

Packaged Glycol Chiller Systems

Operation Manual





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1 Preface

This manual is intended to be used in conjunction with Pro Refrigeration, Inc Chiller Systems

This manual will guide you through the process of installing, commissioning, and maintaining your Pro Chiller System.

Receiving & Unloading

Before signing the Bill of Lading please complete the following:

- Check Service Panels for Damage
- Confirm positive pressure on refrigerant pressure gauges.
- Remove from service panels and visually inspect all piping for broken and or cracked lines.

Please note any obvious, or potential damage on bill of lading prior to signing. Contact Pro Refrigeration, Inc immediately 800-845-7781 to report any damage.

Manufactured By:

Pro Refrigeration, Inc.

Pro Refrigeration is located in Auburn WA. Auburn is located 30 miles from Seattle, WA in the shadow of Mt. Rainier.

Physical Address:
326 8th ST SW
Auburn, WA 98001

www.prochiller.com

Mailing Address:
PO BOX 1528
Auburn, WA 98071-1528

Telephone: 253-735-9466
Fax: 253-735-2631

Customer Service

Please feel free to contact customer service with any questions pertaining to this or any other Pro Refrigeration, Inc product.

Customer Support Hours:

Monday-Friday

7am-5pm (Pacific Standard Time)

Telephone: 253-735-9466

Fax: 253-735-2631

Email: service@prorefrigeration.com



Warnings & Cautions:

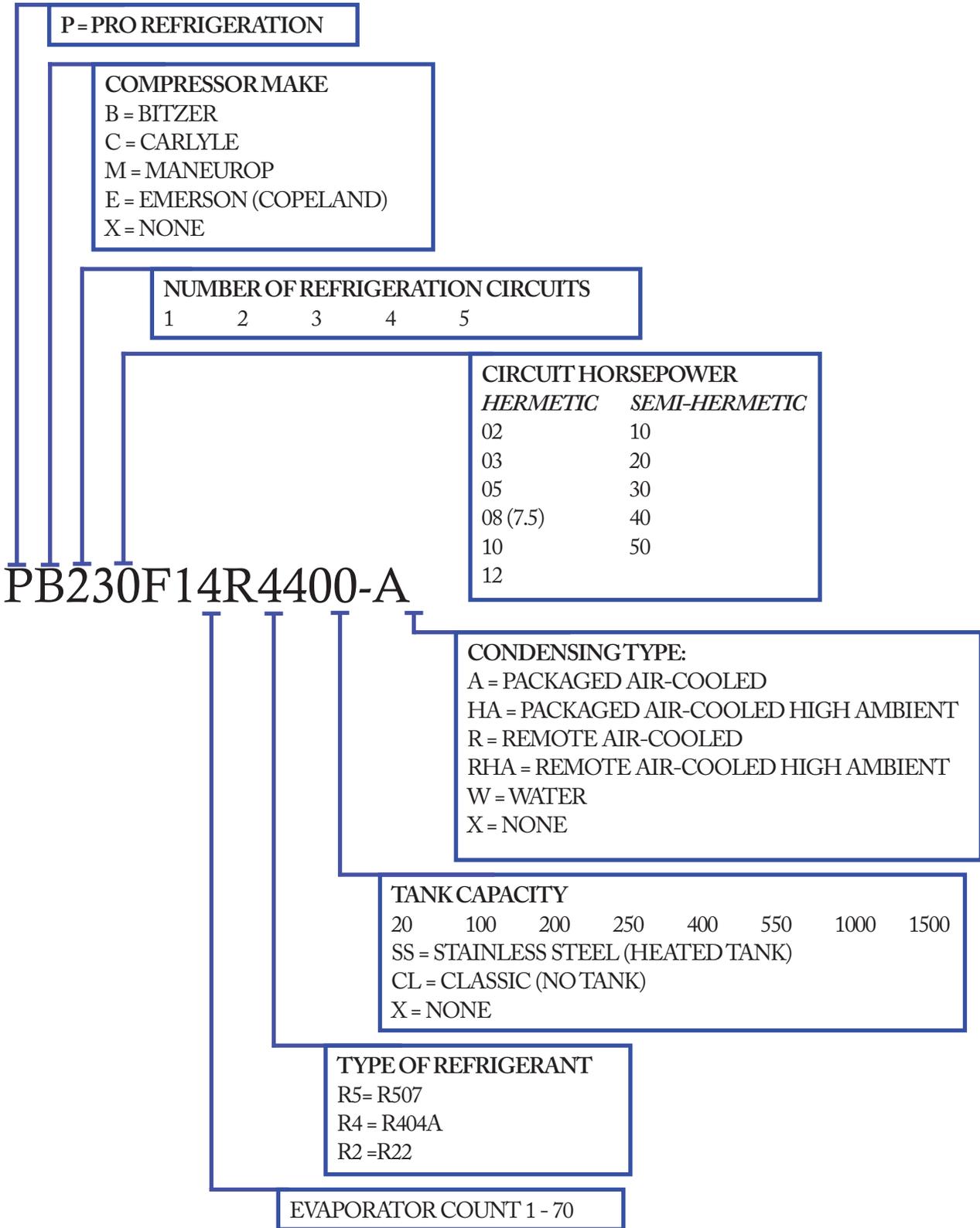
Throughout this manual warnings & cautions will be issued containing pertinent information regarding the safety of you and/or your equipment. These messages will be accompanied by the following symbols:

 **Warning**

 **Caution**



Pro Chiller Model Number Identification





SYSTEM OVERVIEW

The following list of components are standard on all of our chiller systems. We offer a wide selection of compressors and condensing units that are incorporated with these components to produce one of the most efficient chiller systems available. A brief summary of the common Packaged Chiller Components:

ELECTRICAL CONTROL PANEL

All of our chillers are equipped with a control panel with an ETL listing approval. All of the components are wired to the National Electrical Code guidelines. There is no internal wiring required on our standard systems. An electrician must simply supply the chiller with main power service. If chiller is purchased without a main electrical disconnect switch, most local electrical codes will require one to be installed adjacent to the chiller control panel.

GLYCOL STORAGE TANK

All standard models of chillers are supplied with an insulated glycol storage tank. Our glycol tanks are constructed of fiberglass, stainless steel, or polyethylene.

SPIRAL DRUM EVAPORATOR

Our high efficient U.L. Listed evaporator counter flows liquid refrigerant with the chilled glycol water. The internal finned copper tubing offers 3.7 times the surface area of standard smooth copper tubing. By manifolding the evaporators together, we can maximize the efficiency of the heat exchanger surface area. We offer a 5 year replacement warranty for the evaporator. The warranty does not cover failures due to internal freezing of evaporators.

REFRIGERATION EQUIPMENT

We use only the highest quality refrigeration components available. All of our components meet industry standards and are easily sourced for maintenance and repair. On our packaged systems, all of the refrigerant piping is factory installed. The system is charged with refrigerant and functionally tested prior to shipment.

