ADVANCE INDUSTRIAL REFRIGERATION

ADVANCE THE WAY YOU THINK

Installation, Operation, and Maintenance

ControlAIR

3 to 60 tons

Series PW

Packaged Water Cooled DX Unit

Series CA

Split System Air Cooled DX Unit

Series HW

Chilled Water Air Handling Unit

IOM-ControlAIR

Release Date: 11-12-20

Table of Contents

1. GENERAL

Advance Industrial Refrigeration, Inc. reserves the right to make changes and/or improvements in designs, features, options, and procedures without notice or obligation.

1.1. Resources

The following information is available for download: https://www.air-eng.com/resources

Product Catalog and IOM Manual

- Catalog-ControlAIR, "Product Catalog - ControlAIR".
- IOM-ControlAIR, "Installation, Operation, and Maintenance Manual - ControlAIR".

Drawings

- ControlAIR Configurations
- ControlAIR Dimensional Drawings

Model Number Designations

- Series PW
- Series CA
- Series HW

Guide Specifications

- Series PW
- Series CA
- Series HW

Technical Bulletins

- TB-01, "Splitting and Re-assembling Instructions PW Series".
- TB-14, "Piping Recommendation for Refrigerant Systems".
- TB-15, "Condensate Trapping".
- TB-33, "Blowers Maintenance".
- TB-52, "A0002238 Installation Instructions (Wall Mounted Temp/RH Sensor)".
- TB-54, "A0007416 Installation Instructions (Temp/RH Sensor)".
- TB-61, "A0003701 Installation Instructions (Temp/RH Sensor)".
- TB-64, "Torque Bolts Generic Assembly".

Technical Reports

- TR-01, "Pre-startup Checklist".

- TR-02, “A/C Unit Start-up Report”.

Miscellaneous

- AIR Standard Warranty Policy.

2. INSTALLATION

2.1. Safety considerations

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service the equipment. Observe precautions in the literature, tags and labels attached to the unit. Follow all safety codes. Wear personnel protective equipment and put safety as the priority item during work.

WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury and/or death.
Before performing service or maintenance operations on unit, turn off main power switch to unit.
Tag disconnect switch with a suitable warning label.

2.2. Receiving

This unit has been factory run-tested and has gone through a comprehensive inspection prior to its packaging and shipment. However, shipping damage can occur and an inspection of the unit should be performed immediately upon delivery.

Note and photograph any external damage or other damage due transportation on the freight carrier’s forms. Inspect the unit itself for internal damage. A claim should be filed with the shipping company if the equipment is damaged or incomplete.

2.3. Handling

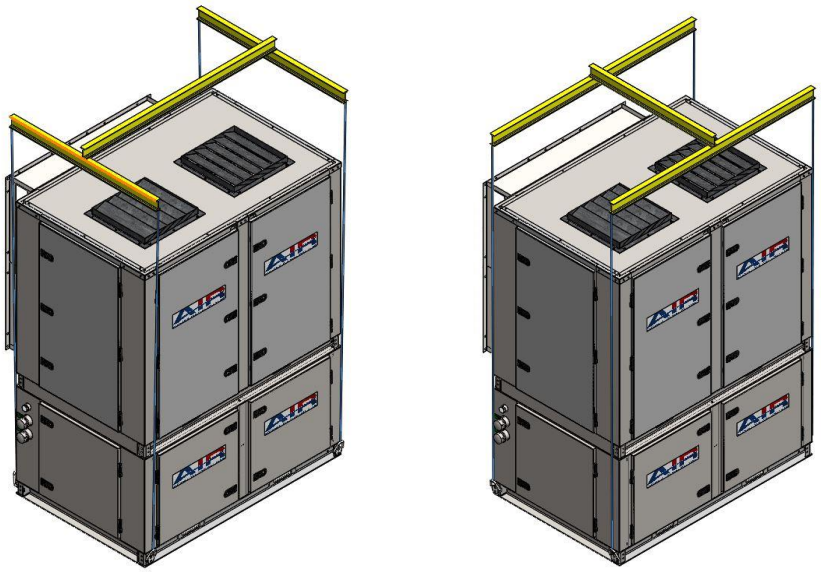
Move the unit in its upright position to the installation site. The unit contains one or two lifting access points for forklift and four brackets in the frame for hoist rings. If the air handler section frame is used for lifting, caution must be taken to ensure that the bolts connected to both frames are tightened when moving the compressor section and air handler section together.

Damage may occur during unit handling for installation. Extreme caution must be taken to prevent any damage to the refrigerant system, especially when handling the unit with forklifts. This unit may contain a system that is pressurized with refrigerant and if it is damaged, the refrigerant

could leak to the atmosphere or cause bodily harm due to the extreme cold nature of the substance. Protective equipment such as gloves and safety glasses to minimize or prevent injury in case of a system leak during installation must be used.

2.4. Lifting

1. Before lifting the unit, be sure that all the shipping material has been removed from unit.
2. To assist in determining rigging requirement, weights are provided in the unit mechanical submittal.
3. Unit must be lifted by all lifting points using the brackets for the hoist ring provide in the unit.
4. Spreader bar(s) must span the unit to prevent damage to the cabinet by lifting cables.
5. Always test-lift the unit to check for proper balance and rigging before hoisting to desired location.



Unit with 4 lifting points.

Unit with 6 lifting points.

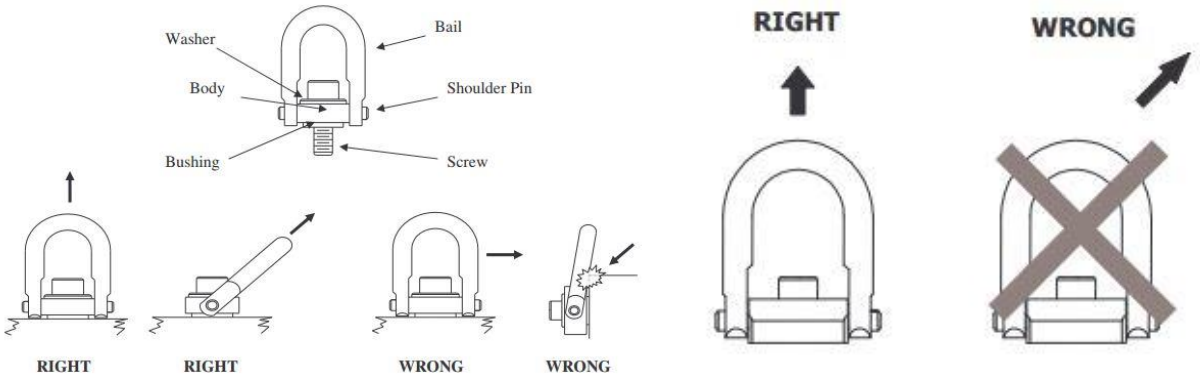
6. Do's and don'ts:

Do

- Tight the hoist rings screw to the recommended torque value.
- Make sure that the hoist ring is free to pivot and swivel in all the directions.
- Always choose a hoist ring with the proper load rating.
- When installing a hoist ring, make sure to use a Grade 8 nut that has full thread engagement.

Don't

- NEVER EXCEED RATED LOAD.
- NEVER APPLY SHOCK LOAD.
- Never use a hoist ring that you believe is damaged.
- Never use a hoist ring that is not tightened to the recommended torque.
- Never shim or use washers between the hoist ring and surface of the object being lifted.



The load in each hoist ring is not simply the total weight divided by the number of hoist rings. The resultant force can be significantly greater at shallow lifting angles and with unevenly distributed loads.

L = Load experienced by each hoist ring

N = Number of hoist rings = 4

W = Total weight

A = Lifting Angle

L = W / (N*sine(A))

2.5. Storage

If you must store the equipment it should be done in a dry area, out of the weather, protected from damages by other equipment in storage or transportation equipment, never stacked, and avoid frequent relocation.

If the equipment is stored longer than 30 days special precautions must be taken to avoid coil damage. All coils should be charged and sealed with low pressure (1 – 5 psig) inert gas, such as nitrogen. This will prevent contaminants from entering the coil. If the coils are not charged and sealed, condensation mixes with air pollutants forming a weak acid and over time it can cause pin hole leaks to develop in the coil tubes.

Prior to long term storage, fan bearings (and motor bearings per the motor manufacturer's specifications) are to be greased at the time of going into extended storage. On belt drive blowers the belt tension should be reduced to less than half the specified value for the fan's design to prevent a sag/set from forming in the shaft and belts.

On a monthly interval, the blower should be checked to ensure that it has remained in an acceptable stored condition. The blower and motors should be rotated seral times by hand while adding enough grease to replenish the bearing surfaces with fresh grease and to maintain a full bearing cavity.

When equipment is installed after being stored, caution should be taken to inspect and replace, if required, belts and gaskets. All moving parts, such as blowers and motors, should be hand tested to ensure that they are free and clean prior to start-up. Finally verify that all lubrication is fresh and full.

2.6. Room Considerations

This unit is designed to control the room temperature within close tolerances. However, the room must be built with a proper vapor barrier to prevent diffusion of moisture through wall, ceiling and floor. Failure to provide a vapor barrier can compromise space conditions.

Proper room sealing is required to prevent excessive infiltration of humid air into the space. Unit sizing must consider the impact of infiltration air or pressurization air on the sensible and latent cooling load capacity required by the unit.

Unless the unit was specified to be installed outdoors by the Customer at the time of purchase, the unit should be installed indoors or under a roof to protect from weather.

2.7. Splitting and Re-assembling

AIR PW series units may be shipped split, if requested, or may be field split and reassembly by customer. Refer to technical bulletin TB-01 for more information about splitting and re-assembling units.

2.8. Ductwork Connection

The supply duct should be properly supported independent of the air handling unit.

Supply and return duct in non-conditioned spaces should be insulated to prevent heat loss and external sweating.

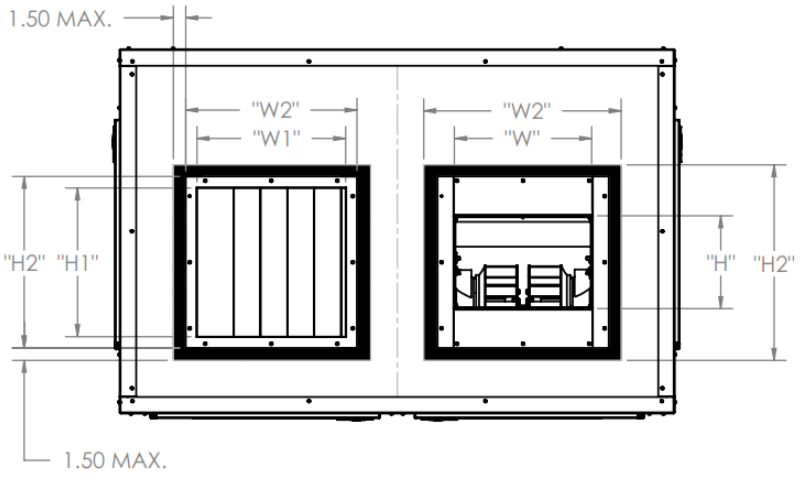
If not insulated, supply duct within conditioned spaces will sweat during periods with frequent traffic and/or open equipment access doors due to infiltration of humid air.

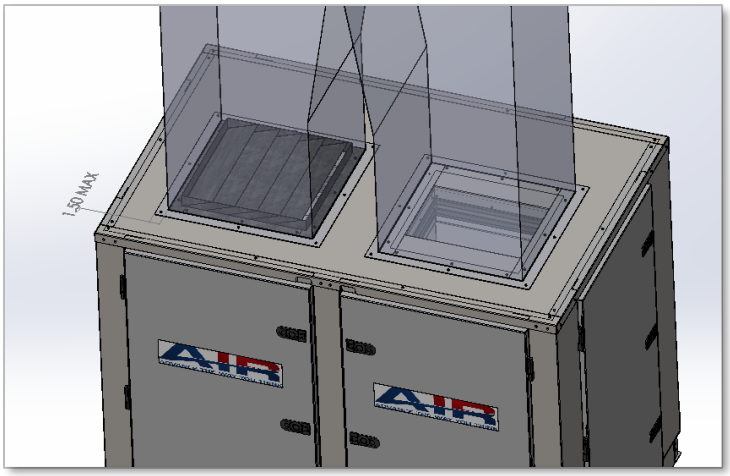
Duct connections to unit should be flanged connect flush to the supply fan outlet (on top) or to the filter rack inlet (rear of unit) using self-tapping screws. Flanges should be gasketed with either full faced 1/8” thick DURO 60 neoprene gasket or Tremco Butyl Sealant.

- Installation of all ducts should be done in accordance with Best Practices and SMACNA.
- Recommended Ductwork to Unit connection screws:
    - Self-tapping screws for metals with one piece hex washer head with a wide flat bearing surface, used in materials such as steel and stainless steel, fully threaded, no longer than 1”. Screws longer than 1” may cause damage to internal components.
    - Stainless steel screws are recommended.

- HVAC duct sealant is recommended to seal all possible leaks.
- Provide a minimum 12” of straight duct on the discharge outlets.
- Provide an access door at each backdraft damper (in discharge outlet) for future maintenance.

Supply Air Duct Opening Dimensions - Height x Width (inches)			
Model Numbers PW, SW, CW, TW SA, TA, CA HW	**Upblast Discharge with Air Damper (H X W)**	**Upblast Discharge without Air Damper (H1 X W1)**	**Recommended Duct Size (H2 X W2)**
Size 00	18 X 18	11-1/4 X 16-5/8	20-7/8 X 20-7/8
Size 01	18 X 18	11-1/4 X 16-5/8	20-7/8 X 20-7/8
Size 02	18 X 18	11-1/4 X 16-5/8	20-7/8 X 20-7/8
Size 03	18 X 18	11-1/4 X 16-5/8	20-7/8 X 20-7/8
Size 04	18 X 18	13 X 18-1/2	20-7/8 X 20-7/8
Size 05	18 X 18	13 X 18-1/2	24-7/8 X 24-7/8
Size 06	22 X 22	16 X 21-1/2	24-7/8 X 24-7/8
Size 07	22 X 22	16 X 21-1/2	24-7/8 X 24-7/8





2.9. Condenser Water (Series PW) and Chilled Water (Series HW) Piping

All piping connecting to the unit must be aligned and supported as to not impart stress on the unit connections.

