C-Series

PACKAGED AIR-COOLED LIQUID CHILLERS

Model CF-07-A-1ZB3
Serial # 097771

INSTALLATION AND OPERATING INSTRUCTIONS

Chiller Solutions LLC
101 Alexander Ave., Pompton Plains, NJ 07444
(800) 468-3826, (973) 835-3222 fax
www.chillersolutions.com

Receiving & Inspection

Visually inspect for any damage that might have occurred during shipping or transit. Note that your rights of damage claim are limited once the bill of lading has been signed. All freight leaving Chiller Solutions is FOB Pompton Plains, NJ 07444. (Please see the Chiller Solutions standard terms and condition of sale along with the Chiller Solutions Acknowledgement of shipping risk of loss forms for more details.)

> "The purchaser above has submitted an order for original equipment products (hereinafter, "products") manufactured by Chiller Solutions LLC (hereinafter "Seller") of 101 Alexander Ave., Unit 3, Pompton Plains, NJ 07444.
>
> Notwithstanding any other agreed on Terms and Conditions of Sale/Purchase by and between the Purchaser and the seller, Purchaser shall make no claims against the Seller for loss upon shipment as a result of the products' transportation, handling, storage, which is f.o.b. point of origin- generally, Pompton Plains, New Jersey, United States of America."

Form CSL-16

Note: Damage occurring in transit may include concealed damage. All damages due to travel related abuse are not covered under the Chiller Solutions Standard Warranty. See Standard Warranty for details.

Please check the following:

1. Visually inspect the unit and container for any signs of damage or abuse.
2. Remove all packaging from the unit and inspect for damage.
3. Open the electrical access door on the front of the unit and inspect for damage.
4. Open the compressor access door on the rear of the unit and inspect for damage.
5. Inspect the refrigerant pressure gauges (if provided) for pressure between 75 and 125 PSI on all gauges. (If gauges are not provided, a certified technician should check to ensure system pressure(s) are within the above limits.)

System Description

The C-Series chillers are one of the most space efficient air cooled chillers available in the market. For a successful installation of the packaged chiller, attention must be given to the clearance allowed around the chiller. The chiller requires coolant fluid to remove heat, electrical power to drive the motors and controls, and air to reject heat. Appropriate clearance around the unit will allow the chiller to draw air through the condenser coils where the heat of absorption and other mechanical heat are rejected. After the heat is added to the air, the fan system discharges the air away from the condenser coils.

Design and Application of the Edwards Packaged Chiller

The Edwards Standard Packaged Chiller is designed primarily for use on a closed loop system of circulation.

Pumping Application

The standard pump supplied with the chiller has been selected for its flow and head characteristics to cover 90% of the usual applications. Care should be taken when the chiller is selected to ensure that the system pump has the correct flow and head for the specific installation intended.

On open trough or sump applications, the flow arrangement might have to be reversed with the flow being pulled from the trough or sump tank to the chiller storage tank. Care should be exercised on systems with extremely long piping runs from the chiller or very high pressure drops through the process to ensure that the pump characteristics are satisfactory.
All pump flow and head ratings in the Edwards Packaged Chiller brochure are based on handling clear, cold, fresh water at a temperature of not over 65°F. On applications using other than water, such as high viscosity solutions, consult factory for pump selection.

Operating Temperature Ranges

CF-Series: The standard temperature ranges for operation are 20°F to 70°F. On applications where the return water is above 70°F, consult factory or local representative for special design. Note: Minimum temperature to process for water (without anti-freeze) is 45°.

CLH-Series: The standard temperature ranges for operation are -20°F to 20°F.

CLM-Series: The standard temperature ranges for operation are -60°F to -10°F.

CLL-Series: The standard temperature ranges for operation are -100°F to -60°F.

CLS-Series: The standard temperature ranges for operation are -50°F to 20°F.

The Refrigeration Cycle Explained

The refrigeration cycle begins with low pressure, superheated vapor entering the suction port of the compressor. This vapor is compressed and discharged as high pressure, high temperature vapor at the compressor discharge port. It then travels through the condenser coils where heat is removed from the vapor which condenses into a high pressure, sub-cooled liquid. This liquid moves through the filter drier, the moisture indicating sight glass and into the expansion valve. The liquid refrigerant is metered through the expansion valve where it expands and cools to become a low pressure, low temperature liquid/vapor mix. This liquid/vapor mix enters the evaporator and absorbs heat from the coolant and evaporates to become low pressure, superheated vapor which enters the compressor suction port to begin the cycle again.

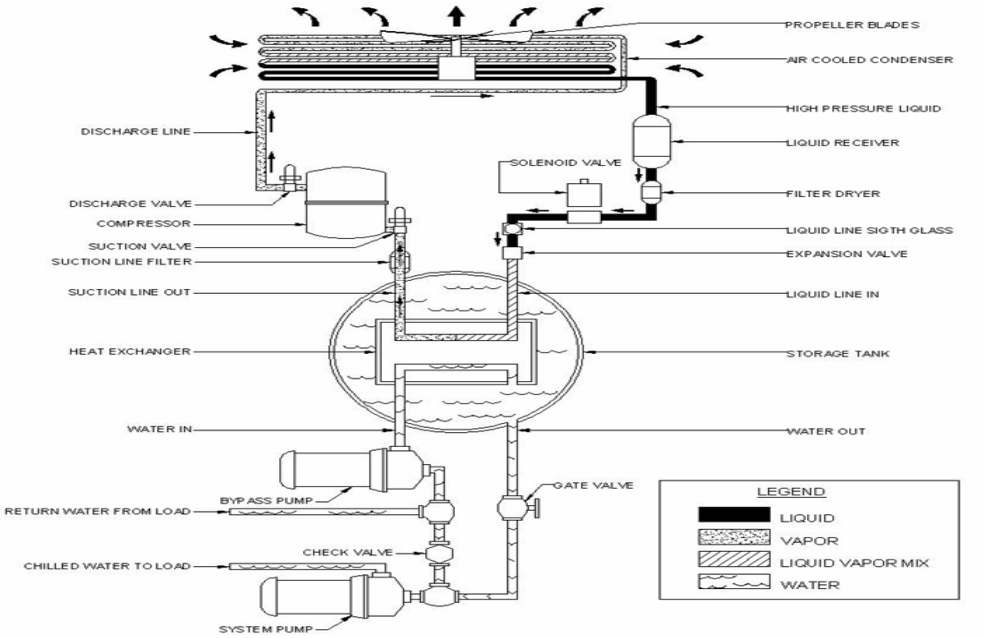
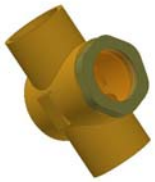


Diagram of Typical Air Cooled Chiller Refrigeration Cycle

Liquid Line Filter Drier

The liquid line filter drier is a hermetically sealed type filter drier designed to assist in screening and dehydrating the liquid refrigerant returning from the condenser. The filter drier is installed prior to the solenoid valve, sight glass and expansion valve thus providing additional protection.

Refrigerant Sight Glass and Moisture Indicator



The sight glass is designed with a moisture indicator to provide a view inside the liquid line. The moisture indicator changes color based on the amount of moisture in the system.

Thermostatic Expansion Valve (TXV)

The expansion valve operates to control the amount of refrigerant that enters the evaporator. The valve is designed in three primary components: the body, the cage, and the power-head. The cage is designed to operate in a range of capacities and can be exchanged with other cage sizes within the design of the expansion valve assembly. The power-head is designed to monitor the suction line temperature and pressure providing control of the amount of superheat directly after the evaporator.

