ADVANCE INDUSTRIAL REFRIGERATION

ADVANCE THE WAY YOU THINK

Installation, Operation, and Maintenance

CoolAIR

7.5 to 60 tons

Series BW
Packaged Water Cooled DX Unit

Series BA
Split System Air Cooled DX Unit

Series BPA
Packaged Air Cooled DX Unit

Series BHW
Chilled Water Air Handling Unit

IOM-CoolAIR

Release Date: 11-12-20

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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-CoolAIR, “Product Catalog - CoolAIR”.
- IOM-CoolAIR, “Installation, Operation, and Maintenance Manual - CoolAIR”.

Drawings

- CoolAIR Dimensional Drawings

Model Designations

- Series BW
- Series BA
- Series BPA
- Series BHW

Guide Specifications

- Series BW
- Series BA
- Series BPA
- Series BHW

Technical Bulletins

- TB-14, “Piping Recommendation for Refrigerant Systems”. (Required for Series BA only).
- TB-15, “Condensate Trapping”.
- TB-33, “Blowers Maintenance”.
- TB-60, “Mechanical Water Regulating Valve Hose Installation”.
- TB-63, “T6 Pro Thermostat Installation Instructions”.
- 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 and process cooling 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 personal 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 a unit, turn off the main power switch.
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. File a claim 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 the unit.
2. To assist in determining rigging requirements, weights are provided in the unit mechanical submittal.
3. Unit must be lifted by all lifting points using the brackets for the hoist ring provided 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.

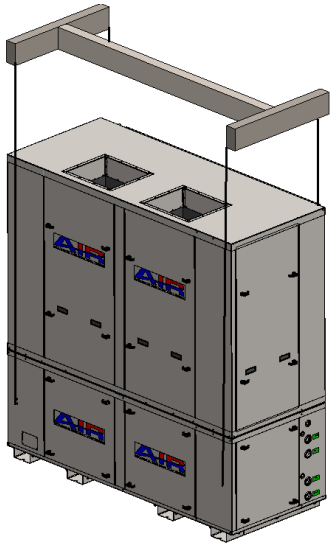


Figure 1: Unit with 4 Lifting Points

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))

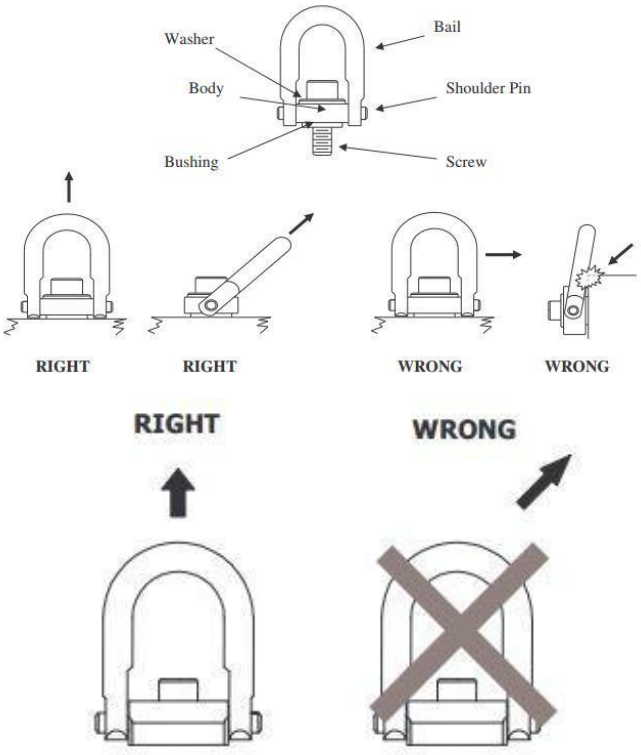


Figure 2: Hoist Rings

2.5. Storage

If required, store the equipment in a dry area, out of the weather, protected from damage by other equipment in storage or transportation equipment. Never stack equipment and avoid frequent relocation.

For split systems, the air handler section and compressor section are each shipped 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 pinhole leaks to develop in the coil tubes. If the equipment is stored longer than 30 days, the Customer should check that each section is still charged to avoid coil damage. Refer to the unit's mechanical submittal.

Prior to long term storage, fan bearings and motor bearings are to be greased per the manufacturer's specifications. On belt driven 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 several 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. Ductwork Connections

The discharge and return opening dimensions are provided in the chart below. For proper fan performance, match the duct size to the dimensions indicated.

Discharge Sizes		
Unit size	**Unit Discharge Opening Size (H X W)**	**Recommended Duct Size (H X W)**
090	11-¼" X 13"	13-¼" X 16"
120	13-⅜" X 15-½"	16-⅜" X 18-½"
180	13-⅜" X 15-½"	16-⅜" X 18-½"
240	11-¼" X 13"	13-¼" X 16"
300	13-⅜" X 15-½"	16-⅜" X 17-½"
360	13-⅜" X 15-½"	16-⅜" X 17-½"

Return Sizes	
Unit size	**Recommended Duct Connection at Filter Rack (H1 X W1)**
090	34-½" X 44-⅞"
120	34-½" X 44-⅞"
180	34-½" X 56-⅞""
240	46-½" X 56-⅞"
300	46-½" X 68-⅞"
360	58-½" X 68-⅞"

