

## 1.0 GENERAL

### 1.1 SUMMARY

These specifications describe requirements for an air conditioning system. The system shall be designed to maintain precision temperature and humidity conditions within the specified room. The manufacturer shall design and furnish all equipment to be fully compatible with the heat dissipation requirements of the site.

The system shall be manufactured by Skil-aire in Baltimore, Maryland U.S.A.

### 1.2 DESIGN REQUIREMENTS

The precision environmental control system shall be a Skil-aire factory assembled Guardian-I™ model vertical floor mounted system. The system shall be specifically designed for indoor installation, unless specified otherwise.

The system shall have a total cooling capacity of \_\_\_\_\_ BTUH and a sensible cooling capacity of \_\_\_\_\_ BTUH based on an entering air temperature of \_\_\_\_\_ °F DB and \_\_\_\_\_ °F WB. The unit shall be supplied with \_\_\_\_\_ volt, \_\_\_\_\_ phase, \_\_\_\_\_ Hz electrical service. The system model number shall be \_\_\_\_\_.

## 2.0 PRODUCTS

### 2.1 STANDARD FEATURES / ALL SYSTEMS

#### 2.1.1 CABINET

The cabinet and access panels shall be fabricated from sturdy heavy gauge galvanized steel. The cabinet and panels shall be painted for corrosion protection and decor matching. The panels shall be lined with 2 lb. density thermal/acoustical insulation for whisper quiet operation. The system shall be designed for front only access with hinged and removable front access door. Removable side panels with quarter-turn fasteners shall be provided for additional ease of installation, service and maintenance on the system.

#### 2.1.2 BLOWER ASSEMBLIES

Blowers shall be belt driven double-inlet, dynamically balanced with multiple forward curved blades mounted on a solid steel keyed shaft. A heavy-duty V-belt fan drive (sized for 200% of motor nameplate horsepower) with adjustable cast iron pulleys keyed and secured to the blower shaft shall be provided for adjusting fan speed to system requirements.

#### 2.1.3 MOTOR ASSEMBLIES

All fan motors shall be permanently mounted, 1750 or

mounted to an adjustable motor frame. Motor pulleys shall be cast iron, keyed, with variable pitch design to allow for field adjustment of specific airflow and static requirements.

#### 2.1.4 EVAPORATOR AIR PATTERNS

##### Up-Flow: (Front Free Return)

The system shall be configured for up-flow air pattern with front free evaporator return air and top evaporator air discharge.

*Note: Upflow Systems are available with Top Evaporator Air Discharge Connections or Plenum Discharge Boxes (2 or 3-way).*

##### Up-Flow: (Ducted Rear Return)

The system shall be configured for up-flow air pattern with ducted rear evaporator return air connections and top evaporator air discharge. Ducted rear return systems require left or right side filter service access.

*Note: Upflow Systems are available with Top Evaporator Air Discharge Connections or Plenum Discharge Boxes (2 or 3-way).*

##### Down-Flow:

The system shall be configured for down-flow air pattern with top free (or ducted) evaporator return air and bottom evaporator air discharge through the raised floor. (Note: Down flow systems require the Adjustable Floor Stand Option.)

#### 2.1.5 FILTERS

The system shall be provided with 4" extended surface pleated disposable type filters rated for 30% average dust-spot efficiency.

#### 2.1.6 ELECTRICAL CIRCUITS

The system shall be provided with a factory installed main electrical enclosure per NEC code requirements. A low voltage transformer with integral protection shall be provided to supply 24 VAC to the control circuit. The fan motor(s), compressor and electric heater (if applicable) shall each have their own contactor. A float switch shall be provided in the evaporator section to sense a clogged condensate drain and shall shut the unit down to prevent water damage.

#### 2.1.7 MAIN POWER NON-FUSED DISCONNECT

The indoor evaporator section shall be provided with a factory installed thru-the-door non-locking main power non-fused disconnect.

#### 2.1.8 MicroSkil-200™ Advanced Microprocessor

The system shall be provided with a MicroSkil-200™ advanced microprocessor based temperature and humidity controller with alarms.

