CULTIVATOR "I" & HYBRID CULTIVATOR I SERIES INDOOR PACKAGED UNIT

GUIDE SPECIFICATIONS

"HYBRID" TECHNOLOGY

SAVING ENERGY

PRODUCT GUIDE SPECIFICATIONS

- INDOOR PACKAGED WATER-COOLED UNITS
- CGWCPSC SERIES UNITS
- STANDARD AND SEMI-CUSTOM

1. **GENERAL**

   Self-contained water-cooled packaged unit shall include compressor(s), evaporator coil with fan(s), shell and tube condenser or brazed plate heat exchanger (for heat pump application), refrigeration piping, electrical components, and enclosing cabinet. The unit shall be factory assembled, internally wired, fully refrigerant charged with R410A (except for unit which shipped out in multiple sections - wiring and refrigerant charge need to be taken care by unit's installer). The unit shall be capable to operate up to 110°F (43°C) leaving condenser water temperature without failure.

2. **CABINET**

   The unit panels shall be constructed from galvanized steel with epoxy painted for excellent finished, weatherability and corrosion resistance up to 1,000 hours salt spray test according to ASTM B-117. Unit framework shall be constructed from extruded aluminum post and nylon corners/joint. Evaporator section shall be of 2-inch, double skin panels with injected polyurethane foam insulation with density 2.5lbs/ft^3, sandwiched between galvanized steel. Hinged access doors shall be provided for easy service and maintenance of unit's internal parts. Unit base shall be constructed with heavy gauge formed sheet metal. Unit base's lifting holes shall be able to accept chains or cables for rigging. Each unit will be comprised of three main sections: a) Evaporator Coil Section b) Compressor/Condenser Section c) Supply Fan Section Special arrangement can be requested to allow unit to be disassembled into sections for access to the mechanical equipment room. To complete the sections assembly, electrical wiring and brazing (for refrigerant and water pipe) between sections is required.

3. **COMPRESSOR & REFRIGERATION PIPING**

   Compressor(s) shall be scroll, refrigerant gas cooled and mounted on the base via vibration isolators. 1, 2, 3, 4, 5 or 6 refrigeration circuits shall be piped with copper tubing and include expansion valve with external equalizer, filter dryer, sight glass, suction accumulator (standard for heat pump models), pressure fittings of manual reset high pressure control as well as charging/access ports in each circuit. Capacity of each compressor shall not be greater than 15 horsepower. The compressors shall comply with the internationally recognized standards CE and UL.

4. **CRANKCASE HEATERS**

   Each compressor shall have a crankcase heater installed, properly sized to minimize the amount of liquid refrigerant present in the oil sump during off cycles.

5. **EVAPORATOR COIL**

   Evaporator coil shall be of draw through air design for uniform air distribution. The evaporator coil shall be quality construction of staggered row of 3/8" (inner grooved) or 1/2" OD seamless copper tube, mechanically bonded to aluminum fins with galvanized coil plates. Evaporator coil shall be minimum of 5 rows with 12 fins/inch spacing. Evaporator coil shall have interlaced or row split circuiting to keep full evaporator coil face active. The coil shall be factory leak and pressure tested to 650psig (45 bar) under

water. A galvanized and painted drain pan shall be provided to cover the entire coil area. The drain pan shall be designed to incorporate sloped gutter for complete condensate removal.

6. **EC FANS**

   Evaporator, Exhaust and Return fans direct drive plenum supply fan, high efficiency direct driven backward curved plenum fan(s) and shall be driven by with a electronically commutated (EC) motor. Fan speed can be stepped to requirements or continuously variable using a 0–10V DC control signal. When required, dual fans for redundancy may be ordered

7. **CONDENSER – SHELL AND TUBE**

   Condenser shall be ASME shell and tube type and mechanically cleanable. Condenser shall have removable water heads to clean tubes. Condenser shall be constructed with 3/4" copper finned tubes with integral subcooling circuit to maximize the system efficiency. Condensers shall be factory manifolded so that installer just require to provide single supply and return cooling tower water connections for low-cost field hook up. Condenser shall be designed for 560 psig refrigerant (shell) side and 300 psig waterside (tube) working pressure. Each condenser shall be equipped with a hi pressure relief valve with a 3/4" female NPT connection (to facilitate connection to the vent piping and run it outside the building). Condenser(s) shall have ball valve(s) or manual balancing valve(s) at before or after the condenser's supply or return water connection. A galvanized and painted drain pan shall be provided underneath the condensers.

