



SMART FAMILY OF COOLING PRODUCTS

1118 First St E, Humble TX 77338

281-540-2805

TACLA14492C | Registered dba of Combined Refrigeration, Inc.

INSTALLATION OPERATION WITH START-UP INSTRUCTIONS Package and split systems

Smart Freeze
The greatest luxury is custom

**DO NOT TURN THE POWER ON TO YOUR NEW SMARTFREEZE UNTIL
THE ENCLOSED COMMISSIONING CHECKLIST HAS BEEN
COMPLETED BY A QUALIFIED TECHNICIAN.**

Smart Family of Cooling Products
SmartFreeze Division
Humble, TX 77338

Phone: 281-540-2805
Fax: 281-540-8847
Web site : www.smartcoolingproducts.com

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Smart Family of Cooling Products
www.SmartCoolingProducts.com
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Product documentation and specifications are subject to change at any time without notice. Any reproduction or modification to this document without prior written authorization from Smart Family is strictly prohibited.

Smart Family Terms & Conditions (continued)

STANDARD Compressor Coverage: SFCP/SmartFreeze offers both standard and optional extended compressor warranties on most models of chillers.

STANDARD Compressor coverage details:

1. Standard Copeland Scroll Compressor coverage: All Copeland Scroll compressors are warranted for **18 MONTHS** from date of manufacture at Copeland. **Should a compressor of this type fail within the Copeland warranty period, warranty exchange for the compressor must be processed through your local authorized Copeland reseller.** When contacting your local authorized Copeland reseller make sure to have the compressors model and serial information available so warranty can be verified.
2. **Standard Copeland SEMI-HERMETIC Compressor coverage:** All Copeland Semi-Hermetic compressors are warranted for **12 MONTHS** from date of manufacture at Copeland. **Should a compressor of this type fail within the Copeland warranty period, warranty exchange for the compressor must be processed through your local authorized Copeland reseller.** When contacting your local authorized Copeland reseller, make sure to have the compressors model and serial information available so warranty can be verified.
3. **In some cases, your local Copeland reseller may charge services fees for freight and other service in relation to a compressor exchange. SFCP does not cover such charges as part of our Limited warranty.**

OPTIONAL FOUR YEAR EXTENDED Compressor Warranty Procedure: General Statement: Extended compressor warranty coverage obligates Smart Family to exchange, (FOB) the factory, the compressor with a comparable compressor with equal capacity. Smart Family, assumes no responsibility for accessories, labor, or freight to or from the factory. Smart Family reserves the right to replace in warranty defective parts from its factory. Any unauthorized substitutions of SFCP Factory parts voids the Optional Extended Compressor Warranty. **Optional Extended Compressor Warranties must be purchased prior to shipment. Pricing is available through your SFCP/SmartFreeze representative.**

OPTIONAL EXTENDED Compressor Warranty Procedure Details:

1. All extended warranty compressors are processed through the Smart Family Factory.
2. To receive an OEM replacement compressor, a PO for the list price of the compressor is to be issued to SmartFreeze. SmartFreeze will produce a billing or VISA / MASTERCARD charge for the cost of the compressor plus freight.
3. **Copeland Scroll compressors:** The original Copeland nomenclature sticker from the compressor body must be returned to our facility within 25 DAYS of the replacement compressor shipment to receive credit.
4. **Copeland Semi-Hermetic compressors:** Must be returned to the factory within 25 DAYS replacement compressor shipment to receive credit. Return compressors are to be shipped pre-paid.
5. Any questions pertaining to Extended Compressors Warranties are to be directed to SmartFreeze Customer Service.

Smart Family Terms & Conditions (continued)

IMPORTANT NOTE ABOUT FACTORY INSTALLED FLUID PUMPS: All SFCP/SmartFreeze supplied fluid pumps are hydro tested prior to installation in our chillers. Prior to shipment, pumps are tested a second time for proper operation under full load. For these reasons it is considered rare to find a defective pump at the time of commissioning.