GLYCOL CIRCULATION & PROCESS PUMPS

CIRCULATION PUMP

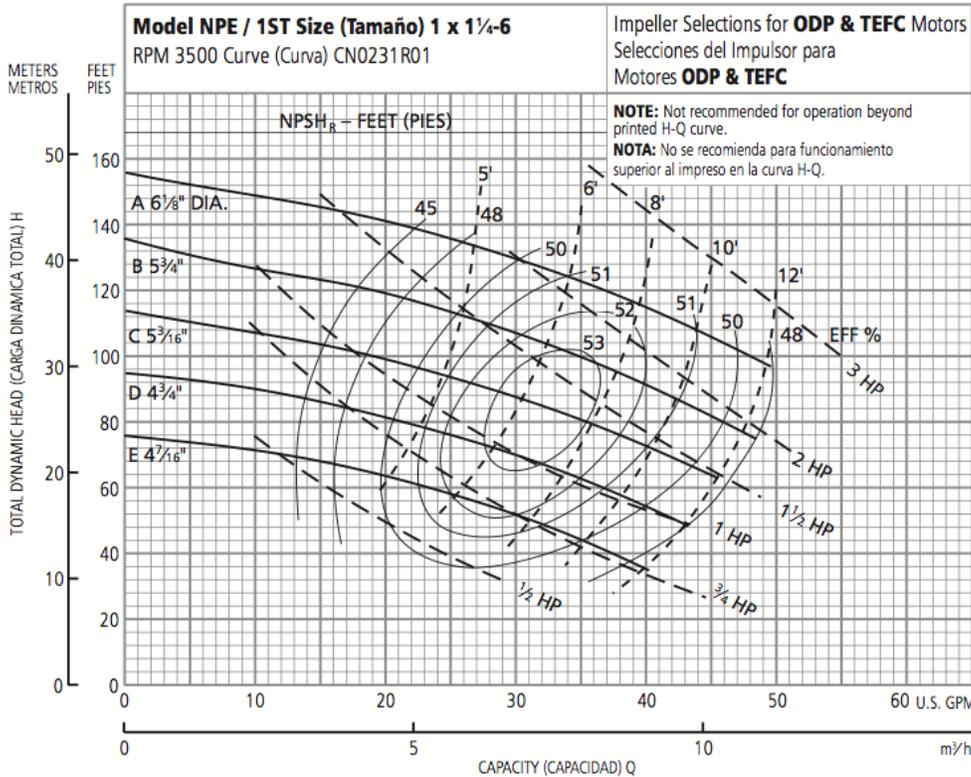
- This stainless steel centrifugal pump is designed to circulate whenever a cooling demand exists. The circulation pump transfers glycol from the storage tank through the evaporator chiller drum and back into the glycol tank. The chiller system is controlled so the system will not operate unless the circulation pump is running .

PROCESS PUMP

- This stainless steel pump is specified to supply your process load with chilled glycol. The process pump takes the chilled glycol from the tank, to the process cooling application, and returns it to the glycol storage tank. This pump does not need to be running in order for the chiller to operate. Our smaller ChilStar chiller systems do not have a glycol process pump, we utilize a single pump for supplying the glycol to the plant as well as circulate to the evaporator.



PUMP CURVES SUPPLIED BY PUMP SERIES

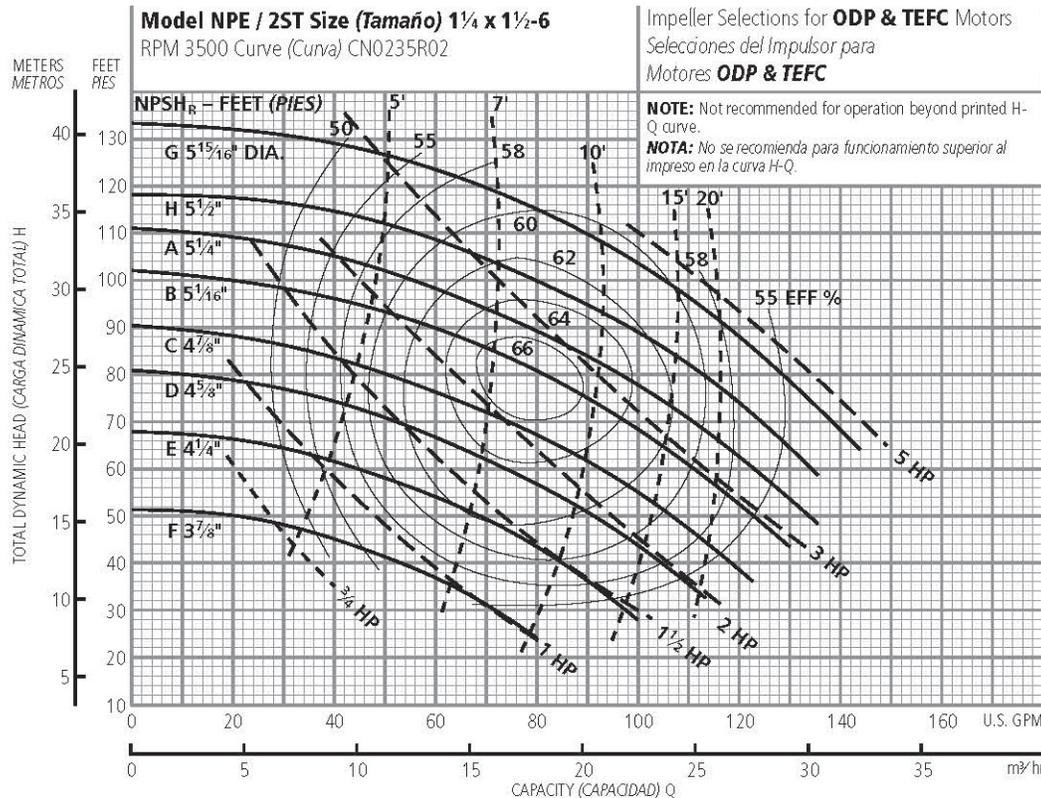


1ST Series Pump Curve

Ordering Code, Código de Pedido	Standard HP Rating, Estándar HP Potencia	Imp. Dia.
E	1/2	4 7/16"
D	3/4	4 3/4"
C	1	5 3/16"
B	1 1/2	5 3/4"
A	2	6 7/8"

NOTE: Although not recommended, the pump may pass a 1/16" sphere.

NOTA: Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".

