Compressed Air System Products

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INSTALLATION, OPERATION AND MAINTENANCE
Instructions for
Refrigerated Water Chillers
Models C-25 through C-8000

CONTENTS

A. INTRODUCTION

AIR/TAK Refrigerated Fluid Chillers are of the high-efficiency type, designed to effectively remove heat from process cooling fluids by means of a refrigeration process. The process fluid temperature is reduced to the temperature required by your machinery.

AIR/TAK chillers are completely automatic in all respects. As with all AIR/TAK products, minimal maintenance is required. It is our recommendation that this manual be followed for any maintenance that might be required. Any, and all, service should be performed by a qualified refrigeration technician, who is trained in the service of refrigerated water chillers.

B. RECEIVING

Upon receiving your chiller:

1. Inspect the shipping carton for any apparent damage.
2. After removing the crate, inspect the unit for any hidden damage.
3. Report any damage immediately to the carrier and notify your supplier.

C. LOCATION

Selecting the proper location:

Air-cooled chillers must have cool room air made available to prevent a heat build-up in the area where the chiller is installed. An exhaust system is recommended to avoid recirculation of hot air from the condenser.

Room temperature at the selected location should not exceed 100°F (35°C), 60 HZ: or 77°F (25°C), 50 HZ, and should not be lower than 50°F (10°C). High room temperatures can effect the efficiency of the chiller. Every 10°F increase in ambient temperature above 95°F (35°C) will result in a 6% decrease in air cooled chiller performance, resulting in higher outlet temperatures and increased operating costs.

To assure an unrestricted flow of cool air through the refrigeration condenser, a minimum distance from the cabinet to the nearest wall of twenty-four inches must be maintained.

All outside installations must have weather protection. Minimum protection should include a shed roof. Air-cooled units must be protected against the wind.

Outside ambient temperature must not exceed 100°F (38°C) nor be lower than 50°F (10°C) where a standard unit is to be located. If ambients below 50°F (10°C) are anticipated, the chiller should be equipped with an optional ultra-low ambient package.

D. FOUNDATION

All chillers are completely free-standing units. Any reasonably level floor that has sufficient strength will serve as a foundation.

E. PIPING

When piping the main fluid lines to the chiller, the use of flexible connections are recommended to avoid piping stress and vibration.

All water-cooled chillers are factory piped for cooling tower water. All water-cooled chillers are supplied with a factory mounted automatic water regulating valve which is designed to maintain the proper working refrigerant head pressure under all chiller load conditions. No adjustment will be necessary. (Full water pressure and flow should be supplied to the water line inlet). Refer to Section L for water cooled water requirements.

F. ELECTRICAL

Chiller nameplate must be checked to verify voltage, phase and cycle. Three phase hermetic refrigeration compressors are designed to operate in either direction of rotation. To change fan rotation, switch any two power leads in the terminal box located at the rear of the chiller.

FOR MODELS C-750 AND LARGER, FAN ROTATION MUST BE CHECKED TO ASSURE PROPER AIR FLOW. AIR MUST ENTER IN THROUGH THE FINNED CONDENSER COIL AND EXIT OVER THE fAN MOTOR.

The chiller is completely wired at the factory. A terminal box or plug at the rear of the chiller is provided for the main power connection. WATER PUMP(S) MUST BE CHECKED FOR PROPER ROTATION. Power connections can be made through the pre-drilled hole on the bottom of the terminal box. Connect the power leads to the terminal block which is conveniently located within the box. Always be sure adequate power is available to maintain efficient operation of your chiller.

Models C-100 and larger, are equipped with crankcase heaters as standard. The crankcase heaters are pre-wired at the factory to be energized at all times. (See Start-Up). Your chiller is equipped with a pumpdown system. The chiller may begin to run immediately after being energized for a short period of time which is normal.

A properly sized fused main disconnect switch (supplied by the installer) must be located near the chiller. Check the wiring diagram supplied with the chiller for the recommended fuse size. The use of fusetron time-delay fuses will permit smaller fuse sizes and, in some instances, a smaller fused disconnect switch may be used.

The chiller wiring must be independent of the chilled water heat load so as not to cycle along with the machinery.