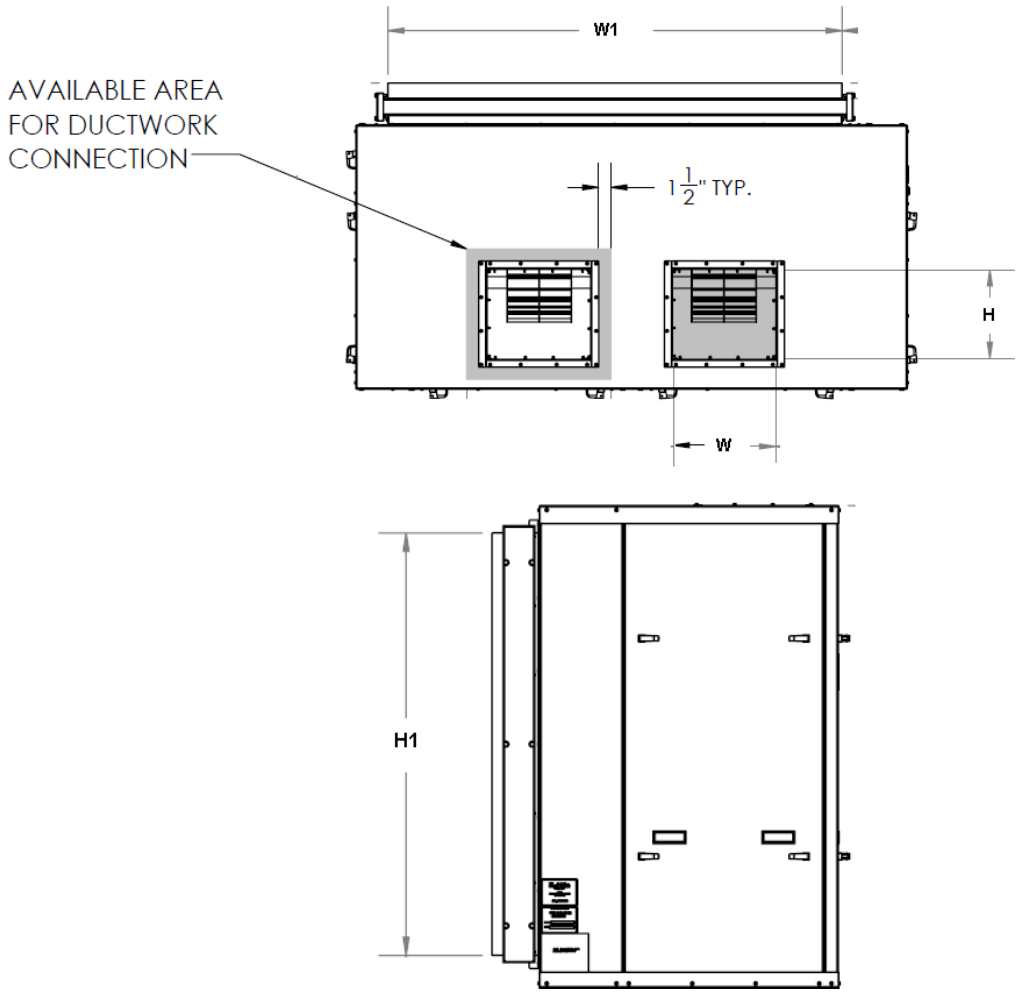


Figure 3: Discharge and Return Connections

Unit sizes 090, 120, and 180 have only 1 discharge connection.

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.

2.8. Condenser Water or Chilled Water 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 should be installed upstream and downstream of the heat exchangers, located to also provide practical service 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.

2.9. 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 borne debris. AIR is not responsible for equipment damage caused by water borne 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.

2.10. Series BA - 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.

2.11. Condensate Drain Piping

All cooling coil drain pans have a connection 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.

2.12. Electrical Drawings 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.

The main power feed to the equipment and the control thermostat are connected to the MCP (Main Control Panel, also referred in this manual as Electrical Enclosure), which is the largest electrical box, mounted to the machine bottom section.

The main power feed is connected to the distribution blocks and the control thermostat is connected to the field terminal blocks.

All electrical connections are depicted in the unit's electrical submittal. The electrical submittal includes the following drawings:

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.

