SubcooledAIR
Portable Climate Control for Commercial and Industrial Applications

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# Subcooled Air 6000: Equipment Specifications And Options

An outdoor, portable, weather-proof, electronically controlled dehumidification, heating and cooling unit utilizing hermetic scroll compressors, for dehumidification and cooling duty, with optional electric heat. Units shall discharge supply and return air horizontally as shown on product drawings.

## Cabinet

### Standard

Internal floor shall be fabricated from 1/8" thick mild steel, welded to the base frame and sealed to prevent air leakage. The external cabinet shall be fabricated from 13 to 16-gauge galvanized steel. After unit assembly, the entire unit shall be covered with a minimum one-mil coat of air-dried rust inhibiting coating for maximum corrosion protection.
The air plenum cabinet casing shall be 13-gauge, galvanized steel, coated with 1 mil of air-dried enamel coating which will withstand 1,000 hours of salt spray per ASTM B-117 over an alkyl primer. An additional coat of air-dry, alkyd top coating shall be applied prior to shipment.

### Option 1

13-gauge Type 304 stainless steel replaces 13-gauge galvanneal steel and coating.

### Option 2

13-gauge Type 316 stainless steel replaces 13-gauge galvanneal steel and coating.

## Frame

### Standard

The unit base frame shall be fabricated of structural steel channels of 0.23-inch wall thickness. Base side and end rails shall be nominal 1.5-inch by 6-inch channel beam and cross members shall be nominal 1.5-by-4-inch channel beams. Rectangular 10-by-4-inch structural steel forklift pockets shall be fitted into side rails to provide support for the base and allow for ease in moving or lifting unit. Additional cross members shall be placed under heavy components as necessary. Vertical frame members shall be fabricated from 3-inch by 3-inch formed steel angles with a 1/4" wall thickness. The unit base frame shall be furnished with lifting eyes capable of accepting cable or chain hooks for rigging. The structural steel framing shall be covered with a minimum three-mil coat of air-dried rust inhibiting primer and three-mil coat of air-dried enamel coating for corrosion protection.

### Option 1

Corner columns shall be fabricated of structural steel 3-inch by 3-inch square tubing of 0.23-inch wall thickness A-36 carbon steel and furnished with one-inch diameter lifting eyes capable of accepting cable or chain hooks for rigging. Base side and end rails shall be nominal 1.5 inch-by-6 inch channel section mild A-36 steel tubing of 0.23-inch wall thickness. Additional cross members shall be placed under heavy components as necessary. The structural steel framing shall be covered with a minimum three-mil coat of air-dried rust inhibiting primer and three-mil coat of air-dried enamel coating for corrosion protection.

### Option 2

After fabrication, the entire frame shall be hot-dip zinc rich galvanizing for maximum corrosion protection.

### Option 3

DNV rated lifting basket. Details subject to customers requirements.

## Access Panels

An access panel shall be provided for the following components at a minimum: filters, compressors, cooling/heating coils and any other serviceable component. Access panels shall be complete with dual single-point, single-cam compression-type latches or cap screws fitted with nylon lock nuts to provide quick access and a positive air seal.

## Air Cooled Condenser Coils

### Standard

Condenser coils shall be constructed of 3/8-inch diameter, 0.012-inch wall thickness seamless copper tubes, mechanically expanded into 0.0045-inch thick aluminum fins, having twelve fins per inch. Coil casings shall be constructed of 16-gauge galvanized steel. Headers shall be copper. The mechanical refrigerant system shall be capable of operating at ambient conditions down to 60 F.

### Option 1

Condenser coils shall be constructed of 3/8-inch diameter, 0.016-inch wall thickness seamless copper tubes, mechanically expanded into 0.0055-inch thick aluminum fins, having twelve fins per inch. Coil casings shall be constructed of 16-gauge Type 304 stainless steel. Headers shall be copper. The mechanical refrigerant system shall be capable of operating at ambient conditions down to 60 F.

### Option 2

Condenser coils shall be constructed of 3/8-inch diameter, 0.016-inch wall thickness seamless copper tubes, mechanically expanded into 0.0055-inch thick aluminum fins, having twelve fins per inch. Coil casings shall be constructed of 16-gauge Type 304 stainless steel. Headers shall be copper. The addition of condenser head pressure control allows the mechanical refrigerant system to be capable of operating at ambient conditions down to 40 F.