G. CHILLED WATER CIRCUIT

1. Chilled Water-to-Refrigerant Heat Exchanger (Evaporator):

   This exchanger is of the tube in tube or shell in tube design depending on the model size. The evaporator is engineered with maximum efficiency in mind.

2. Water pump: The water pump must be checked for proper direction of operation. Set GPM by amps compared to pump curve. The discharge ball valve must also be adjusted to regulate the proper gallon per minute flow to the evaporator as stated on the data label found on the back panel of the chiller. Failure to do so may result in a lack of water pressure to the equipment being cooled or a lack of water temperature drop through the evaporator. THE PUMP SHOULD NEVER BE RUN WITHOUT FLUID TO IT.

3. Air vents: Air vents are required at high points in the system to allow the bleeding of air while filling the system. These vents are to be supplied and installed by the contractor. A water fill port must be added to the suction line by the contractor. To fill the system, open all air vents and begin filling with fluid. When a steady stream of fluid comes from the vents with no air, close the vents. To fill the expansion tank to the proper level, loosen the small nut at the bottom of the airtrol and allow air to escape until fluid comes out. Tighten the nut. Circulate the fluid by turning on the pump. Repeat bleeding of air vents until all air has been removed.

4. Water Tank: On an open system the plastic water tank provided allows for easy filling of the chilled water circuit. Fill the tank by removing the cap at the top of the chiller. Turn the chiller on activating the pump to fill piping. Being aware of the water level in the tank, add if it should run low. You should maintain half capacity in the tank to guarantee a full column of liquid to the pump suction.

H. REFRIGERANT CIRCUIT

1. Refrigerant Compressor:

The refrigerant compressor used is an industrial type, full hermetic or semi-hermetic. These Compressors can be either single phase or three phase, depending on the application. The compressors used are designed for high temperature applications which allows an evaporation temperature range of 20°F (-7°C) to 50°F(10°C.).

Each compressor motor is fully protected by either an internal or external overload which are of the automatic reset type. All compressors used are suction gas-cooled and have a wide working range. The connected electrical load can vary with the compressor load, ambient temperature or cooling water temperature.

2. Air Cooled Condenser and Condenser Fan Cycling Control (Low Ambient):

All air cooled condensers used in the AIR/TAK chillers are industrial plate fin type coils, designed for maximum ambient conditions. Each condenser has a sub-cooling system which permits the condensed refrigerant to be sub-cooled below the normal condensing temperature to within 10°F of the ambient temperature. The condensers are forced convection types and fan motor(s) are controlled by pressure switch(s) (low ambient control). This pressure switch is activated by the condenser head pressure. This pressure will vary with the ambient temperature and evaporator load. As the pressure increases to a factory set cut-in pressure, the fan switch is activated and the fan motor starts. The fan removes the heat within the condenser and lowers head pressure to the factory set cut-out point. With the fan switch controlling the upper and lower pressure limits, the chiller can operate through a wide range of ambient and load conditions. When the ambient is high and the chiller is operating at full load, the condenser pressure and temperature will stabilize and the fan(s) will run continuously.

3. Evaporator: Water-to-Refrigerant Heat Exchanger:

The evaporator is constructed of high quality copper tubing. Cold liquid refrigerant is efficiently fed by a venturi type distributor to each circuit. The circuiting within the evaporator is designed to insure adequate refrigerant velocity to eliminate the problem of oil return to the crankcase.

4. Expansion Valves:

There are two types of expansion valves used.

a) The first type is the automatic type which is used on all AIR/TAK chillers up to, and including, the Model C-75. The Automatic Expansion Valve (AEV) is a pressure sensitive valve which responds to change in evaporator pressure. As the evaporator pressure begins to change in response to load changes, the automatic valve senses this and adjusts the flow of refrigerant to maintain a constant pressure within the evaporator.

b) The second type is the Thermostatic Expansion Valve (TXV) used on Model C-100 and larger. This valve is controlled primarily by temperature. The temperature that is sensed by the (TXV) thermal bulb is the superheat temperature of the refrigerant at the outlet of the evaporator. This is the temperature increase of the refrigerant above the saturation temperature corresponding to the existing evaporator pressures.

5. Hot Gas Bypass Valve C-100 and Larger:

The hot gas bypass valve or capacity regulator permits medium to larger type refrigerated chillers to operate through the range from zero load to 100% load while maintaining evaporator and suction line pressure and temperature.