Condenser Fan Speed Control

Discharge pressure is maintained by use of a variable frequency drive and multiple fan motor arrangement to provide increased or decreased air flow through the condenser under varying ambient and load conditions. This control is preset at the factory to provide proper control over a large range of ambient conditions.

Motor Circuit Protection

Motor protectors are supplied for each pump, compressor, and fan and are labeled according to the provided wiring diagram. Each motor protector is factory set for maximum operating conditions where condensing temperatures may reach as high as 130ºF and exercise additional amp draw on the component.

To manually set protection level, insert a small flat-head screwdriver into the slot located on the dial left of the STOP indicator. Lineup indicator arrow to desired amp protection: counter-clockwise to increase and clockwise to decrease. Care should be exercised when setting the dial outside factory recommendation.

Note: Dial setting is full load motor current. Trip current is 125% of dial setting.

WARNING!	*The opening of the branch-circuit protective device may be an indication that a fault current has been interrupted. To reduce the risk of fire or electric shock, the component of the controller should be examined and replaced if damaged. If burnout of the current element of an overload relay occurs, the complete device must be replaced.*

Gauge Panel

When performing preventative maintenance, or servicing the chiller, the supply of accurate data is essential to troubleshoot and repair any known issues. The upper portion of this stainless steel panel includes one liquid filled pressure gauge for the suction line and one for the discharge. These gauges provide simple read-out of the operating refrigerant pressures.

The 6 point temperature display is mounted to the front of the electrical enclosure. This electronic display utilizes a selector knob to display 1 of six temperatures. The temperatures sensed are:

- Fluid Inlet Temperature
- Fluid Outlet Temperature
- Suction Line Temperature
- Liquid Line Temperature
- Compressor Discharge Temperature
- Condenser Air Outlet Temperature

The pressure-temperature (PT) chart is used by a technician to ensure proper system operation. PT charts are most often used for three purposes: to set a coil pressure so that the refrigerant produces the desired temperature, to check the amount of superheat above the saturated vapor condition at the outlet of the evaporator and to check the amount of sub-cooling below the saturated liquid condition at the end of the condenser.

Coolant Storage System

The major components of the coolant system are the system circulator pump, storage tank and evaporator. The system circulator pump moves the coolant from the storage tank to the equipment to be cooled. The coolant which has picked up heat from the process returns to the evaporator. This is where heat is removed from the coolant by the refrigerant surrounding the evaporator coolant passages. After leaving the evaporator the coolant is discharged into the storage tank where it is ready to be used to complete the coolant cycle. This system includes an evaporator bypass loop which can be used to adjust coolant flow to the evaporator. This ensures that a proper flow is maintained through the evaporator and the refrigeration cycle is kept at top efficiency. The coolant system also incorporates several minor components: an automatic air eliminator, a fill/drain valve, a storage tank sight glass and a storage tank pressure relief valve.

Pressure Relief Valve

The storage tank is designed for a maximum pressure indicated on the relief valve provided on the tank in case the pressure is inadvertently increased above this point. The discharge part of the valve has a 3/4" FPT connection for the addition of a drain line if desired.

Automatic Air Eliminator

To purge air out of the storage tank on initial filling and any air that might be returned to the tank from the interconnecting lines during operation. The air eliminator is located on a line which is 2” below the top of the storage tank forming an air chamber at the top of the tank. This will allow for expansion of the coolant when unit is not in operation.

Storage Tank Sight Glass

All models are equipped with a storage tank sight glass for visual inspection of coolant level. It is equipped with hand valves to close off for cleaning or replacing gauge glass.

Pump Design

Prior to purchasing the chiller, determine the total system flow and pressure drop to ensure that the correct pump is selected at the factory. Commonly, a process may require a higher or lower flow than the chiller is rated for. Once the flow and total dynamic head (TDH) is determined, simply select the appropriate pump for the application. If a specific pump is required that is not listed in the pump selection section, consult the factory for selection assistance.

Integrated Pumping

The system pump is the primary pump for the chiller to move the coolant fluid to the process from the chiller. The standard configuration for the C-Series is for the system pump to return the process coolant fluid back through the evaporator into the storage tank with the suction of the system pump connected to the bottom of the tank. This standard configuration requires that the

system pump operate any time the refrigeration system operates. The C-Series comes with a bypass circuit sized to allow enough coolant fluid flow to return to the evaporator for the safe operation of the refrigeration system. In applications where 2-way valves can effectively shut off all coolant fluid flow to or from the system, the chiller internal bypass valve must remain open or another method of bypass must be installed into the process piping.

Operating the system pump without a means of bypass in the system and the internal chiller bypass valve closed will result in pump failure.

WARNING!!

Optional Bypass Pump

In some applications a bypass pump is desired to maintain the chiller tank temperature, thus allowing the system pump to operate only with a call from the process or operator. Maintaining the tank temperature provides a measure of thermal storage so that when the process calls, coolant at set-point temperature is readily available. The bypass pump uses far less energy than the system pump due to the relatively small amount of pressure drop of the bypass circuit. Additionally, when the system pump is operating full time, the additional heat from pumping must also be chilled thus creating additional parasitic energy usage.

Variable Speed System Pump (optional)

Optional variable speed controls can be added to allow the system pump to maintain a pressure differential across the process with the use of a variable frequency drive and pressure transducer. This increases the efficiency of the system pumping part of the system by using only as much horsepower as is required to maintain a given pressure. As the C-Series chiller operates to maintain the tank temperature, the system pump can be independently controlled. Consult the factory for pricing and details.

Installation

Placement Considerations

The environment the chiller is placed in will directly affect the performance of the system. Thoroughly understand the products limited warranty. An important consideration for the placement of the C-Series chiller is the ability to service the components. The C-Series is designed to make access to each of the components simple with the removal of one of the access panels. Care must be taken not to obstruct access to these panels when piping or electrically connecting the system. Take special care not to restrict access to the front of the system to allow appropriate access to the operating and safety controls, and compressor area for servicing.

Provide enough room on all sides of the unit for servicing and removal of the largest component, should replacement be necessary. Each access panel should have at least 36” of clearance to allow proper service/maintenance of the chiller. Consult local codes for additional clearance limitations. It is also necessary to review the operating environment of the chiller for anything that could affect the performance or longevity of the chiller. Items may include exhaust vents, additional cooling items, corrosive air environments, etc.

The placement of the chiller should partly be determined by the distance and complexity of the piping system. Distance and turns in piping increase the pressure drop of the system directly increasing the amount of energy required for pumping. Minimizing these factors will improve the efficiency of the chiller system

Outdoor Installation

In many metropolitan areas, fumes from vehicle exhaust may create an acidic condition in the air, which will prematurely corrode the components of the system. In some marine environments, salt will also prematurely corrode the components of the system. Some industrial buildings have exhaust vents which can increase the temperature of the air in an area causing a higher temperature air to enter the condenser. Debris from lawn maintenance or a naturally dusty environment can cause blockage in the air coils. While every environment can not be mentioned, care must be taken to ensure that the proper options are selected for a given installation, and that a suitable maintenance program is implemented.