The required field installed water pipe sizes may or may not be the same as the connection sizes at the unit. This will depend on the length of the pipe and the calculated pressure drop of peripheral components.

Water connections on the unit are dimensioned and labeled on the unit's mechanical submittal and labeled on the unit itself.

The Customer should provide isolation valves for the condenser water lines, installed upstream and downstream of the heat exchangers, and located to provide isolation for flow sensing devices, field thermometers, flexible connectors, and any removable pipe spools.

Air vents must be installed in various locations in the piping system to purge the air and avoid problems due to the presence of air in the water loop.

If the unit will remain operational at subfreezing ambient temperatures, the water system must be protected from freezing, by one of the following measures:

1. Insulate or install heat tape on the unit heat exchanger, water piping, pumps, and other components to protect from freezing in low ambient temperatures. Heat tape must be designed for low ambient temperature applications. Heat tape selection should be based on the lowest expected ambient temperature.
2. Add a non-freezing, low temperature, corrosion inhibiting, heat transfer fluid to the chilled water system. The solution must be strong enough to provide protection against ice formation at the lowest anticipated ambient temperature.

NOTE: Use of glycol type antifreeze reduces the cooling capacity of the unit and must be considered in the design of the system specifications.

2.10. Piping Hook-up Components

Piping components include all devices and controls used to provide proper water system operation and unit safety. These components Include the following:

Entering Water Piping

- Isolation valve (located upstream from all components listed below).
- Pipe strainer
  - Mesh no larger than 0.9 mm recommended for cooling coils/evaporators.
  - 0.5 to 1.5 mm mesh recommended for condensers.
- Water pressure gauge with shutoff valves.
- Water temperature gauge.
- Low point drain.
- Relief valve (required if water pressure may exceed 125 psig at any time, including upset conditions. Customer to review shut off pressure of system pumps).
- Flexible hose connection to unit.

Leaving Water Piping

- Isolation valve (located downstream from all components listed below).
- Water pressure gauge with shutoff valves.
- Water temperature gauge.
- High point vent.
- Flexible hose connection to unit.
- Balancing Valve.

CAUTION

Use Piping Strainers!

To prevent condenser damage, pipe strainers must be installed in the water supplies to protect components from water born debris. AIR is not responsible for equipment-only-damage caused by water born debris. 0.5 to 1.5 mm mesh recommended.

Proper Water Treatment!

The use of untreated or improperly treated water may result in inefficient operation and Tube damage due to scaling, erosion, corrosion, algae or slime. It is recommended that the Services of a qualified water treatment specialist be engaged to determine what water treatment Is required. AIR assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

Condenser or Water Coil Damage!

To prevent damage to water components, do not allow pressure (maximum working pressure) to exceed 125 psig @ 150°F.

2.11. Series CA - Split System Field Refrigerant Piping

Refrigerant Piping

AIR does not assume responsibility for the line size selection. The ultimate responsibility for the refrigerant piping sizing is for the installing contractor or Customer's engineer.

Field discharge, liquid or suction lines will not necessarily be the same as the field pipe size required. In some cases, these will vary significantly.

Special care must be taken to ensure proper oil return and efficient operation. Lines must be designed and installed by a qualified refrigeration engineer and mechanic.

Refer to technical bulletin TB-14 for more instructions.

2.12. Condensate Drain Piping

All cooling coil drain pans have a connection on both sides for condensate removal.

A P-trap should be built into the drain line to prevent air from backing up into the unit. Refer to technical bulletin TB-15.

2.13. Electrical Connections and Connections

All electrical connections must be performed by a qualified electrical technician and must follow all local electrical and safety regulations. Failure to do so may cause death, serious personal injury or property damage and will void the warranty of the equipment. AIR is not responsible for any damage caused by not following the instructions present in this document.

The Customer's electrical installer will make holes in the enclosure to attach electrical fittings and pass wires and cables. Make sure to protect the components (with tape or cardboard, for example) to ensure that no debris or metal shavings fall through any component opening.

After drilling holes, make sure that the panel is clean and no metal shavings or other materials are left inside it. If the panel is not cleaned up, those pieces can cause a catastrophic failure and the warranty will be voided.

All electrical connections are depicted on the electrical drawings. The drawings types are:

EF (Electrical Field)

Shows the power connection, the field devices (sensors) installed by the end user, and the equipment nameplate. The equipment nameplate contains the minimum circuit ampacity data which is used to size the conductors feeding power to the equipment and the maximum overcurrent protection data which is used to select the protective device size (breaker of fuses).

EW (Electrical Power)

Shows the wiring schematic for the high voltage components.

EP (Electrical Panel)

Shows the wiring schematic for the low voltage components.

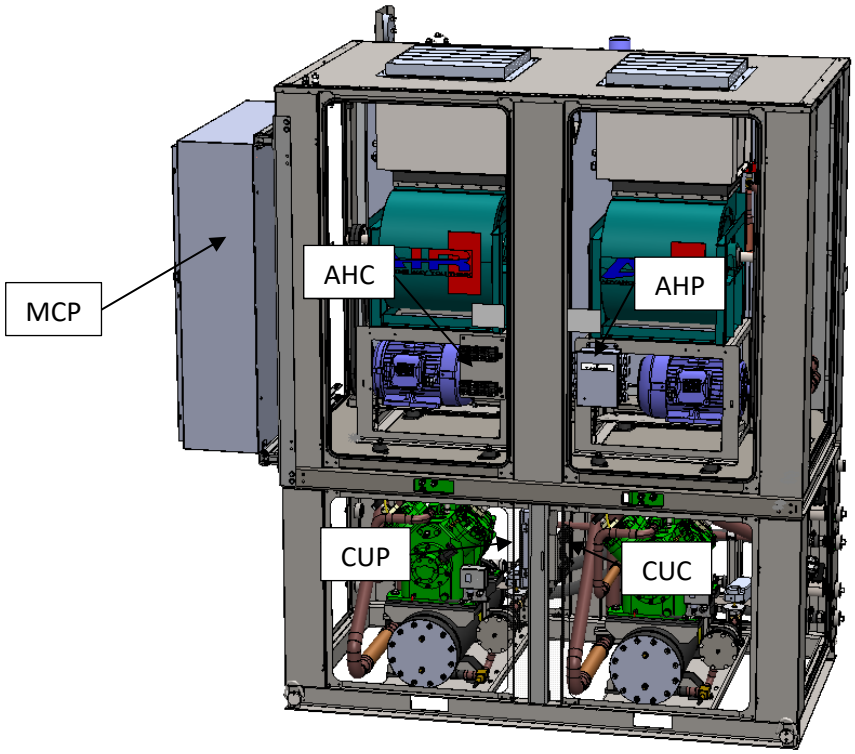
ED (Electrical Detailed)

Shows the connections between the electrical boxes and devices.

EI (Electrical Instruction)

Shows information about network communication, addressing, cables colors conventions, and any other information that is particular to the design.

Refer to electrical drawings for specific connections made inside each block or box.



The main power feeding the equipment is connected to the MCP (Main Control Panel, also referred in this manual as Electrical Enclosure), which is the largest electrical box supplied mounted to the machine or separated from the unit for wall mounting.

With split units or remote electrical enclosure option, the connections between the junction boxes, block and the MCP may require field wiring by the Customer. Refer to the electrical drawings for connections to be made and technical bulletin TB-06, “Electrical Cables for Remote Units”, for cables that can be purchased to simplify the connections.

2.14. Smoke Detector

When mounting the smoke detector, always refer to the respective device mechanical installation manual for detailed explanation.

2.15. Duct Mounted Sensors

When mounting duct mounted sensors, always refer to the respective device mechanical installation manual for detailed explanation. Refer to technical bulletins TB-54 and TB-61.

2.16. Room Mounted Sensor

The room mounted temperature/humidity sensor is a critical part of the system. It measures the controlled variables and therefore it must be properly installed and located. Select a mounting location which is the best representation of a typical temperature and relative humidity inside the room. Keep in mind that some rooms have cold and hot spots. Locating the devices in those locations can affect the system ability to maintain proper control.

The location of the sensors should consider the following:

- Mount sensors 5'-0" above finished floor.
- Do not locate wall mounted sensor in the direct path of supply air from the supply grilles.
- Do not locate wall mounted sensor adjacent to high heat producing electrical equipment.
- Avoid mounting directly on exterior walls, especially if exposed to solar load. If this is the only option, mount thermostat on a mounting bracket at least 3" from the wall surface.
- Consider mounting the wall mounted sensor near the return grille to measure the average space temperature.

Refer to technical bulletin TB-52 and the respective device installation manual for detailed explanation.

3. OPERATION

3.1. System Components

Blower

Units can be equipped with one or two forward curved double width, double inlet blowers or with one or two backward inclined double width, double inlet blowers. All blowers equipped with high quality cast iron pillow block bearings and welded steel frame.

Coils

Series PW and Series CA units are equipped with a single DX evaporator coil. For two cooling circuits coils the DX coil will have an interlaced design. All coils are coated with a corrosion resistance coat.

Series HW chilled water units are equipped with a single chilled water cooling coil. Furnishing coils with a corrosion resistance coating is an option.

Compressors

DX systems are provided with semi-hermetic reciprocating compressors with R-134a refrigerant.

Condenser

The unit may be equipped with air cooled condenser with vertical air flow or with a water cooled shell and tube condenser.

Dampers
Units are equipped with one backdraft damper per blower. These dampers are used to allow airflow in one direction and to prevent reverse air flow.

Electrical Heater
An electric heater is optionally available for the model and it is used for tempering of the make-up air.

Expansion Valve
Units are equipped with one externally adjustable expansion valve per refrigerant circuit, the expansion valve may be thermostatic or electronic. The expansion valve controls the flow of liquid refrigerant entering the coil by maintaining a constant superheat of the refrigerant vapor at the outlet of the coil.

Filter Drier
Each refrigeration circuit is equipped with a filter drier replaceable core shell and Filter drier core that provide guaranteed durability in the most aggressive environmental applications.

High Pressure Cutout Switch
Each refrigerant circuit is equipped with a high pressure cutout switch which is used as safety control. The compressor is stopped by cutting the power supply of the motor of the compressor whenever the discharge pressure of the compressor becomes excessive. This will prevent possible damage of equipment.

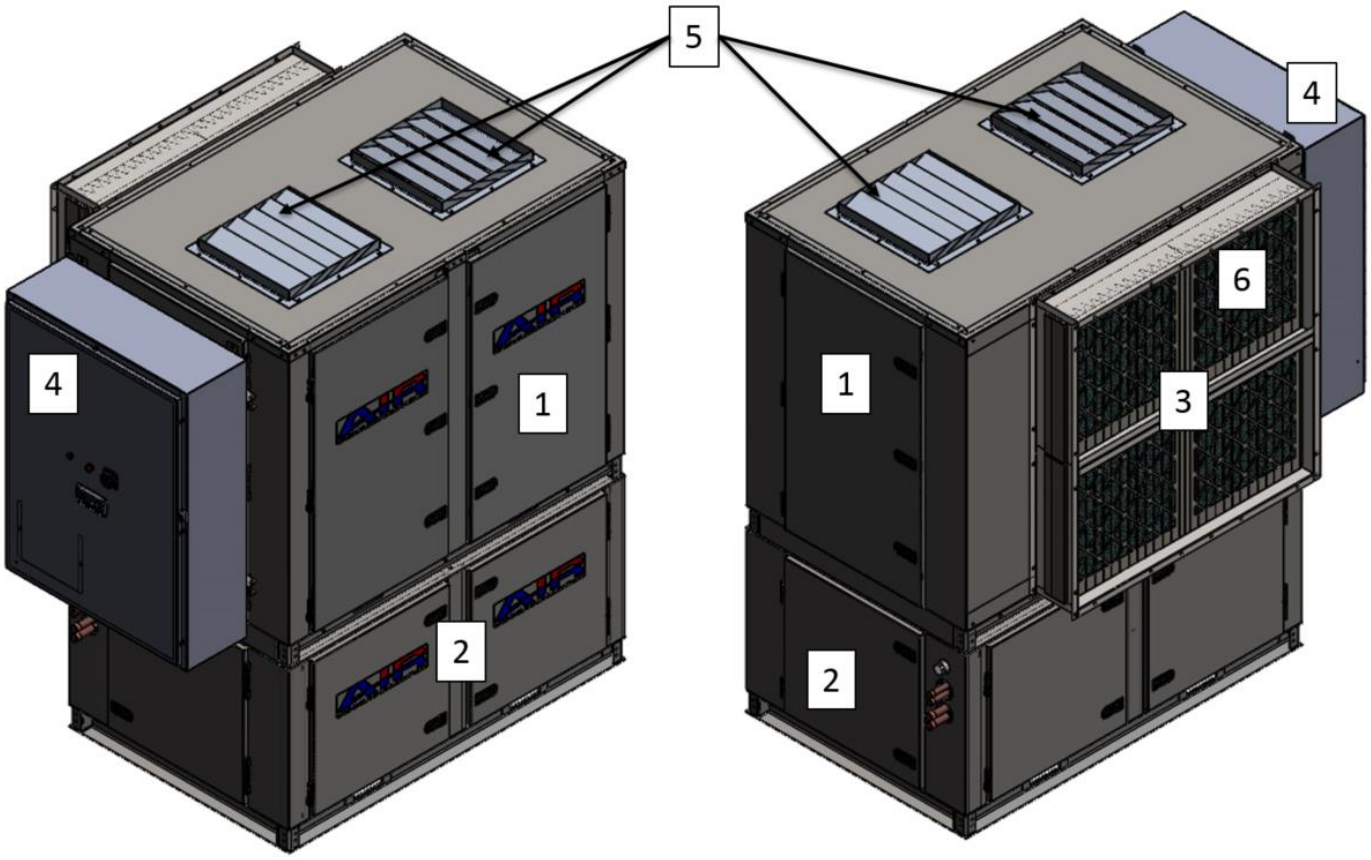
High and Low Pressure Sensor
Each compressor is equipped with a high and low pressure sensor, which monitoring the discharge and suction pressure of the compressor, for safety and system control.