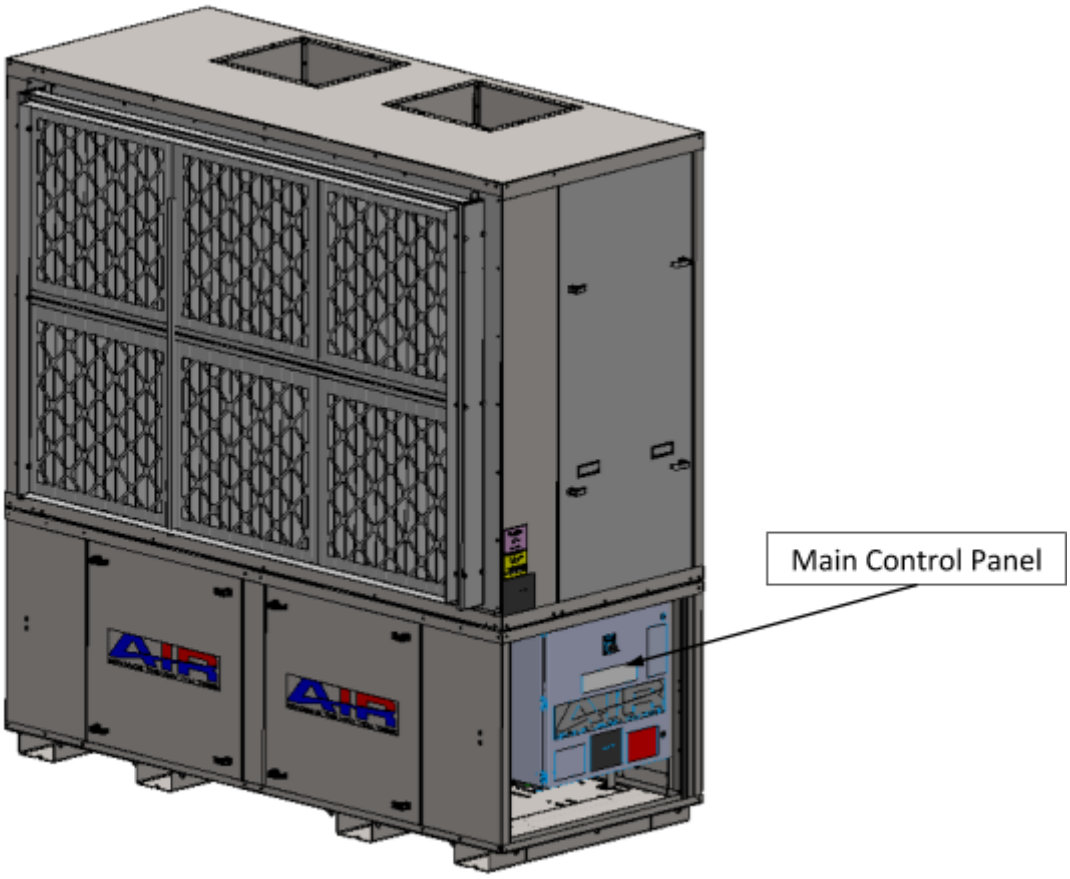


Figure 4: Location of Main Control Panel

2.13. Main Control Panel Layout and Components

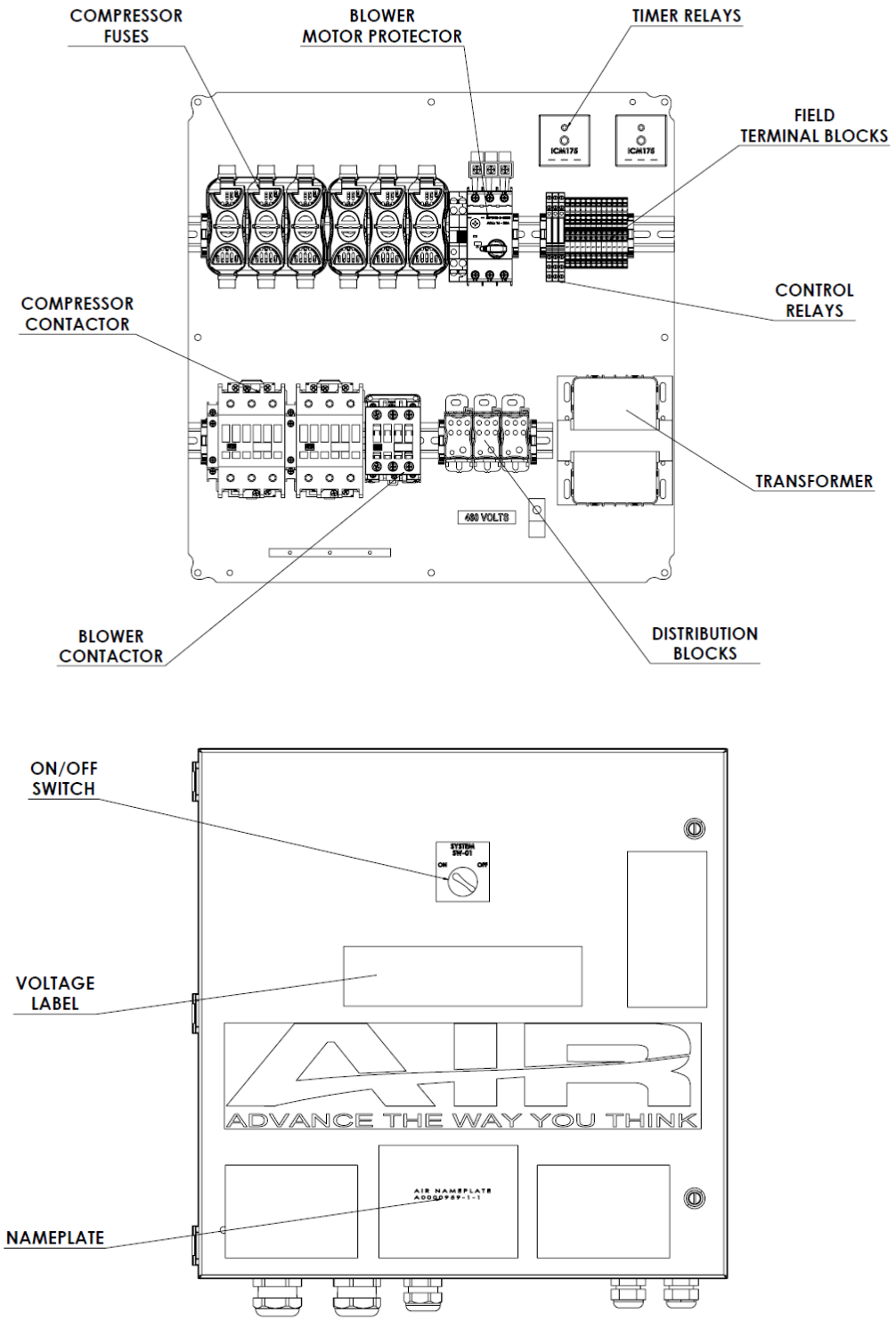


Figure 5: Main Control Panel Layout

2.14. Field Mounted Electronic Device Locations

Typically, the control thermostat is shipped loose and mounted within the controlled space by the Customer's electrical installer according to the unit's electrical submittal, thermostat manual and the last revision of technical bulletin TB-63. AIR assumes no responsibility for improperly installed electronic devices.