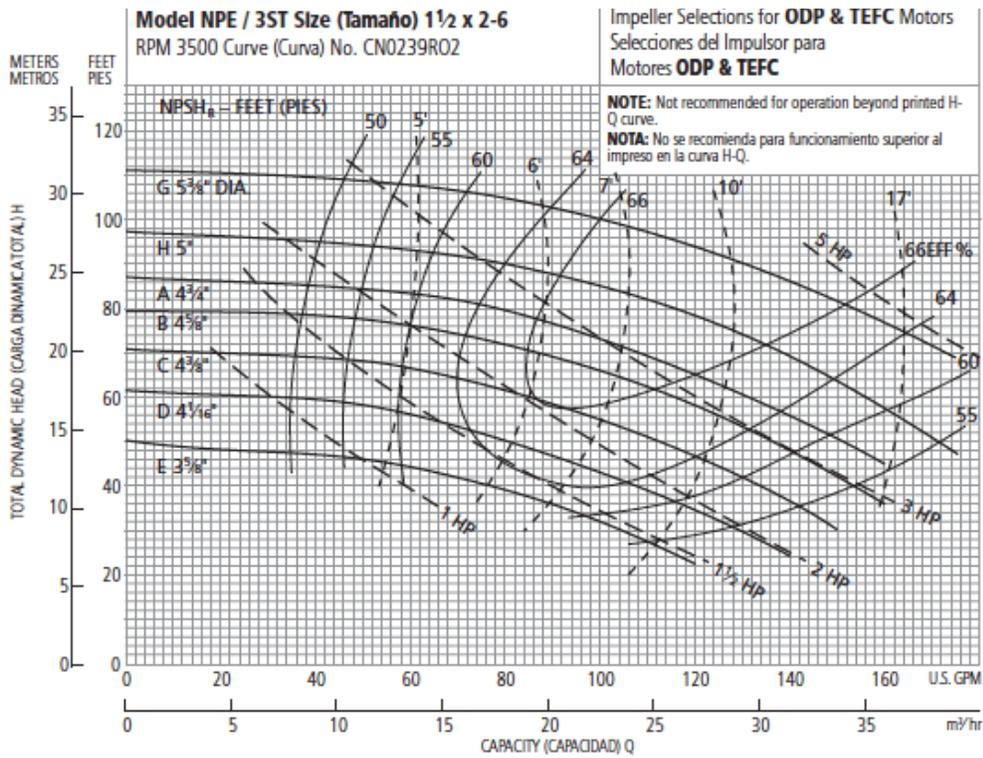


2ST Series Pump Curve

Ordering Code, Código de Pedido	Standard HP Rating, Estándar HP Potencia	Imp. Dia.
F	3/4	3 7/8"
E	1	4 1/4"
D	1 1/2	4 5/8"
C	2	4 7/8"
B	3	5 1/16"
A	3	5 1/4"
H	5	5 1/2"
G	5	5 15/16"

NOTE: Although not recommended, the pump may pass a 3/16" sphere.

NOTA: Si bien no se recomienda, la bomba puede pasar una esfera de 3/16".

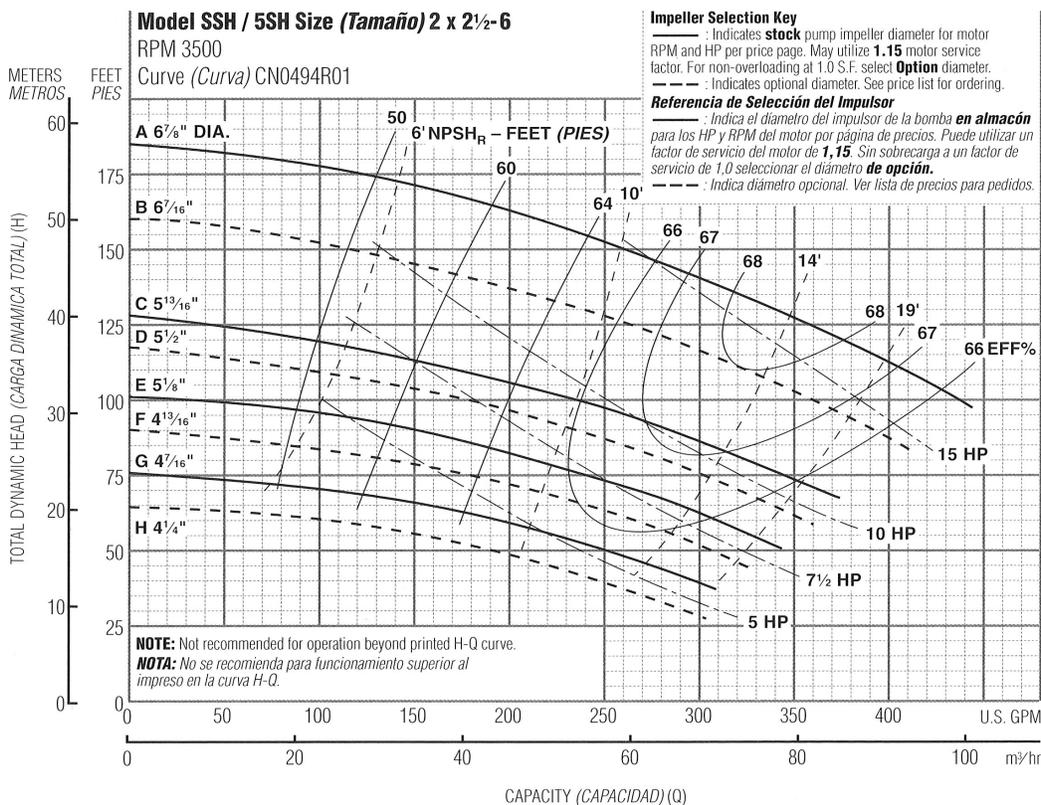


Ordering Code, Código de Pedido	Standard HP Rating, Estándar HP Potencia	Imp. Dia.
E	1	3 ⁵ / ₈ "
D	1½	4 ¹ / ₁₆
C	2	4 ³ / ₈
B	3	4 ⁵ / ₈
A	3	4 ³ / ₄
H	5	5
G	5	5 ³ / ₈

NOTE: Although not recommended, the pump may pass a 1¹/₃₂" sphere.

NOTA: Si bien no se recomienda, la bomba puede pasar una esfera de 1¹/₃₂".

3ST Series Pump Curve



Optional Impeller, Impulsor Opcional

Impeller Code, Código del Impulsor	Dia., Diá.	Motor HP, HP del motor
A	6 ⁷ / ₈ "	15
B	6 ¹ / ₁₆	15
C	5 ¹³ / ₁₆	10
D	5 ¹ / ₂	10
E	5 ¹ / ₈	7½
F	4 ¹³ / ₁₆	7½
G	4 ⁷ / ₁₆	5
H	4 ¹ / ₄	5

NOTE: Pump will pass a sphere to 5/32" diameter.

NOTA: La bomba pasará una esfera a 5/32" diámetro.

5SH Series Pump Curve



INSTALLATION, OPERATION, & MAINTENANCE INSTRUCTIONS

RECEIVING AND INSPECTION

Immediately upon receiving shipment, equipment should be inspected for evidence of any damage received in transit. If shipping damage has occurred, a claim should be made with the transportation company, and your equipment representative should be advised of the nature of the damage.

Equipment should be inspected for compliance with original order acknowledgment (equipment model numbers, voltage, refrigerant, etc.).

SETTING EQUIPMENT

When choosing a location for chiller, the following items should be considered:

- a.) Front and sides of chiller have available service area.
- b.) Electrical enclosure is visible for viewing alarm/indicator lights.
- c.) Chiller should be located as close to process cooling application as possible.
- d.) Availability of electrical power.
- e.) Availability of city (well) water for water cooled condensing. (As applicable)
- f.) Adequate air flow for air cooled condensing. The condenser must be at least 48" away from any obstruction
- g.) Level surface to mount unit.

PIPING

1. All piping must be in accordance with applicable local and state codes.
2. Refrigerant piping should be designed and installed in accordance with recommended practices outlined in ARI or ASHRAE piping guide.
3. Water piping (for water cooled condensers) should be installed to meet application requirements. Keep in mind that condenser barrels may need to be cleaned, all piping should have unions to enable end cap to be removed from condenser. Any piping exposed to freezing ambient conditions should be insulated.
4. Water piping (chilled water) should be installed to meet application requirements. Properly size chilled water process piping to insure that flow is not restricted due to extreme line pressure. It is recommended that chilled water piping be ran in either of the following materials: industrial ABS, copper, or stainless steel. It is not advised to run chilled water piping in galvanized or black-iron pipe (unless you are using a glycol with rust inhibitors), the propylene glycol will erode the pipe and could also cause bacteria problems. Glycol piping should be insulated to prevent condensation.
5. Check all chilled cooling application process piping for leaks prior to adding glycol solution.
6. Circulate water (without glycol) through process piping system and check for leaks.



7. Remove any piping debris, flushed from tank and process piping. Do not turn the chiller switch on until all debris has been removed from the system.