Relief Valve
Each refrigerant circuit is equipped with a pressure relief valve used to limit the pressure in the circuit. The pressure is relieved by allowing the refrigerant to flow from an auxiliary passage out of the system.

Sight Glass
Each refrigerant circuit is equipped with a sight glass that provides accurate identification and better visibility of system conditions through a large viewing window with indicator.

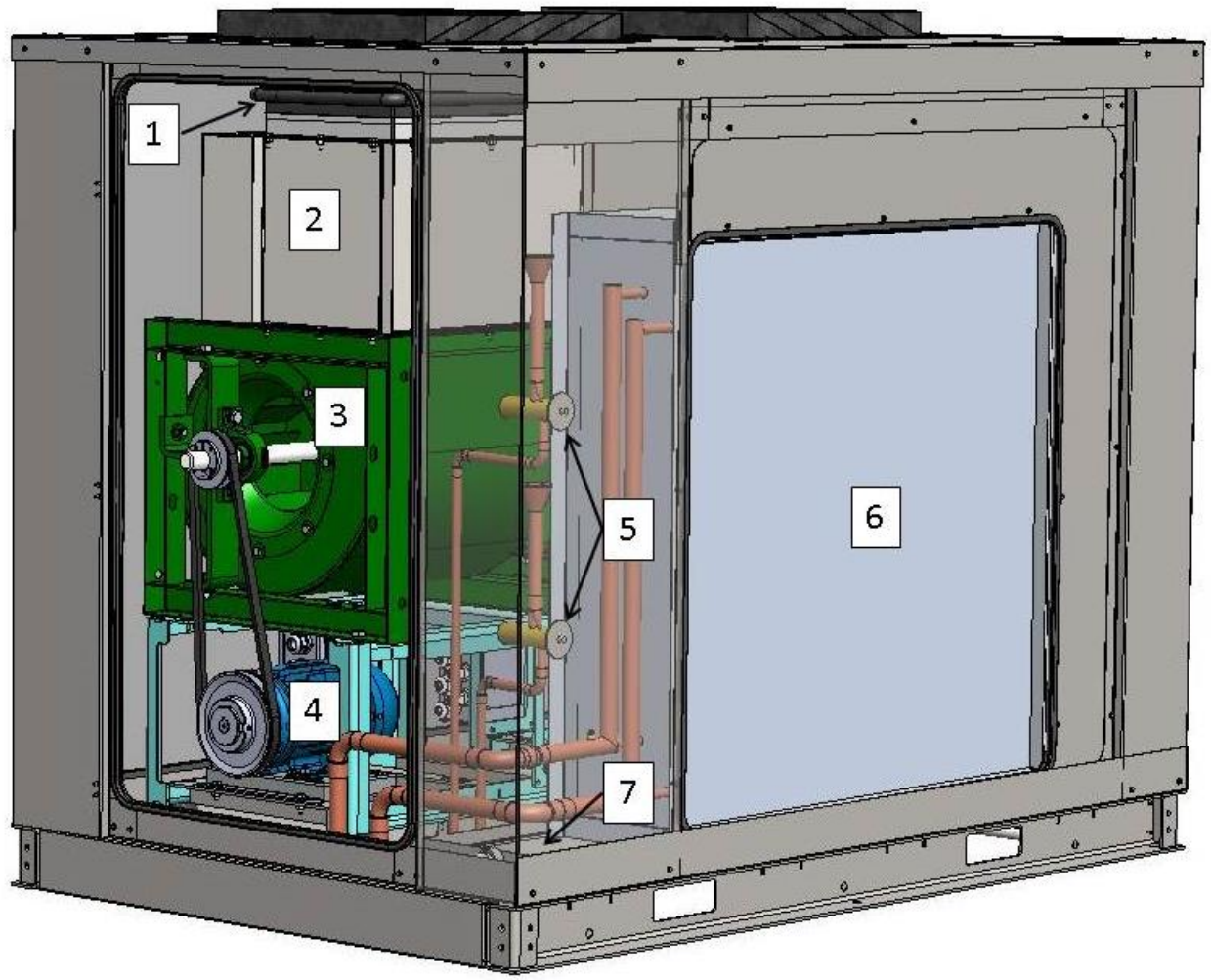
Water Regulating Valve
Each water cooled condenser is equipped with an electronic actuated valve, which is used for regulating the flow of water in the condenser. The water valves give modulating regulation of the condensing pressure and so maintain it constant during operation.

3.2. Components location



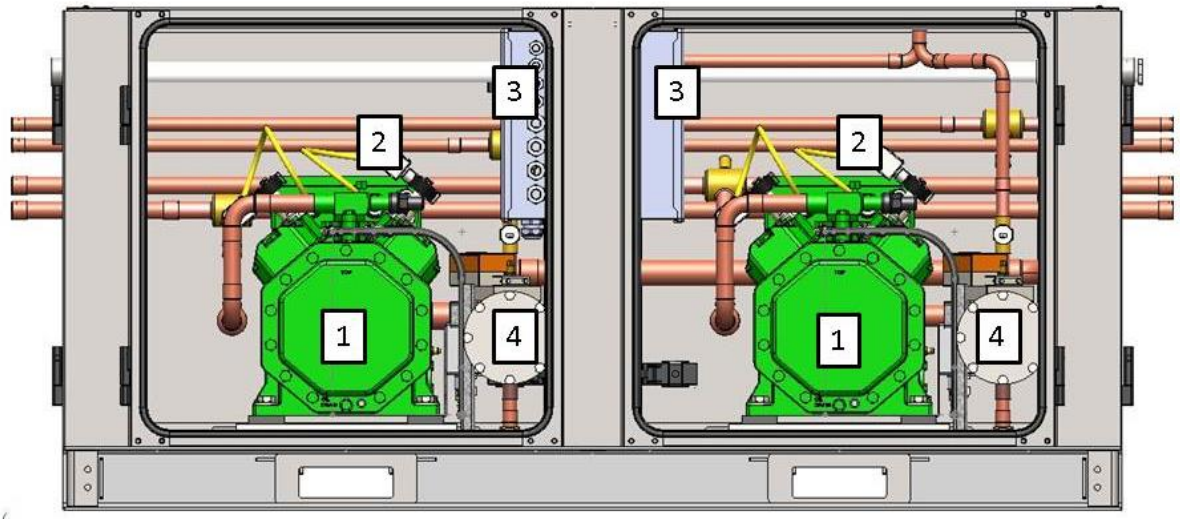
Item	Description
1	AHU Section
2	Compressor Section
3	Filter rack
4	Electrical enclosure
5	Backdraft damper
6	Air Filter

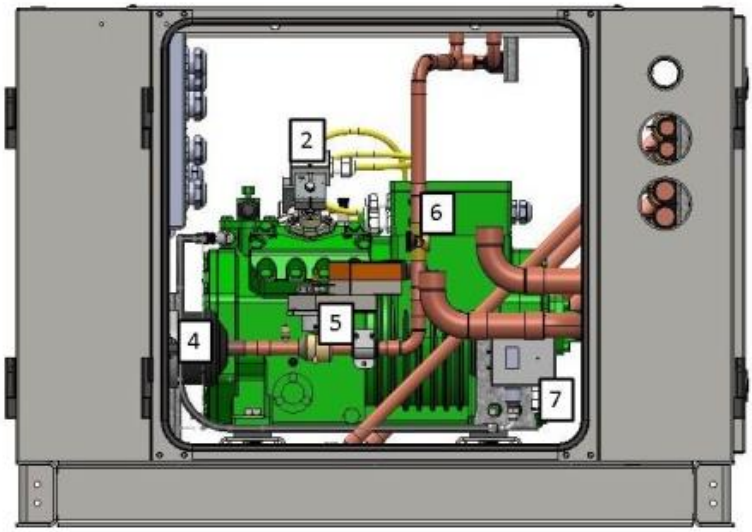
AHU Section internal components



Item	Description
1	Flex duct connection
2	Heater (one per blower, optional)
3	Centrifugal blower
4	Blower motor with adjustable base (one per blower)
5	Thermal or electronic expansion valve
6	DX evaporator coil
7	Drain pan

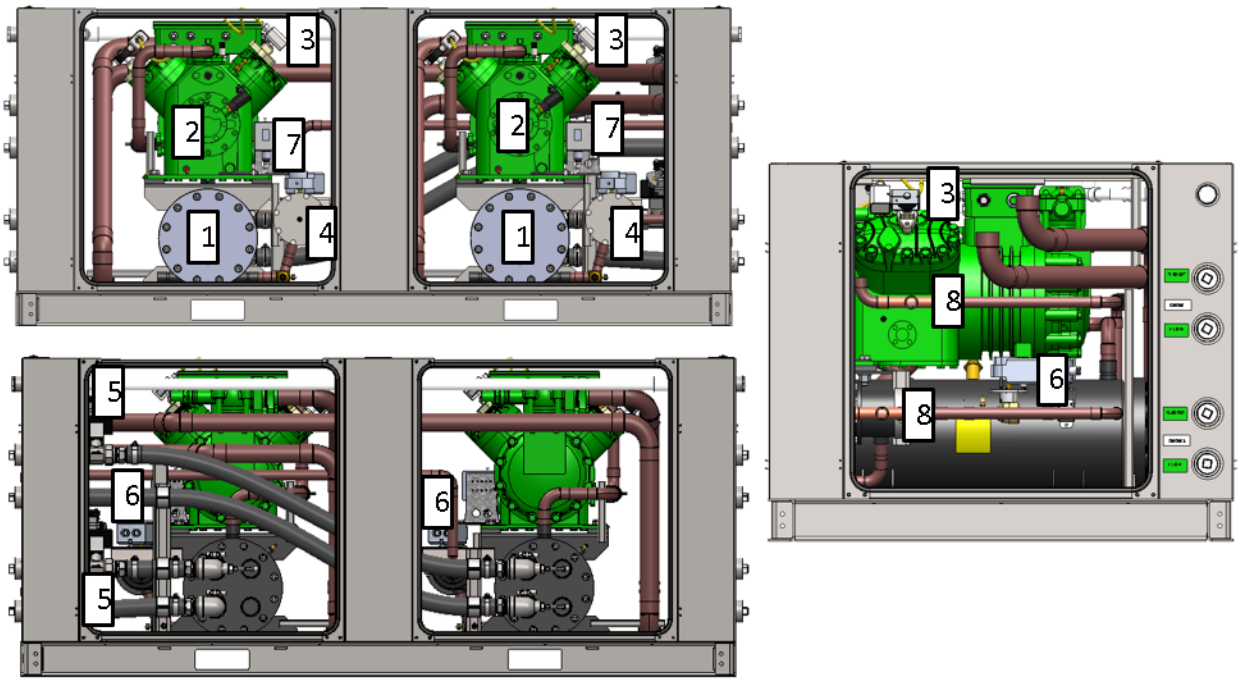
Compressor Section internal components, for remote condenser configurations.





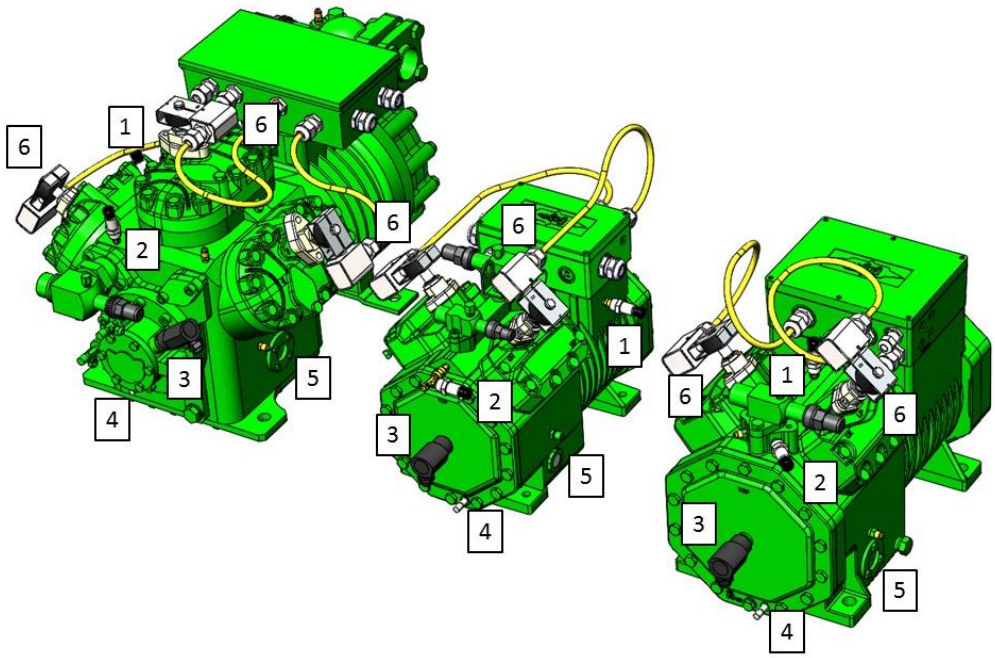
Item	Description
1	Reciprocating compressor
2	Compressor unloader solenoid
3	Junction box
4	Filter drier
5	Ball valve with electronic actuator
6	Sight glass (moisture indicator)
7	High pressure cutout switch

Compressor Section internal components, for water cooled package or split configurations.