Indoor Installation (if ducting exhaust air is required)

Most air cooled condensers are furnished with prop-type fans designed for open-air discharge, without ducts. Air requirements are 600 CFM per ton at nominal rating of unit. If ducts are to be connected for condenser air discharge, care should be exercised when designing ducts to ensure that the pressure drop does not exceed 0.1". Venting of the chiller should be planned and constructed so that no air restrictions occur because of duct size or type of installation. Ducts should be smooth on the inside, as rough places tend to collect debris which will decrease

capacity and eventually clog the duct and prevent the chiller from exhausting condenser air. Elbows, if used, must be smooth on the inside. All joints must be made so that the exhausted end of one section is inside the next one down stream. Whenever an elbow is used, turning vanes should be utilized to control air stream.

If duct work is not implemented at site location or deemed unnecessary, be sure that there are no obstructions, such as a roof or ceiling, above the path of the discharged air. If an obstruction is present, the hot air will not dissipate adequately and may return to the condenser coils and decrease the efficiency of the system.

Clearance Requirements

Operationally, the air condensers must be provided an unrestricted source of clean air. Outdoor installations require locating the system away from potential restrictions so that air can move unobstructed through the condensers.

Ensure that at least 36" of space is allowed from each of the condenser coils to the nearest possible obstruction. Ensure that the discharge of the condenser fan system is unimpeded and that no obstructions can deflect airflow back toward the air cooled condenser coils.

WARNING!

Restricting airflow to the inlet(s) or from the outlet(s) of the condenser section will restrict the ability to reject heat. This will lead to higher discharge pressures, higher power consumption, diminished chilling capacity, and premature failure of system components.

Mounting

The chiller should be installed on a concrete pad or floor or reinforced floor capable of supporting the operating weight of the entire unit. (Refer to manufacturer's data for unit operating weight.) Consult local codes for additional structural requirements or limitations. Where seismic or vibration isolation is desired, use only isolation devices capable of supporting each corner of the machine according to the corner weight. Minimum distances should be maintained around the unit to allow for adequate air flow. Each chiller skid is designed to support the entire weight of the chiller through the base frame. Adequate support for the base frame is to be provided while moving and mounting the chiller. Moving or mounting a packaged chiller may be hazardous and should only be attempted by experienced rigging professionals. Where casters are optionally provided, ensure that the casters are locked and sufficiently blocked prior to operation. Also ensure that these chillers are installed on a level surface.

CAUTION!

Be sure to jack up the chiller evenly on all sides to avoid tipping the chiller over. Do not tilt the chiller more than 20° from its own vertical axis while installing.

Plumbing

On air-cooled models, the only plumbing required is that of connecting the water inlet and outlet from the chiller to the equipment intended to use the chilled liquid solution. These connections should be made prior to the addition of liquid to the chiller. If subject to freezing conditions an anti-freeze solution should be used.

Piping the Chiller

Piping to and from the chiller should conform to standard industry practices which fall in line with all applicable local codes. Some considerations about piping the system are material, size, layout, and serviceability. When piping, take care to avoid obstructing the access panel below the piping and the air coil above the piping. Some anti-freeze solutions may not be suitable for use with certain joint compounds or piping products. Consult the manufacturer's information for confirmation prior to piping.

Materials

Many options such as PVC, steel, copper, stainless steel, etc. may be used to pipe the system. Examine the area of installation to determine the best solution. The material should be selected to operate in the environment, with the selected anti-freeze, at the chilled fluid temperatures, using joining techniques approved by the manufacture of said material. Material should also conform to all applicable local codes.

Field Piping Design and Layout

A well designed piping system will provide a more reliable and efficient chiller system.

- Ensure design of piping meets all applicable codes.
- Use material that is not negatively affected by the heat transfer fluid being used.
- Size the piping large enough to ensure an appropriate velocity through the pipe.
- Reduce pressure drops by using as few elbows between the chiller and the process as practical.
- Support the piping according to all applicable codes or standard industry practices.
- Install air eliminators at the highest areas of the piping system.
- Use ball or butterfly valves near the inlet and outlet of the chiller to allow isolation from the rest of the system for servicing.
- Provide vibration dampening devices where necessary.
- Install a serviceable mesh screen strainer in the return line of the chiller to prevent clogging of the evaporator.
- Provide a convenient fill valve for the system and an appropriately sized expansion tank.

Note: When connecting the supply and return lines from the equipment to the chiller inlet and outlet, be sure to use a suitable flexible connector. Do not connect metal to metal to avoid the possibility of sound transmission from running equipment and other connecting equipment.

POTABLE WATER

If liquids other than water (such as glycol, oils, etc.) are used in a chiller system, do not connect permanently to potable water supply

MAXIMUM PRESSURE

If system is to be filled from city water supply, feed through a 10 PSI pressure reducing valve into the return line. Once system is filled, remove pressure reducing valve and feed line. The chiller storage tank is designed for a maximum pressure indicated on the relief valve.

Pipe Insulation

Insulating the piping is important to prevent condensation from forming on the pipes as well as absorbing heat from the surrounding area. The insulation should meet local codes, and conform to standard industry practice. The insulation should provide reliable thermal resistance and a vapor barrier. The thickness and type of insulation to be used depends on the temperature of the coolant fluid in the system along with the installation environment.

Armaflex Sheet/Roll Insulation Thickness Recommendations	Metal Surface Temperature		
	50°F(10°C)	35°F(2°C)	0°F(-18°C)
BASED ON **NORMAL** DESIGN CONDITIONS AP Armaflex in the thicknesses noted and within the specified temperature ranges will control outer insulation surface condensation indoors under **normal** design conditions, a maximum severity of **85°F (29°C) and 70% RH.** Armacell research and field experience indicate that indoor conditions anywhere in the United States seldom exceed this degree of severity.	3/8″ (10mm)	3/4″ (19mm)	1-1/2″ (38mm)

Understanding the Properties of Anti-freeze

Another consideration in pumping design is fluid viscosity and specific gravity. The addition of antifreeze to the system typically causes the fluid to become more viscous, or thicker, directly increasing pump energy requirements. When more anti-freeze is added than is required, the increase in viscosity results in parasitic energy consumption (mentioned previously). Additionally,

antifreeze also adversely affects the specific heat of the fluid, or thermal conductivity. This impedance to heat transfer will degrade system efficiency thus increasing runtime and energy usage. Ensure that the appropriate amount of anti-freeze mixture is used to ensure optimal performance of the chiller system.