##### Select Features/Benefits:

- 4x20 Character Liquid Crystal Alpha-numerical Display

- User Configurable
- Run-Time Hours
- Current Unit Mode Status
- Alarm Status
- Digital & Analog Inputs / Outputs
- Temperature Anticipation
- Remote Stop / Start Contact
- Summary Alarm Contact
- Automatic or Manual (selectable)  
Restart After Power Loss
- Sequential Load After Restart
- Recovery Delay
- Compressor Short Cycle Timers
- Cold Start Time Delay
- Security Password Access
- Self-Diagnostics
- Service Mode

### Unit Status Display

The control system shall display current unit functions and room status (if applicable):

- Current Dry Bulb Temp Set Point
- Current Relative Humidity Set Point
- System ON/OFF
- Cooling
- Heating
- Humidifying
- Dehumidifying
- Reheating
- Actual Room DB Temperature
- Actual Room Relative Humidity

### Alarm Conditions:

Alarm conditions activate an audible and visual indicator plus close a summary alarm dry contact connection. The control system shall alert to the following alarm conditions (if applicable):

- High Temperature
- Low Temperature
- High Humidity
- Low Humidity
- High Head Press
- Loss of Air Flow
- Loss of Power
- Dirty Filter
- Smoke Detection
- Firestat
- Leak Detection
- Sensor Failure
- Summary Failure
- Glycol Pump Failure

### Digital & Analog Control Inputs / Outputs:

The control system shall be capable of both digital (ON/OFF) and analog (proportional integral, PI) input and output control.

### Select Options:

- Multi-Unit Sequencing (Optional)
- BMS Communications (Optional)

### RS 485 Serial Connection: (Optional)

An RS 485 Serial Port Connection shall be provided for remote communications to BSM and/or Modem.

## 2.2 DIRECT EXPANSION SYSTEM COMPONENTS

### 2.2.1 EVAPORATOR COIL

The evaporator coil shall be quality construction of seamless drawn rifled copper tube, mechanically bonded to tempered aluminum fins with galvanized coil end plates. The coil shall have \_\_\_\_ sq. ft. face area, \_\_\_\_ rows deep. The coil shall be factory pressure tested and the refrigeration system sealed prior to shipment. A stainless steel drain pan shall be provided to cover the entire coil area.

### 2.2.2 SCROLL COMPRESSOR

The compressor shall be the heat pump duty scroll. The compressor shall be mounted on vibration isolators. Each compressor shall be complete with reversible positive oil pump, charging and service ports, internal spring isolation, and discharge gas vibration eliminator.

### 2.2.3 REFRIGERATION CIRCUIT

Each refrigeration circuit shall be pre-piped with type "L" refrigerant copper tubing. Each refrigeration circuit shall include, but not be limited to: expansion valve with external equalizer and rapid bleed-through capacity. Features shall include filter dryer, sight glass, pressure fittings and high pressure/low pressure safety cutouts.

## 2.3 CHILLED WATER SYSTEMS

### 2.3.1 CHILLED WATER AIR HANDLERS (Models U/DC1-V)

The system shall be a chilled water air handling unit. The chilled water coil shall be of quality construction of seamless drawn rifled copper tube, mechanically bonded to tempered aluminum fins with galvanized coil end plates. The coil shall be factory pressure tested. The coil shall have \_\_\_\_ sq. ft. face area, \_\_\_\_ rows deep. A stainless steel drain pan shall be provided to cover the entire coil area. The coil shall be controlled by a factory installed 2-way chilled water control valve. The coil shall be designed to distribute water into the entire coil face area. The coil shall be supplied with \_\_\_\_ °F entering water temperature with a \_\_\_\_ °F temperature rise. The coil shall require \_\_\_\_ GPM of chilled water and the pressure drop shall not exceed \_\_\_\_ Ft. w.g.

## 2.4 STANDARD FEATURES - INDIVIDUAL SYSTEMS

### 2.4.1 AIR COOLED SYSTEMS

#### 2.4.1.1 DX - SPLIT EVAPORATOR WITH REMOTE OUTDOOR PROPELLER FAN AIR COOLED CONDENSER (Models U/DA1 / FAC)

The system shall be a split system with indoor vertical floor mounted evaporator unit and remote outdoor propeller fan condenser. The indoor evaporator section shall include, but not be limited to: evaporator coil, stainless steel condensate drain pan, adjustable belt-driven blower, blower motor, thermal expansion valve with external equalizer, heat pump duty compressors, refrigerant service valves, refrigerant sight glass / moisture indicator, filter drier, 24 volt terminal connection and 4" filters. The remote propeller fan condenser shall include, but not be limited to: condenser coil rated for 95°F ambient, low rpm direct driven propeller fans and low ambient controls. The evaporator and condenser sections shall ship with a dry-nitrogen holding charge ready for field refrigerant (R22) charging.