8. **BRAZED PLATE HEAT EXCHANGER (HEAT PUMP APPLICATION)**

   Brazed plate heat exchanger (BPHE) shall consist of a heat exchanger of copper brazed corrugated metal plates with port holes allowing the two fluids to form a counter current parallel flow. The plates are constructed from AISI 316 stainless steel with copper as brazing material. Each plate has herringbone corrugations to optimize heat transfer with nominal pressure losses and provide support to adjacent plates through brazing points. The construction complies with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels", Division 1. All BPHEs are factory tested in accordance with Pressure Equipment Directive (PED) standards. All BPHEs are PED certified and UL listed. ASME approval is optional and available on request. BPHE must be installed in accordance with manufacturer's recommendations, drawings and installation manual. A strainer with 16 to 20 meshes shall be field installed prior to the inlet of the heat exchanger.

9. **FILTERS - STANDARD**

   Unit shall be provided as standard with 2" thick disposable high efficiency MERV8 pleated filters having average dust spot efficiency of 25-35% in accordance with ASHRAE52-76. Filter(s) shall be either front loading or side loading. Other sizes and efficiencies may be specified as an accessory.

10. **ELECTRICAL CONTROL PANEL**

    The unit mounted control panel enclosure shall be constructed from heavy gauge steel with epoxy painted for excellent finished, weatherability and corrosion resistance. Hinged and lock type access door shall be provided for easy access and security. The control panel shall be completely factory wired and shall include standard IEC DOL with fixed speed compressor and evaporator fan motor circuit breaker and contactors, compressor, evaporator fan motor thermal overload relays, antirecycling time delay, fuse, power and control circuit terminal blocks and features 115V or 24V controls with 460V/3Ph/60Hz, 208V/3Ph/60Hz, 230V/3Ph/60Hz or 575V/3Ph/60Hz power supply with earth. The units control panel is fully wired ready to accept the main power supply (except for unit whereby sections are intended to disassemble, simple wiring connection shall be fulfilled at field).

11. DIRECTOR CONTROLLER

The unit shall be provided with Director Magnum control system with the following features, ¾ The control algorithm and parameters shall be stored in flash memory and EPROM of the controller and shall retain even in the event of power failures, without requiring external backup battery. Controls shall include: User Interface with Display, Temperature controlled, Configurable by user, Alarm status/display, Analog input/output display, Digital input/output status, Remote start/stop input, General alarm output, Self-diagnostics, Security password access with multiple access level for advanced settings and Unit status display. Built-in BMS Communication with Modbus RTU / BACnet IP communication protocol is built-in to the main controller and comes as a standard feature for the Director. For Director controller, BACnet MSTP and LonWorks comes as an optional feature. Pressure Transducers on Suction & Discharge line Pressure transducers are provided as standard in suction and discharge lines of each system. The operating pressure reading will be displayed on the controller user interface.

12. OPTIONS

A. INVERTER COMPRESSOR

The unit's 1st stage compressor shall be equipped with the high efficiency inverter compressor while having fixed speed compressor(s) for the rest of the system(s). All compressors shall be scroll, hermetically sealed, refrigerant gas cooled, quiet running and supported on rubber mounts to minimize vibration. The inverter compressor motor shall be a permanent magnet type and matched with a specially designed, variable frequency drive which modulates the speed of the compressor motor and provides compressor protection functions. The inverter compressor shall include electronic expansion valve (EEV) while thermal expansion valve with external equalizer for other fixed speed compressor(s). The compressors shall comply with the internationally recognized standards CE and UL. The variable speed compressor shall be capable of speed modulation from 25Hz to a maximum of 100Hz. The unit minimum capacity shall be 25% of full load. The resident control algorithms shall make all heating, cooling, and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. The control algorithm maintains accurate temperature control, minimizes drift from set point, and provides better building comfort. A centralized control shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.