Every 5% of concentration of glycol in the chilled system loop, the capacity of the system drops 1%. Refer to the chart for concentration according to the lowest ambient temperature conditions

For example, a system with 60 GPM @ 40ºF:

% Concentration of Glycol	Pressure Drop (PSI)	Pump HP	Loss of Capacity
0	20	1.75	0%
20	22	1.95	5%
50	27	2.35	12%

Gallons of Ethylene Glycol Anti-freeze Required to Lower the Freezing Point of Water in the Storage Tank Only

C-SERIES CHILLER MODEL NO.	STORAGE TANK CAPACITY IN GALLONS	TEMPERATURE						
		+20°F	+10°F	0°F	-10°F	-20°F	-30°F	-40°F
3	15	2.55	3.9	5.25	6.15	6.75	7.65	7.95
5	15	2.55	3.9	5.25	6.15	6.75	7.65	7.95
7	25	4.25	6.5	8.75	10.25	11.25	12.75	13.25
10	50	8.5	13	17.5	20.5	22.5	25.5	26.5
12	50	8.5	13	17.5	20.5	22.5	25.5	26.5
15	70	11.9	18.2	24.5	28.7	31.5	35.7	37.1
20	70	11.9	18.2	24.5	28.7	31.5	35.7	37.1
25	70	11.9	18.2	24.5	28.7	31.5	35.7	37.1
30	70	11.9	18.2	24.5	28.7	31.5	35.7	37.1
35	125	21.25	32.5	43.75	51.25	56.25	63.75	66.25
40	125	21.25	32.5	43.75	51.25	56.25	63.75	66.25
50	165	28.05	42.9	57.75	67.65	74.25	84.15	87.45
60	165	28.05	42.9	57.75	67.65	74.25	84.15	87.45
70	165	28.05	42.9	57.75	67.65	74.25	84.15	87.45
80	250	42.5	65.0	87.5	102.5	112.5	127.5	132.5
100	330	56.1	85.8	115.5	135.3	148.5	168.3	174.9
120	330	56.1	85.8	115.5	135.3	148.5	168.3	174.9
140	330	56.1	85.8	115.5	135.3	148.5	168.3	174.9
180	495	84.15	128.7	173.25	202.95	222.75	252.45	262.35
200	660	112.2	171.6	231	270.6	297	336.6	349.8
240	660	112.2	171.6	231	270.6	297	336.6	349.8
PERCENTAGE ETHYLENE GLYCOL ANTI-FREEZE BY VOLUME		**17%**	**26%**	**35%**	**41%**	**45%**	**51%**	**53%**

Chiller Coolant Charging

A drain/fill valve is located at the bottom of the storage tank. Allow for venting while filling the storage tank. It may be necessary to pump the chiller liquid solution into the storage tank and inter-connecting lines. Care should be taken in selecting the pump for this process. The storage tank is designed for a maximum pressure indicated on the relief valve installed on the storage tank. A sight glass is located on the storage tank for a visual check on chiller liquid level. The storage tank is designed to allow a 2" air cushion at the top of each tank to allow for expansion of the coolant when warm.

POTABLE WATER

If an anti-freeze solution is used in the chiller, do not permanently connect to potable water supply.

AMBIENT FREEZING

Chillers located outdoors should be protected for ambient freeze-up by anti-freeze solution to the lowest outside temperature likely to occur in the area where the chiller is to be installed. Chillers installed indoors should be protected by antifreeze solution to approximately 25°F below the lowest water temperature control setting to be used. Before starting chiller be sure controls are set in accordance with the control setting.

Electrical

The C-Series packaged chiller is engineered for single point electrical connection. All copper conductors should be used when connecting the electrical to the chiller. Electrical connection to the chiller should meet current National Electric Code along with local codes. The C-Series chiller meets or exceeds NEC but may not conform to local codes. Consult your local codes. The machine should be properly grounded and the wire supplying current to the chiller should be heavy enough to handle the chiller load without voltage drop in the line under full load. See nameplate on chiller for minimum circuit ampacity and maximum fuse sizing for electrical supply. All wiring should be installed in accordance with local and national electrical codes.
A disconnect switch should be installed, in sight of the chiller, in the power supply lines. On units ordered with disconnect assembly factory mounted, no further disconnect devices are needed.

Main Power Connection

From the exterior of the chiller, electrical service connection holes have been provided into the main electrical panel. A chase nipple should be used from the exterior panel to the interior electrical box. The main power should connect to the top of the panel mounted disconnect marked L1 through L3, if provided, or directly to the power distribution block.

WARNING!

Failure to provide the correct electrical conductors and wiring could result in component failure and fire.

Failure to follow the prescribed "Main Power Connection" instructions could result in injury or death.

Grounding

An appropriately sized ground must be secured to the Main Ground Lug provided adjacent to the panel mounted disconnect or power distribution block. Ensure that each electrical connection has torque sufficient to resist vibration related loosening. Grounding the chiller should meet current National Electric code along with local codes.

WARNING!

Failure to follow the prescribed "Grounding" instructions may result in erratic operation of the motors and controls of the system or the premature failure of components. Unsafe operation of the system could result in injury or death.

Voltage/ Phase/ Hertz

The C-Series chiller is offered in multiple main power configurations. Ensure that the name plate voltage/ phase/ hertz match the electrical service being provided to the system.

WARNING!

Failure to provide the correct main power configuration to the system may result in severe damage to the system.

Phase Rotation

The C-Series chiller typically utilizes a 3 phase system. Incorrect phasing will result in the motors of the system operating in reverse. Chillers utilizing a scroll or screw style compressor are direction sensitive, and running these compressors in reverse may result in permanent damage to the compressor. Prior to starting the compressor, ensure that the other motors in the system (pumps) are operating in the correct direction. Incorrect phasing can typically be remedied by switching two of the main power legs on the line side of the main power disconnect.

WARNING!

Phasing the system should only be attempted by a qualified electrician as severe injury or death could result.

WARNING!

Operating the system in reverse rotation will result in the failure of the components of the system.

Control Wiring Options

The standard C-Series chiller is configured to allow simple remote operation of the chiller. The control terminal strip provides contacts to operate the “chiller run”, the “pump run”, and an “alarm contact”. Simply provide a normally open relay or switch to these contacts and close the contacts to operate. Consult the wiring diagram for the model of chiller purchased to verify the terminal numbers. These terminals have a factory jumper installed that would be removed if these remote starting options are implemented. You may also optionally purchase switches and/or a remote operating panel in several different configurations from Chiller Solutions. (Consult factory for options and accessories list)

- “**Pump Run Contacts”-** must be closed prior to the compressor starting. A system pump or bypass pump interlock in the compressor control circuit prevents the compressor from operating until the system pump is activated and operating. The

"Chiller Run" contacts, when remotely connected, should close within a few minutes of starting the system pump or could be started simultaneously.

- **"Chiller Run Contacts"-** must be closed for the compressor to begin cooling.

- **"Alarm Contacts"-** will close with suction or discharge pressure safety control lockout. These "dry" contacts can be connected to many different controls to provide the operator or control system information that a safety lockout has occurred. The contacts are rated for 240 volts at 10 amps.

- **"Flow Switch** Contacts**"**- are provided for simple attachment of a coolant flow switch as an option for factory installation or for field attachment. If opened (no flow), these contacts will disable the compressor circuit from operating.

Operation

Start-Up Procedure

CAUTION!

DO NOT TURN DISCONNECT SWITCH TO THE "ON" POSITION UNTIL THE FOLLOWING STEPS HAVE BEEN COMPLIED WITH. UNDERSTAND THE FOLLOWING STEPS BEFORE PROCEEDING WITH UNIT POWER-ON.

1. Ensure that system is completely filled with chiller liquid (water; water/glycol; etc.)
2. Close all gate valves going to the process to be cooled.
3. Turn all compressor and circulator on-off switches to the off position, if applicable.
4. AIR COOLED MODELS ONLY - Check fan blade clearance in venturi to ensure that proper clearance has been maintained and blades are clear.
5. Set all temperature and pressure controls in accordance with the control settings in "*Appendix A*".
6. Open all gate valves on unit that pertain to the recirculation piping.
7. ALL SINGLE PUMP UNITS - Open the by-pass valve located above the circulator in the by-pass line.
8. Place the main power disconnect switch to the "on" position.
9. Turn the by-pass pump to the "on" position and check rotation. Rotation should be in accordance with the direction arrow shown on pump housing. If rotation is incorrect, shut off main power disconnect and interchange two of the three phase wires supplying power to the unit.
10. Unit is now ready for start-up.
    a. Turn disconnect switch to "on" position.
    b. Unit should be left in this position for 12-24 hours to allow time for compressor crankcase heater to boil off any refrigerant liquid that might be in crankcase.
    c. Turn by-pass pump to the "on" position.
    d. Turn compressor on-off switch to the "on" position and compressor will start.