WIRING

1. Select or install an adequate electrical service to handle chiller load. Service must comply with all applicable electrical codes. Refer to the MCA (Minimum Circuit Ampacity) rating recorded on the blue chiller identification label in your chiller's electrical control panel.
2. If not factory installed, an electrical disconnect switch should be installed adjacent to chiller control panel.
3. After electrical service has been properly connected to the chiller, chiller should be energized for at least 24 hr. to allow crankcase heaters to boil out any liquid refrigerant which may have migrated to compressor during shipment.
4. Check all motors for proper rotation. Pump motors must rotate clockwise when inspected from motor end (the end where wire connections are made). To change pump motor rotation, reverse the L1 with L3 power wires. Compressors can operate in either rotation, unless noted on compressor housing.

SYSTEM EVACUATION *(for remote air cooled condensers or remote condensing units)*

1. With refrigeration piping completed and pressure checked, the system is ready for evacuation. Do not use compressor to evacuate system. A quality vacuum pump capable of a 350 micron evacuation is necessary for adequate and dependable system vacuum. Moisture and contaminants in the system not removed by proper evacuation can cause corrosion on compressor windings, expansion valve freeze-up, oil sludge, and high discharge pressures.
2. Attach vacuum pump to low and high side of system through compressor service valves and evacuate to 350 microns. A micron reading device is necessary to ensure that no moisture or contaminants are present before system is charged with refrigerant. NOTE: All of the remote air cooled and remote condensing unit chillers leave the factory with a dry nitrogen holding charge. If system is not pressurized on arrival, re-pressurize with dry nitrogen and leak check system before beginning the refrigeration piping installation.

SYSTEM CHARGING

1. With system evacuated to 350 microns or less, chiller is ready to be charged with refrigerant. All charging lines, hoses and manifolds must be purged with refrigerant to prevent non condensable from being introduced to system.
2. Connect charging line to liquid line access fittings and admit liquid refrigerant into system until flow stops due to pressure equalization between cylinder and system.
3. Connect charging line to suction fitting up stream of accumulator and admit vapor into low side of system.
4. Energize equipment to the refrigeration circuit and continue to admit vapor into low side of system until refrigerant liquid line sightglass clears. (It may be necessary to defeat low pressure freeze control on initial start-up to prevent nuisance cycling of compressor until pressure is above low pressure cut out set point).



PRE START-UP CHECK LIST

- All Electrical Connections are tight, these may loosen during shipment
- Main Disconnect Energized for 24Hr. to allow Crankcase Heater to boil any liquid refrigerant out of crankcase.
- Field Process Piping has been leak checked
- VOLTAGE on Chiller System matches customer supplied VOLTAGE
- Glycol / Water Solution freeze point is at least 20 F. (11 C.) below T-Stat Setpoint
- Glycol Pump Motors Rotation is CLOCKWISE when viewed from motor end
- Glycol Storage Tank is at least 80% Full
- Pressure Bypass Valve tested. To test, Close a valve on the Glycol Supply and visually check for return flow into storage tank.
- Chiller location allows adequate air flow to and from Air Cooled Condenser. (Air Cooled Only)
- Adequate water supply provided to Water Cooled Condenser (Water Cooled Only)

CHILSTAR & MA SERIES CHILLER QUICK START GUIDE

The quick start guide is designed to be used in conjunction with a Pro Chiller System. As such, this guide assumes that all that all electrical and mechanical devices are in the condition provided by the factory.



Please use the services of a licensed and skilled refrigeration technician for chillerstart-up.



Contact Pro Technical Services with any questions or concerns at 800-845-7781



CAUTION Refrigeration ball valves are shipped from the factory in the closed position. Prior to operation adjust valves to the open position.



WARNING Verify that all external power sources have been removed before servicing

STEP 1

Adequate clearance is required around the unit to provide air flow. Ideally you want at least 48" clearance around all four sides of the system. Chiller systems located indoors require adequate ventilation to insure efficient operation. Contact the Factory with any questions about chiller location and placement.

Power must be supplied to chiller electrical panel. Check your local electrical codes, it is likely an electrical disconnect/safety switch will need to be located near the chiller system. Check name plate or manual for electrical power supply requirements.



STEP 2

Open Electrical Panel and make sure all electrical connections are tight. These connections may loosen during shipment. Loose connections can cause motor failures.

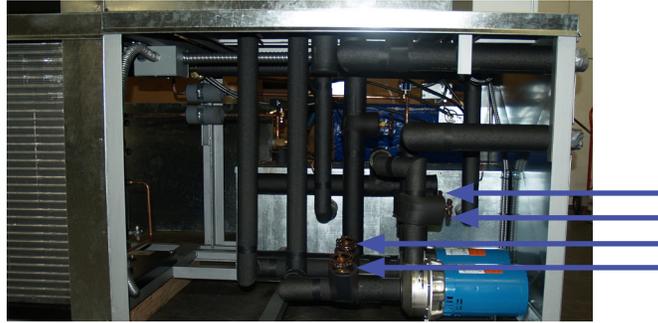


WARNING Do not turn on main power to the chiller system until all of the electrical connections are confirmed to be tight.



STEP 3

Remove Front and Side Service Panels as applicable. Open both of the glycol Valves by turning the handles counter clockwise.



STEP 4

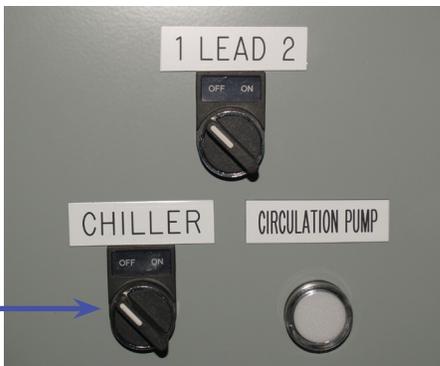
If a tank is installed on your Pro Chiller System fill it with water (no glycol at this time). Otherwise locate the remote tank or water source and prepare the system to flush the piping with water.



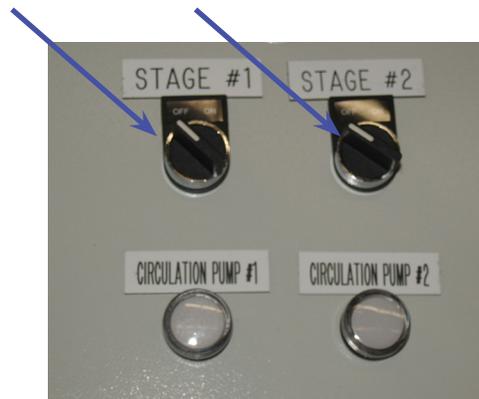
Visually check for any leaks on the system before proceeding.

STEP 5

Turn each circuit's STAGE switch to the ON position. If your chiller is a single circuit system turn the CHILLER switch to the ON position



Single Circuit Chiller System



Dual Circuit Chiller System

Your pump will energize and begin circulating water throughout the piping loop. Open all of the solenoids or heat exchangers on the loop to get a complete system flush. Visually inspect all of your piping for leaks and repair prior to proceeding.

STEP 6

Confirm your pump rotation and that you have an adequate flow. Motor Rotation is clockwise when viewed from Motor end. If rotation is backwards, you will need to switch any two leads (3 phase systems only) on the incoming power supply. Indication of flow does not insure proper pump rotation! In reverse rotation the glycol pump flow is significantly reduced and will effect chiller operation.