To prevent operational issues with your fluid pumps PLEASE READ:

1. Proper rotation of pumps must be field verified. Running your pump(s) in reverse will cause damage within a short period of time. Such damage is NOT covered under your Standard or Extended warranties.
 2. ALWAYS make sure that your chiller, and system, are full of fluid prior to starting your pump(s). Running your pumps dry or with excessive air in the system WILL cause damage to your pump seals. Such damage is NOT covered under your Standard or Extended warranties.
 3. The seals provided in your pumps are rated down to 0F entering fluid temperature. If your entering fluid is lower than 0F the pump(s) must run constant otherwise ice crystals can form on pump seals causing damage at the time of re-start. Such damage is NOT covered under your Standard or Extended warranties.
 4. Your pump(s) amp draw will increase and decrease in parallel with your flow. At the time your pump(s) were specified it is most likely that your process systems external pressure drop was not known. If your systems external pressure drop is lower than expected, there is a good chance that flow rate through your pump(s) may be in excess of design, resulting in excessive amp draw. If this is the case, **a balance valve located on the pump(s) discharge will need to be throttled back to reduce flow and amp draw. AT NO TIME SHOULD YOU RUN YOUR PUMP(S) OVER THE RATED SF AMPS INDICATED ON YOUR PUMP(S) NOMINCLATURE.** Damage to pump(s) or related control components as a result of running in an over amp condition is NOT covered under your Standard or Extended warranties.
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Thank You!

HOW CAN WE HELP?

To our valued customer,

Congratulations on delivery of your new SmartFreeze chiller! We know there are a lot of manufacturers out there like ourselves. We greatly appreciate your trust in us and we look forward to providing you with the highest quality products on the market. We are proud to manufacture in the USA!

Sincerely,

Timothy Baker

Timothy Baker

President

After delivery of your new SmartFreeze chiller, the following items will be critical to assure years of trouble free service from your new equipment:

- Factory level commissioning
- Plumbing system design and component selection
- Plumbing system installation
- Electrical service design installation and connection
- Regular scheduled service

**** Please Read Section in this booklet pertaining to**

Services	Contact information
To schedule factory commissioning: This is a fee based service and requires at least TEN DAYS advanced notice in most cases.	Technical Assistance: 281-540-2805

FACTORY COMMISSIONING

IMPORTANT READ BEFORE INSTALLING

- **THIS EQUIPMENT MUST BE INSTALLED BY QUALIFIED PERSONNEL IN ACCORDANCE WITH ALL LOCAL AND NATIONAL CODES.**
- **AN EARTH GROUND LUG IS PROVIDED ON THE CABINET INTERIOR FOR PROPER GROUNDING ACCORDING TO NATIONAL ELECTRICAL CODES. AN EARTH GROUND IS NECESSARY TO ENSURE PERSONNEL SAFETY TO PREVENT ELECTRICAL HAZARDS AROUND THIS EQUIPMENT.**
- **THIS EQUIPMENT IS NOT FOR USE AS AN INDUSTRIAL WATER SOURCE FOR DRINKING OR FOOD INGREDIENT WATER FOR HUMANS OR ANIMALS.**
- **READ AND FOLLOW INSTALLATION INSTRUCTIONS FOR PROPER OPERATION.**
- **THE MAIN ELECTRICAL SUPPLY TO THIS EQUIPMENT MUST REMAIN ON TO KEEP COMPRESSOR CRANK CASE HEATERS FUNCTIONAL. FAILURE TO DO SO CAN RESULT IN NON-WARRANTY COMPRESSOR DAMAGE.**
- **THIS UNIT IS EQUIPPED WITH A PILOT DUTY FLOW SWITCH. THE CHILLER'S REFRIGERATION SYSTEM WILL NOT OPERATE UNLESS THE CIRCULATION PUMP IS CIRCULATING WATER THROUGH THE EVAPORATOR. IN MANY CASES, THE FLOW SWITCH MUST BE FIELD CALIBRATED AS PART OF EQUIPMENT COMMISSIONING.**

Factory Commissioning Services

To request factory commissioning: Availability of factory commissioning service can vary depending on when service will be needed and your geographic location.