The location of the thermostat should consider the following:

- Mount thermostat 5'-0" above finished floor.
- Do not locate thermostat in the direct path of supply air from the supply grilles.
- Do not locate thermostat 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 thermostat near the return grille to measure the average space temperature.

Figure 6: Thermostat

3. OPERATION

3.1. System Components

Blowers

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

Coils

Series BH and Series BA units are equipped with a single DX evaporator coil. For two cooling circuits, the DX coil will have an interlaced design. Furnishing coils with a corrosion resistance coating is an option.

Series BHW 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 scroll compressors with R-410a refrigerant.

Condensers

Series BH units will be equipped with water cooled shell and tube condenser(s).

Series BA units will be equipped with an air cooled condenser with vertical air flow.

Expansion Valves

DX units are equipped with one externally adjustable thermostatic expansion valve per refrigerant circuit. 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 Driers

Each refrigeration circuit is equipped with a filter drier with replaceable drier core for durability in the most aggressive environmental applications.

High and Low Pressure Cutout Switches

Each refrigerant circuit is equipped with a high and low pressure cutout switch for safety control. The compressor motor is de-energized when the discharge or suction pressure of the compressor becomes excessive. This prevents possible compressor damage.

Relief Valves

Each refrigerant circuit is equipped with a pressure relief valve to limit the pressure in the circuit to a safe level. The pressure is relieved by allowing the refrigerant to flow through an auxiliary passage out of the system.

Sight Glasses

Each refrigerant circuit is equipped with a sight glass to provide accurate identification and better visibility of system conditions through a large viewing window with indicator.

Water Regulating Valves

Each water cooled condenser is equipped with a pressure actuated valve, which is used for regulating the flow of water in the condenser. The water regulating valves modulate to maintain constant condensing pressure during operation.