Note: Condenser fans will start modulating once head pressure exceeds 200 PSI. The pressure transducer located on the compressor discharge line provides a 4-20mA signal to a VFD which modulates fan RPM to maintain discharge pressure.

Start-up After Prolonged Shut down

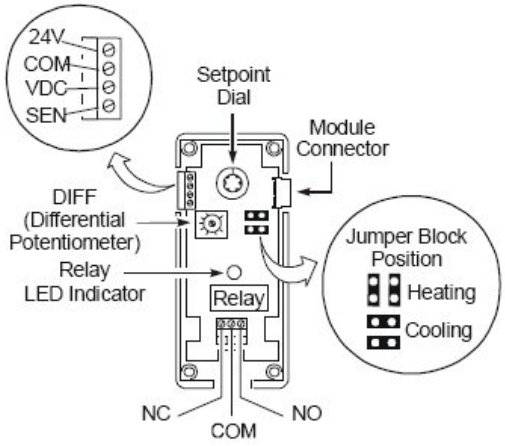
If water temperature in storage tank and lines are high (above 75°F) upon start-up, the compressor may shut off on the high pressure control. This is normal; if it occurs, wait until suction and discharge pressures (as read on pressure gauges) read approximately within 5 PSI of each other, then reset the discharge control. This operation may have to be repeated until the water temperature in the tank reaches a lower temperature.

WARNING!!

Compressor operation without rated coolant fluid flow through the evaporator could result in a freezing condition in the evaporator which could cause a freeze rupture. Closing the By-pass valve on a system that has no other means of by-pass could result in the loss of flow to the evaporator. Ensure that the compressor suction safety cutout device is appropriately calibrated to the chiller operating conditions along with the freeze point of the coolant.

Temperature Control

The refrigeration compressor is controlled based on the temperature of the coolant returning from the process by a model A350 temperature control. The A350 temperature control is an on/off electronic control with a single pole double throw relay output and LED relay status indicator. The temperature control has an adjustable differential and remote temperature sensor. The temperature control has a range of -30°F to 130°F with a differential adjustment range of 1°F to 30°F.



A350A/B Board Layout and Terminal Locations

Set Point Adjustment: Set point is defined as the temperature at which the compressor will be shut off. Use the Set point Dial on the front of the temperature control to adjust the set point. The set point is factory calibrated at mid-scale to a tolerance of +/- 1°F. Set point tolerance at the extreme ends of the set point range in relation to the printed scale may vary as much as +/-3°F

Differential Adjustment: Differential is defined as the required rise in temperature above the set point to start the compressor again. To adjust the differential setting you must remove the front cover by loosening the four captive cover screws. Refer to the diagram for the location of the differential adjustment

Note: The sensing bulb of the water temperature control is located in the evaporator supply line of the chiller and is controlling the operation of the refrigerant compressor based on this temperature. When the sensed temperature reaches set point the compressor is stopped. When the sensed temperature is above set point plus differential, the compressor is started again. The coolant supply temperature may be colder than the set point temperature, this should be considered when selecting your coolant to prevent freeze up conditions.

CAUTION!

Before adjusting set point below 45°F, be sure to check the freeze point of the coolant solution with a hydrometer or refractometer. The coolant solution should contain enough anti-freeze to protect it to 15°F below the temperature control set point.

Refrigerant High/Low Pressure Safety Control

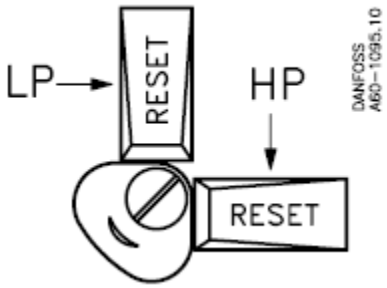
The dual pressure control senses the discharge and suction pressures in the refrigeration circuit.

The high pressure safety control is used to prevent dangerously high pressures from damaging the refrigeration circuit in the event of a system malfunction. The high side of this control comes preset from the factory at 550 PSI, and should not be set higher. The differential is fixed at approximately 60 PSI

The low pressure cut out is used to prevent freezing of the coolant in the evaporator in the event of low suction pressure. If the control trips on low pressure, check the setting of this control and the setting of the temperature control. They should be in accordance with the charts in the "Refrigeration Pressure Safety Control Adjustment" section of this manual. Frequent shutdowns on low suction usually indicate that the machine is low on refrigerant gas. The low pressure safety control is set at the factory to 100 PSI.

Resetting the Pressure Control

The manual reset mechanism is convertible to automatic reset, however this should not be done. Manual reset will avoid damage to the compressor. On equipment with locked out controls, first determine and remedy the cause of the lockout before proceeding. Once the control has tripped, the compressor will not start until the manual reset switches have been pressed.



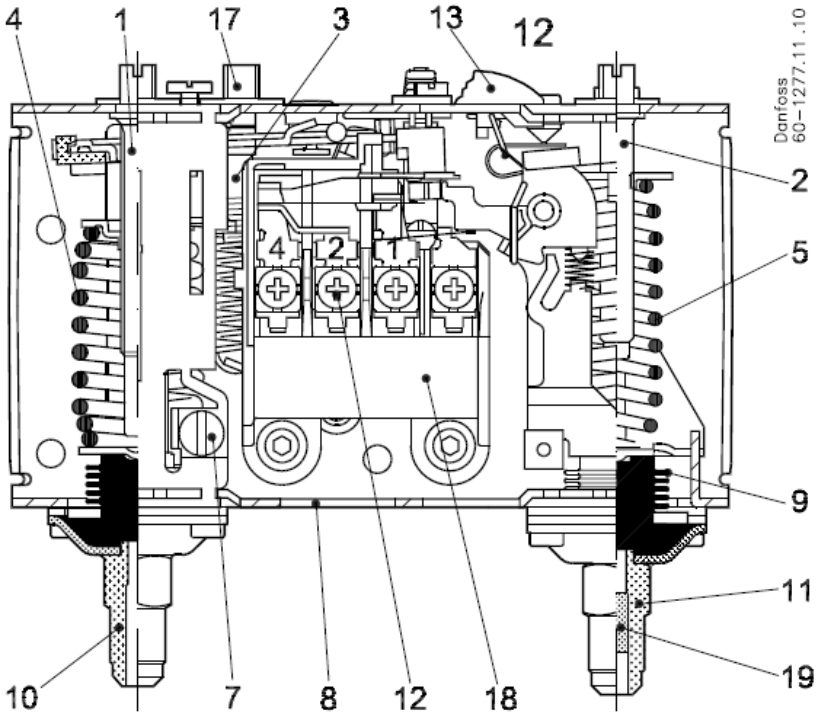
If the lockout is caused by the controls high side cut out, allow the pressure to drop at least 60 PSI below the cut out set point press and release the HP RESET button on the top of the control to restore operation of the chiller.