To confirm flow, check the Flow Meter. If no flow is indicated, it is likely there is an air lock in the pump and you will need to bleed the air from system. Confirm both valves are open and try cycling the power to the pump OFF and ON. If still no flow, turn power off and carefully open the plug located on the stainless steel head of the pump, bleed air from pump head and re-tighten pump head plug.

STEP 7

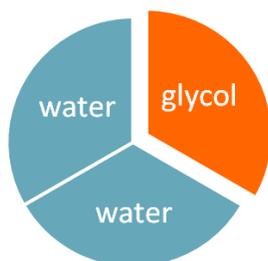
After 15-30 minutes of flushing, turn STAGE / CHILLER switches OFF and drain the water from system and tank. If no tank is installed open up your piping inside the processing plant and drain water. It is important to drain as much water as possible from tank jackets and heat exchangers. Any remaining water will dilute glycol concentration and could also leave contaminants within piping loop.

If a tank is installed use a Wet/Dry vacuum to clean out any particles inside the tank. It is important to get as much debris as possible. Any debris left in the system can cause solenoid valves to hang open or not fully open.

STEP 8

Close the piping system and we are now ready to charge the system with a minimum of 35% USP Grade Propylene Glycol / 65% Water. Use a refractometer or glycol percentage tester to insure the proper glycol concentration.

With the system completely drained, charge the system with one part glycol for every 2 parts of clean water. As you introduce the glycol to the piping system, additional glycol/water will need to be added. Operating level of the glycol solution must be within 4-6" from top of tank.



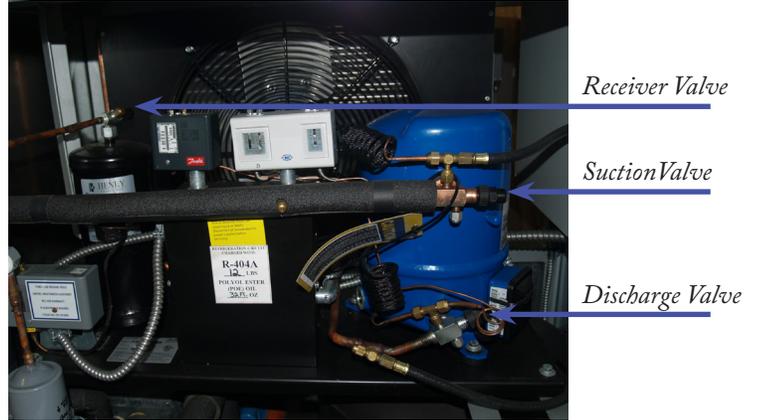


STEP 9

Open all Refrigerant Valves on the chiller refrigeration systems. Quantity of valves and location vary based on compressor/condensing unit make. Check name plate and documentation to confirm the make of your chiller's compressor/condensing unit.

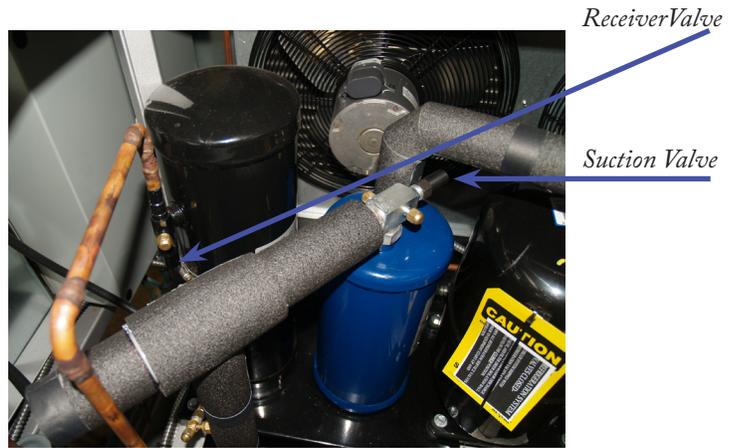
Danfoss Condensing Units:

- * Receiver Valve
(located on small receiver tank),
- * Suction Service Valve
(located on compressor)
- * Discharge Service Valve
(located on compressor).



Emerson Condensing Units:

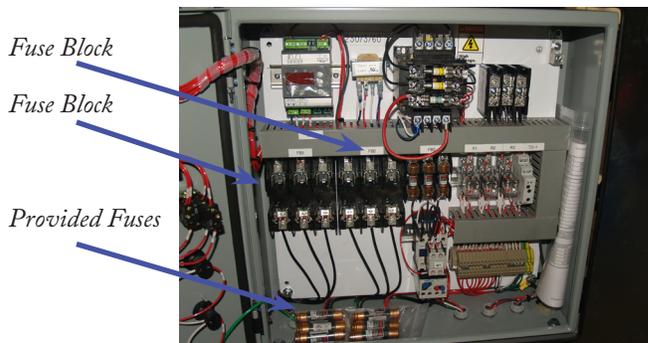
- * Receiver Valve
(located on small receiver tank),
- * Suction Service Valve
(located near accumulator)



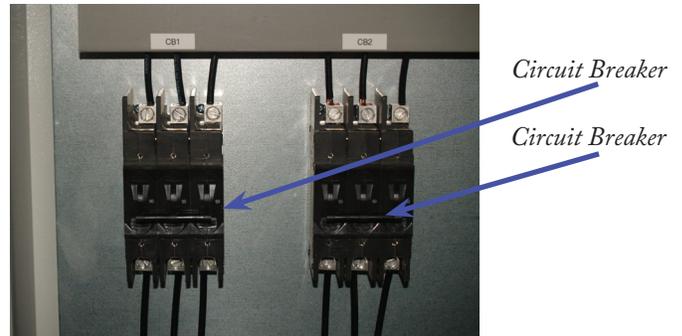
To OPEN, remove Valve Stem Covers and adjust valve stem all the way out by turning counter clockwise. It is advised to have a refrigeration technician open these valves, it may require the use of a special valve wrench to open.

STEP 10 **WARNING** Verify that all external power sources have been removed before servicing

Compressor/Condensing unit fuses are shipped inside the main electrical enclosure in a plastic bag. Install these into the fuse block associated with your condensing unit. If chiller has circuit breakers switch them to the ON position.



System with fuse blocks



System with circuit breakers



STEP 11

Close electrical panel door and turn electrical disconnect to the ON position. Turn CHILLER or STAGE switches to ON. The chiller circulation pump should start running and compressors should stage on/off according to the glycol setpoint temperature.

Please call Pro Refrigeration Inc's Technical Support with any questions at 800-845-7781