### Optional Condenser Coil Coating

Electrical deposition coated aluminum-fin coils shall have a flexible epoxy polymer coating uniformly applied to all coil surface areas without material bridging between fins. The coil shall be completely immersed in the coating bath. The coating shall be electrodeposited and be free from voids, checks, cracks and blisters. Coating process shall ensure complete coil encapsulation. Uniform dry film thickness from 0.8 to 1.2 mil on all surface areas including fin edges. The coating shall be cured by baking at a metal temperature not to exceed 400ºF. Corrosion durability will meet a minimum 2000 hours of 5% salt spray test per ASTM B117-90.

## Condenser Fans

### Standard

Condenser fans shall be direct drive, adjustable pitch, glass reinforced plastic propeller type blades with a split aluminum hub. The hub is mounted to the fan motor through a separate split-taper, keyed, steel bushing. Condenser fan motors shall be three-phase, 1140RPM, OPAO type. Fans shall be cycled off when not required for minimum electrical usage.

## Scroll Compressors

The compressor shall utilize an orbiting scroll with axial and radial compliance for compression. Compressors shall be a high efficiency, suction gas cooled, single speed, hermetic type, with three Teflon bearings and a cast iron motor frame. Compressors shall be mounted on rubber-in-shear isolators. An oil level sight glass, an oil level adjustment fitting, high and low pressure taps, and discharge and suction service valves, check valve with an internal solenoid valve to silently prevent reverse rotation shall be included. Compressors shall have a quick acting discharge temperature probe, four motor winding temp sensors with a solid state module for compressor overload protection. Other safety devices include high-pressure cutout, and low-pressure freeze protection. Capacity reduction will be done with hot gas bypass and compressor staging and on dual compressor models.

## Refrigeration Circuit

### Standard

The refrigerant circuit shall be completely piped, tested, dehydrated, and fully charged with oil and refrigerant R-410a. The refrigerant circuit components shall include compressor, condenser, liquid line service and charging valve, filter drier, sight glass, and fused-plug pressure relief device. The refrigeration circuit shall also include a liquid line solenoid valve to enable a pump-out

at the beginning of the compressor cycle. Compressors carry a one year warranty from the manufacturer.

**Optional**

Liquid Receiver – ASME code
Suction Accumulator – ASME code

## Evaporator Coil

**Standard**

Direct expansion coil shall be constructed of 3/8-inch diameter, 0.012-inch wall thickness seamless copper tubes expanded into aluminum fins, having ten fins per inch. Coil casings shall be constructed of 16-gauge galvanized steel. Headers shall be copper. Evaporator coil shall be provided with adjustable superheat controls and external equalizers. Coils shall be tested to be leak free with nitrogen at 300 PSIG underwater. The entire refrigerant piping circuit shall be leak tested at 300 PSIG nitrogen pressure.

**Option 1**

Direct expansion coil shall be constructed of 1/2-inch diameter, 0.016-inch wall thickness seamless copper tubes expanded into aluminum fins, having ten fins per inch. Coil casings shall be constructed of 16-gauge 304 stainless steel. Headers shall be copper. Evaporator coil shall be provided with adjustable superheat controls and external equalizers. Coils shall be tested to be leak free with nitrogen at 300 PSIG underwater. The entire refrigerant piping circuit shall be leak tested at 300 PSIG nitrogen pressure.

The evaporator coil shall be provided with a drain pan, which shall be fabricated of 14-gauge, 304 stainless steel and sloped, for positive drainage of condensate. A 3/4-inch diameter condensate drain connection shall be provided on one side of the unit for slab coils and shall be field trapped by others.

**Optional Evaporator Coil Coating**

Electrical deposition coated aluminum-fin coils shall have a flexible epoxy polymer coating uniformly applied to all coil surface areas without material bridging between fins. The coil shall be completely immersed in the coating bath. The coating shall be electrodeposited and be free from voids, checks, cracks and blisters. Coating process shall ensure complete coil encapsulation. Uniform dry film thickness from 0.8 to 1.2 mil on all surface areas including fin edges. The coating shall be cured by baking at a metal temperature not to exceed 400ºF. Corrosion durability will meet a minimum 2000 hours of 5% salt spray test per ASTM B117-90.