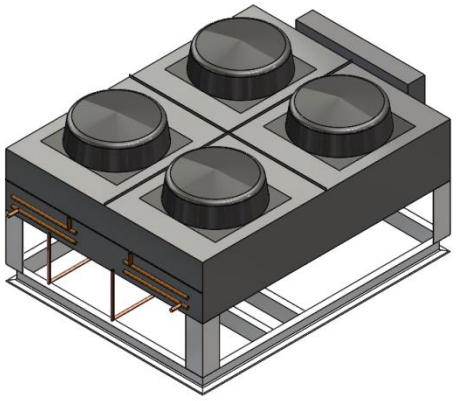
Item	Description
1	Water cooled condenser
2	Reciprocating compressor
3	Compressor unloader solenoid
4	Filter drier
5	Water regulating valve
6	Ball valve with electronic actuator
7	High pressure cutout switch
8	Sight glass (moisture indicator)

Compressor Details

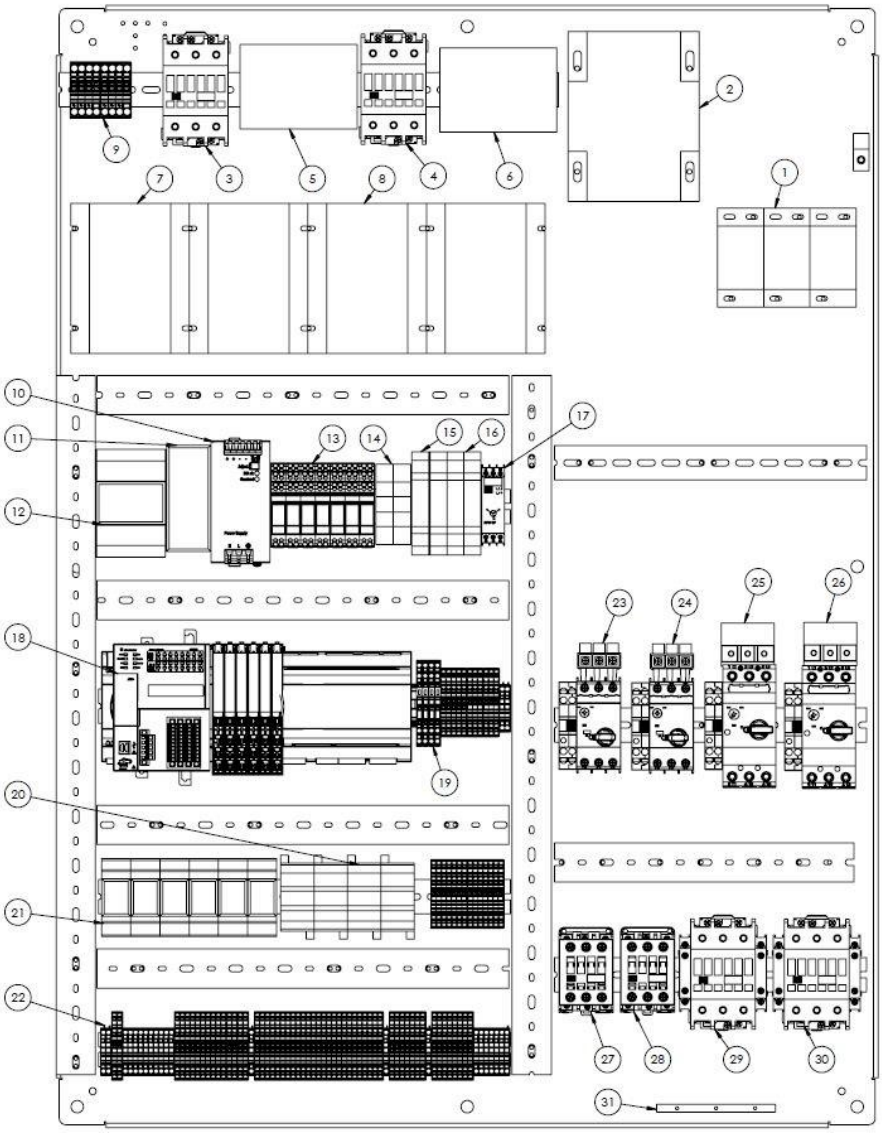


Item	Description
1	Low pressure sensor
2	High pressure sensor
3	Oil sensor
4	Crankcase heater
5	Compressor oil sight glass
6	Unloader solenoid

Air Cooled condenser: may have 1, 2 or 4 fans.



Electrical enclosure back panel



ITEM	DESCRIPTION
1	MAIN POWER DISTRIBUTION BLOCK
2	CONTROL TRANSFORMER
3	HEATER 1 CONTACTOR
4	HEATER 2 CONTACTOR
5	HEATER 1 FUSES
6	HEATER 2 FUSES
7	HEATER 1 SCR (MASTER AND SLAVE)
8	HEATER 2 SCR (MASTER AND SLAVE)
9	HEATER(S) POWER DISTRIBUTION TERMINALS
10	POWER SUPPLY 24VDC
11	ETHERNET SWITCH
12	ELECTRONIC EXPANSION VALVE(S) DRIVER (EVD)
13	CONTROL RELAYS
14	BREAKERS
15	CONTROL TRANSFORMER SECONDARY FUSE
16	VOLTAGE PHASE MONITOR FUSES
17	VOLTAGE PHASE MONITOR (VPM)
18	PLC / UNIT CONTROLLER
19	24VDC FUSES
20	CONTROL RELAYS BANKS
21	SOLID STATE RELAYS (SSR)
22	TERMINAL BLOCKS
23	BLOWER 1 MOTOR PROTECTION
24	BLOWER 2 MOTOR PROTECTION
25	COMPRESSOR 1 MOTOR PROTECTION
26	COMPRESSOR 2 MOTOR PROTECTION
27	BLOWER 1 CONTACTOR
28	BLOWER 2 CONTACTOR
29	COMPRESSOR 1 CONTACTOR
30	COMPRESSOR 2 CONTACTOR
31	GROUND BAR

3.3. Sequence of Operations

1. To start the unit, turn the LOCAL-OFF-REMOTE switch to "Local" position for system local control. "Remote" position is for remote start from a Building Management System or remote panel via a relay contacts. In the "Off" position the compressors shut down. Some units are furnished with START-STOP switches. Turn to “Start” position to start unit.
2. The blower(s) will start and run continuously. The compressor(s) will start based on temperature reading and set point and/or relative humidity and set point. Also, all system safety controls must be in a “no fault” state (e.g. voltage phase monitor, overloads, E-stop). The compressor(s) contactor coil energizes, starting the compressor and opening an auxiliary contact removing the 120V from the crankcase heater. The controller manages the refrigerant line solenoid/shutoff valve. The HMI screen indicates status.
3. **(WATER COOLED SYSTEM MODELS ONLY)**

   The system will control/regulate the water regulating valve to maintain the discharge pressure set point.
4. **(REMOTE AIR-COOLED SYSTEM MODELS ONLY)**

   Condenser fans are immediately engaged when the compressor contactor closes. Depending on the size, type and destination of the condensing unit, fans may be energized individually or in pairs. The first fan starts with signal from compressor contactor auxiliary contact.
5. Temperature Control:

   A PLC will control system capacity by cycling the compressor(s) and unloader(s). As space/room air temperature rises above set point, the system demand increases and the first compressor starts. As temperature continues to rise and the calculated system demand increases, the first compressor loads and eventually the second compressors is started. As temperature continues to rise, the system demand reaches 100%, bringing compressor(s) to 100% capacity. As temperature falls, this sequence is reversed until the compressor(s) cycles off. Depending on capacity, compressors will have one, two or three unloaders.
6. Some systems are fitted with VFD controlled compressors. In these cases, the capacity control is done by varying the compressor motor frequency, in which unloaders are used for safety mechanisms only.
7. If the temperature falls below the space/room heating set point, the system will use the heaters to warm-up the room.
8. Relative Humidity Control:

   The upper humidity limit is controlled by the cooling coil. It results from the inherent de-humidification that occurs with mechanical cooling (condensate forming on the cooling coil surface due to coil temperature below the air dew point).
9. A PLC will control system capacity by cycling the compressor(s) and unloader(s) when the space/room air relative humidity is above setpoint plus a threshold. The Relative Humidity demand override the Cooling demand, thus forcing the compressors to run loaded even

in situations when the temperature is satisfied. The system demand will increase to maintain the temperature of the air leaving the coil at a setpoint which corresponds to the wet bulb temperature of the space/room temperature and relative humidity set points.

10. To avoid over cooling during dehumidication, the system will re-heat the air temperature using an electric resistance heater.
11. Some systems are fitted with VFD controlled blowers. In those cases, while in relative humidity control, if the temperature leaving the coil is above setpoint even with compressors running at 100%, the system will slow down the blowers and decrease the airflow until temperature reaches the desired set point.
12. Safety controls are designed into the compressor(s) and blower(s) control circuit. If any of these safeties sense a problem the appropriate contact will open/close and shut down the compressor. The HMI screen indicates status and alarms.
13. If either the compressor motor or fan motor draws excessive current caused by overloads or short circuits, the current limiting overloads will trip and isolate the faulty motor from the 3 phase power line.

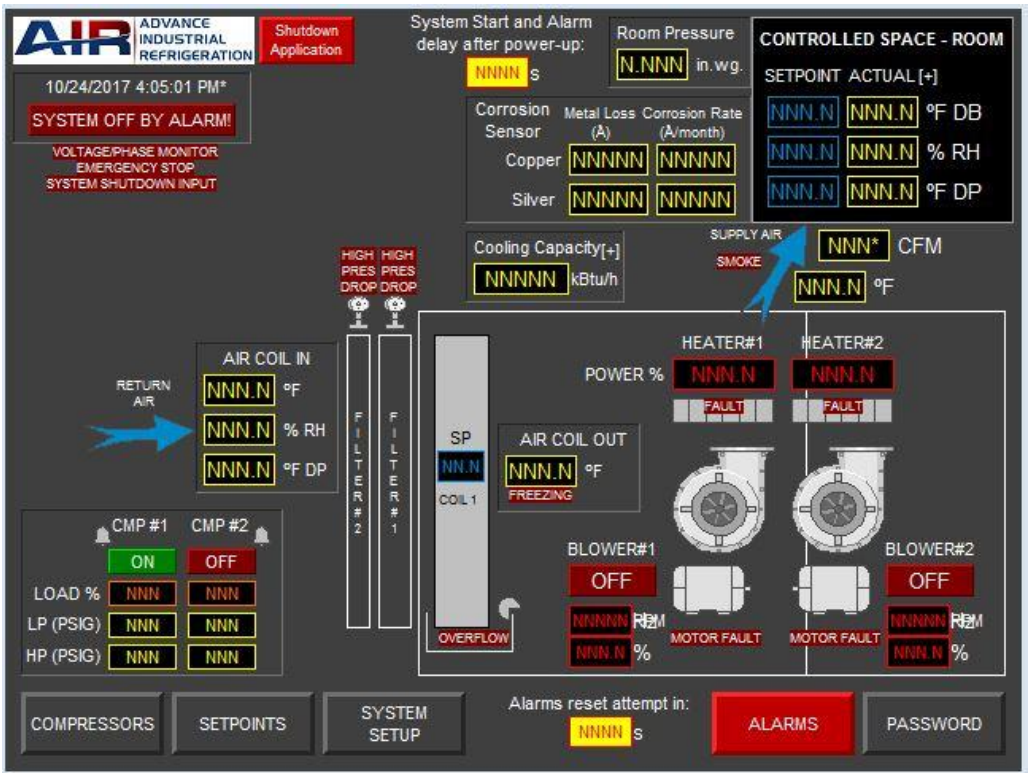
    Important: Determine cause of over current before resetting overload. To reset open control panel with main power "OFF" and press the reset switch on the overload.
14. Multiple alarm conditions are monitored during operation.

3.4. Allen-Bradley CompactLogix PLC with PanelView Touch

This chapter applies to systems fitted with Allen-Bradley CompactLogix PLC and PanelView Touch HMI. Sample graphic displays are shown below. Contact AIR for details for your specific unit control system.

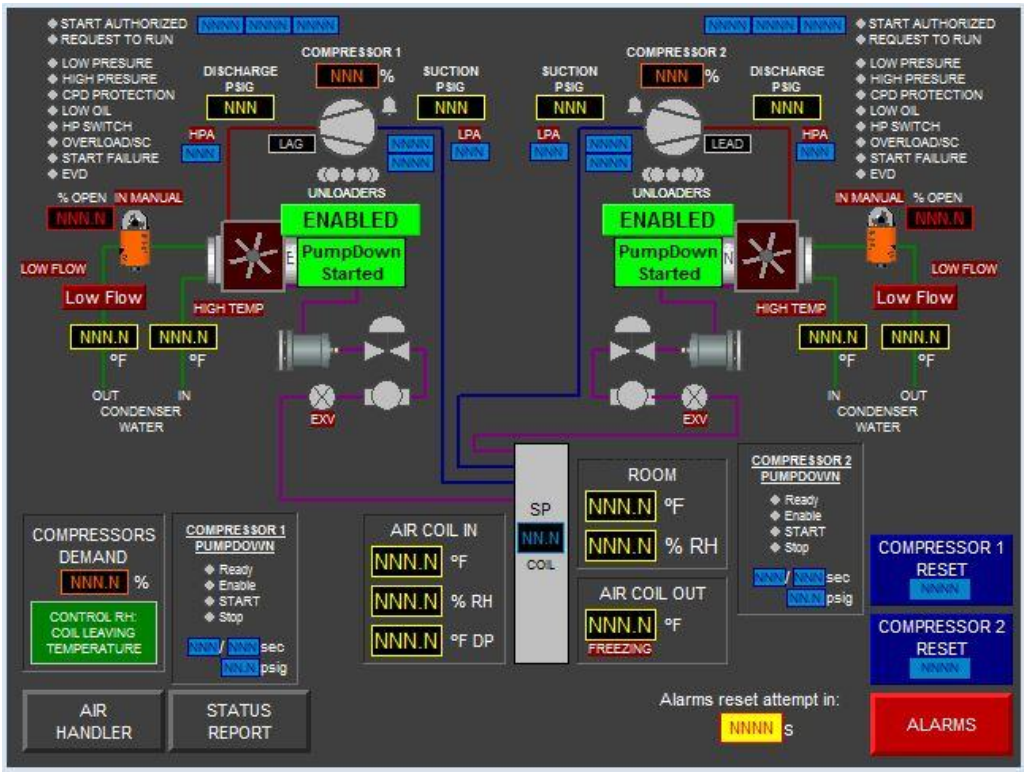
3.4.1. Main

All main variables and equipment status are listed under this screen. It gives an overview of the system and its component.