B. DISCHARGE PLENUM

Discharge plenum shall be provided to route vertical discharge air to horizontal. Discharge plenum shall be constructed from 2-inch double skin panels with injected polyurethane foam insulation with density 2.5lbs/ft3, sandwiched between galvanized steel. Discharge plenum's framework shall be constructed from extruded aluminum post with nylon corners/joints.

C. DISCHARGE PLENUM ATTENUATOR

Discharge Plenum with Sound Attenuating Baffle Discharge plenum shall be provided with additional sound attenuating baffle consisting of 2.0-inch fiberglass insulation suppressed by perforated liner.

D. SOUND ATTENUATION

m Panel walls with Sound Attenuating Baffle

E. HEAT PIPE

Wrap-Around Heat Pipe Wrap around heat pipe shall be provided to precool incoming hot air and re-heat air that passed through the cooling coil (which located at the middle of the wrap-around heat pipe). Heat pipe pre-cool and re-heat coil shall be 2 rows with fins/inch spacing not more than

F. BPHE

Brazed Plate Heat Exchanger (only available to Cooling Only models) Brazed plate heat exchanger (BPHE) shall consist of a package of copper brazed corrugated metal plates with port holes allowing the two fluids to form a counter current parallel flow. The plates are constructed from AISI 316 stainless steel with copper as brazing material. Each plate has herringbone corrugations to optimize heat transfer with nominal pressure losses and provide support to adjacent plates through brazing points. The construction complies with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels", Division 1. All BPHEs are factory tested in accordance with Pressure Equipment Directive (PED) standards. All BPHEs are PED certified and UL listed. ASME approval is optional and available on request. BPHE are installed in accordance with manufacturer's recommendations, drawings and installation manual. A strainer with 16 to 20 meshes shall be field installed prior to the inlet of the heat exchanger.

G. HEAD PRESSURE CONTROL

Condenser Head Pressure Control Head pressure control shall be provided when entering condenser water is below 55°F and waterside economizer is not available. Head pressure control shall consist of a two-way modulating valve with spring return actuator. Valve actuator shall be controlled through the unit control system to maintain refrigerant head pressure by reducing water flow when necessary to allow proper functioning of the thermostatic expansion valves. A bypass valve must be added if the system is intended for constant pumping (please consult factory for this design if required)

H. WATER REGULATING VALVES

A two-way water regulating valve(s) with spring return actuator(s) shall be provided at the water outlet(s) of each condenser(s). Valve actuator shall be controlled through the unit control system to maintain the designated refrigerant head pressure. A bypass valve must be added if the system is intended for constant pumping. (Please consult factory for this design if required).

I. HOT GAS BYPASS

Hot Gas Bypass The refrigerant circuit (applicable to 'first in last out' refrigeration system only) shall be provided with a hot gas bypass system for low room/building load application and evaporator coil freeze prevention.

J. HOT WATER COILS

Hot Water Heating Coil Hot water coil shall be located at the upstream of cooling or waterside economizer coil. Hot water coil shall be constructed from 1/2" copper tubing. Hot water coil shall be 1 row with fins/inch spacing not more than 14. Coil tubes are mechanically bonded to aluminum fins with galvanized coil plates. Hot water coil shall provide vent and drain connection. Hot water coil shall be factory leak and pressure tested to 300psig (21bar) under water.