If the lockout is caused by the controls low pressure cut out, allow the pressure to rise above the cut in set point press and release the LP RESET button on the top of the control to restore operation of the chiller.

Check the troubleshooting guide for possible reasons for this safety control trip prior to reset of the device. This control should not be reset repeatedly as this may cause damage to the chiller. Consult the electrical diagram for more information on impact of the High/Low Pressure Safety Control on the compressor circuit. This control is tested for proper operation during factory testing.

High/Low Pressure Safety Control Diagram

1. Low pressure (LP) setting spindle
2. High pressure (HP) setting spindle
3. Differential
4. Low pressure main spring
5. High pressure main spring
6. Differential spring
7. Ground terminal
8. Cable entry
9. Bellows
10. LP connection
11. HP connection
12. Control terminals
13. Reset button
14. Arm
15. Switch
16. Tumbler
17. Locking plate
18. Contact housing
19. Damping device



High/Low Pressure Safety Control Adjustment

The following guidelines and diagrams illustrate the procedures for adjusting these controls.

Low Pressure Safety Control

The low side of the pressure safety control has a scale that displays the CUT-OUT set point. (See visible scale on left side of control.) Turning the low pressure cut-out adjustment screw clockwise raises the cut out set point. Turning the low pressure cut-out adjustment screw counterclockwise lowers the cut out set point.

High Pressure Safety Control

The high side of the dual pressure control has a scale that displays the CUT OUT set point. (See the visible scale on right side of control.) Turning the high pressure cut-out adjustment screw clockwise raises the cut out set point. Turning the high pressure cut-out adjustment screw counterclockwise lowers the cut out set point.

 **CAUTION!**	*DO NOT ADJUST POINTERS BEYOND THE HIGHEST OR LOWEST INDICATOR MARKS ON THE CONTROL'S PRESSURE SCALE. ADJUSTING POINTERS BEYOND INDICATOR MARKS MAY DAMAGE SCREW THREADS AND CAUSE INACCURATE CONTROL OPERATION.*

CHART 1
CHILLERS INSTALLED INDOORS USING R-410A

COLUMN A	COLUMN B	COLUMN C		COLUMN D
Desired Temperature Control Setting °F	High Pressure Safety Control cut out °F	Low Pressure Safety Control cut out PSI	°F	Minimum Required Freeze Point of Coolant Solution °F
75	550 PSI	103	32	32
70	550 PSI	103	32	32
60	550 PSI	103	32	32
55	550 PSI	103	32	32
50	550 PSI	103	32	32
45	550 PSI	103	32	32
40	550 PSI	99	30	25
35	550 PSI	89	25	20
30	550 PSI	80	20	15
25	550 PSI	72	15	10
20	550 PSI	64	10	5

NOTE: Above figures are for units installed indoors where temperature does not fall below 32 ° F.

CHART 2
CHILLERS INSTALLED OUTDOORS USING R-410A

COLUMN A	COLUMN B	COLUMN C		COLUMN D
Lowest Expected Ambient Temperature °F	High Pressure Safety Control cut out °F	Low Pressure Safety Control cut out PSI	°F	Minimum Required Freeze Point of Coolant Solution °F
30	550 PSI	80	20	15
25	550 PSI	72	15	10
20	550 PSI	64	10	5
15	550 PSI	56	5	0
10	550 PSI	50	0	-5
5	550 PSI	43	-5	-10
0	550 PSI	38	-10	-15
-10	550 PSI	27	-20	-25
-20	550 PSI	19	-30	-35

IMPORTANT!

Chillers to be installed outdoors should be protected against freeze-up to lowest possible temperature likely to occur in the area where chiller is to be installed.

Superheat Adjustment

The superheat can be adjusted using a service wrench. The adjustment screw is located under the hex head seal cap opposite the dome of the power-head.

WARNING!

ONLY A CERTIFIED REFRIGERATION TECHNICIAN SHOULD ATTEMPT TO ADJUST THE SUPERHEAT; VALVES ARE FACTORY-SET TO A SPECIFIC SUPERHEAT. IF ADJUSTMENT IS NEEDED REFER TO INSTRUCTIONS BELOW FOR PROPER PROCEDURE. IMPROPER ADJUSTMENT MAY RESULT IN VALVE MALFUNCTION AND/OR SYSTEM DAMAGE.

Expansion valves are factory-set. However, the superheat can be adjusted if needed. To properly adjust the thermal expansion valve to other superheat settings:

1. Remove adjustment seal cap on the thermal expansion valve.
2. Turn the adjusting stem in a clockwise direction to increase the super heat, and counter clockwise to decrease. Allow adequate time between adjustments for system to stabilize before re-checking superheat.
3. When the desired superheat is achieved, reinstall the seal cap.

Refrigerant Pressure Temperature Chart

Refrigerant-410A

Bold Indicates Vacuum in Inches of Mercury

°F	PSIG	°F	PSIG	°F	PSIG	°F	PSIG
-50	5.8	2	52.5	54	155.6	106	348.5
-48	6.9	4	55.2	56	161.1	108	358.3
-46	8.0	6	58.0	58	166.7	110	368.2
-44	9.2	8	60.9	60	172.5	112	378.3
-42	10.4	10	63.9	62	178.5	114	388.7
-40	11.7	12	67.0	64	184.5	116	399.2
-38	13.0	14	70.2	66	190.7	118	410.0
-36	14.4	16	73.4	68	197.1	120	420.9
-34	15.9	18	76.8	70	203.6	122	432.1
-32	17.3	20	80.2	72	210.3	124	443.5
-30	18.9	22	83.8	74	217.1	126	455.1
-28	20.5	24	87.4	76	224.0	128	466.9
-26	22.2	26	91.2	78	231.1	130	478.9
-24	23.9	28	95.1	80	238.4	132	491.2
-22	25.7	30	99.0	82	245.9	134	503.7
-20	27.5	32	103.1	84	253.3	136	516.4
-18	29.4	34	107.3	86	261.2	138	529.4
-16	31.4	36	111.6	88	269.2	140	542.5
-14	33.5	38	116.0	90	277.3	142	556.0
-12	35.6	40	120.5	92	285.5	144	569.6
-10	37.8	42	125.1	94	294.0	146	583.6
-8	40.0	44	129.9	96	302.6	148	597.7
-6	42.4	46	134.8	98	311.4	150	612.1
-4	44.8	48	139.8	100	320.4		
-2	47.3	50	144.9	102	329.6		
0	49.8	52	150.2	104	339.0		

