZED STEEL.
- II. AGENCY LISTING:
1. UNIT IS UL AND CANADIAN UL LISTED AS A ROOM AIR TERMINAL UNIT. CONTROL # 9N65, AHRJ 880 CERTIFIED.
- III. INSULATION:
1. 1-INCH (25.4 MM) MATTE-FACED INSULATION--INTERIOR SURFACE OF UNIT CASING IS ACOUSTICALLY AND THERMALLY LINED WITH 1-INCH, 1.0 LB/FT³ (25.4 MM, 16.0 KG/M³) COMPOSITE DENSITY GLASS FIBER WITH A HIGH-DENSITY FACING. INSULATION R-VALUE IS 3.85. INSULATION IS UL LISTED AND MEETS NFPA-90A AND UL 181 STANDARDS. THERE ARE NO EXPOSED EDGES OF INSULATION (COMPLETE METAL ENCAPSULATION).
 2. WIRE PENETRATIONS ARE COVERED BY GROMMETS. THERE ARE NO EXPOSED EDGES OF INSULATION (COMPLETE METAL ENCAPSULATION).
- IV. PRIMARY AIR VALVE:
1. AIR VALVE ROUND--THE PRIMARY (VENTILATION) AIR INLET CONNECTION IS AN 18-GAUGE GALVANIZED STEEL CYLINDER SIZED TO FIT STANDARD ROUND DUCT. A MULTIPLE-POINT, AVERAGING FLOW SENSING RING IS PROVIDED WITH BALANCING TAPS FOR MEASURING +/-5% OF UNIT CATALOGED AIRFLOW.
 2. AN AIRFLOW VERSUS PRESSURE DIFFERENTIAL CALIBRATION CHART IS PROVIDED.
 3. THE DAMPER BLADE IS CONSTRUCTED OF A CLOSED- CELL FOAM SEAL THAT IS MECHANICALLY LOCKED BETWEEN TWO 22-GAUGE GALVANIZED STEEL DISKS.
 4. THE DAMPER BLADE ASSEMBLY IS CONNECTED TO A CAST ZINC SHAFT SUPPORTED BY SELF-LUBRICATING BEARINGS.
 5. THE SHAFT IS CAST WITH A DAMPER POSITION INDICATOR. THE VALVE ASSEMBLY INCLUDES A MECHANICAL STOP TO PREVENT OVER-STROKING. SEE , P. 16 FOR AIR LEAKAGE PERFORMANCE DATA.
- V. OUTLET CONNECTION:
1. SLIP AND DRIVE CONNECTION--TERMINAL UNITS COME STANDARD WITH SLIP AND DRIVE CONNECTION.
 2. HOT WATER COILS (IF APPLICABLE):
 1. ALL HOT WATER COILS ARE FACTORY-INSTALLED ON THE DISCHARGE OUTLET.
 2. FULL FIN COLLARS PROVIDED FOR ACCURATE FIN SPACING AND MAXIMUM FIN-TUBE CONTACT.
 3. THE 3/8" (9.5 MM) OD SEAMLESS COPPER TUBES ARE MECHANICALLY EXPANDED INTO THE FIN COLLARS. COILS SHALL BE SUBJECTED TO A PRESSURE DECAY TEST AT 450 PSIG FOR A MINIMUM OF 45 SECONDS.
 4. COILS SHALL THEN BE EVACUATED AND CHARGED WITH A HELIUM GAS MIXTURE AND PRESSURIZED TO 150 PSIG. WHILE PRESSURIZED WITH THE HELIUM GAS MIXTURE, THE COIL SHALL BE CHECKED WITH A GAS ANALYZER TO DETECT HELIUM LEAKS.