K. STEAM COILS

Steam Heating Coil Steam coil shall be located at the upstream of cooling or waterside economizer coil. Steam coil shall be of the extended surface type, constructed from 5/8" copper tubing and having plate fins of aluminum extending at right angles to the tubes. Steam coil shall be double tube coils having internal steam distributing tubes not less than 3/8" in outside diameter with directional

kinetic orifices paced at suitable intervals to provide positive condensate removal and uniform steam distribution over the entire face of the coil. Coil tubes are mechanically bonded to aluminum fins with galvanized coil plates. Steam coil shall be maximum of 2 rows with fins/inch spacing not more than 14. Steam coil shall be factory leak and pressure tested to 400psig (28bar) under water.

L. HOT GAS REHEAT COILS

Modulating Hot Gas Reheat Hot gas reheat coil (aluminum fin copper tuber) shall be provided downstream of evaporator cooling coil for dehumidification purpose

M. WATER-SIDE ECONOMIZER

Waterside Economizer Waterside economizer shall include a 4 row 1/2" tube coil with fins/inch spacing not more than 12 FPI, control valves, water temperature sensor, shut off valve(s) (at economizer coil outlet), and water piping. Economizer coil shall provide vent and drain connection. Economizer coil shall be factory leak and pressure tested to 300psig (21bar) under water.

N. AIR-SIDE ECONOMIZER

Airside Economizer Airside economizer shall include a mixing box which comprised of low leak opposed blade type outdoor air and return air damper, 0 to 100% fully modulating damper actuator (spring return type) on outside air and return air damper and dry bulb sensors.

O. EXHAUST FANS

Exhaust Fan System (Airside economizer must be selected) Exhaust fan option shall include belt driven DIDW (Double Inlet Double Width) forward curved fan as the exhaust fan. The exhaust fan shall be supplied together with TEFC exhaust fan motor, belts and pulleys and VFD. Low leak opposed blade type return air damper and its corresponding 0 to 100% fully modulating damper actuator (spring return type) shall be supplied. The exhaust shall include a backdraft damper. A building pressurization sensor shall be used to sense the pressure difference between indoor and outdoor ambient atmospheric pressure. The exhaust fan will automatically turn on and regulate the VFD fan speed to reduce the indoor pressure whenever necessary.

P. RETURN FANS

Return Fan System (Airside economizer must be selected) Return fan option shall include direct driven backward curved plenum fan as the return fan. The return fan shall be supplied together with TEFC return fan motor and VFD. Low leak opposed blade type exhaust and return air damper and their corresponding 0 to 100% fully modulating damper actuator (spring return type) shall be supplied. Return fan shall operate whenever supply fan is in operation. A building pressurization sensor shall be used to sense the pressure difference between indoor and atmospheric pressure. The unit exhaust damper shall modulate to reduce the indoor pressure whenever necessary. When economizer option is selected, the return air damper shall modulate based on the economizer cooling demand. Return fan speed shall modulate accordance to duct static pressure.

Q. SERVICE VALVES

Discharge / Suction / Liquid Line Service Valves Service valves shall be provided at each refrigerant lines for service convenience.

R. PROTECTIVE COATINGS

Evaporator Coil Fin Materials In lieu of standard aluminum fin, alternative fin material and/or protective coating include, ¾ Hydrophilic coated aluminum fin ¾ Copper Fin ¾ Aluminum fin with DB-Coat 12.21 Stainless Steel Drain Pan A stainless steel (SS304) condensate drain pan shall be provided underneath evaporator coil in lieu of standard galvanized and painted drain pan.

S. FILTER DRIERS

Replaceable Core Filter Drier Replaceable filter core drier shall be provided in lieu of standard filter drier for the convenience of filter drier's core replacement.

T. ELECTRONIC EXPANSION VALVES

Electronic Expansion Valve (EEV) In lieu of standard thermal expansion valve equipped on fixed speed compressor's system, electronic expansion valve (EEV) shall be provided for precise superheat control.

Liquid Line Solenoid Valve (LLSV) Factory fitted liquid line solenoid valve shall be provided for each refrigeration circuit. 12.25 High and Low Pressure Gauges Each compressor shall be provided with unit mounted pressure gauges to monitor discharge and suction line pressure.