6. Low Pressure Switch:

The low pressure switch is a safety device that protects the refrigeration compressor from low suction pressure resulting from a loss of refrigerant charge.

7. High Pressure Switch:

The high pressure switch is a safety device that limits the discharge pressure from the refrigerant compressor. If the discharge pressure exceeds the factory set point, the high pressure switch opens the electrical circuit to the compressor and the system is shut down.

High discharge pressures may result from conditions such as: plugged or dirty condensers, high ambient temperature, high fluid inlet temperatures, high fluid flow rates, non-condensables (air or water inside the refrigeration system) or fan motor failures.

8. Crankcase Heater:

The crankcase heater is a low wattage heater that is connected to or immersed in the refrigerant compressor crankcase. The wattage of this heater is normally 50 to 65 watts. This heater is not controlled by the operational switch of the chiller, but is factory wired directly to the incoming power. The purpose of the crankcase heater is to prevent liquid refrigerant migration back to the crankcase while the compressor is not in operation. This migration of the liquid refrigerant occurs when the compressor crankcase is at a lower vapor pressure than the evaporator and other system components. The crankcase heater must raise the temperature of the crankcase and oil to a temperature higher than the evaporator and all of the interconnecting piping. To accomplish this, the crankcase heater must be energized twenty-four hours before the chiller is started. This is accomplished by turning the chiller operational switch to "OFF" and switching on the main power. The chiller is then allowed to warm up for twenty-four hours after which time the operational switch may be turned to the "ON" position.

9. Automatic Water Regulating Valve:

This control is found only in chillers equipped with water cooled condensers. The purpose of the valve is to control the flow of water through the condenser at a rate that is factory set to maintain a constant condensing pressure.

10. Oil Sightglass:

The oil sightglass is found on the side of the crankcase on accessible semi-hermetic compressors to provide a visual means of checking the oil level. The oil must be checked only while the compressor is in operation. During compressor operation the oil sight glass should be approximately 1/2 full.

11. Low Oil Pressure Switch:

This switch is found on semi-hermetic compressors. The oil pressure switch is a pressure differential switch which senses the pressure difference between the compressor crankcase pressure and the outlet pressure of the oil pump. The oil pressure must be maintained above the crankcase pressure to insure proper lubrication (minimum pressure of 9 psi).

If an adequate oil pressure over compressor crankcase pressure is not maintained, the low oil pressure switch will open and shutdown the refrigerant compressor. This switch is a manual reset switch. Before resetting, the unit must be thoroughly checked to determine the cause of the failure. A built in time delay of 120 seconds is provided to permit the refrigeration compressor to start and establish a satisfactory oil pressure.

12. Refrigerant Liquid Line Filter-Dryer:

A liquid line filter-dryer is used on all AIR/TAK refrigerated chillers. The purpose of the filter-dryer is to eliminate the possibility of moisture, or other foreign particles, from moving throughout the system. These particles, such as carbon, can cause early compressor failure. The filter-dryer also has a high quality desiccant which is capable of removing moisture to a very low point and can also remove a reasonable quantity of acid.

13. Water Pressure Switch:

This control is used only on chillers equipped with water cooled condensers. The purpose of this switch is to assure that adequate water pressure is available to the refrigerant condenser.

14. Desuperheating Valve:

This valve is used on larger capacity chillers. Due to the larger refrigerant charges associated with these models, the addition of the desuperheating valve is necessary. The valve's purpose is to provide liquid refrigerant to desuperheat hot discharge gas used to establish suction gas pressure.

15. High Temperature Control:

This control is used to protect the compressor from excessive return gas temperature. During the start-up phase, the high temperature light may be lit until the refrigeration system reaches its normal running temperatures and pressures. (See Start-up; Section I).

During normal operation on Models C-25 through C-1000 this control will activate the high temperature light when return gas temperatures become excessive. Immediate action is required by the customer to turn off the chiller. On models C-1200 and above, this control will activate the high temperature light and will also open the electrical circuit on the compressor and shutdown the chiller. The chiller will not restart without the customer turning the selector switch to "OFF" and then back to "ON". Customer evaluation should be undertaken to determine the cause of the high temperature condition.

After start-up, the high temperature light condition may result from: plugged or dirty condensers, high ambients, high inlet fluid temperatures or high fluid flow rates.