When ordering service:

1. A purchase order should be on file with Smart Family at least 30 days prior to your estimated commissioning date. In order to be processed, your PO must include: Bill to, Ship to, daily rate (please contact our Service department for daily rate), Site contact information. A line item on the PO indicating "PLUS TRAVEL COSTS" must also be indicated. Open credit accounts will be charged after service is rendered. COD accounts will be charge to VISA or MASTERCARD ten days prior to service. COD accounts must provide credit card information at the time of PO submission to prevent scheduling delays.
Important: PLEASE make sure that all contact information provided on your PO is complete and correct. Failure to do so can impact scheduling.
2. A completed "**Commissioning Request Form**" (Located in the back of this booklet) must be completed and returned to SFCP no less than seven business days prior to your required commissioning date. Completed forms can be sent to SFCP by fax: 281-540-8847 or Email: bjones@smartcoolingproducts.com. After faxing your form to us, we recommend that you call our office at 281-540-2805 within 24 hours to confirm receipt. **Important: PLEASE make sure that all contact information provided on your Commissioning Request Form is complete and correct. Failure to do so can impact scheduling.**
3. Approximately 72 hours prior to commissioning, a Smart Family service advisor will attempt contact using the information provided on your PO and Commissioning Request Form. At that time, the commissioning site information will be verified and we will confirm that your system is ready for commissioning. If our Service Advisor is not able to make contact within 48 hours of commissioning, service will be postponed until contact is made. **Important: A reschedule charge of \$250.00 will apply if we are not able to confirm commissioning within 48 hours of dispatch to the commissioning site.**

NEED MORE INFORMATION ON OUR COMMISSIONING SERVICES?

CALL

281-540-2805

Section #1 – Unit Inspection and Accepting Delivery

Upon delivery of your new SmartFreeze equipment:

1. Verify that the equipment is the correct model, voltage and phase against the order confirmation supplied by Smart Family of Cooling Products.
2. Verify the serial number matches that on the bill of lading.
3. Inspect all exterior components for visible damage. Report any apparent damages or material shortages to the carrier and make a notation on the delivering carrier's bill of lading copy. Specify the extent and type of damage and then notify Smart Family. immediately. **Do not proceed with the installation of a damaged unit without the approval of Smart Family; to do so will be at the risk of assuming all responsibility for the damage.**

***** PROTECT YOURSELF: IF THE EQUIPMENTS EXTERIOR CRATING SHOWS ANY SIGNS OF DAMAGE, NOTATE ON THE BILL OF LADING "POSSIBLE FREIGHT DAMAGE" BEFORE THE DRIVER LEAVES. ALWAYS TAKE PICTURES OF ANY SUSPECT DAMAGE.**

Inspection Checklist — To protect against loss due to damage incurred in transit complete the following checklist:

___ Inspect each piece before accepting delivery. Check for torn cartons, broken skids, bent sheet metal, torn shrink wrap.

___ Check the unit(s) for concealed damage before storage and as soon as possible after delivery. In event of suspected concealed damage, ask the driver to wait. Concealed damage must be reported within 1.5 days of receipt.

___ If concealed damage is found, stop unpacking the shipment. Do not move damaged material from the receiving location. Take photos of the damage. The owner must provide reasonable evidence that the damage did not occur after delivery.

___ Notify the carrier of the damage as soon as possible. Request an immediate joint inspection by the carrier and consignee. A determination of responsibility will be made and the carrier will authorize repairs in the event of admission of fault.

___ Notify SFCP/SmartFreeze immediately. We will coordinate repairs with the owner and carrier; do not attempt to make repairs locally without Smart Family's permission.

Accepting Delivery

It is the consignee's responsibility to accept delivery of damaged goods unless permission to refuse delivery has been given by Smart Family. . DO NOT REFUSE DELIVERY of damaged goods without prior authorization. The ownership of the shipment has passed from Smart Family to the customer at the time of shipment. Refusal of the delivery may impede the recovery of damages.

UNAUTHORIZED REFUSAL OF SHIPMENT WILL RESULT IN A 20% RESTOCKING CHARGE TO THE CUSTOMER. SMART FAMILY IS NOT, AND WILL NOT BE, RESPONSIBLE FOR DAMAGES, OR FOR FILING FREIGHT CARRIER CLAIMS.