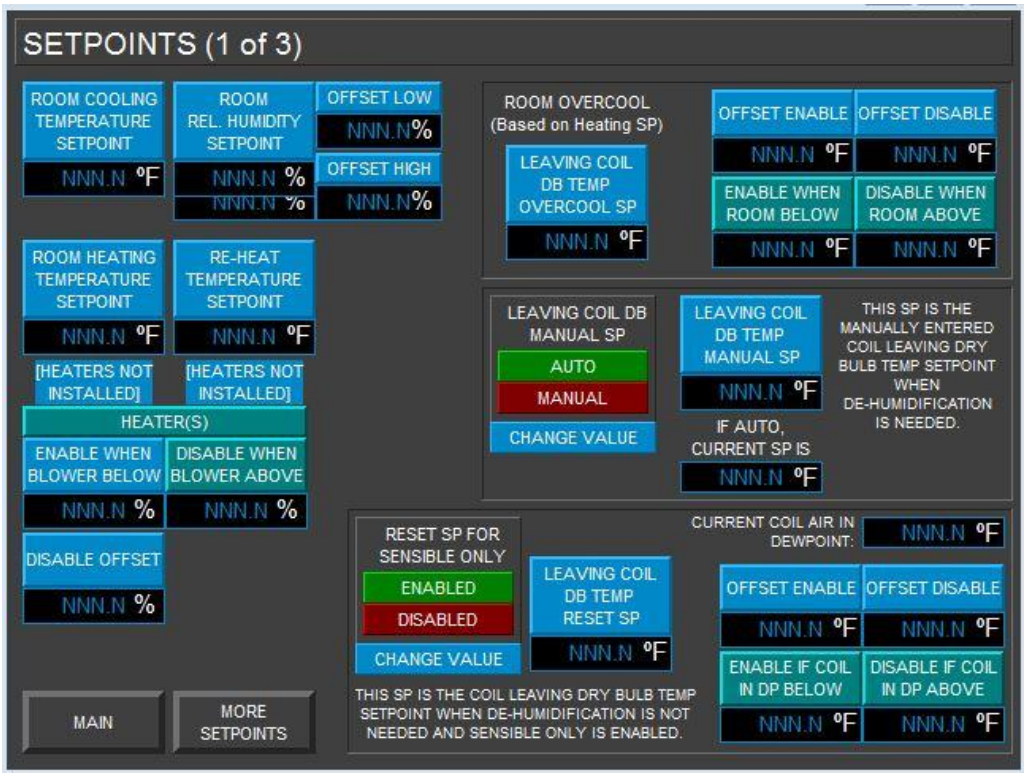


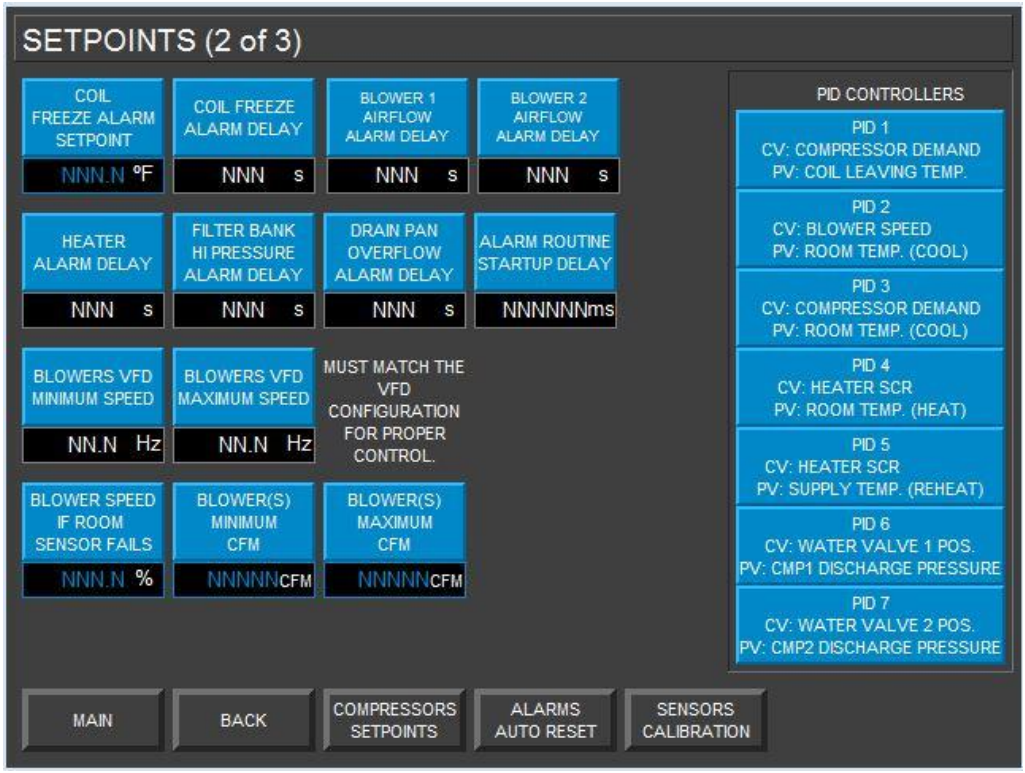
3.4.2. Compressors

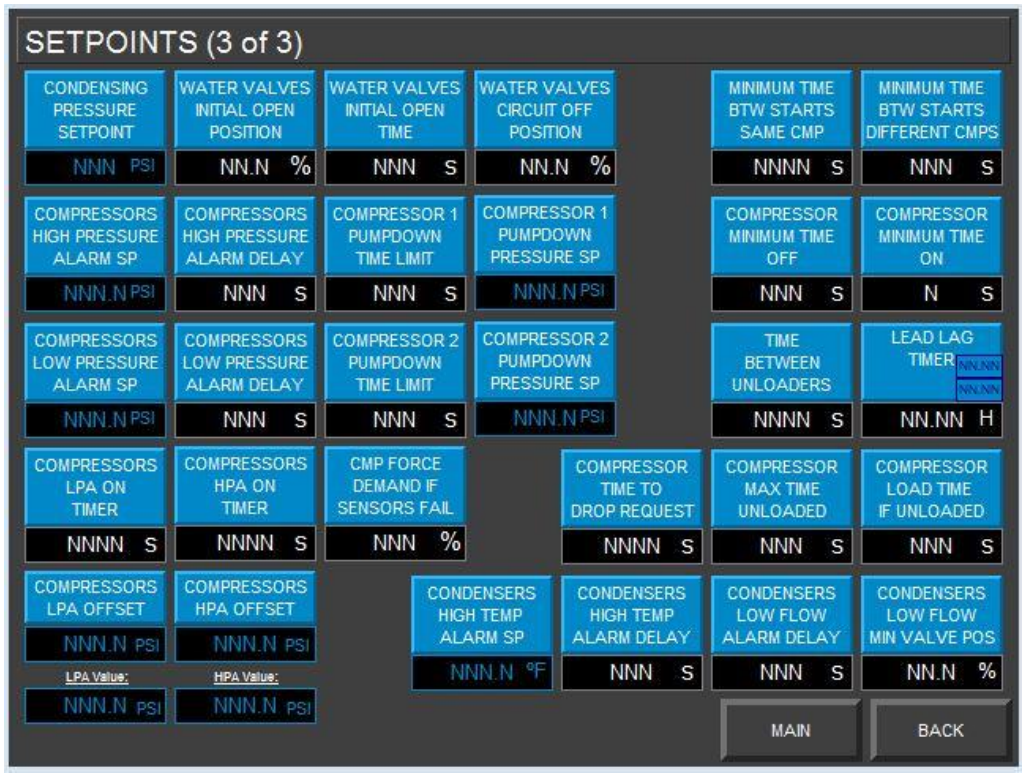
Both compressors status are listed. Some of the variables on this screen can also be seen on the main screen.



3.4.4. Setpoint Screens:

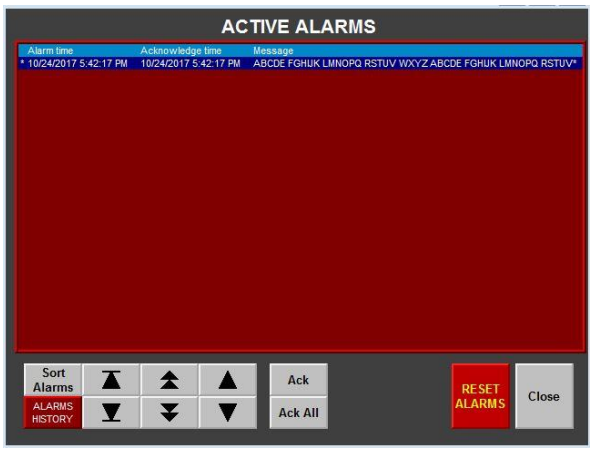


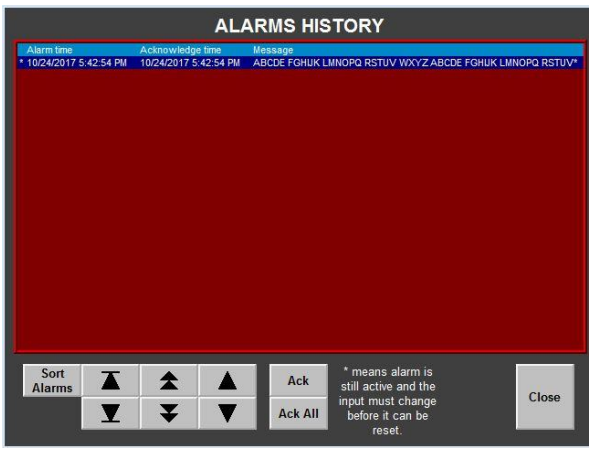

SETPOINTS (2 of 3)
COIL FREEZE ALARM SETPOINT
NNN.N °F
COIL FREEZE ALARM DELAY
NNN s
BLOWER 1 AIRFLOW ALARM DELAY
NNN s
BLOWER 2 AIRFLOW ALARM DELAY
NNN s
HEATER ALARM DELAY
NNN s
FILTER BANK HI PRESSURE ALARM DELAY
NNN s
DRAIN PAN OVERFLOW ALARM DELAY
NNN s
ALARM ROUTINE STARTUP DELAY
NNNNNNms
BLOWERS VFD MINIMUM SPEED
NN.N Hz
BLOWERS VFD MAXIMUM SPEED
NN.N Hz
MUST MATCH THE VFD CONFIGURATION FOR PROPER CONTROL.
BLOWER SPEED IF ROOM SENSOR FAILS
NNN.N %
BLOWER(S) MINIMUM CFM
NNNNNCFM
BLOWER(S) MAXIMUM CFM
NNNNNCFM
PID CONTROLLERS
PID 1
CV: COMPRESSOR DEMAND
PV: COIL LEAVING TEMP.
PID 2
CV: BLOWER SPEED
PV: ROOM TEMP. (COOL)
PID 3
CV: COMPRESSOR DEMAND
PV: ROOM TEMP. (COOL)
PID 4
CV: HEATER SCR
PV: ROOM TEMP. (HEAT)
PID 5
CV: HEATER SCR
PV: SUPPLY TEMP. (REHEAT)
PID 6
CV: WATER VALVE 1 POS.
PV: CMP1 DISCHARGE PRESSURE
PID 7
CV: WATER VALVE 2 POS.
PV: CMP2 DISCHARGE PRESSURE
MAIN
BACK
COMPRESSORS SETPOINTS
ALARMS AUTO RESET
SENSORS CALIBRATION


SETPOINTS (3 of 3)
CONDENSING PRESSURE SETPOINT
NNN PSI
WATER VALVES INITIAL OPEN POSITION
NN.N %
WATER VALVES INITIAL OPEN TIME
NNN S
WATER VALVES CIRCUIT OFF POSITION
NN.N %
MINIMUM TIME BTW STARTS SAME CMP
NNNN S
MINIMUM TIME BTW STARTS DIFFERENT CMPS
NNN S
COMPRESSORS HIGH PRESSURE ALARM SP
NNN.N PSI
COMPRESSORS HIGH PRESSURE ALARM DELAY
NNN S
COMPRESSOR 1 PUMPDOWN TIME LIMIT
NNN S
COMPRESSOR 1 PUMPDOWN PRESSURE SP
NNN.N PSI
COMPRESSOR MINIMUM TIME OFF
NNN S
COMPRESSOR MINIMUM TIME ON
N S
COMPRESSORS LOW PRESSURE ALARM SP
NNN.N PSI
COMPRESSORS LOW PRESSURE ALARM DELAY
NNN S
COMPRESSOR 2 PUMPDOWN TIME LIMIT
NNN S
COMPRESSOR 2 PUMPDOWN PRESSURE SP
NNN.N PSI
TIME BETWEEN UNLOADERS
NNNN S
LEAD LAG TIMER
NN.NN H
COMPRESSORS LPA ON TIMER
NNNN S
COMPRESSORS HPA ON TIMER
NNNN S
CMP FORCE DEMAND IF SENSORS FAIL
NNN %
COMPRESSOR TIME TO DROP REQUEST
NNNN S
COMPRESSOR MAX TIME UNLOADED
NNN S
COMPRESSOR LOAD TIME IF UNLOADED
NNN S
COMPRESSORS LPA OFFSET
NNN.N PSI
COMPRESSORS HPA OFFSET
NNN.N PSI
LPA Value:
NNN.N PSI
HPA Value:
NNN.N PSI
CONDENSERS HIGH TEMP ALARM SP
NNN.N °F
CONDENSERS HIGH TEMP ALARM DELAY
NNN S
CONDENSERS LOW FLOW ALARM DELAY
NNN S
CONDENSERS LOW FLOW MIN VALVE POS
NN.N %
MAIN
BACK

3.4.5. Active Alarm / Alarm History

The Alarm History screen contains the time of the alarm, the acknowledgment time and the message corresponding to the alarm. The alarm message is a self-explanatory text that allows quick troubleshooting of the equipment. The active alarm screen will only show alarms that are currently on.