5. ALTERNATIVELY, THE COIL SHALL BE SUBJECTED TO A FINAL AIR-UNDER-WATER LEAK TEST AT 300 PSIG.
 6. THE 1-ROW COIL HAS 144 ALUMINUM FINS PER FOOT.
 7. FULL FIN COLLARS PROVIDED FOR ACCURATE FIN SPACING AND MAXIMUM FIN-TUBE CONTACT.
 8. COIL CONNECTIONS ARE LEFT-HAND. RIGHT-HAND CONNECTIONS ARE OPTIONAL.
 9. COILS ARE ASSEMBLED WITH EITHER 3/8" OR 7/8" (22.2 MM) OD BRAZE CONNECTIONS.
- E. PIPE EXPANSION FITTING (PIPE):
- I. MANUFACTURERS:
1. FLEXICRAFT
 2. SIMILAR
- II. CONSTRUCTION:
1. METAL EXPANSION JOINTS SHALL CONSIST OF A SINGLE HYDRAULICALLY FORMED METAL BELLOWS WITH FLANGE END FITTINGS.
 2. FLANGES SHALL BE CARBON STEEL AND ANSI B16.5 150#.
 3. THE BELLOWS SHALL BE 316 STAINLESS STEEL.
- III. JOINTS:
1. JOINTS SHALL BE DESIGNED TO MEET THE DESIGN PRESSURES AND TEMPERATURE FOR THE SYSTEM AND SHALL BE CAPABLE OF ACCOMMODATING PIPING SYSTEM AND EQUIPMENT MOVEMENTS AS NEEDED.
- F. DUCT EXPANSION FITTING:
- I. MANUFACTURERS:
1. FLEXICRAFT
 2. SIMILAR
- II. CONSTRUCTION:
1. EPDM ELASTOMER FLEXIBLE ELEMENT MATERIAL FOR FABRIC EXPANSION JOINTS.
 2. REINFORCED WITH FIBERGLASS.
 3. FABRIC TO BE 1/4" THICKNESS AND RATED FOR 300F.
 4. FABRIC DUCT EXPANSION FITTING TO HAVE FLANGE CONNECTION FOR DUCTWORK CONNECTION.
- G. AIR SEPARATOR (AS-1-1):
- I. MANUFACTURER:
1. BELL & GOSSETT
 2. AMTROL
- II. COMPONENTS:
1. THE AIR SEPARATOR SHALL BE DESIGNED, CONSTRUCTED, AND STAMPED IN ACCORDANCE WITH SECTION VIII, DIVISION I OF THE ASME BOILER AND PRESSURE VESSEL CODE, AND REGISTERED WITH THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS.
 2. THE AIR SEPARATOR SHALL HAVE A MAXIMUM TEMPERATURE RATING OF 350°F (177°C).
 3. THE AIR SEPARATOR BODY SHALL BE MADE OF CAST IRON OR CARBON STEEL.
 4. THE AIR SEPARATOR BODY SHALL BE THREE TIMES THE NOMINAL INLET/OUTLET PIPE DIAMETER.
 5. THE AIR SEPARATOR SHALL INCLUDE THREADED BLOW DOWN CONNECTION TO ALLOW FOR SEDIMENT TO BE REGULARLY CLEANED OUT OF THE UNIT.
 6. THE AIR SEPARATOR SHALL INCLUDE A THREADED AIR REMOVAL CONNECTION ON TOP OF THE UNIT SO AN AIR VENT OR EXPANSION/COMPRESSION TANK CAN BE CONNECTED, ALLOWING COLLECTED AIR TO BE REMOVED FROM THE UNIT.
 7. THE AIR SEPARATOR SHALL INCLUDE A PERFORATED BAFFLE WITH 3/16" PERFORATIONS AND 51% OPEN AREA (R-MODELS ONLY). THE BAFFLE SHALL BE MADE OF CARBON STEEL (R-MODELS ONLY).
 8. THE AIR SEPARATOR SHALL INCLUDE A REMOVABLE PERFORATED STRAINER WITH 3/16" PERFORATIONS AND 51% OPEN AREA (R-MODELS ONLY).
 9. THE REMOVABLE STRAINER SHALL BE MADE OF 304 STAINLESS STEEL (R-MODELS ONLY).
 10. THE AIR SEPARATOR SHALL BE AVAILABLE WITH FLANGED END CONNECTIONS.
 11. FLANGE END CONNECTIONS SHOULD BE DESIGNED ACCORDING TO ANSI STANDARDS.
- III. ACCESSORIES:
1. BLOWDOWN VALVE.
 2. AIR VENT
- H. FLOOR-MOUNTED EXPANSION TANK (ET-1-1):
- I. MANUFACTURER:
1. BELL & GOSSETT
 2. AMTROL
- II. GENERAL:
1. PRE-CHARGED VERTICAL STEEL EXPANSION TANK WITH INTEGRAL HEAVY DUTY BUTYL RUBBER DIAPHRAGM
 2. TANK SHALL HAVE 0.302"-0.32" CHARGING VALVE CONNECTION (STANDARD TRIP VALVE) TO FACILITE THE ONSITE CHARGING OF THE TANK TO MEET SYSTEM REQUIREMENTS.
