

## 1.0 GENERAL

### 1.1 SUMMARY

These specifications describe requirements for an air conditioning system. The system shall be designed to maintain temperature 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, a division of Tithe Corporation, in Baltimore, Maryland U.S.A. The system shall be approved and labeled by Underwriters Laboratories, Inc. (UL). The system shall be New York City MEA (MEA-386-90-E) and Chicago Code Approved.

### 1.2 DESIGN REQUIREMENTS

The comfort control system shall be a Skil-aire factory assembled Convertible-Vertical™ 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 panels shall be lined with 2 lb. density thermal/acoustical insulation for whisper quiet operation. Large recessed, removable side panels with quarter-turn fasteners shall provide ease of installation, service and maintenance on the system.

#### **Splittable for Ease of Rigging:**

The cabinet shall be modular in design to allow for easy field break-down and reassembly of top evaporator and bottom condensing unit sections for rigging purposes. As a standard, the system shall ship from the factory as a one piece unit.

*(Note: Optionally the Convertible-Vertical™ system can ship from the factory split for field assembly after rigging.)*

#### 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.

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### 2.1.3 MOTOR ASSEMBLIES

All fan motors shall be permanently mounted, 1750 or 3450 RPM, with overload protection. Motors shall have permanently lubricated ball bearings and be resiliently 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 AIR PATTERN -Top Evaporator Discharge

The system shall be configured for rear ducted or free return evaporator air intake and top ducted evaporator air discharge. Packaged air cooled systems shall be configured for rear ducted same-face condenser air inlet and outlet. Air inlet and outlet connections shall include factory provided turned-out duct flanges for ease of field duct connection.

*(Note: Front Evaporator Air Discharge is optionally available.)*

#### 2.1.5 FILTERS

The system shall be provided with 2" extended surface pleated disposable type filters rated for a 40% average dust-spot efficiency and a MERV rating of 8. The filters shall be removable without shutting down the system.

#### 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 24 volt control circuit terminal strips shall be clearly labeled for thermostat wiring and interlock. 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.

**Self-Contained Systems:** (single point power) Self-Contained systems shall be designed for single point main power connection.

**Split DX Systems:** (separate power) Split systems shall require separate main power supplies to the evaporator and condensing unit sections. The evaporator and condensing unit sections shall be electrically interlocked by a field wired 24 volt control signal.

## 2.2 DIRECT EXPANSION SYSTEM COMPONENTS

### 2.2.1 EVAPORATOR COILS

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 COMPRESSORS

Each compressor shall be the heat pump duty scroll. Each compressor shall be mounted on vibration isolators and located in the condensing section out of the evaporator air stream. 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 PCA-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 AIR COOLED, SELF-CONTAINED

(Models PAA-V)

The system shall be self-contained vertical floor mounted air conditioner with integral factory installed air cooled condensing unit. The condensing unit shall be a belt driven, centrifugal blower type. The condenser coil shall be constructed of copper tubes and aluminum fins. The condenser coil shall be sized for full heat of rejection at 95°F ambient and be capable of operation to \_\_\_\_°F low ambient air temperature. The system shall be factory tested, charged with refrigerant, sealed prior to shipment.

#### 2.4.1.2 DX -SPLIT EVAPORATOR WITH REMOTE OUTDOOR PROPELLER FAN AIR COOLED CONDENSER

(Models XAA-V / F)

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 2" 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.

#### 2.4.1.3 DX -AIR HANDLING UNIT ONLY

(Models BAA-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.

#### 2.4.1.4 INDOOR REMOTE CENTRIFUGAL BLOWER AIR COOLED CONDENSING UNIT

(Models CAA-V)

The system shall be a vertical floor mounted indoor remote air cooled condensing unit designed for field connection to the specified DX Air Handling Unit. The condensing unit shall be a belt driven, centrifugal blower type. The condensing unit shall be sized for full heat of rejection at 95°F ambient and be capable of operation to \_\_\_\_°F low ambient air temperature. The condensing unit shall be factory tested, charged with refrigerant, sealed and prior to shipment.