SYSTEM WARRANTY

1. All orders must be in writing and are subject to acceptance by PRO REFRIGERATION INC. at its principle office in Auburn, Washington, United States of America.
2. Prices are subject to change without prior notice and PRO REFRIGERATION INC. reserves the right to invoice the products sold at prices in effect at the time or times of shipment. Prices do not include any LOCAL, STATE, FEDERAL, OR FOREIGN TAXES OR EXCISES.
3. Risk or loss shall in every case pass to purchaser upon delivery of goods to the possession of the freight carrier or customer. PRO REFRIGERATION INC. shall have no responsibility for any claimed shortages unless 1) PRO is notified within ten (10) days after receipt of goods, 2) Agent or carrier has with-in such time has been notified of such shortages by purchaser, or 3) Purchaser has filed claim with carrier for the damage or shortage claimed.
4. Any delivery dates that may be indicated herein are estimates only and are not guaranteed, Pro Refrigeration shall not be held liable for any delay in performance or for non-performance caused by circumstances or events beyond its reasonable control, including but not limited to: Fire, Labor Disputes or Shortages, Accidents, Factory Conditions, War, Government Action, or Inability to Obtain Material, Fuel, Equipment, Supplies, or Transportation.
5. PRO REFRIGERATION INC. reserves the right to change Specifications, Design, & Material in the interest of product improvement, without incurring obligation to purchaser.
6. In lieu of all other Warranties expressed or implied, including without limitation implied warranties of merchants ability and of fitness for a particular purpose, Pro Refrigeration Inc. warrants its products to be free from defects in material or workmanship under normal use and service when properly installed and applied. The foregoing warranty shall not apply to, and the purchaser shall have sole responsibility for any defects attributable in whole or in part to A) Failure to properly install the products, B) Failure to use the products in accordance with installation and operating instructions, C) Any determination by purchaser or others that the products are not of proper size, configuration, or capacity of intended use, D) The negligence of inexperience of the purchaser or its employees or agents, or E) Any other cause beyond reasonable control of Pro Refrigeration Inc. The liability of Pro Refrigeration Inc. under such warranty is limited to the repair or replacement FOB Factory, at Pro's option, of any part or parts which Pro's examination shall disclose to its satisfaction to have been defective in material and/or workmanship. And Pro Refrigeration Inc. shall in no event be responsible for 1) the cost of any work done by purchaser or employees of purchaser on products furnished by Pro Refrigeration Inc. or 2) for any consequential damage. Such warranties shall be limited to defects of which Pro Refrigeration Inc. is notified within one (1) year of start-up of product or fifteen (15) months from factory ship date of product claimed to be defective. On parts furnished by Pro Refrigeration Inc., which are manufactured by others, Pro Refrigeration Inc. extends the same warranty it receives from such manufacturers.
7. No products sold by Pro Refrigeration Inc. shall be returned without Pro Refrigeration's written permission. Products returned shall be subject to a handling and transportation charge.

WARRANTY REPAIR PROCEDURE

Unfortunately, there will be situations where a component will fail or a chiller will fail due to a problem that was not detected at the factory. We will assist in any way we can when a situation does occur. We pride ourselves on building a high quality system that will give the customer years of service, if a problem occurs it is a top priority that the problem is repaired. The information listed below is based on our standard system warranty. If the chiller system fails within the warranty period, due to defective components or flawed factory workmanship, please follow the steps outlined below.



FAULTY COMPONENT

All of the components on the Chiller System carry the original manufacturers warranty. Typically the warranty period is one year from date of start-up or 15 months from date of factory shipment. Our Spiral Drum Evaporators have a five year warranty from date of start-up or 5 years and 3 months from date of factory shipment.

In the event of a component failure, we will replace the defective component. When a component is diagnosed as faulty, please call our warranty department at (206) 735-9466. They will issue a RMA number, when the defective component is received a replacement will then be shipped. All freight costs must be pre-paid. If a defective component is needed immediately, we will ship a replacement when we are notified of the problem. We will then send an invoice for the component and when the defective component is received, a credit for the invoice will be issued. Our warranty covers only the replacement of the defective component, it does not cover labor to install component, shipping costs, or lost product due to the defective component. Component warranties are void if the component or chiller system is being used outside of the design parameters.

WORKMANSHIP FLAW

Our chillers are warranted against flaws in workmanship for a period of one year from the date of start-up or 15 months from the date of factory shipment. All of our chillers must pass a stringent quality check list before being approved for shipment, unfortunately some problems may be unnoticed. If a system is found to possess a workmanship flaw please call the factory, (253) 735-9466, and inform us of the defect which was detected. We will request a written quotation by a certified refrigeration mechanic to perform the repair. All supplies that are used for the repair will be supplied by us or they must be listed in written quotation. We will then decide either to accept the quotation or have the repair performed by a refrigeration contractor of our choice.

If a repair is needed immediately, please call us at (253) 735-9466 and we will do our best to take care of the problem promptly.

PLEASE SHIP ALL PRE-APPROVED RETURNS TO:

PRO REFRIGERATION INC.

ATTN: WARRANTY DEPARTMENT

326 8TH ST. SW UNIT #6

AUBURN, WA. 98001

PHONE (253) 735-9466 FAX (253) 735-2631



VARIABLE FREQUENCY DRIVE (OPTION MAY NOT BE SUPPLIED WITH CHILLER)

The iQpump (P7U) is a Pulse Width Modulated Drive for 3-Phase AC induction motors. This type of Drive is also known as an Adjustable Frequency Drive, Variable Frequency Drive, AC Drive, AFD, ASD, VFD, and Inverter.

The iQpump (P7U) is a variable torque AC drive, designed specifically for Simplex and Multiplex pumping applications. The pump applications include Booster Systems, Submersible Deep Well, Fluid Storage Tanks, Metering Pumps, Commercial and Residential Irrigation Systems.

The iQpump (P7U) sets a new benchmark for size, cost, performance, ease-of-use benefits, comprehensive pump and motor protection features, and quality. The iQpump (P7U) includes numerous built-in features such as H/O/A Operation, Selectable Pump Control Engineering Units, PI Control, Pump Basic Control, Pump Protection, Multi-Pump Control (Lead/Lag), and Pump Messaging Terminology.

The LCD keypad/operator is equipped with Hand/Off/Auto functions, copy feature, and 5 lines of display with 16 characters per line.

Modifying Variable Frequency Drive Set Point

STEP 1

Verify that the U1-01 is flashing on Digital Operator Display and press the  button.

STEP 2

Press the  to move the cursor to the digit you

wish to modify.

STEP 3

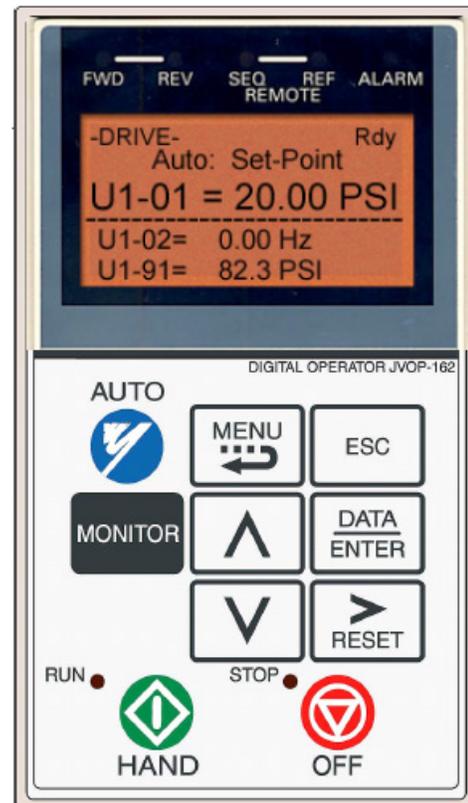
Press the  or  button to modify

to modify the number of the digit your cursor has selected.

STEP 4

Once you have your desired set point press the

 button to save changes.