Section #2 - STANDARD ORDER TERMS AND CONDITIONS OF SALE:

THE FOLLOWING TERMS AND CONDITIONS APPLY TO ALL ORDERS AND SUPERSEDE AND REPLACE ANY STANDARD TERMS AND CONDITIONS OF BUYERS PURCHASE ORDER. TERMS APPLY TO ALL CRR, DUN-RITE,, AND SMART FAMILY PRODUCTS.

Credit: All orders shall be at all times subject to the approval of Combined Refrigeration Resources, Inc. credit department. Combined Refrigeration Resources, Inc. may at any time delay, suspend or decline any order or shipment until receipt of payment in full, or agreement by Combined Refrigeration Resources, Inc. to other acceptable security or terms and conditions satisfactory to Combined refrigeration Resources, Inc. credit department.

Pricing: All goods shall be invoiced when shipped Initial orders will require prepayment (Credit Card, Wire Transfer, Money Order, Company Check) until a line of credit has been established, at which time payment terms will be applied. Orders will be filled at the prices that are in effect at the time of order, unless Buyer request that shipment be delayed Fifteen (15) days or more from the date of the order; in which orders will be filled at the prices that are in effect at the time of the shipment. If actual shipment goes beyond Fifteen (15) days of time of completion or order readiness date, the Seller reserves the right to charge additional holding charges or fees. No order may be held longer than Fifteen (15) days without explicit acceptance by the Seller.

Payment Terms: Standard payment terms shall be 30% down payment, 30% upon completion of major components or project milestones, and remainder COD unless otherwise noted and accepted.

Acceptance: All orders must be in writing and are not binding until accepted by the Seller's office. Orders are accepted subject to strikes, accident, and other causes beyond our control. We will not be liable for any delay in delivery or for any damages suffered by the Buyer for reason of such delay.

Delivery: We will endeavor to ship by promised delivery date, but failure to do so for any cause whatever will not give Buyer right to cancel or hold Seller responsible for any damages resulting from the failure to deliver within the time stated.

Routing: Where prices include freight, the Seller determines the routing. If special routing is requested, a charge will be made for the difference between such routing costs and normal minimum freight charges to same point.

Shipping: Combined Refrigeration Resources, Inc. reserves the right to make multiple partial shipments as the order may be filled and ready for shipment, at its sole discretion and without notice to Buyer. All goods are shipped by Buyer's risk and are shipped F O B. shipping point. If material is received in damaged condition. Buyer should contact transportation agent and immediately file claim.

Cancellations: Orders for standard or stocked components, such as parts, maybe canceled only with written consent of the Seller and upon payment of reasonable cancellation charges by the Buyer as set out below. There will be a 10% handling charge for order cancellations by buyer; except that orders cancelled by buyer within five (5) days of scheduled shipment shall be nonrefundable and payment in full will be required. Special orders for goods not normally stocked, including all equipment orders, are non-cancelable by buyer and nonrefundable, and payment in full will be required. Minimum cancellation fees for equipment orders, such as air handlers, chillers, pump tank units, and packaged AC units, are: (1) 10% with acceptance of order (ii) 40% at time of release (iii) 100% within 6 weeks of project completion.

Taxes: In case of the imposition of any additional duty tax or other governmental charge upon raw materials entering into production of the goods represented by the invoice, and order acknowledgment, or upon or measured by the production, sale or shipment of said goods by Federal, State, or Municipal authorities, which would be applicable to this sale, then the contract price may be increased by the amount of such additional cost or expense to the Seller, which is caused thereby Unless specifically exempted, all sales, use and any other Federal, State, Municipal or Governmental tax will be invoiced to the purchaser as a separate item in addition to the price of the equipment and are to be paid by the purchaser.