U. FILTERS

4-Inch Filters on top of standard 2-Inch Filters (2+4" Filter) Optional 4 inches thick MERV14 disposable pleated filters shall be supplied on top of the standard 2 inches MERV8 filter.

HEPA filters can be ordered as a field installed accessory that conveniently fits on top of the unit discharge for easy access and service.

V. DISCONNECTS

This is a non-fused disconnect to isolate the main incoming power supply to the unit. An option fused disconnect may be specified.

W. INDICATION LIGHTS

Indicating Lights Indication shall be provided for Supply fan run, overload trip, compressor run high pressure trip and overload trip.

X. POWER PROTECTION

UVR/Phase Failure Protect Phase Failure Relay shall be provided for over voltage, under voltage and phase loss protection.

Y. COMMUNICATIONS

Interface Module BACnet IP, BACnet MSTP / LonWorks communication protocol comes as an add on option apart from the standard available features shall be provided.

Z. EMERGENCY LOCK OUT

Lock Out Stop Emergency stop switch shall be provided for Blower Fan.

AA. FAN PROVING SWITCH

Differential Pressure Switch for Evaporator Blower Differential pressure switch shall be provided to interlock with the control circuit. It is used to sense air flow and feedback to the controller.

BB. ELECTRIC HEATERS

Electric Heater (include starter) Electric heater shall be provided for heating purpose. Electric heater is interlock with supply fan and will turn off if supply fan fails. Heater high temperature limit switch acts as a safety switch to cut off the heater in case of sensing high temperature. Contactor and circuit breaker shall be provided for electric heater.

CC. CO2 SENSORS

CO2 Sensor shall have the ability to monitor the concentration (parts per million, ppm) of CO2 (Carbon Dioxide) in the air. As the CO2 concentration changes, the outside air damper modulates. The sensor shall be duct mounted and field wired back to the unit.

DD. CO2 PURGE CONTROL RELAYS

The unit shall be provided with one or both purge control relays. The relay(s) shall close enabling the ventilation damper and or the exhaust fan upon detection of high levels of CO2.

EE. IONIZATION POWER & RELAYS

The unit shall be provided with a separate power transformer to power the ionizers. An independent control relay shall energize the power to the ionizers when utilized. The relays shall be able to be controller to both occupied and unoccupied periods.

FF. VARIABLE FREQUENCY DRIVES

VFD for Evaporator Blower Motor Variable Frequency Drive (VFD) on evaporator blower motor shall be provided (for belt driven plenum fan application only).

GG. FIRE RELAY

24VAC fire relay with transformer A 24VAC fire relay shall be installed together with an isolation transformer to lock out the unit when this signal is activated.

HH. DUCT STATIC PRESSURE CONTROL

Supply Duct Static Pressure Sensor Duct static pressure sensor shall be supplied to be installed in the supply duct to monitor the static pressure. This sensor shall be supplied to control the supply fan VFD speed.

II. BUILDING PRESSURE CONTROL

Building Pressurization Sensor Building pressurization sensor shall be supplied to be installed in cooling space to monitor the room pressurization level. This sensor shall be used to on / off the exhaust fan and modulate the speed when necessary to maintain standard room pressurization level.

JJ. DISCHARGE PLENUM

The unit shall be provided with a supply air discharge plenum that directly installs on the top of the unit. This plenum shall deliver the air horizontally. The discharge plenum shall be specified with a single or multiple duct connection, single or multiple supply discharge air registers. Registers may be order with OBD and blade flow direction. Plenum shall also offer a variety of other air discharge devices such as drum louvers and direction jet nozzle diffusers.

KK. CONVENIENCE OUTLET

Convenience outlet shall be provided with factory installed step down transformer with 115v-1ph receptacle. This power circuit shall be fused booth on the primary and secondary side.

LL. CUSTOM CONFIGURATIONS

Unit configuration shall be available in custom configurations and specialty accessories. Consult the factory for available custom applications.

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