## Energy Recovery Loop Coils

Energy Recovery Loop coils shall be constructed of ½-inch seamless copper tubes expanded into aluminum fins. Coil casing shall be constructed of 16-gauge galvanized steel. Headers shall be copper and shall be provided with vent and drain connections. Header connections shall be to be male solder type copper. Coils shall be tested to be leak free with nitrogen at 300 PSIG underwater. Water piping shall be leak tested at 150 PSIG air pressure.

Type K copper water piping, along with control valves connect energy recovery loop coils located before and after refrigerant evaporator coil section, to a centrifugal circulating pump. Water and/or propylene glycol is circulated through the pump and coils to pre-cool and post-heat process air. When activated (off/on), this set of coils allows up to 25% more air to be dehumidified to a 40ºF dew point.

Energy Recovery Loop coils shall be provided with a drain pan, which shall be fabricated of 14-gauge 304 stainless steel and sloped, for positive drainage of condensate. A one-inch diameter condensate drain connection shall be provided on one side of the unit for slab coils and shall be field trapped by others.

## Centrifugal Circulating Pumps

High tensile cast iron casing, motor adapter and support base; enclosed, fully-balanced, non-overloading, continuous-duty, bronze impellar; mechanical shaft seal with stainless steel, Buna N carbon/ceramic parts, brass stub shaft. Back pull-out close-coupled design for ease in maintenance. Vent and drain plugs in all positions. Piping is female pipe thread NPT. 125 psig maximum case working pressure. Maximum fluid temperature 212ºF. Single-phase NEMA 56C frame, 3450 RPM, ODP motor. Baked-on electro-coat paint.

## Condenser Reheat Coil

Condenser reheat coil shall be constructed of ½-inch seamless copper tubes expanded into aluminum fins. Coil casings shall be constructed of 16-gauge galvanized steel. Headers shall be copper. The condenser reheat coil is piped to the reheat circuit; including a Reheat Condenser, three-way liquid diverting valve and check valve. Coils shall be tested to be leak free with nitrogen at 450 psig underwater. The entire water piping circuit shall be leak tested at 125 psig water pressure.

## Reheat Condenser

Underwriters Laboratories, Inc. (U.L.) and Canadian Standards Association (C.S.A.) approved reheat condenser shall utilize a coaxial "tube-in-tube" design; Water flows through the inner tube while refrigerant flows in the annulus between the copper inner tube and steel outer tubes. The convoluted inner tube has increased heat transfer surface area per unit length yet still permits full flow of both water and refrigerant around its entire periphery for improved performance. Turbulence imparted by the convolutions to both the water and refrigerant flows further enhances the thermal performance, while inhibiting the accumulation of deposits on the surfaces.

Maximum working pressures are 400 psig on the water side and 620 psig on the refrigerant side. The entire refrigerant piping circuit shall be leak tested at 300 psig air pressure. Hot compressed refrigerant gas is piped to the reheat condenser prior to continuing through the refrigerant circuit. Water and/or propylene glycol is circulated through the other side of this heat exchanger and then through the Condenser Reheat Coil with a centrifugal circulating pump. Also included in this Type K copper piping system is a three-way, solenoid actuated, liquid diverting valve and a check valve.

## Electric Heater

Electric heating coils shall be the open type consisting of low watt density (35 Watts/sq. in. wire surface) heating elements housed in a 16 gauge galvanized steel casing. A perforated diffuser screen shall be provided to provide uniform airflow. All circuits shall be equal capacity balanced three-phase circuits and shall be based on 24 amps at 460 volts. The electric heat control panel contains three pole line break contactors sized for either 24 or 48 Amp service as required to satisfy control step requirements, and fuses sized for either 30 or 60 amps as required to satisfy National Electric Code requirements. The control panel also includes manually replaceable line break high limit thermal cutout for primary safety protection, relays, pressure differential airflow switch and an on-off switch.