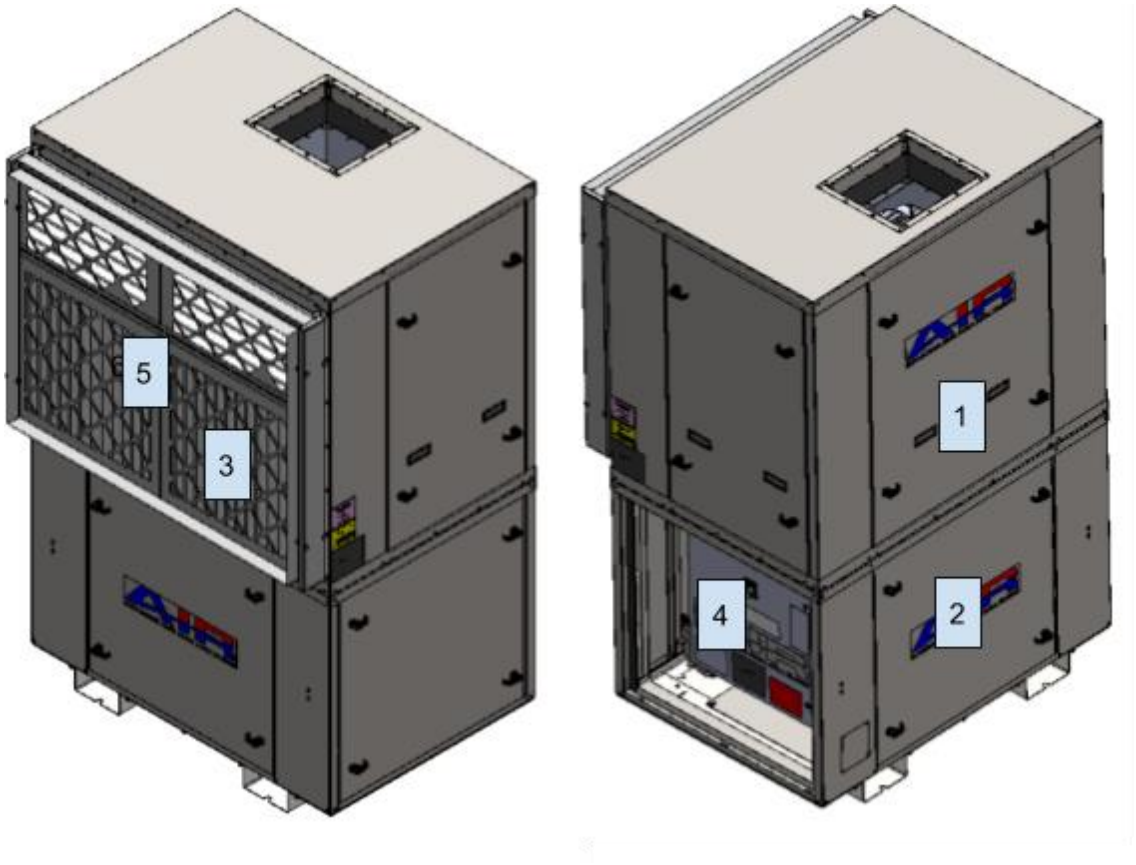


Figure 6: Components Location

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

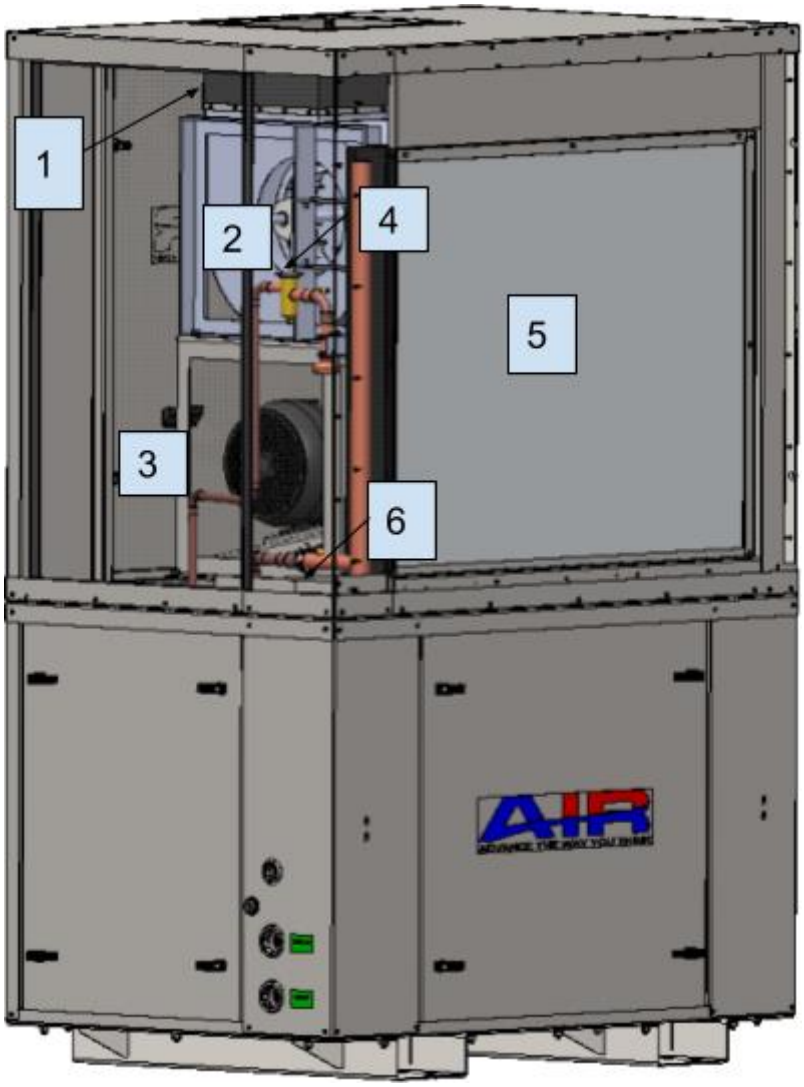


Figure 7: AHU Section Internal Components

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

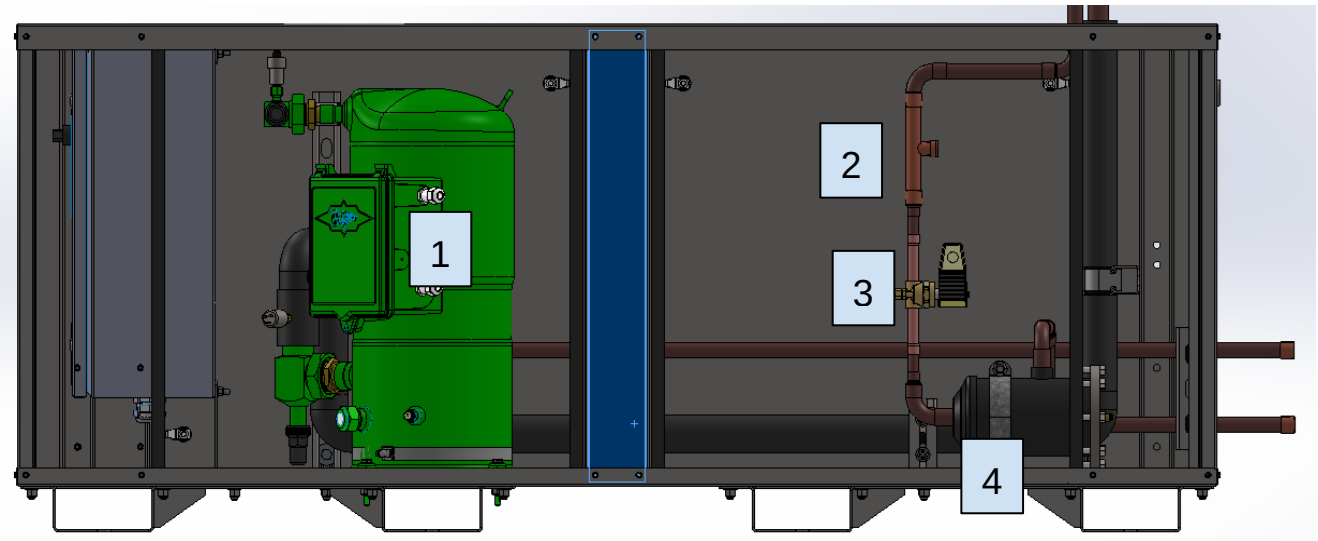


Figure 8: Compressor Section Internal Components

Item	Description
1	Compressor
2	Sight glass (moisture indicator)
3	Solenoid valve
4	Filter drier