Warranty: We agree that the apparatus manufactured by the Seller will be free from defects in material and workmanship for a period of one year under normal use and service and when properly installed: and our obligation under this agreement is limited solely to repair or replacement at our option, at our factories, of any part or parts thereof which shall, within one year from date of original installation or 18 months from date of shipment from factory to the original purchaser, whichever date may first occur, be returned to us with transportation charges prepaid which our examination shall disclose to our satisfaction to have been defective THIS AGREEMENT TO REPAIR OR REPLACE DEFECTIVE PARTS IS EXPRESSLY IN LIEU OF ALL OTHER EXPRESS OR IMPLIED WARRANTIES OF ANY KIND. SELLER HEREBY DISCLAIMS AND EXCLUDES THE IMPLIED WARRANTY OF MERCHANTABILITY AND FURTHER DISCLAIMS AND EXCLUDES ANY IMPLIED WARRANTY OR FITNESS. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE OF SELLER'S SALES ORDER ACKNOWLEDGEMENT. Labor is not included in warranty terms neither is extended compressor warranty, installation, start -up, or any other field service.

Special Products: On all quantity orders for special products or products not covered in published price sheets, Seller reserves the right to over-ship and under-ship 5% of the quantity of the last production release.

Shortages: No claims for shortages will be considered unless same are made in writing to the Seller within 10 days of receipt of shipment.

Refunds/Returns: No goods may be returned for credit unless written authorization by Combined Refrigeration Resources, Inc. has been given in advance. Returned product that was shipped as ordered is subject to a minimum 35% restocking charge, depending on the condition and age of the returned goods. Products that are obsolete, discontinued, modified or special goods are not returnable. Product shipped in error will be allowed full credit upon return. ANY BUYER WITH AN OUTSTANDING BALANCE TO COMBINED REFRIGERATION RESOURCES, INC. WILL NOT BE authorized for returning product for credit. Refunds may only be applied to future purchases and are not redeemable for credit. All authorized return shipments must be made as directed by us and with transportation charges prepaid to point of origin of our shipment unless instructed otherwise. Shipment of material returned without authorization or improperly tagged or not prepaid, are subject to refusal and immediate return to shipper.

Sole Terms: Failure of the Seller to object to provisions contained in customer's purchase orders or other communications shall not be deemed a waiver of the terms or conditions hereof nor acceptance of such provision. The printed terms hereon combined with the other writings entered into between the parties, are the entire contract and all of the terms thereof. No oral statements, warranties, representations, stipulations or terms have any binding effect or be any part of the contract whatsoever. Failure of the Buyer to object in writing within five (5) days of receipt thereof to Terms of Sale contained in the Seller's acceptance and/or acknowledgment, or other communications, shall be deemed an acceptance of such Terms of Sale by Buyer.

OSHA: The Occupational Safety and Health Act (OSHA) imposes certain requirements on an employer" including many relating to the use of machine and equipment. Since these requirements are directly related to the conditions under which and the manner in which the machinery or equipment is used, Seller, makes no warranty, expressed or implied, of merchantability under, fitness under, compliance with, or liability under OSHA, its interpretations and/or regulations. Further, the Seller makes no warranty of any kind other than the warranty set forth in paragraph 10 of the terms of sale.

Patent Indemnity: The Company shall protect and indemnify the Buyer from and against all claims, damages, judgments and loss arising from infringement or alleged infringement of any United States patent by any of the articles or material delivered hereunder, provided that in the event of suit or threat of suit for patent infringement, the Company shall promptly be notified and given full opportunity to negotiate a settlement. The Company does not warrant against infringement by reason of the Buyer's design of the articles or the use thereof in combination with other materials or in the operation of any process. In the event of litigation, the Buyer agrees reasonably to cooperate with the Company. All parties concerned shall be entitled, in connection with any proceeding under the provisions of this article, to be represented by counsel at their own expense.

Section #3 – Installation & Setup

(Things you NEED to know)

Mounting (General information): Units must be installed in a level position, on a firm support. Never use a wooden shipping skid as a permanent base.

Roof top installations: Ensure that the weight with water does not exceed design conditions of roof. If weather patterns in your area produce wind speeds that exceed 30 MPH tie downs are recommended. Always contract with a fully licensed and insured crane operator when such services are needed.

Ground mounted installations: Install the equipment in a location that will provide protection against possible impact damage. When locating the equipment near parking areas it is recommended to install safety barricades around the equipment. This equipment does not come equipped with tamper proof door hinges or fasteners. Be advised that some precautions will need to be taken by the owner of the equipment to prevent tampering that could result in injury or death.