#### **2.4.1.2 DX - AIR HANDLING UNIT ONLY** (Models U/DB1-V)

The system shall be a vertical floor mounted split DX - Air Handling Unit designed for field connection to the specified remote condensing unit. The air handling unit shall include, but not be limited to: evaporator coil, stainless steel condensate drain pan, adjustable belt-driven blower, blower motor, thermal expansion valve with external equalizer, refrigerant service valves, refrigerant sight glass / moisture indicator, filter drier, 24 volt terminal connection and 2" filters.

#### **2.4.1.3 OUTDOOR, REMOTE PROPELLER FAN, AIR COOLED CONDENSING UNIT** (FU models)

The remote air cooled condensing unit shall be an outdoor mounted direct drive, propeller fan type arranged for vertical air discharge. The condensing unit shall be sized for full heat of rejection at 95°F ambient and be capable of operation to \_\_\_ °F. The condenser coil shall be constructed of copper tube and aluminum fins. The coil shall be factory tested, and refrigeration system sealed prior to shipment. The condenser fan motor shall have permanently lubricated bearings and inherent internal overload protection.

### **2.4.2 WATER COOLED SYSTEMS**

#### **2.4.2.1 WATER COOLED, SELF-CONTAINED** (U/DW1-V models)

The system shall be self-contained vertical floor mounted air conditioner with integral factory installed water cooled condensing unit. Water cooled systems shall have coaxial, counter flow liquid condensers with adjustable 2-way water regulating valves per circuit to maintain head pressure with condenser water flow. The unit shall require \_\_\_ GPM of \_\_\_ °F water and have a maximum pressure drop of \_\_\_ Ft. w.g.

### **2.4.3 GLYCOL COOLED SYSTEMS**

#### **2.4.3.1 GLYCOL COOLED, SELF-CONTAINED** (U/DG1-V models)

The system shall be self-contained vertical floor mounted air conditioner with integral factory installed glycol cooled condensing unit. Glycol cooled systems shall have coaxial, counter flow liquid condensers with adjustable 2-way glycol regulating valves to maintain head pressure with condenser glycol flow. The unit shall require \_\_\_ GPM of \_\_\_ °F glycol and have a maximum pressure drop of \_\_\_ Ft. w.g.

#### **2.4.3.2 DRY COOLER & SIMPLEX PUMP PACKAGE** (FCPP models)

The drycooler shall be complete with field mounted expansion tank and aquastat to control fan motor operation. The coil shall have seamless copper tubes bonded to aluminum fins for high transfer efficiency. The motor(s) shall have permanently lubricated bearings with inherent overload protection on 1 Phase motors and three coil overloads on 3 Phase motors.

The pump package shall include controls to operate the drycooler and the pump. The pump package shall be enclosed in a weatherproof housing. The pump shall be rated for \_\_\_ GPM at \_\_\_ Ft. of head, and operate on \_\_\_ volt, \_\_\_ PH, 60 Hz.

## **2.5 OPTIONS**

### **2.5.1 AIR COOLED CONDENSER - LOW AMBIENT CONTROL**

#### **2.5.1.1 0°F AMBIENT - FAN CYCLING**

Condenser fan cycling controls shall be factory installed to allow for low ambient condenser operation to 0°F minimum air temperature.

#### **2.5.1.2 -20°F VARIABLE SPEED FAN**

Variable speed head pressure controls shall be factory installed to allow for low ambient condenser operation to a -20°F minimum air temperature. Compressor crankcase heater and cold start time delay relay shall also be factory installed with -20°F low ambient control option.

#### **2.5.1.3 -30°F FLOODED CONDENSER**

A flooded condenser system shall be provided to allow for low ambient condenser operation to -30°F. The flooded system shall include a factory installed liquid refrigerant receiver and head pressure control valve. Compressor crankcase heater and cold start time delay relay shall also be factory installed with -30°F low ambient control option.

### **2.5.2 WATER / GLYCOL COOLED - HEAD PRESSURE CONTROL VALVES**

#### **2.5.2.1 3-WAY WATER / GLYCOL HEAD PRESSURE CONTROL VALVE**

Each refrigerant circuit's head pressure shall be controlled by a factory provided 3-way water/glycol regulating valve rated for 150 psig w.w.p.

trolled by a factory provided 3-way water/glycol regulating valve rated for 150 psig w.w.p.

## 2.5.2.2 350 PSI HIGH PRESSURE - WATER/GLYCOL HEAD PRESSURE CONTROL VALVES

Each refrigerant circuit's head pressure shall be controlled by a factory provided high pressure rated \_\_\_\_ (2 or 3) -way water/glycol regulating valve rated for 350 psig w.w.p.