Troubleshooting Guide

ISSUE	POSSIBLE CAUSE	SUGGESTED REMEDY
UNIT WILL NOT START	1. Main circuit breaker tripped	1. Reset breaker
	2. Main disconnect—blown fuse	2. Check and replace fuse
	3. Power lines loose at terminal or broken wire	3. Replace or repair wiring
COMPRESSOR WILL NOT START	1. Compressor fuses blown	1. Replace fuses
	2. Faulty wiring	2. Check for loose connection or broken wire
	3. Control not set in accordance with chart	3. See charts in "*High/Low Pressure Safety Control*" section of this manual
	4. On-Off switch defective	4. Replace
	5. Defective temperature control	5. Replace control
	6. Defective suction-discharge control	6. Replace control
	7. Defective freeze-up protection control	7. Replace control
	8. Defective oil pressure control	8. Replace control
	9. Compressor external overload protector defective	9. Replace overload
	10. Defective internal overload protector or sensor	10. Replace compressor
	11. Defective control module on compressor (solid state protection model compressors only)	11. Replace module
	12. (Optional) High temperature lock-out control tripped	12. Reset control
	13. Grounded compressor	13. Replace compressor
	SINGLE PHASE COMPRESSORS	
	14. Defective capacitor relay	14. Replace relay
	15. Defective start or run capacitor	15. Replace capacitor
SYSTEM OR BY-PASS PUMP WILL NOT START	1. Faulty wiring	1. Check for loose or broken wires
	2. Defective contactor	2. Replace contactor
	3. Pump fuses blown	3. Replace fuses
	4. Defective On-Off switch	4. Replace switch
	5. Defective motor internal overload	5. Replace motor
	6. Mechanical shaft seizure	6. Replace pump assembly
	SINGLE PHASE MOTORS	
	7. Defective motor capacitor	7. Replace capacitor
FAN WILL NOT START	1. Faulty wiring	1. Check for loose or broken wires
	2. Defective contactor	2. Replace contactor
	3. Fan fuse blown	3. Replace fuses
	4. Defective motor internal overload	4. Replace motor
	5. Mechanical shaft or bearing seizure	5. Replace or repair shaft or bearings
	6. Loose or broken fan belt	6. Tighten or replace belt
	HEAD PRESSURE CONTROL MODELS	
	7. Defective pressure staging switch	7. Replace switch

ISSUE	POSSIBLE CAUSE	SUGGESTED REMEDY
COMPRESSOR GOES OFF ON HIGH PRESSURE DURING NORMAL EQUIPMENT OPERATION	**AIR COOLED**	
	1. Dirty condenser	1. Clean
	2. Fan motor fuses blow	2. Replaces fuse
	3. Fan motor fails	3. Replace motor
	4. Fan motor belt failure	4. Replace belt
	5. Fan shaft or bearing seizure	5. Replace or repair shaft or bearing
	6. Exhaust duct clogged	6. Remove and clean
	7. Filter drier clogged	7. Replace drier
	8. Restriction in refrigerant lines	8. Find restriction and correct
	9. Air intake to condenser restricted	9. Remove restriction
	10. Control setting too low	10. Set in accordance with chart in "*High/Low Pressure Safety Control*" section of this manual
	11. Exhaust air inhibited	11. Ensure proper clearance of unit.
	WATER COOLED	
	11. Shortage of coolant to condenser	11. Increase feed
	12. Defective water regulating valve	12. Replace valve
COMPRESSOR GOES OFF ON LOW SUCTION CONTROL	1. Control settings incorrect	1. Set in accordance with charts in "*High/Low Pressure Safety Control*" section of this manual
	2. Pump failure	2. See "Pump Will Not Start" section
	3. Low on refrigerant	3. Check for leaks, repair and recharge
	4. Low on coolant solution	4. Add additional solution
	5. Coolant filter screens on equipment being cooled clogged	5. Remove, clean, and reinstall screens
	6. Restriction in refrigerant lines	6. Find restriction and correct
COMPRESSOR GOES OFF ON OIL PRESSURE	1. Low on oil	1. Check level and add oil
	2. Oil restrainer clogged	2. Remove, clean and reinstall
	3. Oil pump defective	3. Replace oil pump
	4. Defective oil pressure control	4. Replace oil pressure control
	5. Faulty wiring to resistors in oil pressure control	5. Trace wiring in accordance with electrical schematic
	6. Erratic expansion valve	6. Check for dirt on seat of valve, clean and reinstall, replace if defective
COMPRESSOR GOES OFF ON FREEZE-UP PROTECTION	1. Control setting wrong	1. Set in accordance with charts in "*High/Low Pressure Safety Control*" section of this manual
	2. Pump failure	2. See "Pump Will Not Start" section
	3. Low on refrigerant	3. Check for leak, repair, and recharge
	4. Low on coolant solution	4. Add additional solution
	5. Coolant filter screens on equipment being cooled clogged	5. Remove, clean and reinstall
	6. Restriction on refrigerant lines	6. Find restriction and correct
	7. Faulty wiring to resistors on oil pressure control	7. Trace wiring in accordance with electrical schematic
COMPRESSOR RUNS CONTINUOUSLY REGARDLESS OF LOADING CONDITIONS	1. Low on refrigerant charge	1. Check for leaks, repair and recharge
	2. Defective low pressure control	2. Replace control

ISSUE	POSSIBLE CAUSE	SUGGESTED REMEDY
	3. Defective solenoid valve (will not pump down)	3. Replace valve
	4. Leaky compressor valves	4. Replace valve plates
COMPRESSOR SHORT CYCLES	1. Low on refrigerant	1. Check for leaks, repair and recharge
	2. Liquid line solenoid valve not holding (Model CC-20 Ton and up)	2. Remove, inspect for particles on seat, clean and reinstall, replace if defective
	3. Discharge valve leaking on compressor	3. Replace valve plates
	4. Compressor has ruptured internal safety relief valve	4. Replace valve
	5. Cut-in and cut-out on suction pressure control set too close	5. Set in accordance with charts in "*High/Low Pressure Safety Control*"

Warranty

1. Specific Legal Rights.
This limited warranty gives you specific legal rights, and you may also have other rights which may vary from state to state. Some states do not allow limitations of how long an implied warranty lasts and some states do not allow the exclusion or limitation of incidental or consequential damages, so the limitations and exclusions herein may not apply to you.

2. Limited Warranty.
Manufacturer warrants that the Products sold hereunder will be free from defects in material and workmanship for a period of one year from the date of purchase from Manufacturer, which period shall not exceed one year and six months from the actual date of manufacture. If the Products do not conform to this Limited Warranty during the warranty period (as herein above specified), Buyer shall notify Manufacturer in writing of the claimed defects and demonstrate to Manufacturer's satisfaction that said defects are covered by this Limited Warranty (such as through Buyer's return to Manufacturer of the claimed defective part(s), upon authorization by Manufacturer). If the defects are properly reported to Manufacturer within the warranty period, and the defects are of such type and nature as to be covered by this warranty, Manufacturer shall, at its own expense, furnish replacement parts for the defective Product or, at Manufacturer's sole option through written notification to Buyer, replacement Product. Shipping and installation of any return or replacement parts shall be at Buyer's expense.

3. Other Limits.
THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Manufacturer does not warrant against damages or defects arising out of improper or abnormal use or handling of the Products; against defects or damages arising from improper installation (where installation is by persons other than Manufacturer), against defects in products or components not manufactured by Manufacturer, or against damages resulting from such non-Manufacturer made products or components. Manufacturer passes on to Buyer the warranty it received (if any) from the maker thereof of such non-Manufacturer made products or components. This warranty also does not apply to Products upon which repairs have been effected or attempted by persons other than pursuant to written authorization by Manufacturer. The sale of Products to any third party are conditioned by the heretofore listed exclusions and limitations and as a condition of sale to said third party.

4. Exclusive Obligation.
THIS WARRANTY IS EXCLUSIVE. The sole and exclusive obligation of Manufacturer shall be to repair or replace the defective Products in the manner and for the period provided above. Manufacturer shall not have any other obligation with respect to the Products or any part thereof, whether based on contract, tort, strict liability or otherwise. Under no circumstances, whether based on this Limited Warranty or otherwise, shall Manufacturer be liable for incidental, special, or consequential damages. The maximum liability incurred by Manufacturer under terms of this warranty or for return of alleged defective product shall be the actual original Buyer's purchase price from Manufacturer of said product.