 3. THE TANK SHALL HAVE A MAX DESIGN TEMPERATURE OF 240F AND A MAX WORKING PRESSURE OF 125 PSIG.
- III. TANK:
1. THE TANK SHALL BE CONSTRUCTED IN ACCORDANCE WITH SECTION VIII OF THE ASME BOILER AND PRESSURE VESSEL CODE AND STAMPED 125 PSI (862 KPA) WORKING PRESSURE.
- K. CEILING-MOUNTED INLINE EXHAUST FAN (TF-1-1,2&3, TFX-1-1&2, TF-4-1&2):
- I. MANUFACTURER:
1. GREENHECK
 2. PENN BARRY
 3. COOK
- II. GENERAL DESCRIPTION:
1. BASE FAN PERFORMANCE AT STANDARD CONDITIONS (DENSITY 0.075 LB/FT³)
 2. EACH FAN SHALL BEAR A PERMANENTLY AFFIXED MANUFACTURE'S NAMEPLATE CONTAINING THE MODEL NUMBER AND INDIVIDUAL SERIAL NUMBER
- III. WHEEL:
1. FORWARD CURVED OR BACKWARD INCLINED CENTRIFUGAL WHEEL
 2. CONSTRUCTED OF GALVANIZED STEEL.
 3. STATICALLY AND DYNAMICALLY BALANCED IN ACCORDANCE TO AMCA STANDARD 204-05
- IV. MOTOR:
1. ELECTRONICALLY COMMUTATED MOTOR
 2. MOTOR ENCLOSURES: TOTALLY ENCLOSED FAN COOLED.
 3. ELECTRONIC COMMUTATION TYPE MOTOR (ECM) SPECIFICALLY 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.
 4. MOTORS ARE PERMANENTLY LUBRICATED, HEAVY DUTY BALL BEARING TYPE TO MATCH WITH THE FAN LOAD AND PRE-WIRED TO THE SPECIFIC VOLTAGE AND PHASE.
 5. INTERNAL MOTOR CIRCUITRY TO CONVERT AC POWER SUPPLIED TO THE FAN TO DC POWER TO OPERATE THE MOTOR OR INTEGRATED VARIABLE FREQUENCY DRIVE.
 6. 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.
 7. MOTORS CAN ACHIEVE UP TO 95% EFFICIENCY, MODEL AND HORSEPOWER DEPENDENT.
- V. HOUSING:
1. CONSTRUCTED OF HEAVY GAUGE GALVANIZED STEEL
 2. INTERIOR SHALL BE LINED WITH 0.5 INCHES OF ACOUSTICAL INSULATION
- VI. SPRING LOADED ALUMINUM BACKDRAFT DAMPER:
1. PREVENTS AIR FROM ENTERING BACK INTO THE BUILDING WHEN FAN IS OFF.
 2. ELIMINATES RATTLING OR UNWANTED BACKDRAFTS.
- VII. MOUNTING BRACKETS:
1. FULLY ADJUSTABLE FOR MULTIPLE INSTALLATION CONDITIONS

- VIII. ACCESS PANEL:
1. ONCE INSTALLED SHALL HAVE EASY ACCESS TO INTERNAL COMPONENTS
- IX. DISCONNECT SWITCHES:
1. FACTORY MOUNTED AND SHIPPED LOOSE FOR FIELD MOUNTING
 2. NEMA 1; INDOOR APPLICATION NO WATER. (SINGLE POLE ROCKER SWITCH ASSEMBLY)(TWO POLE ROCKER SWITCH ASSEMBLY)
 3. WIRED FROM FAN MOTOR TO JUNCTION BOX INSTALLED WITHIN MOTOR COMPARTMENT
 4. ACCESS FOR WIRING SHALL BE EXTERNAL
- X. VIBRATION KIT:
1. AVAILABLE FOR SUSPENDED INSTALLATIONS
 2. INCLUDES PREPUNCHED HOLE FOR EASE OF INSTALLATION AND SHALL HAVE ALL HARDWARE TO MOUNT ONE UNIT.
- J. INLINE TUBULAR EXHAUST FAN (MXF-1-1):
- I. MANUFACTURER:
1. GREENHECK
 2. PENN BARRY
 3. COOK
- II. GENERAL:
1. BASE FAN PERFORMANCE AT STANDARD CONDITIONS (DENSITY 0.075 LB./FT³).
 2. FANS SELECTED SHALL BE CAPABLE OF ACCOMMODATING STATIC PRESSURE AND FLOW VARIATIONS OF +/-15% OF SCHEDULED VALUES.
 3. EACH FAN SHALL BE BELT DRIVEN IN AMCA ARRANGEMENT 9 ONLY WITH WHEEL SECURED TO THE FAN SHAFT.
 4. FANS ARE TO BE EQUIPPED WITH LIFTING LUGS.
 5. AFTER FABRICATION ALL CARBON STEEL COMPONENTS SHALL BE CLEANED AND CHEMICALLY TREATED BY A PHOSPHATIZING PROCESS TO INSURE PROPER REMOVAL OF GREASE, OIL, SCALE, ETC. FAN SHALL THEN BE COATED WITH A MINIMUM OF 2-4 MILS OF PERMATECTOR (POLYESTER URETHANE), ELECTROSTATICALLY APPLIED AND BAKED. FINISH COAT SHALL BE RAL 7023, CONCRETE GREY. COATING MUST EXCEED 1,000-HOUR SALT SPRAY UNDER ASTM B117 TEST METHOD.
- III. FAN HOUSING AND OUTLET:
1. FAN HOUSING TO BE AERODYNAMICALLY DESIGNED WITH PUNCHED INLET AND OUTLET FLANGES FOR DUCTWORK CONNECTION ON INLINE FANS.
 2. FAN HOUSING SHALL BE CONSTRUCTED OF ROLLED STEEL WITH A CONTINUOUS SEAM WELD.
 3. HOUSING AND BEARING SUPPORT SHALL BE CONSTRUCTED OF WELDED STRUCTURAL STEEL MEMBERS TO PREVENT VIBRATION AND RIGIDLY SUPPORT THE SHAFT AND BEARINGS.
 4. EITHER AN OSHA COMPLIANT WEATHERHOOD, OR AN OSHA COMPLIANT BELT GUARD SHALL BE INCLUDED TO COMPLETELY COVER THE MOTOR PULLEY AND BELT(S).
- IV. FAN WHEEL:
1. THE FAN WHEEL SHALL BE OF THE NON-OVERLOADING BACKWARD INCLINED CENTRIFUGAL TYPE. WHEELS SHALL BE STATICALLY AND DYNAMICALLY BALANCED TO BALANCE GRADE G6.3 PER ANSI S2.19.
 2. LEVEL 1 WHEEL SHALL BE CONSTRUCTED WITH HALF-WELDED AND HALF-RIVETED ALUMINUM. THE MAXIMUM PRESSURE CAPABILITIES SHALL BE 2 INCHES W.G.
 3. ALUMINUM PARTS SHALL NOT REQUIRE PROTECTIVE COATING.
 4. THE WHEEL AND FAN INLET SHALL BE CAREFULLY MATCHED AND SHALL HAVE PRECISE RUNNING TOLERANCES FOR MAXIMUM PERFORMANCE AND OPERATING EFFICIENCY.
- V. FAN MOTORS AND DRIVE:
1. MOTORS TO BE NEMA T-FRAME, 1800 RPM, OPEN EXPLOSION PROOF-SPARK RESISTANT B CERTIFIED WITH A 1.15 SERVICE FACTOR.
 2. DRIVE BELTS AND SHEAVES SHALL BE SIZED FOR 150% OF THE FAN OPERATING BRAKE HORSEPOWER, AND SHALL BE READILY AND EASILY ACCESSIBLE FOR SERVICE, IF REQUIRED.
 3. FAN SHAFT TO BE TURNED AND POLISHED STEEL, THAT IS SIZED SO THE FIRST CRITICAL SPEED IS AT LEAST 25% OVER THE MAXIMUM OPERATING SPEED FOR EACH PRESSURE CLASS.
 4. FAN SHAFT BEARINGS SHALL BE AIR HANDLING QUALITY, BEARINGS SHALL BE HEAVY-DUTY GREASE LUBRICATED, SELF-ALIGNING OR ROLLER PILLOW BLOCK TYPE.