### 2.4.2 WATER COOLED SYSTEMS

#### 2.4.2.1 WATER COOLED, SELF-CONTAINED

(PWA-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.

#### 2.4.2.2 REMOTE WATER COOLED CONDENSING UNIT

(CWA-V models)

The system shall be a vertical floor mounted indoor remote water cooled condensing unit designed for field connection to the specified DX Air Handling 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 **2.5.1.2 0°F AMBIENT -FAN CYCLING** unit shall require \_\_\_\_ GPM of \_\_\_\_ °F water and have a (F Model Remote Propeller Fan Condensers) maximum pressure drop of \_\_\_\_ Ft. w.g.

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

## **2.4.3 GLYCOL COOLED SYSTEMS**

### **2.4.3.1 GLYCOL COOLED, SELF-CONTAINED** (PGA-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 REMOTE GLYCOL COOLED CONDENSING UNIT** (CGA-V models)

The system shall be a vertical floor mounted indoor remote glycol cooled condensing unit designed for field connection to a DX Air Handling Unit. Glycol cooled systems shall have coaxial, counter flow liquid condensers with adjustable 2-way glycol regulating valves per circuit 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.

### **2.4.3.3 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 -LOW AMBIENT DAMPER

(PAA, CAA Centrifugal Blower Condensing Units)

A low ambient inlet damper shall be provided for the condenser section to allow operation to 0°F minimum air temperature. The damper shall include an actuator that is controlled directly by the condensed liquid line pressure. The damper shall be field mounted with all control piping furnished by the installer.

#### 2.5.1.3 -20°F VARIABLE SPEED FAN

(F Model Remote Propeller Fan Condensers)

Variable speed head pressure controls shall be factory installed to allow for low ambient condenser operation to -20°F minimum air temperature.

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

#### 2.5.2.1 3-WAY WATER/GLYCOL HEAD PRESSURE CONTROL VALVES (PWA & PGA Models)

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.

#### 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 \_\_\_\_\_(2or3)-way water/glycol regulating valve rated for 350 psig w.w.p.

### 2.5.3 CONTROL OPTIONS

#### 2.5.3.1 DigiSkil-100™: Remote Wall Mounted, Non-Programmable Digital Thermostat

A DigiSkil-100™ model remote wall mounted single stage heat / cool non-programmable thermostat with digital display shall be factory provided for field installation. The thermostat shall include FAN AUTO-ON and COOL-OFFHEAT selector switches.

#### 2.5.3.2 DigiSkil-200™: 7-Day Programmable Wall Mounted Digital Heat / Cool Thermostat

A DigiSkil-200™ model remote wall mounted deluxe 7-day programmable heat pump ready thermostat with digital display shall be factory provided for field installation. The thermostat shall include FAN AUTO-ON, COOL-OFFHEAT-EM (emergency heat), SET and PROG/MAN selector switches.

#### 2.5.3.3 MicroSkil-100™: Microprocessor with Alarms

The system shall be provided with a MicroSkil-100™ model Microprocessor based controller with Alarms. Centered in the remote wall mounted controller shall be a graphic LCD display with characters to show the operating mode, time, set points and actual readings. The temperature and humidity sensors shall be internal to the remote display. The controller shall be capable of three different set points: normal, temporary and night per day, 7 days per week.

# GUIDE SPECIFICATIONS: Convertible-Vertical™

The controller shall include the following visual and audible alarm indications(if applicable):

- High and Low Temperature
- Dirty Filter
- SensorFailure
- CommonAlarmFailure

The controller shall include the following system operations (if applicable):

- Unit Operational Status Indication -Cooling, Heating
- Fan -continuous or on demand
- Auto-restart upon power loss
- Remote stop/start connection
- Short cycle protection
- Cold start time delay
- Heat pump operation with aux. heat

## 2.5.3.4 MicroSkil-200™, Advanced Microprocessor Controller with Alarms

The system shall be provided with a MicroSkil-200™ advanced microprocessor based controller withalarms.