16. Start Timer:

Standard on C-1200 and larger chillers. This timing device is used in conjunction with the High Temperature Control in item 16. During start-up, this device will temporarily energize the compressors electrical circuit. The start timer is factory set to allow adequate time for the refrigeration system to reach normal suction gas temperatures. If normal suction gas temperatures do not occur within the factory set time, the compressor will shut down. (See item 16 above.)

17. Pump Down System:

Standard on all chillers above C-150, liquid line and hot gas line solenoid valves are wired to open when the power on switch is turned on, and to close when the switch is off. When in the off position, the chiller will pump most of the refrigerant charge into the receiver until the low pressure switch de-energizes the compressor.

18. Freeze Control:

Standard on all chillers. When the water temperature leaving the evaporator nears freezing, this switch de-energizes the compressor while allowing the water pump (if provided) to continue to run.

I. START-UP

After the installation of your chiller at a suitable location, the following checks should be made:

a) The refrigerant analyzer gauge should be indicating the chiller shut down pressure of 125-175 PSIG. If analyzer pressure is above or below normal shut down pressure, do not start the chiller. Pressures may vary with ambient temperature.

b) The operational switch must be in the "OFF" position.

c) The main electrical disconnect is energized.

d) The amber power on light is "ON".

e) (Water cooled units only). Open water supply valve.

Units that DO NOT require a crankcase heater (Models C-25 through C-75 can be started immediately after step E (above) by turning the on off switch on. The red High Temperature Light may remain on for a short time after the unit is started and the Refrigerant Analyzer Pressure will drop to its normal range to indicate 58-76 PSIG. When the red High Temperature Light goes out, the chiller is ready to assume full load operation.

MODELS C-100 AND LARGER ARE EQUIPPED WITH CRANKCASE HEATERS AS STANDARD. THE CRANKCASE HEATERS MUST BE ENERGIZED TWENTY-FOUR HOURS BEFORE INITIAL START-UP OR AFTER ANY PROLONGED SHUT DOWN. After the 24hour period, the chiller may be started. The Refrigerant Analyzer pressure will drop and bring itself to the normal running pressure, 58-76 PSIG. When the red High Temperature light goes out, the chiller is ready to assume full load operation.

Chillers having dual condenser fans will have one (1) fan which may start when the operational switch is turned on. The cycling of the fan(s) is controlled by the low ambient control which is factory preset to maintain the proper head pressure within the refrigerant system.

J. DESIGN CONDITIONS

Each chiller is shipped complete and ready for installation. Every chiller is tested and preset at the factory for optimum service at the design conditions. The following are the standard design conditions for a refrigerated chiller operating at 60 HZ:

95°F(35°C)Ambient Temperature
(Room Temperature)

K. SHUT-DOWN

All chillers may be shut down by simply turning the operational switch to "OFF." Models C-100, and larger, require the main power disconnect to remain on unless service or maintenance work is to be performed. Models C-200-A and larger have one fan motor wired to run to lower head pressures after shut-down.

L. MAINTENANCE

A properly installed AIR/TAK refrigerated chiller requires very little in the way of maintenance to provide years of trouble-free service. A very simple routine maintenance program is all that is required. This program will consist of two check points:

1. Refrigeration Condenser:

    a) Inspect the refrigeration condenser for lint and dirt.

    b) The refrigeration condenser should be checked for lint or dirt monthly in a clean environment and more often in a dirty environment. If the condenser is found to be dirty, it must be cleaned with low pressure dry air.

    c) Check refrigerant lines for oily connections and vibration in lines. Check wiring for loose and broken wire ties. (See Troubleshooting Guide).

2. Condenser Fans:

    a) Inspect condenser fans; i.e., bent or broken blades, and for free rotation.

    b) Check condenser fan(s), brackets and on motor shaft for tightness.

3. Gauges:

    a) Check gauges for proper readings.

4. Circulating Pump:

    a) Check for leaks.

    b) Grease motor if fitting is supplied.