## 2.5.3 STEAM GENERATING HUMIDIFIER (Standard)

The humidification system shall be an electrode canister type, complete with fill valve, drain valve, adjustable humidity output, and automatic flush cycle. Humidification shall be in the coil bypass to provide maximum humidification efficiency. The humidifier shall be producing \_\_\_\_\_ lbs/hr.

## 2.5.4 REHEAT OPTIONS

### 2.5.4.1 ELECTRIC REHEAT (Standard)

The electric reheat shall be a factory installed low watt density finned-tubular nickel plated element heater with overheat safety controls. The electric reheat shall have a capacity of \_\_\_\_\_ BTUH and a KW rating of \_\_\_\_ KW

### 2.5.4.2 STEAM REHEAT

The steam reheat coil shall have copper tubes and aluminum fins with capacity of \_\_\_\_\_ BTUH with \_\_\_\_ Ft. w.g. steam. The system shall be factory pre-piped with a 2-way steam control valve.

### 2.5.4.3 HOT WATER REHEAT

The hot water reheat coil shall have copper tubes and aluminum fins with a capacity of \_\_\_\_\_ BTUH when supplied with \_\_\_\_ °F entering water temperature, \_\_\_\_ GPM at \_\_\_\_ Ft. w.g. The system shall be factory pre-piped with a 2-way hot water control valve.

## 2.5.5 PLENUM DISCHARGE BOX - UPFLOW UNITS

A (2-way, 3-way or ducted) plenum discharge box shall be provided for field installation to the top of the upflow unit. The plenum box shall be 18.5 inches high, insulated and painted to match the color of the unit.

## 2.5.6 FLOOR STAND

A \_\_\_\_ inch high floor stand shall be factory provided for field installation. The floor stand shall have adjustable legs with vibration isolation.

### 2.5.6.1 Turning Vanes - DOWNFLOW UNITS

Turning vanes shall be factory provided with the floor stand to direct the discharge air either to the front or rear of the unit.

## 2.5.7 CONDENSATE PUMP

A condensate pump shall be factory installed. The condensate pump shall have the capacity of \_\_\_\_ GPH at \_\_\_\_ Ft. of head. The condensate pump shall be complete with integral float switch, pump and motor assembly, check valve and reservoir.

## 2.5.8 HOT GAS BYPASS (DX Systems)

The refrigerant circuit shall be provided with a hot gas bypass system for evaporator freeze-protection and capacity modulation during low load conditions.

## 2.5.7 VARIABLE AIR VOLUME (VAV) OPTION KIT

The system shall be designed for evaporator supply air control for application with a variable air volume (VAV) system. The shall incorporate Skil-aire's VAV Option Kit which shall include, but not be limited to:

- Variable Frequency Drive - factory installed
- Static Pressure Sensor / Transducer - field installed
- MicroSkil-200, Advanced Microprocessor Controller w/ Supply Air Control Algorithm
- Circuit 1: Modulating (0-10 Vdc) Hot Gas Bypass
- Circuit 2: Standard Hot Gas Bypass

## 2.5.9 FIRESTAT

A firestat shall be factory installed within the evaporator return air stream to immediately shut down the environmental control system when activated.

## 2.5.10 SMOKE DETECTOR

A smoke detector shall be factory installed within the evaporator return air stream to immediately shut down the environmental control system when activated.

## 2.5.11 REMOTE WATER-LEAK DETECTOR

A remote water-leak detector shall be factory provided for field installation. The remote water-leak detector shall be wired to shut down all A/C unit water producing functions upon sensing a water leak.

## 2.5.12 ECX - ECONOMIZER / FREE-COOLING CYCLE (Models U/DA1, W1 & G1-V\_-ECX)

The system shall be provided with an auxiliary Skil-aire™ ECX economizer cooling coil with a factory mounted 3-way control valve. The ECX coil shall be capable of providing rated sensible capacity without compressor operation when entering water/glycol fluid temperatures are 45°F or below.

## 2.5.13 COMPRESSOR SOUND JACKETS (Not Available with Crankcase Heater)

An acoustical compressor sound jacket shall be factory installed. The sound jacket shall be designed for ease of compressor maintenance via a snap closure system.

## 2.5.14 4 YEAR EXTENDED (5 YR TOTAL) COMPRESSOR WARRANTY (PART ONLY)

The A/C unit shall be provided with a 4 year extended (5 year total) A/C unit manufacturer's limited compressor warranty. The warranty shall be for compressor part only and shall not include labor, transportation or parts other than the compressor.