 5. BEARINGS SHALL BE SELECTED FOR A BASIC RATING FATIGUE LIFE (L-10) OF 80,000 HOURS AT MAXIMUM OPERATING SPEED FOR EACH PRESSURE CLASS (AVERAGE LIFE OR (L-50) OF 400,000 HOURS).
 6. BEARINGS SHALL BE FIXED TO THE FAN SHAFT USING CONCENTRIC MOUNTING LOCKING COLLARS, WHICH REDUCE VIBRATION, INCREASE SERVICE LIFE, AND IMPROVE SERVICEABILITY. BEARINGS THAT USE SET SCREWS SHALL NOT BE ALLOWED.
 7. BEARINGS SHALL HAVE EXTENDED LUBE LINES WITH ZERK FITTINGS TO ALLOW FOR LUBRICATION.
- VI. DISCONNECT SWITCHES:
1. FACTORY MOUNTED AND SHIPPED LOOSE FOR FIELD MOUNTING
 2. NEMA 1; INDOOR APPLICATION NO WATER. (SINGLE POLE ROCKER SWITCH ASSEMBLY)(TWO POLE ROCKER SWITCH ASSEMBLY)
 3. WIRED FROM FAN MOTOR TO JUNCTION BOX INSTALLED WITHIN MOTOR COMPARTMENT
 4. ACCESS FOR WIRING SHALL BE EXTERNAL
- K. CEILING-HUNG INLINE EXHAUST FAN (TF-1-1):
- I. MANUFACTURER:
1. GREENHECK
 2. PENN BARRY
 3. COOK
- II. GENERAL:
1. BASE FAN PERFORMANCE AT STANDARD CONDITIONS (DENSITY 0.075 LB/FT³)
 2. EACH FAN SHALL BEAR A PERMANENTLY AFFIXED MANUFACTURE'S ENGRAVED METAL NAMEPLATE CONTAINING THE MODEL NUMBER AND INDIVIDUAL SERIAL NUMBER
- III. WHEEL:
1. NON-OVERLOADING, BACKWARD INCLINED CENTRIFUGAL WHEEL
 2. CONSTRUCTED OF ALUMINUM.
 3. STATICALLY AND DYNAMICALLY BALANCED IN ACCORDANCE TO AMCA STANDARD 204-05
 4. THE WHEEL CONE AND FAN INLET WILL BE MATCHED AND SHALL HAVE PRECISE RUNNING TOLERANCES FOR MAXIMUM PERFORMANCE AND OPERATING EFFICIENCY.
 5. SINGLE THICKNESS BLADES ARE SECURELY RIVETED OR WELDED TO A HEAVY GAUGE BACK PLATE AND WHEEL CONE.
- IV. MOTOR:
1. ELECTRONICALLY COMMUTATED MOTOR
 2. MOTOR ENCLOSURES: TOTALLY ENCLOSED FAN COOLED.
 3. ELECTRONIC COMMUTATION TYPE MOTOR (ECM) SPECIFICALLY 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.
 4. MOTORS ARE PERMANENTLY LUBRICATED, HEAVY DUTY BALL BEARING TYPE TO MATCH WITH THE FAN LOAD AND PRE-WIRED TO THE SPECIFIC VOLTAGE AND PHASE.
 5. INTERNAL MOTOR CIRCUITRY TO CONVERT AC POWER SUPPLIED TO THE FAN TO DC POWER TO OPERATE THE MOTOR OR INTEGRATED VARIABLE FREQUENCY DRIVE.
 6. 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.
 7. MOTORS CAN ACHIEVE UP TO 95% EFFICIENCY, MODEL AND HORSEPOWER DEPENDENT.
- V. HOUSING/CABINET CONSTRUCTION:
1. CONSTRUCTION MATERIAL: GALVANIZED
 2. SQUARE DESIGN CONSTRUCTED OF HEAVY GAUGE GALVANIZED STEEL
- VI. HOUSING SUPPORT & DRIVE FRAME:
1. DRIVE FRAME IS CONSTRUCTED OF STRUCTURAL STEEL WITH FORMED FLANGES.
- VII. DISCONNECT SWITCH:

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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 #2

DWG NUMBER :

M-802

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.