M. TROUBLESHOOTING GUIDE

SYMPTOM	PROBABLE CAUSE	REMDY
Chiller not running. (Power on light off, high temperature light off, analyzer gauge normal.)	a. Disconnect open. b. Fuse blown. c. Wiring, improper or broken. d. Control transformer defective.	a. Close disconnect. b. Replace fuse. c. Check wiring diagram or repair. d. Replace.
Chiller not running. (Power on light on, high temperature light on, analyzer gauge normal)	a. Overload tripped. b. High pressure switch open (if supplied). c. Low water pressure switch (water cooled). d. Low oil pressure switch (if supplied). e. High suction gas temperature.	a. Allow to cool & reset. Check for overload. b. Reset and check for cause. c. Increase water pressure. d. Reset and check oil level. e. Check for high ambient or over-loaded condition.
Chiller running. (Power on light on, analyzer gauge high)	a. High inlet water temperature. b. High ambient temperature. c. Dirty or plugged condenser coil. d. Defective water regulator (water-cooled) e. Defective fan control. f. Defective fan motor. g. Defective refrigerant compressor valves. h. Suction pressure too high.	a. Check heatload. b. Cool ambient or relocate unit. c. Clean condenser coil. Blow with compressed air. d. Repair or replace. e. Replace. f. Replace. g. Repair or replace compressor. h. Adjust hot gas bypass valve.
Chiller running (Power on light on, high temperature light on, analyzer gauge pressure low)	a. Leak in refrigerant circuitry. b. Suction pressure too low.	a. Locate and repair. b. Adjust hot gas bypass valve. Check refrigerant charge.

M. TROUBLESHOOTING GUIDE CONTINUED

SYMPTOM	PROBABLE CAUSE	REMDY
Chiller running. (Power on light on, high temperature light off, analyzer gauge pressure low)	a. Defective hot gas bypass valve. b. Defective fan control (low ambient control). c. Low ambient termperature. d. Low refrigerant charge.	a. Replace. b. Replace. c. Heat ambient or relocate unit. d. Repair leak and add refrigerant.
Chiller not running. (Power on light on, high temperature light on, analyzer gauge pressure low)	a. Low pressure switch open. b. Service valves closed. c. High suction gas temperature.	a. Check for leak and repair. b. Open valves. c. Check for leak.

IMPORTANT: Consult factory before making adjustments on any controls noted in the Trouble-shooting Guide. The adjustments note must be made by an authorized refrigeration repair serviceman and are listed as a guide for service personnel. The adjustments should not be made by unauthorized personnel since all controls are preset at the factory.

AIR/TAK WARRANTY POLICY

AIR/TAK products are warranted to be free from defects in materials and workmanship for a period of one year from date of shipment or up to one year from verified date of installment not to exceed 15 months. Date of installation will be verified upon receipt of the completed Warranty Registration Card. All Air/Tak refrigerated dryers will additionally be warranted on parts only (excluding fan motors and drain valves) for a period of two years from the date of shipment. Also, deliquescent and regenerative air dryer pressure vessels and refrigerated air dryer heat exchangers have a 5-year prorated warranty.

All damaged pressure vessels and heat exchangers returned to AIR/TAK for warranty consideration must be returned freight prepaid. Warranty will be determined after factory inspection. Failure to return a damaged heat exchanger or pressure vessel will result in warranty denial.

Repairs, adjustments, parts, etc. are limited to actual labor cost provided that such defects are promptly reported and approved following AIR/TAK's warranty procedures. In no event shall the cost of repairs exceed the actual cost of materials and labor.

AIR/TAK or its representatives reserve the right to decide which warranty items are authorized. AIR/TAK shall not be liable for incidental or consequential damages which may result from a breach of the warranty described above.

For more information on warranty policies and procedures, contact your authorized AIR/TAK Distributor.

AIR/TAK's line of quality compressed air system products includes:

COMPRESSED AIR SYSTEM FILTERS * AIR-COOLED AFTERCOOLERS
REFRIGERATED AIR DRYERS * CAD COMBINATION AFTERCOOLER DRYER SYSTEMS
RAD-PAK REFRIGERATED AIR DRYER/FILTER PACKAGES * HEATLESS REGENERATIVE AIR DRYERS
HLD-PAK HEATLESS REGENERATIVE AIR DRYER/FILTER PACKAGES
BLOWER PURGE REGENERATIVE AIR DRYERS * EXTERNALLY HEATED REGENERATIVE AIR DRYERS
AIR CHILLERS * FLUID CHILLERS

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