1. GENERAL

1.1 SECTION INCLUDES

A. Packaged and Split System Outdoor Air Unit
B. Heat Exchanger
C. Refrigeration Components
D. Unit Operating Controls
E. Roof Curb (if applicable)
F. Electrical Power Connections
G. Operation and Maintenance Service

1.2 RELATED SECTIONS

A. Section 15170 - Motors.
B. Section 15242 – Vibration Isolation.
C. Section 15290 – Ductwork Insulation
D. Section 15885 – Air Cleaning
E. Section 15952 – Controls and Instrumentation
F. Section 16180 – Equipment Wiring Systems

1.3 REFERENCES

A. NFPA 90 A & B – Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems (all) ETL Listed and Labeled ANSI/ASHRAE 15 – Safety Code for Mechanical Refrigeration.
B. Standard for Safety, Heating and Cooling Equipment – Third Edition, UL 1995 CSA C22.2 236-05, dated February 18, 2005, with revisions through July 30, 2009 (all for cooling and for electric heat)
C. ANSI/ASHRAE/IESNA 90.1-2010 – Energy Standard for New Buildings except Low Rise Residential Buildings.
D. ANSI Z21.47/UL 1995 – Unitary Air Conditioning Standard for Safety Requirements.
E. California Energy Commission Administrative Code – Title 20/24 – Establishes the Minimum Efficiency Requirements for HVAC Equipment Installed in New Buildings in the State of California. (all)
F. ANSI/NFPA 70-1995 – National Electric Code. (all)
G. International Fuel Gas Code (g/e)

1.4 SUBMITTALS

A. Submit unit performance data including: capacity, nominal and operating performance.
B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.
C. Submit shop drawings including overall dimensions as well as installation, operation and service clearances. Indicate lift points and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.
D. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.

1.5 DELIVERY AND STORAGE

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting of units.
B. Protect units from physical damage. Leave factory shipping covers in place until Installation.

1.6 WARRANTY

A. Provide all parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.
B. Provide 2nd thru 5th year parts only warranty for compressor(s).
C. Provide 2nd thru 10th year limited parts only warranty for heat exchanger (gas fired units only).

2. PRODUCTS

2.1 SUMMARY

A. The contractor shall furnish and install packaged or split system outdoor air unit(s) as shown and scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

B. APPROVED MANUFACTURERS: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include, but are not limited to:

1. iAIRE
2. Desert-Aire
3. AAON
4. Modine Co.
5. Reznor

2.2 GENERAL DESCRIPTION

A. Unit(s) furnished and installed shall be packaged or split system (as shown and scheduled on the contract documents). Unit(s) shall consist of an insulated, weather-tight metal cabinet, downturn outdoor air intake with metal mesh filter assembly, evaporator coil, condensate drain pan, hot gas reheat coil, electric post-heater or indirect gas heater, supply air blower assembly and an electrical control center. All specified components and internal accessories shall be factory installed.

2.3 UNIT CONTRUCTION

A. Materials: Formed, single wall or double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.
   1. Outside casing: galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Pre-painted components as supplied by the factory shall have a baked enamel finish.
   2. Internal assemblies: galvanized (G90) steel except for motor supports which shall be minimum14 gauge galvanized (G90) steel.

B. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.
   1. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
      a) Thickness: 1/2 inch (50 mm)
      b) Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.

C. Access Panels / Doors: Unit shall be equipped with insulated, hinged doors or removable access panels to provide easy access to all major components. Doors and access panels shall be fabricated of galvanized G90 steel or painted galvanized steel.

D. Supply Air blower assemblies: Blower assembly shall consist of an electric motor and a belt or direct-drive fan. Assembly shall be mounted on heavy gauge galvanized steel rails and further mounted on 1.125 inch thick neoprene vibration isolators. Blower motor shall be capable of continuous speed modulation and controlled by a VFD.

E. Evaporator Coil: Evaporator coil shall be AHRI Certified and shall be (silver) soldered or brazed into the compressed refrigerant system. Coil shall be constructed of copper tubing, permanently bonded to aluminum fins and enclosed in a galvanized steel frame. If two compressors are used as components of the unit, then the evaporator coil shall be of circuited configuration, permitting independent operation of either

compressor without conflict with the other compressor. Optional **ElectroFin**® coil coatings are available.