If an alarm locks the unit down, preventing it from running, the respective compressor/circuit will be shown as alarmed/faulted. In those cases, press **"RESET ALARMS"** pushbutton. The equipment will enter a check routine and try to re-start.

Two alarms require special treatment:

High pressure cut out alarm	It requires the operator/user to manually push the white button on the face of the high pressure cut out switch located next to the compressor. This is necessary because the device contains a latching relay.
Compressor protection device	It requires the operator/user to access the "Compressor" screen and touch the respective CPD OIL RESET button (1 or 2). When this is done, the PLC opens up the circuit to the device using a relay, interrupting its power for 7 seconds and resetting the latching relay.

3.5. Carel PCO5+ with pGD1

This chapter applies to systems fitted with Carel PCO5+ PLC and pGD1 HMI.

Sample graphic displays are shown below. Contact AIR for details for your specific unit control system.

3.5.1. HMI

How to Navigate the Screens

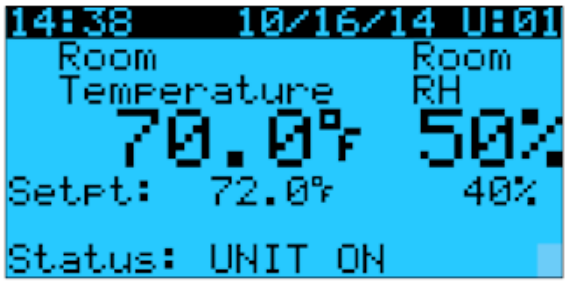
All the screens are configured in loops. To navigate through the screens, press the UP and DOWN arrows. When the end of the loop is reached, a screen with the message “END LOOP MASK” is shown and it returns to the first screen of the loop.

To access a specific field within a screen, press ENTER and the cursor will move and blink next to the value to be changed. When the flashing cursor is next to the field requiring change the user can change the field value by using the UP and DOWN. Pressing ENTER again to save the new value and the cursor will move to the next field. Pressing ENTER will continually advance the cursor on to the next field. When the cursor is blinking again in the top left corner of the screen, the controller is ready to advance to the next screen using the UP and DOWN buttons.

Press ESC at any time to go back to the previous loop.

3.5.2. Main loop

Displays information about the system.



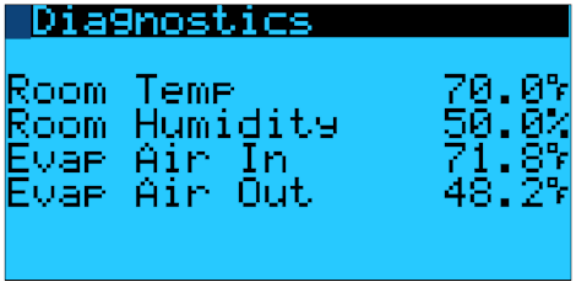
Time, date, U=PLC plan address.

Current room temperature and relative humidity (RH).

Current setpoints for room temperature and room relative humidity.

Unit status: ON or OFF. “OFF by INPUT” means that the selector switch is in the OFF position. “OFF by ALARM” means that there is an active alarm that requires the machine to turn off.

The system objective is to control the room temperature and room RH by tracking these values to match with the desired setpoints.

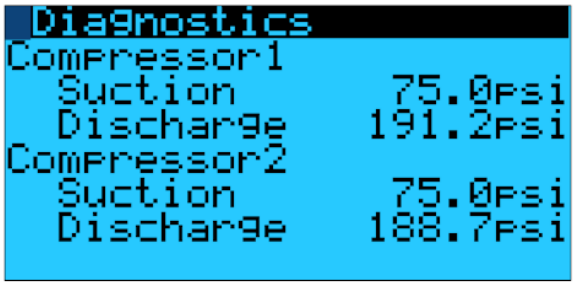


Values for room temperature and room relative humidity from sensor mounted in the controlled room environment, evaporator entering air temperate from sensor mounted on the inlet of the filter rack, and evaporator leaving temperature from sensor mounted on the top of the unit with the sensing element behind the evaporator coil.

When demand is above 0%, compressors are requested to start, load, and unload. The System Demand assumes the highest value between Cooling Demand and Humidity Demand. High System Demand percentage values translates into more compressors running.

Cooling Demand is calculated based on the deviation between Room Temperature and its setpoint.

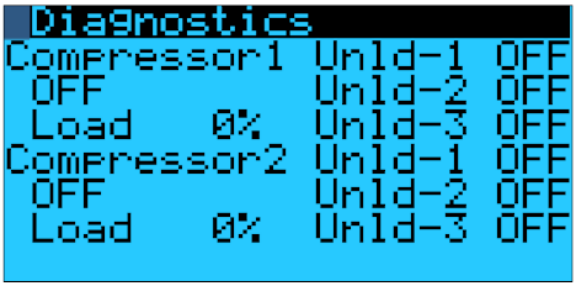
Humidity Demand is calculated based on the deviation between Room RH and its setpoint.



Displays suction (low pressure) and discharge (high pressure) pressure values for each compressor. These values vary with running condition. Common values are:

Suction: 25-40 psi

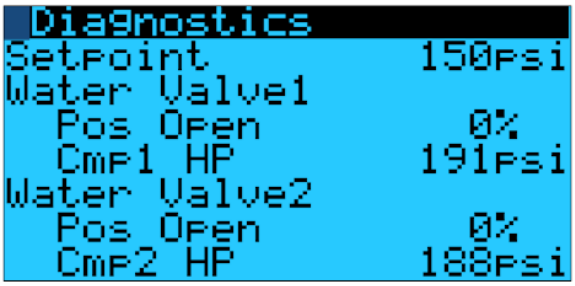
Discharge: 130-170 psi



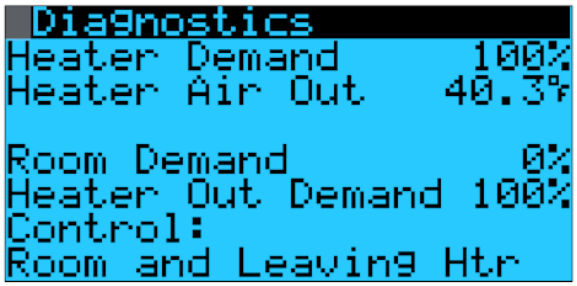
Each compressor state (ON or OFF) and its calculated load in %. It also displays the state (ON or OFF) for each unloader (Unld).

The number of unloaders varies with the model number. If the compressor is ON and all unloaders are OFF it means that the compressor is fully loaded (100%) and delivering maximum cooling capacity to the system. If one or more unloaders are ON, the compressor is in an unloaded state and the load % is less than 100%. It value depends on the number of unloaders that are ON. If all unloaders are ON, the compressor delivers 0% of its maximum cooling capacity, therefore running fully unloaded.

The compressors and unloaders states (ON or OFF) are based on the System Demand %.



Only applicable to water cooled units. It displays the compressor high pressure (HP) setpoint, the current value for each compressor HP and the current open position of the respective water valve. The controller opens the valve to lower the HP and closes the valve to increase the HP.

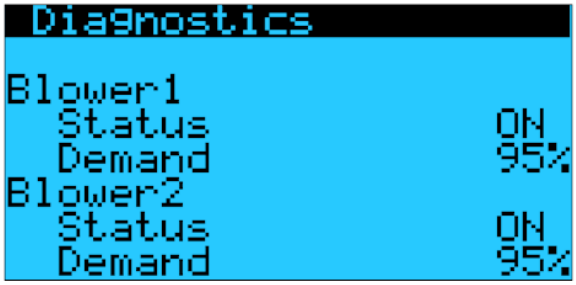


When heaters are available, this screen displays the heaters variables. Heater demand is the power % applied to the heater through a 0-10VDC signal to the heaters SCR's.

Heater Demand assumes the highest value between Room Demand and Heater Out Demand.

Control displays which demands are being considered for Heater Demand. On this example, both Room Demand (Room) and Heater Out Demand (Leaving Htr) are being considered. The control can be changed to only one Demand.

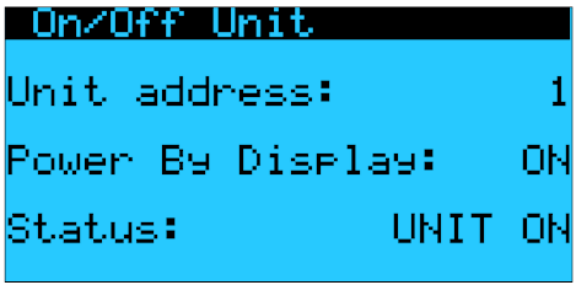
Heater Air Out is the temperature of the air leaving the heaters. When the Heater Demand is higher than 0% this temperature should be higher than the temperature entering the heater (which is the same as the temperature leaving the cooling coil - Evap Air Out).



It displays the Blowers status (ON or OFF) and the demand in %. The demand is the same as the % of the maximum speed configured for the blower in the VFD. In this example, if the maximum speed is set to 1800 RPM at 60Hz, 95% corresponds to a VFD output of 57Hz and 1,710 RPM.

When the unit is equipped with blowers VFD's, the system will decrease the blowers demand/speed to control the temperature of the air leaving the coil when in humidity control.

3.5.3. On/Off Unit

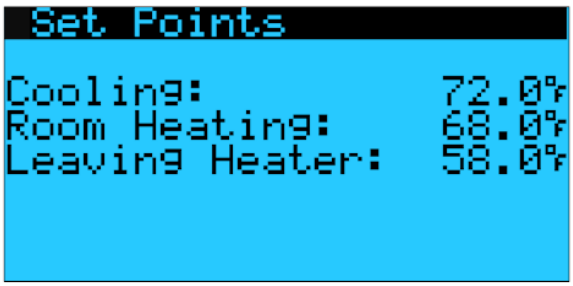


Unit address: 1 (cannot be changed)

Power By Display: ON. Set of OFF to turn unit off by display. Regardless of the position of the start/stop switch on the door the unit will not start. Status will show "OFF by KEYPAD"

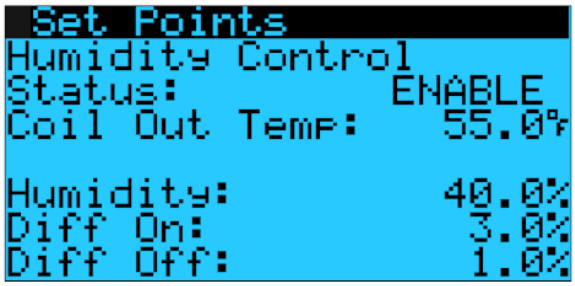
3.5.4. Setpoints

Allow an authorized user to change the setpoint parameters.



Cooling is the setpoint for compressor demand controls.

Room Heating and Leaving Heater setpoints are used to control the heaters. Leaving Heater is used for re-heat during humidity control.



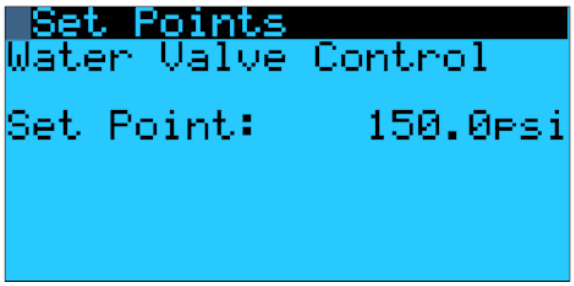
When Humidity control is desired, change the status to ENABLE. There are 2 components for humidity control. The first one is the humidity setpoint (shown here as 40.0%) and the differential for when the humidity control should start and stop.

Start humidity control: Humidity SP + Diff On

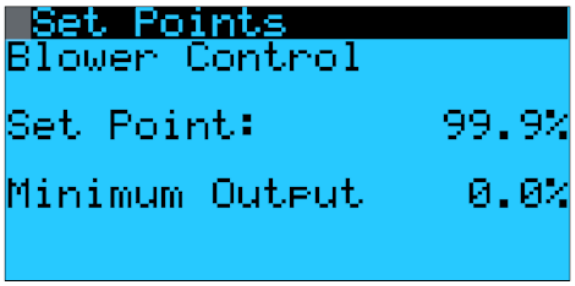
Stop humidity control: Humidity SP – Diff Off

In this case, Diff On is 3.0%, which sends the equipment into humidity control when the relative humidity (RH) reaches 43.0% and stops the humidity control loop when RH is below 39.0% because Diff Off is 1.0%.

When the equipment enters humidity control, it will increase System Demand and modulate the blowers speed to achieve the Coil Out Temp setpoint. In this case, the setpoint is 55.0%. The Coil Out Temp setpoint shall be set in a manner where the psychometrics properties of the air leaving the unit are at desirable levels.



Set the compressors discharge pressure (HP) setpoint. The water valve will modulate to maintain this pressure (also known as compressor head pressure).