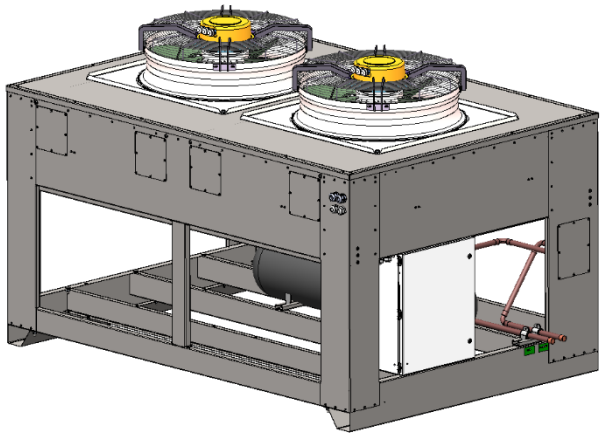


Figure 9: Air Cooled Condenser (may have 1 or 2 fans)

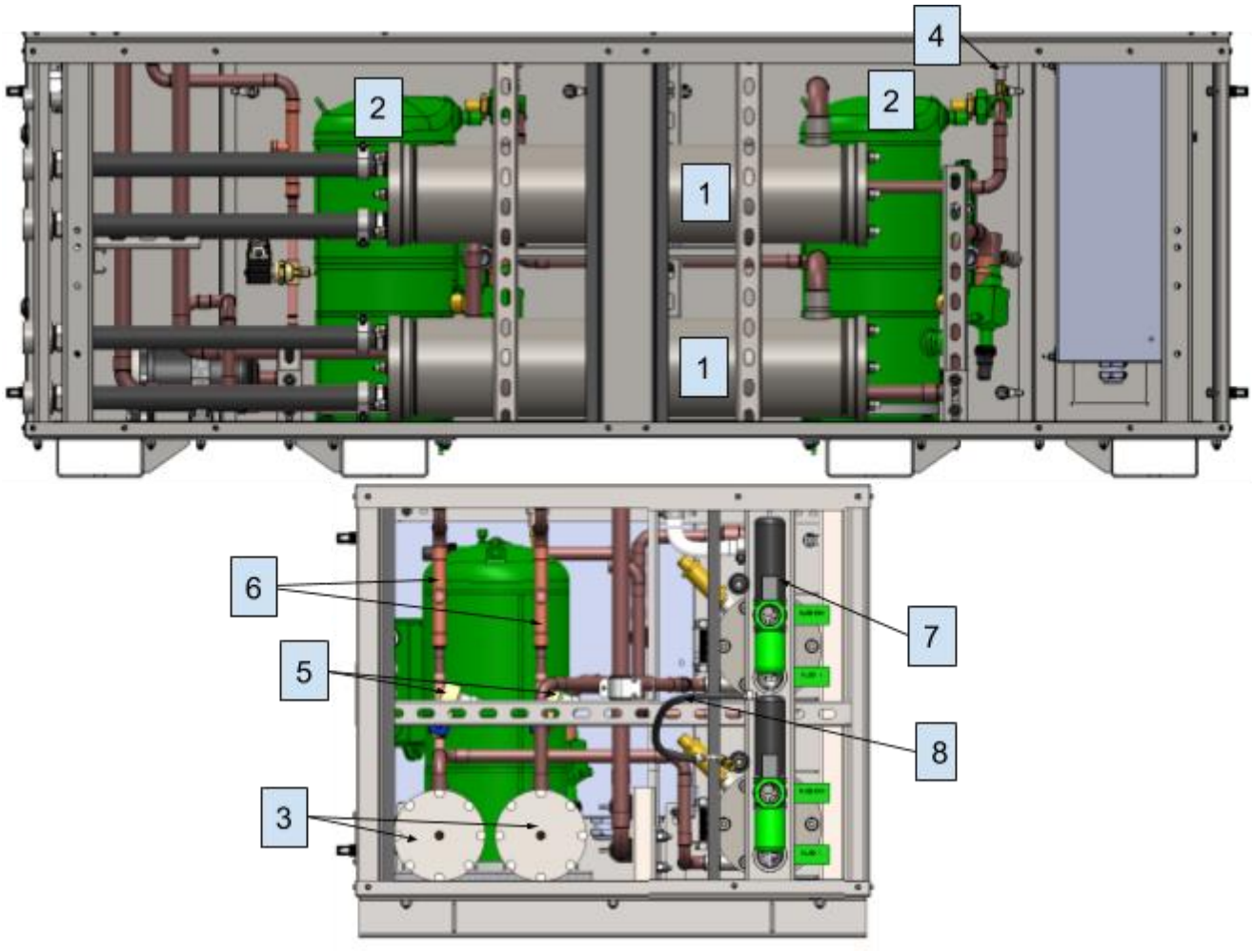


Figure 10: Series BH Compressor Section Internal Components

Item	Description
1	Water cooled condenser
2	Scroll compressor
3	Filter drier
4	High pressure cutout switch
5	Ball valve with electronic actuator
6	Sight glass (moisture indicator)
7	Water regulation valve
8	Hose connecting high pressure to water valve