Digital Operator Display



CHILLER SYSTEM START-UP SHEET

CHILLER MODEL #: _____
 CHILLER SERIAL #: _____
 CUSTOMER : _____
 START-UP DATE : _____

PRE START-UP CHECK LIST

- All Electrical Connections are tight, these may loosen during shipment
- Main Disconnect Energized for 24Hr. to allow Crankcase Heater to boil any liquid refrigerant out of crankcase.
- Field Process Piping has been leak checked
- VOLTAGE on Chiller System matches customer supplied VOLTAGE
- Glycol / Water Solution freeze point is **at least 20 F. (11 C.) below T-Stat Setpoint**
- Glycol Pump Motors Rotation is **CLOCKWISE** when viewed from motor end
- Glycol Storage Tank is **at least 80% Full**
- Pressure Bypass Valve tested. To test, Close a valve on the Glycol Supply and visually check for return flow into storage tank.
- Chiller location allows adequate air flow to and from Air Cooled Condenser. (Air Cooled Only)
- Adequate water supply provided to Water Cooled Condenser (Water Cooled Only)

X	DESCRIPTION	DATA #1	DATA #2	DATA #3	DATA #4
	Percentage of Propylene Glycol to Water in System				
	Glycol / Water Solution freeze point (Refractor Reading)*				
	Incoming Line Voltage Reading (L1-L2, L2-L3, L1-L3)				
	Control Transformer Secondary Voltage Reading				
	Circulation Pump Motor Amp Readings				
	Process Pump Motor Amp Readings				

PRESSURE CONTROL SETTINGS (refer to Operation Manual for Factory Settings)

	High Pressure Cut-Out				
	Low Pressure Cut-In				
	Low Pressure Cut-Out				
	Oil Failure Control				

P29NC-3 FREEZE PROTECTION SETTINGS (refer to Operation Manual for Factory Settings)

	Low Pressure Cut-Out				
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TEMPERATURE CONTROL SETTINGS (refer to Operation Manual for Factory Settings)

	Setpoint Temperature				
	Differential Setting				

OPERATING DATA**

	Glycol Solution Temperature (Thermostat Display Temp.)				
	Suction Pressure (PSI)				
	Suction Line Temperature at Compressor				
	Discharge Line Pressure (PSI)				
	Discharge Line Temperature				
	Liquid Line Pressure (PSI)				
	Liquid Line Temperature				
	Glycol Temperature at Evaporator Inlet				
	Glycol Temperature at Evaporator Outlet				
	Ambient Air Temperature				
	Condenser Water Temperature Inlet & Outlet (If applicable)				
	Compressor Amp Draw				
	Complete Chiller System Amp Draw				

* A Refractometer should be used to obtain the actual Glycol Solution Freeze Point. To order a Refractometer please call Technical Assistance at (253) 735-9466, these are also available from most propylene glycol suppliers.

** Operating Data should be recorded in the order listed. To determine proper operation of the chiller system, please record all Data simultaneously, or record all data completely with-in as short of period as possible. Data should be recorded at different Glycol Operating Temperatures (example: record at 45 F. / 35 F. / 25 F.)

FOR TECHNICAL ASSISTANCE CALL (253) 735-9466 , Monday thru Friday 6:00 AM TO 5:00 PM PACIFIC STAND. TIME

TECHNICIAN: _____

COMPANY: _____

SIGNATURE: _____

TEL. #: _____



OPERATING AND SAFETY CONTROL SET POINT GUIDE

Below you will find all our standard electrical controls listed with the recommended settings at different operating conditions.

These settings are based on systems using Refrigerant R404A

CONTROL	CUT IN	CUT OUT	DESIRED	GLYCOL	GLYCOL %
			TEMP	FREEZE	
High Pressure Control		400 psi	25 °F	0 to -10°F	36-42%
Low Pressure Control	30 psi	10 psi	25 °F	0 to -10°F	36-42%
Freeze Control (PENN P29NC-3)		30 psi	25 °F	0 to -10°F	36-42%
High Pressure Control		400 psi	30 °F	0 to 5°F	33-36%
Low Pressure Control	30 psi	10 psi	30 °F	0 to 5°F	33-36%
Freeze Control (PENN P29NC-3)		35 psi	30 °F	0 to 5°F	33-36%
High Pressure Safety		400 psi	35 °F	0 to 5°F	33-36%
Low Pressure Control	30 psi	10 psi	35 °F	0 to 5°F	33-36%
Freeze Control (PENN P29NC-3)		35 psi	35 °F	0 to 5°F	33-36%
High Pressure Safety		400 psi	40 °F	0 to 10°F	30-36%
Low Pressure Control	30 psi	10 psi	40 °F	0 to 10°F	30-36%
Freeze Control (PENN P29NC-3)		40 psi	40 °F	0 to 10°F	30-36%

Please check the set point before starting the system.

Unauthorized adjustment of freeze protection will void the warranty. Please consult the factory (253-735-9466) prior to adjusting the setpoint.

On remote or air remote condensing unit systems, operating controls may have to be defeated to allow for system charging of refrigerant. Be sure to set reset any defeated controls before completing start-up procedures.

To order a refractometer (glycol solution tester) please contact your sales representative or contact the factory at the above listed phone number



CHART #1

Weight % Propylene Glycol	Volume % Propylene Glycol	Freezing Point* in Fahrenheit	Freezing Point* in Celsius	Degree Brix**
0	0	32	0.0	0
5	4.8	29.1	-1.6	4.8
10	9.6	26.1	-3.3	8.4
15	14.5	22.9	-5.1	12.9
20	19.4	19.2	-7.1	15.4
21	20.4	18.3	-7.6	16
22	21.4	17.6	-8.0	16.7
23	22.4	16.6	-8.6	17.4
24	23.4	15.6	-9.1	18.4
25	24.4	14.7	-9.6	19
26	25.4	13.7	-10.2	19.6
27	26.4	12.6	-10.8	20.2
28	27.4	11.5	-11.4	20.8
29	28.4	10.4	-12.0	21.4
30	29.4	9.2	-12.7	22
31	30.4	7.9	-13.4	22.7
32	31.4	6.6	-14.1	23.6
33	32.4	5.3	-14.8	24.4
34	33.4	3.9	-15.6	25.3
35	34.4	2.4	-16.5	26.1
36	35.4	0.8	-17.3	26.9
37	36.4	-0.8	-18.2	27.5
38	37.4	-2.4	-19.1	28
39	38.4	-4.2	-20.1	28.5
40	39.4	-6	-21.1	29.1
41	40.4	-7.8	-22.1	29.6
42	41.4	-9.8	-23.2	30.2
43	42.4	-11.8	-24.4	30.7
44	43.4	-13.9	-25.5	31.3
45	44.4	-16.1	-26.7	31.8
46	45.4	-18.3	-28.0	32.4
47	46.4	-20.7	-29.3	33
48	47.4	-23.1	-30.6	33.5
49	48.4	-25.7	-32.1	34.1
50	49.4	-28.3	-33.5	34.7
51	50.4	-31	-35.0	35.5

shaded area represents recommended Glycol Water Percentage

*Glycol freeze point should be 20 to 25 F. below operating temperature or below coldest winter ambient conditions. Whichever is coldest.

** Degree Brix is a measure of sugar concentration in a fluid and is important in fermentation applications. Although there are no sugars in glycol, it will affect the refractive index of the fluid in a similar fashion.



Chart #2		
Nominal Pipe Size Inches	Inside Diameter Inches	Volume Gallons per 100 feet of pipe
1 1/4"	1.38	7.76
1 1/2"	1.61	10.58
2"	2.067	17.43
2 1/2"	2.469	24.87
3"	3.068	38.4
3 1/2"	3.548	51.36
4"	4.026	66.13
5"	5.047	103.9
6"	6.065	150.1
8"	7.981	259.9
10"	10.02	409.6

Calculating the amount of Glycol Required per job

1. To calculate the quantity of fluid within cooling system.
 - A. Use chart #2 to estimate Process Piping Volume.
 - B. Add Total from step A to chiller glycol tank capacity.
 - C. Add total from step B to Total Process Heat Exchanger Volume Capacity
 - D. Use chart #1 to find percentage concentration.
- E. Multiply total system volume by glycol percentage required.