Set Point is the speed at which the blower(s) shall run when not in humidity control. This value corresponds to the maximum frequency setup in the VFD (typically 60Hz).

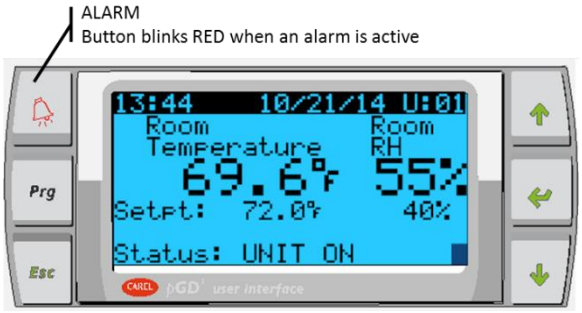
Minimum Output is the minimum speed proportional to the VFD minimum frequency that the blower is allowed to run when in humidity control. Because the minimum frequency in the VFD is typically setup to 45Hz, it means that at 0% the blower will be running at 45Hz. This value can be changed if a higher minimum frequency is desired without the need to re-configure the VFD. For example, if the user wants the new minimum speed to be 50Hz, then Minimum Output shall be 33.3%.

Formula:
Minimum Output %
= Hz increase divided by (Maximum Frequency minus Minimum Frequency) times 100
= (5/(60-45))*100
=33.3

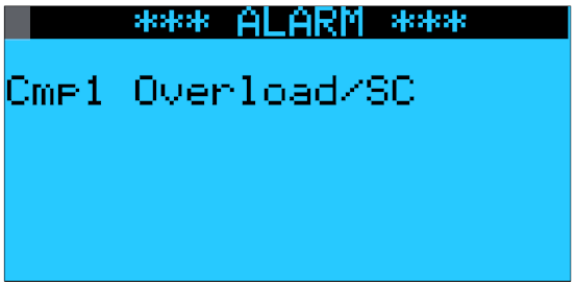
3.5.5. Alarms

Alarms are intended to protect the equipment and the people working on it. Some alarms stop the machine entirely while others are just warnings to the operator.

When an alarm is active, the ALARM button will blink RED.



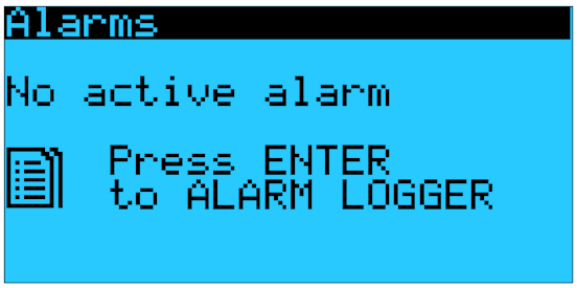
Press the ALARM button to enter the alarm loop.



As you scroll DOWN or UP using the buttons, you will see all active alarms.

The last screen is a shortcut for the ALARM LOG loop. See ALARM HISTORY loop section for the explanation.

Press the ALARM button twice to clear the alarms. If the alarm is still active, you will continue to see the alarm. If the alarm condition no longer exists and the alarms were successfully cleared out, you will the message “No active alarm” as shown below and when exiting the Alarm loop the ALARM button stops blinking.



All alarms are OPEN to alarm. The alarm is active if the respective input is open. The exceptions are the compressor and blower overload alarms: they are CLOSE to alarm.

Some alarms require special attention before an attempt to clear alarms: compressor protection, compressor low oil, and high pressure switch.

Compressor protection and low oil

The following alarms have a special alarm screen that allows the user to reset the device:

- Cmp1 Protection
- Cmp2 Protection
- Cmp1 Low Oil Flow
- Cmp2 Low Oil Flow

Press ENTER and move the cursor to the NO position. Using the arrows change it to YES. A countdown will start. Do not change it back to NO. If you do so, restart the procedure.

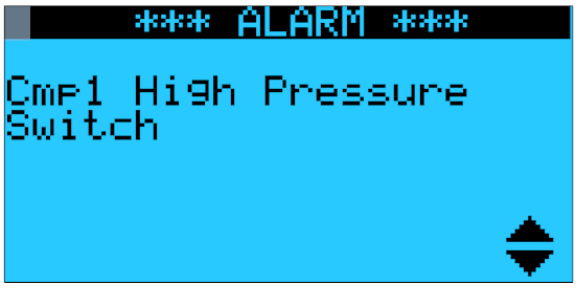
During the countdown, the PLC will de-energize the respective sensor/device, which allows the alarm state of the device to be reset. When the countdown is done the cursor changes from YES to NO. Press ENTER to move the cursor to the top and allow the UP and DOWN buttons to change the screen to the following alarm.

High pressure switches

The high pressure switch alarm requires the user to manually push a button in the respective device.

The alarms are:

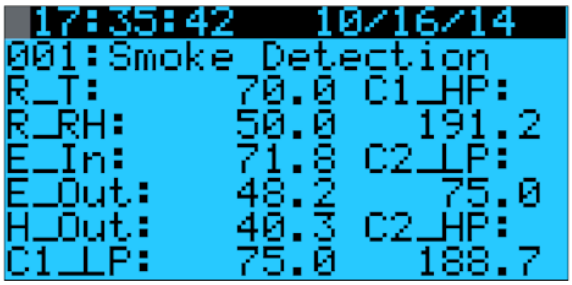
- Cmp1 High Pressure Switch
- Cmp2 High Pressure Switch



Locate the respective alarmed high pressure switch next to the compressor and press the white button.

3.5.6. Alarm History

Displays the log of the last 100 alarms.



Each alarm has the following information:

- Date and time
- Sequential number (001 in this case)
- Short description for alarm
- Values for 9 variables at the time when the alarm occurred (to help with troubleshooting):
  - R_T: room temperature
  - R_RH: room relative humidity
  - E_In: evaporator air entering temperature
  - E_out: evaporator air leaving temperature
  - H_out: heater air leaving temperature
  - C1_LP: compressor 1 low pressure (suction)
  - C1_HP: compressor 1 high pressure (discharge)
  - C2_LP: compressor 2 low pressure (suction)
  - C2_HP: compressor 2 high pressure (discharge)

Try to clear the alarm in the screen. If the alarm is not cleared out repeat the process. Sometimes multiple presses are necessary.

3.6. List of Alarms

1. Room Humidity Sensor Failure
2. Room Temperature Sensor Failure
3. Evaporator Entering Temp Sensor Failure
4. Evaporator Leaving Temp Sensor Failure
5. Heater Out Temp Sensor Failure
6. Cmp1 High Pressure Sensor Failure
7. Cmp2 High Pressure Sensor Failure
8. Cmp1 Low Pressure Sensor Failure
9. Cmp2 Low Pressure Sensor Failure
10. Cmp1 Protection
11. Cmp1 Low Oil Flow
12. Cmp1 Overload/SC
13. Cmp1 Low Pressure
14. Cmp1 High Pressure
15. Cmp1 High Pressure Switch
16. Cmp2 Protection
17. Cmp2 Low Oil Flow
18. Cmp2 Low Pressure
19. Cmp2 Overload/SC
20. Cmp2 High Pressure
21. Cmp2 High Pressure Switch
22. Smoke Detected
23. Blower 1 Overload/SC
24. Blower 2 Overload/SC
25. Heater Fault
26. Air Filter Dirty
27. Condenser Flow
28. Drain Pan Full
29. Emergency Stop
30. Voltage Phase Monitor
31. EVD/EVO A Alarms
32. EVD/EVO BA Alarms

3.7. Troubleshooting

NOTE: All repairs to the unit should be done by qualified service personnel (i.e. for refrigeration, a licensed refrigeration mechanic; for electrical, a licensed electrician). For mechanical repairs, plant personnel can be used. Call Advance Industrial Refrigeration service technician for any additional support or service assistance needed.

WARNING! EXTREME CAUTION MUST BE TAKEN BEFORE ENTERING THE CONTROL PANEL. POWER TO THE CHILLER MUST BE SHUT OFF BEFORE CHECKING ANY ELECTRICAL CONNECTIONS.

WARNING

Main Power (3 phase) must be energized for 24 hours before starting unit and should be left on overnight and weekends. This is necessary to keep the crankcase heaters energized and prevent refrigerant from condensing and mixing with the oil in the compressor sump. Failure to comply with this rule can severely damage the compressor. The unit is only safe to start if there is a visual indication of oil level.

This section is primarily for use with all non-screw compressor models where the standard control panel and fault indication is used. All systems with the optional PLC or all screw compressor models have a plain language PLC interface.

1	**Symptom 1**	**Unit will not start**
1.1	Power Off	Main switch open. Circuit breakers open. Assure all breakers and switches are on.
1.2	Main Power Line Open	Check fuses.
1.3	Fuse is blown	Check circuits and motor winding for shorts or grounds. Investigate for possible overloading. Replace fuse or reset breakers after fault is corrected.
1.4	Defective contactor or coil	Repair or replace.
1.5	Control Circuit Open	Check control voltage fuses and transformer.
1.6	Motor electrical trouble	Check motor for open circuit, short circuit, or motor burnout.
1.7	Compressor is Faulted	Clear the faults in the controller and push the Reset button if existent.
1.8	Loose wiring	Check all wire junctions. Tighten all terminal screws.

2	**Symptom 2**	**Compressor has excessive noise or vibration**
2.1	Flooding of refrigerant into crankcase	Check setting of expansion valve
2.2	Improper or worn compressor supports	Replace supports
2.3	Worn compressor	Replace or rebuild compressor.

3	Symptom 3	High Refrigerant Discharge Pressure
3.1	Dirty tube and fin surface (air cooled condenser)	Clean with compressed air or water spray, Use fin comb if fins bent
3.2	Condenser problems	Check if condenser is plugged. Remove and clean if necessary.
3.3	Condenser water flow/pressure/temperature	Have mechanical personal verify water flow to condenser. Excessive piping pressure drop will cause low flow. Check all pipe valves. Make sure they are open. Verify if water temperature is well above design (typically 90F).
3.4	Water regulating valve	Verify if water regulating valve is operational. Check connections with refrigerant high pressure side.
3.5	System overcharged with refrigerant	Remove excess refrigerant.
3.6	Non-condensable in system (Air in System)	Have refrigeration service technician evacuate the system and recharge it.
3.7	Dampers	Check that inlet and discharge dampers (if used) are operating properly. If not, repair or replace if defective. Back draft dampers not operating properly. Repair or replace if defective.
3.8	Blower Belts	Blower belts may be loose, requiring adjustment. (if applicable).
3.9	High Pressure Control	Verify the High Pressure Control. It requires a manual reset.

4	Symptom 4	Low Suction Pressure
4.1	Lack of refrigerant	Check for adequate refrigerant charge (bubbles or misty sight glass indicates low charge). If charge is low, have system checked for leaks and recharged by a refrigeration service technician.
4.2	Evaporator dirty	Clean chemically
4.3	Clogged liquid line filter-drier	Replace cartridge(s)
4.4	Improperly Set Low Pressure parameters	Have refrigeration service technician reset control or Pressure Control replace if defective.
4.5	Expansion valve malfunctioning	Check and reset for proper superheat. Replace if necessary. Check thermal bulb and capillary tube for damage.
4.6	Condensing temperature too low	Check condensing temperature regulation system.
4.7	Insufficient chilled water or Air flow	Adjust flow rate across evaporator
4.8	Process air Temp.	Check entering air/water temperature. Verify the system conditions and find out if the air/water is too cold based on design conditions.
4.9	Flooding Control Valves	Have refrigeration service technician check flooding control valves for proper operation. Adjust valves or replace if defective.

5	Symptom 5	Low Oil Pressure/Level
5.1	Low Oil Level	Add oil to proper level. Assure oil carry through in system piping
5.2	Low-oil level/pressure sensor defective	Replace sensor.
5.3	Flooding of refrigerant into crankcase	Adjust thermal expansion valve
5.4	Crankcase Heater Failed	Have electrician check fuses for power to the crankcase heater.
5.5	Failed Oil Pump	Have pump repaired or replaced by a refrigeration service
5.6	Short Cycling	Pumps oil out of the compressor and unit does not run long enough for the oil to return. Check for short cycling.

6	Symptom 6	Motor Overload Relays or Circuit Breakers/Fuses Open
6.1	Low voltage during high load conditions	Check supply voltage for excessive line drop
6.2	Loose power wiring	Check all connections and tighten
6.3	High condensing temperature	See Corrective Steps for high refrigerant discharge pressure
6.4	Power line fault causing unbalanced voltage	Check voltage. Notify power company. Do not start until corrected.

For symptoms not listed here, please check the alarms section. The alarms have a display text explanation that can help troubleshoot the problem.

4. MAINTENANCE

4.1. Regular Maintenance Items

4.1.1. Compressors

Oil change is not compulsory for factory-made systems. In the case of “field installations”, it is recommended to change the oil for the first time after approximately 100 operating hours. During oil change, also clean oil filters and magnetic plugs for compressors with integrated oil pump. After that, change the oil and clean oil filters and magnetic plug approximately every 2 years.

Oil type:

- BSE32
- BSE55 for R134a: Tc > 158°F

A yearly oil analysis is recommended to boost compressor reliability.

4.1.2. Air Cooled Condensers

Periodical cleaning of finned surfaces can be done by washing down dust with warm water spray and a mild detergent. Do not use alkaline or acidic solution as it will attack the coil material.

The inner face of the coil may be cleaned by the access panel on the side of the units or by removing the fan guards.

Always pressure clean in reverse of the air flow.

4.1.3. Water Cooled Condensers

Condensers are designed for maintenance-free operation. However, it is advisable to clean the condenser cooling fluid tubes regularly. The contamination depends directly on the quality of the cooling fluid used.

- Materials in the cooling fluid in dissolved or solid form can be deposited inside the condenser tubes (e.g. lime, sand, algae or silt).
- Organic materials such as algae can build up local elements.
- When seawater is used as cooling fluid, shells can also grow on the inner walls of the tubes.