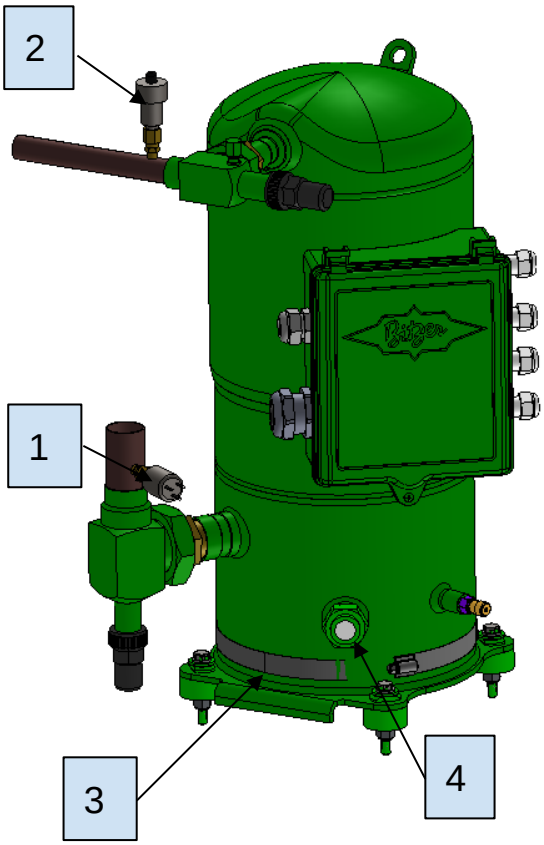


Figure 11: Compressor Details

Item	Description
1	Low Pressure Sensor
2	High Pressure Sensor
3	Crankcase Heater
4	Compressor Oil Sight Glass

3.2. Sequence of Operation

1. To start the air conditioning unit, turn the ON/OFF switch to the "ON" position. In the "Off" position the compressors and blowers shut down. All the other configurations are made through the thermostat.

2. The thermostat will be shipped already pre-programmed and the end user only needs to input the setpoint. For more information about the thermostat and its features, refer to the thermostat manual and the last revision of technical bulletin TB-63.

3. The blower will start and run as soon as it receives a signal from the thermostat or any compressor start. Cooling demand signal sent by the thermostat opens the liquid line solenoid valve. Then, the compressor(s) will start based on the low pressure switch at the suction line. The compressor(s) contactor coil energizes starting the compressor and opening an auxiliary contact removing the 120V from the crankcase heater.

4. (Series BW only) The system will control/regulate the water regulating valve to maintain the discharge pressure set point.

5. (Series BA and BPA only) Condenser fans are ready to start 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 fans start and control according to the temperature from the refrigerant line.

6. Temperature Control. The thermostat will control system capacity by cycling the compressor(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 second compressors starts. As temperature falls, this sequence is reversed until the compressor(s) cycle off.

7. 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.

8. If either the compressor motor or blower motor draws excessive current caused by overloads or short circuits, the current limiting overloads/fuse will trip/blow and isolate the faulty motor from the 3 phase power line. **Important:** Determine cause of over current before resetting overload or replace fuses. To reset, open the main control panel with main power "OFF" and press the reset switch on the overload or replace fuses.

4. MAINTENANCE

4.1. Troubleshooting Charts

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 UNIT 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 the condenser is clogged. Remove and clean if necessary.
3.3	Condenser water flow/pressure/temperature	Have mechanical personnel verify water flow to the 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 the 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 a refrigeration service technician evacuate the system and recharge it.
3.7	Blower belts	Blower belts may be loose, requiring adjustment. (if applicable).
3.8	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 the 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 the thermal bulb and capillary tube for damage.
4.6	Condensing temperature too low	Check the 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 a 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/pressure sensor defective	Replace sensor.
5.2	Flooding of refrigerant into crankcase	Adjust thermal expansion valve.
5.3	Crankcase heater failed	Have the electrician check fuses for power to the crankcase heater.
5.4	Short cycling	Pumps oil out of the compressor and the 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 the power company. Do not start until corrected.

4.2. 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

- BCV32

A yearly oil analysis is recommended to boost compressor reliability.

4.3. 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 an 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.

4.4. Water Cooled Condensers

Water cooled 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 a 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 assembly. 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.

4.5. Filters

It is important to check filters on a regular basis and change 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.

4.6. 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 drivers according to instructions below. 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.

4.7. 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. 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.