Example: Brewery Application with Fermenters as Process Heat Exchangers

- A. Process Piping: 250' of 1 1/2" pipe = 26 1/2 gallons
 - B. Chiller Tank Capacity: 63 gallons + 26 1/2 gallons = 89 1/2 gallons
- C. Fermenter Cooling Jackets: 8 fermenters @ 6 gallons each = 48 + 89 1/2 = 137 1/2 gallons
 - D. System requires -5 F. freeze point or 39% Glycol concentration.
 - E. 39% of 137 1/2 gallons = 53.63 gallons of Propylene Glycol Required.

A Refractometer (Glycol Percentage Tester) must be used to determine actual solution freeze point.

These are available from your Propylene Glycol Supplier or contact us at (253) 735-9477.



PROBLEM	POSSIBLE CAUSES	CORRECTIVE STEPS
compressor will not run	A Main Switch / Circuit Breaker Open B Fuse Blown C Thermal Overloads Tripped D Defective Contactor or Coil E System shut down by Safety Device F No Cooling is required G Liquid Line solenoid will not open H Motor Electrical Trouble I Loose Wiring J Circulation Pump Not Running	A Reset Switch / Circuit Breaker B Check Electrical Circuits and Motor Windings for shorts or grounds. Investigate for possible overloading. Replace Fuse or reset Circuit Breaker after fault is corrected. C Reset any tripped thermal overloads, Check unit closely when unit comes online. D Repair or replace coil E Determine Type and Cause of shut down and correct before resetting. F Wait until Unit calls for Cooling. Check setting of Thermostat. Check the Temperature of Glycol Solution. G Check for Voltage at Solenoid Coil, replace coil. H Check motor for opens, short circuit, or burnout. I Check all wire junctions, tighten loose connections. J Check overload relay on circulation Pump
Compressor noisy or vibrating	A Liquid Refrigerant Flooding to Crankcase B Worn Compressor	A Check Superheat Setting of Expansion Valve(s). Check the Glycol Solution Percentage, make certain that evaporator is not freezing up. B Replace Compressor
High Discharge Pressure	A Condenser Water Supply is insufficient or temperature is too high. B Fouled Condenser (Water) Fouled Cooling Tower Dirty Condenser Fin or Tube Surface (Air) C Non-Condensables in System D System overcharged with Refrigerant E Discharge Valve Partially closed F High Ambient Conditions	A Adjust Water Regulating Valve, investigate ways to increase water supply. B clean C Purge out non-condensables, reclaim refrigerant and recharge with new refrigerant. D Remove excess refrigerant charge E Open Valve F Check Condenser Rating Tables
Low Discharge Pressure	A Faulty Condenser Fan Control B Suction Shut off partially closed C D E Insufficient Refrigerant Charge F Low Ambient Conditions	A Check Fan Controls B Open Valve C Adjust Water Regulating Valve or Water Supply D See "Low Suction Pressure" below E Check for leaks, repair & recharge F Check Condenser rating tables
Low Suction Pressure	A Lack of Refrigerant B Clogged Liquid Line Filter Drier C Expansion Valve malfunction D Condensing Temperature too low E Compressor will not unload F Insufficient Flow through evaporator G Not enough Glycol Concentration or Glycol Level in Tank is too Low.	A Check for leaks, repair, & recharge. B Replace C Check Superheat Setting, adjust or replace. D Check means of regulating Condensing Temperature E See "Compressor will not unload" section below F Check circulation pump rotation and motor amperage. Make sure Gate Valves on Evaporator inlet & outlet are completely open. G Add required Glycol to System
7-5		
High Suction Pressure	A Excessive Load B Expansion Valve malfunction	A Reduce Load or add additional cooling equipment B Check Superheat of TXV, replace if necessary
Compressor will not unload	A Unloader mechanism defective B Faulty Thermostat or Pressure Control	A Replace mechanism B Check settings of device, replace if necessary
Oil Alarm	A Excessive Liquid Refrigerant in crankcase B Oil Failure Control defective C Worn Oil Pump D Stuck reversing gear on oil pump E Worn Bearings F Low Oil Level G Pump Housing Gasket leaks	A Check crankcase Heater. Adjust TXV superheat. B Replace C Replace Oil Pump. D Reverse Rotation of Compressor E Replace Compressor F Check System for leaks, repair, & add Oil. G Replace Gasket
Motor Overload Fault, tripped Circuit Breaker, or Blown Fuses	A Low Voltage during high load conditions B Grounded wiring in motor or power circuit C Loose power wiring D High Condensing Pressure E Voltage unbalance F High Ambient at bi-metal Overload Relay	A Check for excessive voltage drop B Check wiring and repair fault. C Check wiring and tighten any loose connections D See corrective steps for "High Discharge Pressure" E Check Power Supply. Contact Power Company. Do not Operate until fault is corrected. F Provide Ventilation to Motor Controls
Compressor Thermal Switch Open	A Operating out of design conditions B Discharge Valve Partially closed C Blown Valve Plate Gasket D Power Line Fault	A Add facilities to prevent system from operating out of design conditions. B Open C Replace Gasket D Check Power Supply. Contact Power Company. Do not Operate until fault is corrected.
Low Pressure Freeze Alarm	A Wrong Pump Rotation B Evaporator Freeze Up C Incorrect Freeze Point setpoint	A Reverse Rotation of circulation pump (CW from motor end) B Check Glycol Percentage. Must be at least 20 F below thermostat set point. C Adjust freeze point for application, consult factory.



CHILLER SYSTEM PREVENTIVE MAINTENANCE CHECK LIST

Inspection/Replacement Items and Frequency

For Technical Support Please Contact Pro Refrigeration, Inc. Technical Services at
(253) 735 - 9466

DAILY

<p style="text-align: center;">Date</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 20px; height: 20px;"></td><td><u>Air Cooled Condenser Clear of Obstruction</u></td></tr> <tr><td style="width: 20px; height: 20px;"></td><td><u>Glycol Inlet Temp</u></td></tr> <tr><td style="width: 20px; height: 20px;"></td><td><u>Check for Audible or Visual Alarms</u></td></tr> <tr><td style="width: 20px; height: 20px;"></td><td><u>Refrigerant Sight Glass Inspection</u></td></tr> </table>		<u>Air Cooled Condenser Clear of Obstruction</u>		<u>Glycol Inlet Temp</u>		<u>Check for Audible or Visual Alarms</u>		<u>Refrigerant Sight Glass Inspection</u>	<p style="text-align: center;">Date</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 20px; height: 20px;"></td><td><u>Chiller System Setpoint</u></td></tr> <tr><td style="width: 20px; height: 20px;"></td><td><u>Glycol Outlet Temp</u></td></tr> <tr><td style="width: 20px; height: 20px;"></td><td><u>Inspect for glycol leaks</u></td></tr> </table>		<u>Chiller System Setpoint</u>		<u>Glycol Outlet Temp</u>		<u>Inspect for glycol leaks</u>
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Daily Inspection Notes: _____

WEEKLY

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Weekly Inspection Notes: _____

MONTHLY

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Monthly Inspection Notes: _____

YEARLY

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	Replace Comp. Contactor								

Yearly Inspection Notes: _____



NOTES



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NOTES

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326 8th ST SW
Auburn, WA 98001
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