## Supply Fan

Fans are Direct Drive Backward Inclined Airfoil, Industrial Centrifugal type. Fans shall be tested in accordance with ANSI/ASHRAE 51-1985 and ANSI/AMCA 210-85 test codes and guaranteed by the manufacturer to deliver at the rated published performance levels. In addition, each unit shall be factory run tested prior to shipment.

**CONSTRUCTION-** the fan housing shall be designed to meet Class III construction standards. The housing shall be constructed of 10 gauge and 12 gauge sheet steel material with continuous seam type welding and side angle reinforcement. Lifting eyes shall be supplied.

**WHEEL**- the Backward Inclined Airfoil wheel features continuously welded backward curved double thickness airfoil blades. Wheel shall be constructed from heavy gauge aluminum. Blades shall be continuous and precision welded to flat wheel cone and back plate. The wheel shall be dynamically and statically balanced and shall be attached to the shaft with a split taper lock bushing.

**MOTORS**- Fan motors shall be foot mounted, NEMA Design B, standard industrial, continuous duty, ball bearing, variable torque type suitable for operation on voltage, phase and hertz, as listed in the fan schedule. Motor bearings shall have a minimum L-10 life, as defined by AFBMA, of at least 40,000 hours (200,000 hours average life). Units shall be supplied with motor wiring connections extended through liquid tight conduit to outside the fan housing. If motors have regreasable bearings, extended grease lines shall be supplied for lubrication of the motor bearing.

**BALANCING**- The wheel assembly shall be statically and dynamically balanced in accordance with ANSI/AMCA 204-96 "Balance Quality and Vibration Levels for Fans" to Fan Application Category BV-3, Balance Quality Grade G6.3. In addition, direct drive fan wheels shall be balanced on the fan shaft after final assembly in the fan casing, in the manufacturing facility.

**GUARDS-** OSHA approved safety guards are furnished for the discharge outlet to prevent unintentional contact with the blower wheel. Guard material is minimum 18 gauge galvanized steel.

**FINISH**- The unit after fabrication, shall be cleaned and chemically pretreated by a phosphatizing process and shall be painted inside and outside with an air dried enamel.

## Air Filtration

### Standard Medium Efficiency Pleated Media Filters

The unit shall be provided with 2-inch pleated filters of MERV 7 efficient in accordance with ASHRAE Test Standard 52.1-92, front loaded 2-inch pleated-media filters. Filter bank shall be face loaded on the entering side of the cooling coil. Access to the filters will be through a side door located behind the air inlet and ahead of the first cooling coil.

## General Electrical

All internal electrical wiring must be run in flexible weatherproof conduit. Line and low voltage wiring must be isolated from one another. The unit shall be equipped for single source power connection.

## Main Control Panel – Exterior

### Standard

The main control panel will have access door(s) for direct access to the controls. The panel shall be dust and weather-tight. Wire and conduit entrance will be inside of unit cabinet.

### Option 1

Nema 12 enclosure

### Option 2

Nema 4 enclosure

### Option 3

Nema 4X enclosure

## Main Control Panel Components

The control panel includes the following:

1. Individual fusing, contactors, and adjustable manual starters for all motor loads.
2. Control power transformer with primary and secondary (24 Volt or 120 Volt) fusing.
3. 24 Volt or 120 Volt control transformer and fuse.
4. All control relays necessary for control functions.
5. A 24 Volt or 120 Volt control terminal strip containing wired terminals for all controls, numbered in accordance with the wiring diagram.
6. Thermostat type temperature controls.

The above components shall be in addition to electrical components associated with other sections, which shall be incorporated in the main control panel to facilitate maintenance and trouble shooting.
Safety Controls:

1) Compressor lockout protection provided for either internal or external overload.
2) Low-pressure protection.
3) High-pressure protection (high pressure switch or internal).
4) Improper voltage and phase protection.
5) Supply-air sensor shall be located in the unit and should be used to disable compressor during low inlet temperature conditions.

## SAFETY SWITCH

Located in the main control panel is a three-phase heavy duty, fused, externally operated, molded case switch (non-automatic circuit breaker) suitable for copper wire up to and including 1-1/4 inch conduit.