The accumulation of materials in the inner walls of the condenser tubes inhibits heat transfer causing decline in performance and raising the system head pressure.

Cleaning

Suitable condenser tubes cleaning methods and cleaning intervals depend on the type and extent of contamination.

Carefully brush off soft deposits such as algae or silt. Use cleaning agent if necessary. Rinse well afterwards.

Rinse solid coatings, such as lime or shell, with suitable solvent. The use of citric acid is very effective and environmentally friendly. Fill the condenser tubes with 25% citric acid/ water solution. Allow to react for 24 hours. During this period, occasional circulation by pumping increases the effect. Afterwards, flush the released materials out of the pressure vessel.

Dispose all contaminants properly per local regulations.

Heads Removal

When a head is removed for cleaning, it is recommended to replace the sealing gasket. Consult AIR for required gasket.

Observe the gasket orientation during assemble. Wrong gasket orientation will cause the condenser not to perform properly due to improper cooling fluid flow.

Refer to technical bulletin TB-64 for information about the proper torque for the head bolts.

WARNING

Cleaning agents must not react with the tube material. Cleaning should be performed by qualified personnel. Biological hazard. May cause disease.

4.1.4. Filters

It is important to check the filters in the regular basis and changed when necessary, to ensure proper operation of the unit.

Air Filter

Some units come with dirty filter indicator, which will show when the filters become obstructed. Although this should not be relied on as the only determinant for replacing filters. A maladjusted filter differential pressure switch may not give a proper indication of a clogged filter.

To check the filter differential pressure switch for proper adjustment, temporarily cover about 75% of the return air opening using heavy cardboard or similar material. The alarm should energize when 75% of the air is blocked, simulating dirty filters. If the alarm energizes prematurely or does not energize at all, the pressure switch should be adjusted. Doors must remain closed when determining if an adjustment is necessary.

Clogged filter can restrict air flow and create problems such as coil icing or poor air distribution.

Liquid Line Filter Drier

The filter drier core normally does not need to be changed. However, after intervention at any device in the refrigerant line, such as copper lines and fittings, compressor, condenser, valves or coils, it is important to replace the filter drier core. Startup the machine, operate for several minutes, stop the machine, and replace the filter drier core.

4.1.5. Drives (sheaves and belts)

V-belt drives need periodic inspection and occasional belt replacement. When inspecting drives, look for dirt buildup, burrs or obstructions which can cause premature belt or drive replacement. If burrs are found, use fine emery cloth or a stone to remove the burr. Be careful that dust does not enter the bearings.

Check the sheaves for wear. Excessive slippage of belts on sheaves can cause wear and vibration. Replace worn sheaves with new ones. Carefully align sheaves to avoid premature sheave failure.

Observe belts for wear. If fraying or other wear is observed to be mostly on one side of the belts, the drives may be misaligned. Reinstall the drives according to instructions bellow. Never use belt dressing on any belts.

When replacing belts, replace the entire set. After initial replacement and tensioning, recheck belt tension after a few days to adjust belt tension again. New belts require a break-in period of operation.

Refer to technical bulletin TB-33 for belt tension adjustment and sheave alignment.

IMPORTANT!!!

The proper amount of tension to apply to belts is the minimum necessary to transmit the required power without slippage. To apply more tension than necessary shortens the life of the belts and bearings.

4.1.6. Blower Bearings

For instructions covering, bearing assembly or disassembly, or installation details, contact AIR Engineering. Any bearing which is disassembled should be kept separate from other bearing parts, as components may not be interchangeable. Maintain cleanliness of components and bearings to prevent bearing contamination.

Lubrication

Proper lubrication of bearings helps assure maximum bearing life. All fans are equipped with decals indicating relubrication intervals for normal operating conditions. However, every installation is different. The frequency of lubrication should be established accordingly.

Experience has shown that airborne moisture and heavy dust will dramatically reduce the life of the bearing lubricant. If any of these adverse conditions exist, it is recommended that bearings be regreased after several days of operation. Lubrication intervals can then be adjusted based on the condition of the purged grease.

The figure below illustrates the decal for ball bearings, attached to the blower. Observation of the condition of the grease expelled from unit ball or roller bearings at the time of relubrication is the best guide as to whether regreasing intervals and the amount of grease added should be altered. This observation is particularly important when bearings operate continuously over 160°F.

Greases are made with different bases. There are synthetic base greases, lithium base, sodium base, etc. Avoid mixing greases with different bases. They could be incompatible and result in rapid deterioration or breakdown of the grease.

All bearings are filled with grease before leaving the factory. When the fans are started, the bearings may discharge excess grease through the seals for a short period of time. Do not replace the initial discharge because leakage will cease when the excess grease has worked out. Sometimes the bearing has a tendency to run hotter during this period and one should not get alarmed unless it lasts over 48 hours or gets above 220ºF. When relubricating, use a sufficient amount of grease to purge the seals.

Rotate bearings during relubrication where good safety practice permits.

WARNING

1. This equipment must not be operated without proper guarding of all moving parts. While performing maintenance be sure remote power switches are locked off. See installation manual for recommended safety practices.
2. Before starting: Check all setscrews for tightness and rotate wheel by hand to make sure it has not moved in transit.

**Relubrication Schedule (Months)*
Ball Bearing Pillow Blocks**

Shaft DIA	Speed (RPM)								
	500	1000	1500	2000	2500	3000	3500	4000	4500
½" thru 1 11/16" (13 – 45)	6	6	5	3	3	2	2	2	1
1 15/16" thru 2 7/16" (50 – 60)	6	5	4	2	2	1	1	1	1
2 11/16" thru 2 15/16" (65 – 75)	5	4	3	2	1	1	1		
3 7/16" thru 3 15/16" (80 – 100)	4	3	2	1	1				

* Suggested lubrication interval under ideal continuous operating conditions. Relubricate while running, if safety permits, until some purging occurs at seals. Adjust lubrication frequency depending on conditions of purged grease. Use one-half of listed interval for vertical shaft applications or for 24 hour operation. Hours of operation, temperature, and surrounding conditions will affect the relubrication frequency required.

1. Lubricate with a high quality NLGI No. 2 lithium-base grease having rust inhibitors and antioxidant additives, and a minimum oil viscosity of 500 SUS at 100°F (38°C). Some greases having these properties are:
   Shell - Gadus S2 V100 2 — Exxon - Ronex MP
   Mobil - Mobilith SHC100 — Mobil - Mobilith SHC220
2. Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.

4.1.7. Blower Wheel and Shaft Maintenance

Periodically inspect the shaft and wheel for dirt buildup, corrosion, and signs of excess stress or fatigue. Clean the components and, when appropriate, apply new coatings. Any addition of coatings or weld can create an imbalance. Check the balance of the assembly. Refer to technical bulletin TB-33 for bearings maintenance.

4.1.8. Heating Elements

Periodically check all electrical connections, including field and factory-made connections for tightness, and all wiring for deterioration at least once a year.

Other parts of the heating system such as fans and filters, should also be periodically inspected for obstructions, proper operation, etc.

Inspect the terminal enclosure and conduit connections for evidence of water leaks or moisture collection. Tighten connections as required. Clean up any corrosion. Do not continue using a heater with signs of damage.

Where buildup of dirt or solids on the heating elements or significant corrosion is expected, periodically inspect the heating elements. Do not continue using a heater with signs of damage.

4.1.9. Dampers

Check all dampers to ensure they open and close properly and without binding. Backdraft dampers can be checked by hand to determine if blades open and close freely.

4.1.10. Evaporator Coil

Coils must be cleaned to maintain maximum performance. Check coil once per year under normal operating conditions and if dirty, brush or vacuum clean. Soiled fins reduce the capacity of the coil, demand more energy from the fan and create an environment for odor and bacteria to grow and spread through the conditioned zone. When using high pressure water (700 psi or less) may be used to clean coils with a fin thickness over 0.0095 inches thick. TEST THE SPRAY PRESSURE over a small corner of the coil to determine if the fins will withstand the spray pressure.

Drain pans in any air conditioning unit will have some moisture in them; therefore, algae and other organisms will grow due to airborne spores and bacteria. Periodic cleaning is necessary to prevent this buildup from plugging the drain and causing the drain pan to overflow. Inspect twice a year to avoid the possibility of overflow. Also, drain pans should be kept clean to prevent the spread of disease. Cleaning should be performed by qualified personnel.

WARNING

Biological hazard. May cause disease. Cleaning should be performed by qualified personnel.

4.2. Maintenance Checklists

The following maintenance instructions form a part of the operations required for this type of equipment. However, It is not possible to give fixed and precise rules for permanent maintenance procedures capable of keeping all units in perfect operating condition since too many factors depending on local conditions specific to the installation, the way the machine is operated, the frequency of operation, climatic conditions, atmospheric pollution, etc. Only trained experienced personnel can establish strict maintenance procedures adapted to the conditions listed above.

All operations must be performed in conformity with the maintenance plan; this will extend the service life of the unit and reduce the number of serious and costly breakdowns. It is essential to keep a service log for monthly records of operating conditions of the machine. This log will serve as an excellent diagnostic tool for maintenance people; likewise, the machine operator, by noting down changes in machine operating conditions, will often be able to anticipate and avoid problems before they actually occur or worsen.

AIR cannot be held responsible for any malfunctioning of any equipment it provides if it is caused by a lack of maintenance or by operating conditions beyond those recommended in this manual.

Shown below, and as an illustration only, are some of the most common rules applied for maintenance.

ADVANCE INDUSTRIAL REFRIGERATION

Maintenance Inspection Check List

Model Number:		Serial N0.:						
Prepared by:		Date:						
Temperature Set at (°F)		Discharge Pressure (psig):	Suction Pressure (psig):	Every Month	Every 3 Months	Every 6 Months	Every Year	Every 2 Years
Y / N	**Air Filter**	**Location / Comment**						
	Check for restricted air flow			X				
	Check filter differential switch				X			
	Wipe filter rack section clean				X			
Y / N	**Air Distribution Section**	**Location / Comment**						
	Check for restriction on air dampers							
Y / N	**Air Cooled Condenser (if applicable)**	**Location / Comment**						
	Condenser coil clean			X				
	Motor mounts tight			X				
	Motor fan bearings in good condition			X				
	Refrigeration lines properly supported			X				
Y / N	**Blower Section**	**Location / Comment**						
	Blower wheel free of debris moves freely			X				
	Check belt tension, alignment and condition			X				
	Bearings in good condition			X				
	Check pulleys and motor mounts			X				
	Check all fasteners, set screw and locking collars for tightness			X				
	Motor fan bearing in good condition			X				
	Check air flow safety switch operation				X			
	Lubricate Bearings					X		
Y / N	**Compressor**	**Location / Comment**						
	Check oil levels			X				
	Check for leaks			X				
	Check for excessive vibration			X				
	Check for abnormality noise			X				
	Check compressor mounting			X				
	Compressor Oil Analysis						X	
	Change compressor oil							X
Y / N	**Electronic Water Regulating Valve**							
	Tight Handle set screw to 44 lb.in			X				

ADVANCE INDUSTRIAL REFRIGERATION

Maintenance Inspection Check List

Model Number:		Serial N0.:		Every Month	Every 3 Months	Every 6 Months	Every Year	Every 2 Years
Prepared by:		Date:						
Temperature Set at (°F)		Discharge Pressure (psig):	Suction Pressure (psig):					
Y / N	**Electrical Panel**							
	Check fuses				X			
	Check contactor operation				X			
	Check all electrical connections				X			
	Check operation sequence				X			
	Check calibration of change over thermostat				X			
Y / N	**Electronic Water Regulating Valve**							
	Tight Handle set screw to 44 lb.in (belimo Valves with - ARQX actuators)			X				
Y / N	**Evaporator**							
	Check for leaks			X				
	Check protective coating			X				
Y / N	**Fielding Identification**							
	Check for missing identification labels, and replace if necessary			X				
	Check for unreadable labels, and replace if necessary			X				
Y / N	**Heater**							
	Check electrical connections						X	
	Tight heater element nuts			X				
	Tight electrical box fasteners			X				
	Check for dust				X			
Y / N	**Insulation**							
	Check for physical damage			X				
	Check for indications of leaks			X				
	Check for missing/broken bands			X				
Y / N	**Refrigeration Cycle/Section**							
	Check crankcase temperature			X				
	Check liquid refrigerant though the sight glass			X				
	Check expansion valve operation				X			
	Check solenoid valve operation				X			
Y / N	**Structural parts**							
	Tight all fasteners			X				
	Check all structural components used to support blowers, compressors, motors, etc. ...			X				

ADVANCE INDUSTRIAL REFRIGERATION

ADVANCE THE WAY YOU THINK

Maintenance Inspection Check List

Model Number:		Serial N0.:		Every Month	Every 3 Months	Every 6 Months	Every Year	Every 2 Years
Prepared by:		Date:						
Temperature Set at (°F)		Discharge Pressure (psig):	Suction Pressure (psig):					
Y / N	**Piping**							
	Check leaks from the process			X				
	Check valves for leaking			X				
	Check all piping supports			X				
	Check for excessive vibration			X				
Y / N	**Water Cooled Condenser (if applicable)**							
	Check for leaks			X				
	Check the percentage of antifreeze (if applicable)			X				
	Clean condenser tubes						X	

4.3. Maintenance Log

Date _____ Time _____
Prepared by: _____
Notes: _____

Date _____ Time _____
Prepared by: _____
Notes: _____

Date _____ Time _____
Prepared by: _____
Notes: _____

Date _____ Time _____
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Date _____ Time _____
Prepared by: _____
Notes: _____

Date _____ Time _____
Prepared by: _____
Notes: _____

ADVANCE INDUSTRIAL REFRIGERATION

ADVANCE THE WAY YOU THINK

Installation, Operation, and Maintenance

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IOM-ControlAIR

Release Date: 9-15-20