F. Control panel / connections: Units shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections.
G. Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be non-corrosive composite or welded austenitic stainless steel sheet material and provided with a welded stainless steel drain connection at the front for connection to a P trap. Drain pan shall be sloped in two directions to provide positive draining and drain connector shall be sealed at penetration through cabinet wall.
H. Electric heater shall be provided for heating cycle and / or temperature control. Heater shall comply with UL 1995 and be constructed on a galvanized steel frame. heater shall be staged or SCR control and shall include a temperature sensor with field adjustable set point, located in the air stream.
I. Reheat Coil with factory installed modulating hot gas reheat valve, shall be of the copper tube / aluminum fin design and shall be located downstream of the evaporator coil. Optional **ElectroFin**® coil coating is available.
J. Indirect gas furnace: (If applicable)
    1. Shall be ETL Certified as a component of the unit.
    2. Shall have an integral combustion gas blower.
    3. Shall be ETL Certified for installation downstream of a cooling coil.
    4. Shall have fault sensors to provide fault conditions to optional digital controller or building controls.
    5. Shall have 4-pass tubular heat exchangers, constructed of type 409 stainless steel. Heat exchanger tubes shall be installed on the vest plate by means of swaged assembly, welded connections are not acceptable. Heat exchanger tubes shall be supported by a minimum of two fabricated assemblies that support the tubes and also permit expansion and contraction of the tubes.
    6. Heat exchanger shall have a 10 year warranty.
    7. Furnace control shall be staged or modulating.
K. Packaged DX System: unit shall have an integral compressor(s) and evaporator coil located within the weather-tight unit housing. The evaporator and condenser coils can be coated with **ElectroFin**® coil coating (optional). Condenser coils and appurtenant condenser fan assemblies shall be factory installed as integral subassemblies of the unit. Condenser fan motors shall be three phase type 56 frame, Open Air Over and Shaft Up. Each condenser fan motor shall have a vented frame, rated for continuous duty and be equipped with an automatic reset thermal protector. Motors shall be UL Recognized and CSA Certified. The refrigerant compressor(s) shall be hermetic scroll-type modulating using a capacity control valve A.P.R. device for modulation of compressor capacity and to help prevent icing of the evaporator coil under low load conditions. The refrigeration circuit shall be equipped with liquid line filter drier, metering device, manual reset high pressure and low pressure cutouts and all appurtenant sensors, service ports and safety devices. Compressed refrigerant system shall be fully charged with R-410A refrigerant. Each compressor shall be factory-equipped with an electric crankcase heater to boil off liquid refrigerant from the oil.
L. Capacity Modulation: a VFD driven compressor shall be used to modulate capacity of the first stage only.
M. Packaged DX Control and Diagnostics: The Packaged DX system shall be controlled by an onboard microprocessor based digital controller (DDC) that indicates both owner-supplied settings, unit status and fault conditions that may occur. The DDC shall be programmed for discharge air control or space control.
N. Motorized dampers: Motorized damper of [low leakage type shall be shipped loose to prevent shipping damage.
O. Sensors are considered to be part of various optional operational modes or device controllers and are to be factory supplied and installed as specified by the A/E.
P. Blower section construction: Supply air blower shall be forward curved, direct drive (smaller units) or belt drive type (larger units). Blowers hall include neoprene pad isolation.

Q. Filters: Filters shall be MERV 7 minimum.

R. Ratings are to be established in accordance with AMCA 210, “Laboratory Methods of Testing Fans for Rating.”

2.4 UNIT CONTROLS

A. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors or it can be operated as a heating and cooling system controlled by a Building Management System (BMS) with optional BACnet or LON gateway. This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.
B. Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status. DDC controller shall have a built-in keypad to permit operator to access read-out screens without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable.
C. Economizer control shall be temperature or temperature / dew point
D. Operating protocol: The DDC shall be factory-programmed for [LonWorks] [BACnet MSTP] [BACnet IP] [Modbus] [Modbus RTU] [Modbus IP].
E. Variable Frequency Drive (VFD): Unit shall have factory installed variable frequency drive for modulation of the supply air blower assembly. The VFD shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.

2.5 FANS AND MOTORS

A. Indoor Fan shall direct or belt drive, factory installed and wired to on-board Variable Frequency Drive and shall be equipped with slide out service access.
B. All fan motors shall meet the U.S. Energy Policy of 2005/10 (EPACT).
C. All fan motors shall be permanently lubricated and / or have thermal overload protection.
D. Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.
E. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

2.6 MODULATING INDIRECT GAS FIRED HEATING SYSTEM

A. Completely Assembled, factory installed heating system shall be integral to the unit and approved for use, downstream from refrigerant cooling coils.
B. The unit shall have fully modulating or staged, indirect gas fired heat. The heating section will have high turndown burners firing into individual stainless steel tubular heat exchangers. The heat exchangers shall be constructed of type 409 or optional type 304 stainless steel, capable of draining internal condensate.
C. Gas Burner Safety Controls shall include controls for the proving of combustion air prior to ignition, and continuous flame supervision.
D. Timed freeze-stat shall monitor heat output and shall discontinue all heating attempts and or unit operation in the event that the heating section fails to ignite or fails to maintain programmed supply air temperature within range...
E. Include built in thermal over-temperature protection
F. Limit Controls: High Temperature limit controls will shut off gas flow in the event of excessive temperatures resulting from restricted indoor air flow, loss of indoor air flow or flame roll-out.

2.7 EVAPORATOR CONDENSER AND REHEAT COILS

A. Evaporator and Hot Gas Reheat Coils shall be constructed of copper tubes mechanically bonded to aluminum fins. Micro-Channel Coils shall NOT be acceptable in these positions.
B. Coils shall be leak tested at the factory to ensure pressure integrity. The Evaporator, Condenser, and Reheat Coils shall be pressure and leak tested.
C. The Condenser coil shall be copper tubes mechanically bonded to aluminum fins, or micro channel design.
D. To prevent re-hydration of condensate from the evaporator coil, the hot gas reheat coil face, and the evaporator coil face shall be separated.