### 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

- TemperatureAnticipation
- 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 RelativeHumiditySet Point
- System ON/OFF
- Cooling
- Heating
- Actual Room DB Temperature
- Actual Room RelativeHumidity

### 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):

- HighTemperature • Dirty Filter
- LowTemperature • SmokeDetection
- Firestat • Leak Detection
- High Head Press • SensorFailure
- Loss of Air Flow • Summary Failure
- Loss of Power

### 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

### RS 485 Serial Port Connection: (Optional)

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

## 2.5.4 HEAT OPTIONS

### 2.5.4.1 ELECTRICDUCTHEATER

(Field Installed)

The electric heat shall be a field installed duct heater with nichrome open wire elements, contactors and limit controls. The electric heater shall be UL approved. The electric heat shall have a capacity of \_\_\_\_\_ BTUH and a KW rating of \_\_\_\_ KW.

### 2.5.4.2 STEAM HEAT

(Field Installed Steam Heat Coil Box & Valve)

A steam heating coil box and valve shall be provided for field installation to the evaporator air inlet. The steam heating coil shall have copper tubes and aluminum fins with capacity of \_\_\_\_\_ BTUH with \_\_\_\_ Ft. w.g. steam. A factory provided 2-way steam control valve shall be provided for field installation.

### 2.5.4.3 HOT WATER HEAT

(Field Installed Hot Water Heat Coil Box & Valve)

A hot water heating coil box and valve shall be provided for field installation to the evaporator air inlet. The hot water heating 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. A factory provided 2-way hot water control valve shall be provided for field installation.

### 2.5.4.4 HEAT PUMP OPTION

(PAH-V, PWH-V & PGH\_V models)

The system shall include a factory installed heat pump heating cycle including reversing valve, automatic defrost cycle (if appl.) and remote wall mounted temperature controller with auxiliary heating control capability. The heat pump mode heating capacity shall be \_\_\_\_\_ BTU/ HR.

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## 2.5.5 CONDENSATE PUMP

A condensate pump shall be factory provided for field installation. 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.

## 2.5.6 HOT GAS BYPASS

(DX Systems)

Each 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-air'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

## 2.5.8 MAIN POWER NON-FUSED DISCONNECT

A main power non-fused disconnect shall be factory provided for field installation.

## 2.5.9 AIR SIDE ECONOMIZER

(All Model Types)

The system shall be provided with an Air-Side Economizer to include factory provided and field installed air side economizer mixing box and controls per the following sequence of control:

On a call for cooling by the indoor space thermostat, the indoor fan and the economizer shall be energized. The outdoor air control shall determine whether the outdoor air is suitable for "free/economizer-cooling". If the outdoor air is suitable, mechanical cooling shall be locked out by the outdoor enthalpy control. The motor actuator shall be energized, operating the outdoor air and the return air dampers. The motor actuator shall be regulated by the mixed air sensor to maintain proper discharge air temperature.

When outdoor air is not suitable for "free/economizer-cooling", the Economizer shall be locked out and the outdoor air damper shall maintain minimum position while the indoor fan is operating. Upon unit shutdown or power loss, the spring return motor actuator shall close the outdoor air damper.

The Economizer shall be automatically locked out during the heat mode (if applicable).

The Air Side Economizer shall include: prewired modulating spring return motor actuator, compressor lockout, minimum position potentiometer, outdoor air control (enthalpy), mixed air sensor, multi-tap transformer and damper linkage.

The Air-Side Economizer and Controls shall ship separately from the unit for field installation.

*(Note: Refer to supplemental Air Side Economizer dimensional data for more information.)*

## 2.5.10 ECX -ECONOMIZER / FREE-COOLING CYCLE

(Field Installed ECX Coil Box & Valves)

The system shall be provided with field installed external economizer cooling coil box with field installed 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.

*(Note: Please Consult your local sales representative for dimensional and upgraded blower motor requirements for ECX option.)*

## 2.5.11 COMPRESSOR SOUND JACKETS

(Not Available with Crankcase Heater Option)

Acoustical compressor sound jackets shall be factory installed. The sound jacket shall have a snap closure system for ease of removing and reinstallation during maintenance. The sound jacket shall have a Noise Reduction Coefficient (NRC) of 85 per ASTM C-423 and a Sound Transmission Loss (STC) of 11 per ASTM E-90.