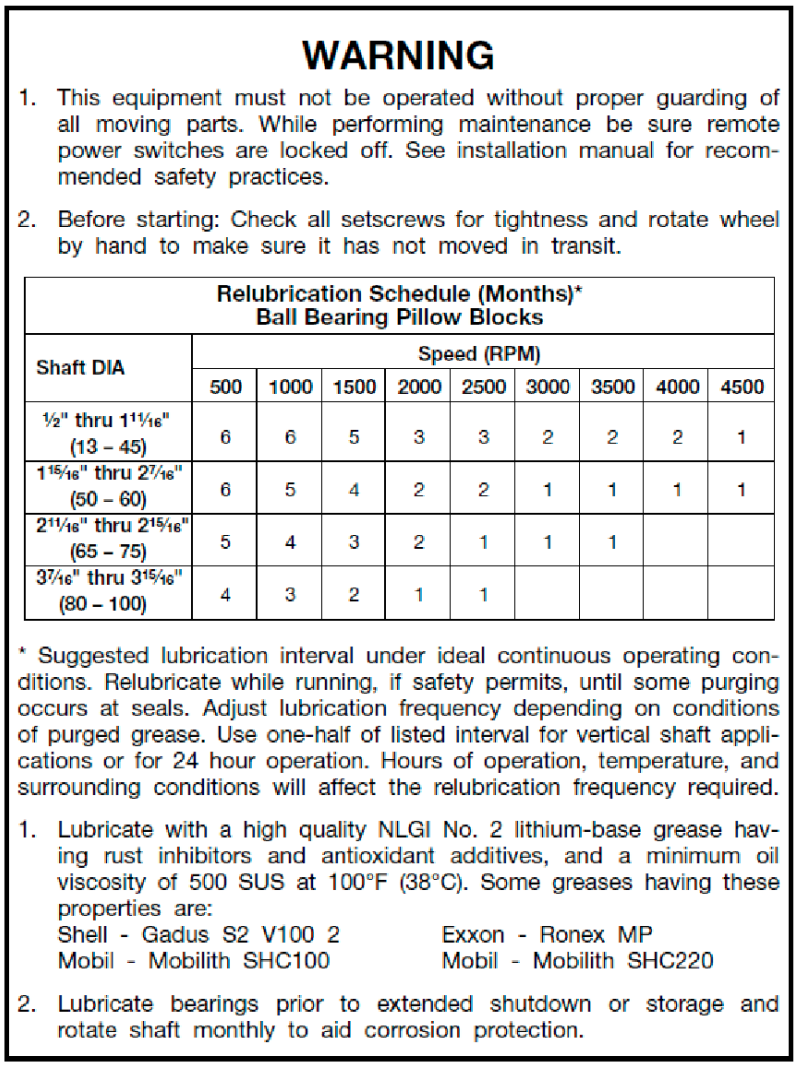
The figure below illustrates the decal for ball bearings, attached to the blower. Observation of the condition of the grease expelled from unit ball or roller bearings at the time of relubrication is the best guide as to whether regreasing intervals and the amount of grease added should be altered. This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

Refer to technical bulletin TB-33 for bearings maintenance.



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.

Figure 12: Ball Bearing Decal

4.8. 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.

4.9. 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. 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.

4.10. Maintenance Checklists

The following maintenance instructions form a foundation 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, and likewise the machine operator, by documenting changes in machine operating conditions. This information should be utilized to anticipate and avoid problems before they actually occur or worsen.

AIR cannot be held responsible for the 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 or the original design conditions.

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

Model Number:		Serial N0.:		Every Month	Every 3 Months	Every Year	Every 2 Years
Prepared by:		Date:					
Temperature Set at (°F)		Discharge Pressure (psig):	Suction Pressure (psig):				
Y/N	**Evaporator / Water Coil**	**Location / Comment**					
	Check for leaks			X			
	Check the percentage of antifreeze (if applicable)			X			
	Check coating (if applicable)			X			
Y/N	**Compressor**	**Location / Comment**					
	Check oil levels			X			
	Check for leaks			X			
	Check for excessive vibration			X			
	Check for abnormal noise			X			
	Check compressor mounting			X			
	Compressor oil analysis					X	
	Change compressor oil						X
Y/N	**Refrigeration Cycle/Section**	**Location / Comment**					
	Check crankcase temperature			X			
	Check liquid refrigerant though the sight glass			X			
	Check expansion valve operation				X		
	Check solenoid valve operation				X		
	Check hold back valves operation				X		
Y/N	**Condenser**	**Location / Comment**					
	Check for leaks			X			
	Condenser Coil Clean			X			
	Refrigerant lines properly supported				X		
Y/N	**Axial Fan**	**Location / Comment**					
	Check for excessive vibration			X			
	Check for abnormal noise			X			
	Fan clean			X			
	Check bearing for replacement (replace approx. 30000hrs)				X		

Model Number:		Serial N0.:		Every Month	Every 3 Months	Every Year	Every 2 Years
Prepared by:		Date:					
Temperature Set at (°F)		Discharge Pressure (psig):	Suction Pressure (psig):				
Y/N	**Air Filters**	**Location / Comment**					
	Check for restricted airflow			X			
	Check filter differential switch (if applicable)				X		
	Wipe filter rack section clean				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 airflow safety switch operation				X		
	Lubricate bearings					X	
Y/N	**Water Regulating Valve**	**Location / Comment**					
	Check for refrigerant leaks			X			
Y/N	**Piping**	**Location / Comment**					
	Check leaks from the process			X			
	Check valves for leaking			X			
	Check all piping supports			X			
	Check for excessive vibration			X			
Y/N	**Field Identification**	**Location / Comment**					
	Check for missing identification labels, and replace if necessary			X			
	Check for unreadable labels, and replace if necessary			X			
Y/N	**Insulation**	**Location / Comment**					
	Check for physical damage			X			
	Check for indications of leaks			X			
	Check for missing/broken bands			X			

Model Number:		Serial N0.:		Every Month	Every 3 Months	Every Year	Every 2 Years
Prepared by:		Date:					
Temperature Set at (°F)		Discharge Pressure (psig):	Suction Pressure (psig):				
Y/N	**Corrosion**	**Location / Comment**					
	Check for corrosion at support points, bolts or between flanges			X			
	Check for coating or painting deterioration			X			
Y/N	**Structural Parts**	**Location / Comment**					
	Tighten all fasteners			X			
	Check all structural components used to support pumps, compressors, motors, etc.			X			
Y/N	**Electrical Panel**	**Location / Comment**					
	Check fuses				X		
	Check contactor operation				X		
	Check all electrical connections				X		
	Check operation sequence				X		
	Check calibration of change over thermostat				X		

4.11. Maintenance Logs

Date _____ Time _____
Prepared by: _____
Notes: _____

Date _____ Time _____
Prepared by: _____
Notes: _____

Date _____ Time _____
Prepared by: _____
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