5. Other Statements.
Manufacturer's employees or representatives' ORAL OR OTHER WRITTEN STATEMENTS DO NOT CONSTITUTE WARRANTIES, shall not be relied upon by Buyer, and are not a part of the contract for sale or this limited warranty.

6. Entire Obligation.
This Limited Warranty states the entire obligation of Manufacturer with respect to the Products. If any part of this Limited Warranty is determined to be void or illegal, the remainder shall remain in full force and effect.

7. Extended Service Option.
Manufacturer may offer Buyer a third party Limited Parts and/or Service Agreement for an additional charge which can extend certain product(s) protection to Buyer beyond the Limited Warranty period above. Contact Manufacturer for the current details.

Effective for Products Manufactured from March 1, 2004.

Factory Test Data

DATE: 7/13/2009 **MODEL:** CF-07-A-1ZB3 **SERIAL#:** 097771

ELECTRICAL 460 Volt 3 Phase 60 Hz

Coolant System Fluid:

Type: Water — Specific Heat: 1

Concentration: 100% — Specific Gravity: 1

Freeze Point: 32°F

Refrigeration System Refrigerant Type: R-410A Charge: 11 LBS

	Run 1 9:45 AM		Run 2 10:15 AM		Run 3 10:45 AM	
Suction Pressure	102	PSI	107	PSI	109	PSI
SST	33	°F	34	°F	35	°F
Suction Line Temp.	42	°F	44	°F	45	°F
Suction Superheat	9	°F	10	°F	10	°F
Discharge Pressure	396	PSI	398	PSI	398	PSI
SDT	116	°F	116	°F	116	°F
Discharge Line Temp.		°F		°F		°F
Discharge Superheat		°F		°F		°F
Liquid Line Temp.		°F		°F		°F
Subcooling		°F		°F		°F
Ambient Temp.	70	°F	70	°F	70	°F
Coolant Entering Temp.	48	°F	51	°F	52	°F
Coolant Leaving Temp.	45	°F	48	°F	49	°F
Tested Heat Load	67900	BTU/H	67900	BTU/H	67900	BTU/H
	5.7	Tons	5.7	Tons	5.7	Tons

Pressure Controls Setttings: Low Side 100 PSIG High Side 550 PSIG

Electrical

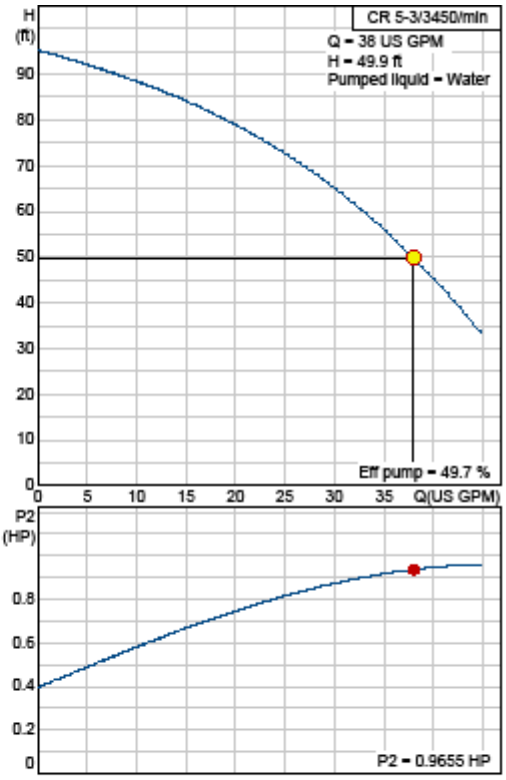
Hypot Test 1 Minute @ 1.96k Volt 1.03 MA Result: PASS

Voltages L1-L2 473 L1-L3 474 L2-l3 470 Control Voltage 25.4

	Run 1 9:45 AM				Run 2 10:15 AM				Run 3 10:45 AM			
	L1	L2	L3		L1	L2	L3		L1	L2	L3	
Compressor 1	11.8	10.8	10.7	Amps	11.8	10.8	10.4	Amps	11.9	10.7	10.4	Amps
System Pump	1.7	1.6	1.8	Amps	1.7	1.6	1.6	Amps	1.7	1.7	1.6	Amps
Bypass Pump	1.4			Amps	1.4			Amps	1.3			Amps
Condenser Fan Hz		30.4		Hz		30.4		Hz		30.7		Hz
Condenser Fan Output	3.3	3.4	3.1	Amps	3.4	3.4	3.2	Amps	3.3	3.4	3.2	Amps
Unit Total	14.3	13.5	13.2	Amps	14.1	13.5	13	Amps	14.3	13.6	12.9	Amps

System Pump Information

Description	Value
Product name:	CR 5-3 A-B-A-E HQQE
Product Number:	96084099
EAN number:	5700395189377
Technical:	
Speed for pump data:	3484 rpm
Rated flow:	30.38 US GPM
Rated head:	61 ft
Impellers:	3
Type of shaft seal:	HQQE
Approvals on nameplate:	NEMA
Stages:	3
Pump version:	A
Model:	A
Cooling:	TEFC
Materials:	
Material, pump housing:	Cast iron EN-JL1030 DIN W.-Nr. 25 B ASTM
Material, impeller:	Stainless steel 1.4301 DIN W.-Nr. 304 AISI
Material code:	A
Code for rubber:	E
Installation:	
Maximum ambient temperature:	104 °F
Max pressure at stated temp:	232 / 250 psi/°F 232 / -4 psi/°F
Standard, pipe connection:	OVAL
Connect code:	B
Size, pipe connection:	1 1/4" NPT
Flange size for motor:	56C
Liquid:	
Liquid temperature range:	-4 .. 248 °F
Electrical data:	
Motor type:	71BB
Number of poles:	2
P2:	1 HP
Power (P2) required by pump:	1 HP 1 HP
Mains frequency:	60 Hz
Rated voltage:	3 x 208-230 / 460 V
Service factor:	1,25
Rated current:	3.25-3.35 / 1.68 A
Starting current:	590-650 %
Cos phi - power factor:	0.81-0.72
Rated speed:	3430-3460 rpm
Enclosure class (IEC 34-5):	IP55
Insulation class (IEC 85):	F
Motor protection:	NONE
Motor Number:	85900703
Others:	
Net weight:	51.2 lb
Gross weight:	56.7 lb
Shipping volume:	1.77 ft³



Condenser Fan VFD Settings

Telemecanique Variable Frequency Drive Settings

Project:	CF-07-A-1ZB3 Oak Gloves		
Serial #:	097771		
Motor/Drive:	Condenser Fans / ATV31HU22N4		
HP	2 * 0.75 = 1.5 HP	Voltage	460
RPM	1140	Amperage	2 * 2.0 = 4 Amps
Power Factor	.78	Service Factor	1

Settings Menu - SET	
LSP	0.0
HSP	60.0
ITH	4.0

Drive Control Menu - DRC	
BFR	60
UNS	460
FRS	60
NCR	4.0
NSP	1140
COS	.78
UFT	L

I/O Menu - I/O	
TCC	2C
TCT	LEL
RRS	NO
CRL3	11.8
CRH3	15.0
R1	FLT
R2	NO

Control Menu - CTL	
FR1	AI3