2.8 REFRIGERANT CAPACITY CONTROL

A. Units with scroll compressors shall be equipped with a VFD driven compressor on the lead circuit to modulate compressor capacity, and prevent evaporator frosting or freezing
B. The Condenser coil shall be copper tubes mechanically bonded to aluminum fins, or micro channel design.
C. To prevent re-hydration of condensate from the evaporator coil, the hot gas reheat coil face, and the evaporator coil face shall be separated.
D. Compressors that pulse refrigerant as a means of capacity control will not be acceptable.

2.9 REFRIGERATION SYSTEM.

A. Compressor(s):All units shall have direct drive hermetic or semi-hermetically sealed compressors with centrifugal oil pumps
B. Motor shall be suction gas cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate rated voltage.
C. Internal overloads shall be provided in each compressor.
D. Each compressor shall have a crankcase heater to minimize the amount of liquid refrigerant present in the oil sump during off cycles.
E. Provide each circuit with hermetically sealed refrigerant circuit(s) factory supplied completely piped with liquid line filter drier, liquid line charging port suction and liquid line charging ports, accumulator, and/or liquid receiver.
F. Units shall come with a hot gas, reheat coil, hot gas modulating valve, accumulator and receiver.

3.0 SEQUENCE OF OPERATION.

A. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and / or sensors. The unit can also be operated as a heating and cooling system controlled by a Building Management System (BMS). The unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors to control its operation by one of the following two sequences.

DISCHARGE AIR CONTROLLED (DAT)

In the UNOCCUPIED mode, the outside air unit will be o and the outside air damper, if supplied, will be closed. Occupied or Unoccupied is signaled to the IAIRE controller via a normally open or normally closed contact on the OCCUPIED input with a clock or switch. An open contact on the input indicates OCCUPIED, a closed contact indicates UNOCCUPIED.

In the OCCUPIED mode, the outside air damper will open and the supply fan will ramp up to the configured fan speed (dependent on whether the unit is heating or cooling). The Fan input is monitored to determine if fan is operating or not. If not operating, the IAIRE controller will enter into an alarm state, start staging off compressors, and attempt to cycle the fan until it starts.

There is a configurable EAT Heat Lockout (default 58F). If the entering air temperature (EAT) is < or = to the lockout, then the heat stages will cycle to maintain the discharge air temperature DAT setpoint.

There is a configurable EAT Cool Lockout (default 61F). If the EAT is > or = to this lockout than Y1 is always on and Y2-Y4 is staged on depending on demand (if enabled), along with the modulated hot gas valve will be used to maintain the DAT.

If the EAT is > the EAT Heat Lockout (default 58F) and < the EAT Cool Lockout (default 61F), the unit has 3 possible modes of operation. If DAT needs cooling, the unit will free cool. If DAT requires heat, the unit will turn on heat to try to maintain DAT. If there is a call for humidity control (Humidity above the Humidity Stage 1 Set point), (defaulted to 50% RH and user configurable), Y1 will stage on and the modulated Hot Gas will try to maintain DAT.

PROCESS CONTROLLED

In the unoccupied mode, the outside air unit will be off and the outside air damper, if supplied, will be closed. Occupied or Unoccupied is signaled to the IAIRE controller via a normally open or normally closed contact on the OCCUPIED input with a clock or switch. An open contact on the input indicates OCCUPIED, a closed contact indicates UNOCCUPIED.

In the OCCUPIED mode, the outside air damper will open and the supply fan will ramp up to the configured fan speed (dependent on whether the unit is heating or cooling). The Fan input is monitored to determine if the fan is operating or not. If not operating, the IAIRE controller will enter into an alarm state, stage OFF cooling or heating and attempt to cycle the fan until it starts.

There is a configurable EAT Heat Lockout (default 58F). If the entering air temperature (EAT) is less than or equal to the lockout, then the heat stages will cycle to maintain the discharge air temperature and space temperature set-point.

There is a configurable EAT Cool Lockout (default 61F). If the EAT is more than or equal to this lockout then Y1 is always on and Y2-Y4 is staged on depending on demand (if enabled). The modulating hot gas reheat cycle will be used to maintain the space temperature.

If the EAT is greater than the EAT Heat Lockout (default 58F) and less than the EAT Cool Lockout (default 61F), Y1 will turn on and the modulating hot gas reheat cycle will be used to maintain space temperature. If EAT less than Space Temperature and Space Temperature is greater than the set-point, free-cooling will engage and Y1 will be off. While in this mode, if space humidity is > 50% then Y1 will stage on and if its > 70% then Y2 will stage on as well. The modulating hot gas reheat cycle will be used to maintain space temperature.

THERMOSTAT CONTROLLED

Unit is equipped with a space humidity sensor. System operates like a standard thermostat except when space humidity is higher than setpoint (user defined) and the unit is not in cooling. Unit will act like a discharge air control machine until humidity is at setpoint.

NO CONTROLS

Unit comes with no controls. All sensors and devices are brought out to a terminal strip to allow a controls contractor to take control of unit.