Regardless of where this equipment is to be installed, SmartFreeze recommends that the equipment be securely fastened. It is also recommended to **consult with a qualified structural engineer** when attempting to determine the proper mounting apparatus. The foundation under the chillers must be strong and level. The loaded weight of the storage tank must be considered. Compute the floor load by adding the water storage capacity weight (gals. cap. x 8.3 lbs.) to the shipping weight.

It is recommended that all installations be performed by qualified licensed contractors. This should assure proper installation and operation of the chiller unit.

Compressor mountings: Compressors that are spring mounted, are rigidly secured from the factory to prevent shipping damage. After mounting the unit and prior to commissioning, the following steps should be taken.

- 1- Loosen and remove the (4) nuts and washers used to hold the compressor firmly in place.
- 2- Remove and discard the (4) shipping spacers between the compressor and its mounting base.
- 3- Install the (4) rubber spacers, provided as loose items, over the compressor mounting stud. On all SmartFreeze equipped with Semi-Hermetic compressors, the rubber spacers are wired to the "head-end" of the compressor.
- 4- Reinstall the (4) nuts and washers removed in step 1 above leaving approximately 1/16" space between the nut and washer. This will allow the compressor to "float" on the mounting springs.

Water connections: It is recommended that a qualified technician perform the installation of the plumbing system. Proper sizing and connection to the headers is critical to reliable and efficient chiller operation. Please refer to the "Header Sizing" chart for more information.

HEADER SIZING CHART

CHILLER CAPACITY	OPTIMUM HEADER SIZE
2.0 ton - 5.0 ton	1"
7.5 ton - 10.0 Ton	1-1/2"
15.0 Ton	2"

The header size is dependent on three factors:

1. Distance from the pump to the machinery.
2. The size of the pump.
3. The number of the heat exchangers and the flow rate required.

The above recommendations are based on the standard pump furnished with the chiller and a total of 50' of piping. If the distance is greater, it may be necessary to increase the pump, pump impeller, size of the pipes or a suitable combination thereof. It is recommended to keep friction loss of the piping system to a minimum through using as few elbows as possible throughout the piping system.

For best results, SmartFreeze recommends having a qualified mechanical engineer size the piping system. If this information is provided to SmartFreeze at least three weeks before the shipment of the chiller, Smart Family can size the pump capacity to the engineered specifications. In the event that the engineering required a larger pump capacity than quoted, a quotation will be issued for the difference.

Notes:

Section #3 – Installation & Setup

(Things you NEED to know)

All field piping must conform to the requirements of the equipment as well as all applicable national and local codes.

Piping - General: Care has been taken to insure that factory piping are properly braced and all gasketed joints are tight. These may loosen or break during shipment & must be checked as part of start-up. All joints, especially threaded and gasketed joints, should be checked again after one to two weeks of operation. Take corrective action as necessary.

All lines must be supported. The distance between supports will vary with the diameter and wall thickness of the pipe or tubing used, the weight of the fluid being carried, as well as the number of valves and fittings in the line. Supports should be provided near changes in direction, at branch lines and particularly near valves. The weight of the tubing must not be carried through the valves body since this may distort the valve to the point where it will not function properly. Horizontal supports must be close enough to prevent sag which would impose excessive stress. Vertical supports must be close enough to adequately support the weight of the tube as well as to prevent sway caused by blowing wind. As a guide, the following table may be used.

Tube OD - in	3/8 - 7/8	1 1/8	1 3/8 - 1 5/8	2 1/8	2 5/8	3 1/8
Nom pipe size - in		3/4 -1	1-1/4	1-1/2	2	3
Max. span - ft	5	6	7	9	10	12

Chilled Fluid Piping: Various types of pipe may be used, but care must be taken to ensure that the material is compatible with the type of service for which it is intended.

General “good practice” for fluid piping includes:

- 1- Fluid lines should be kept as short and direct as possible.
- 2-They should be sized for low pressure drop in order to minimize pump requirements.
- 3-Lines should be insulated..
- 4-Use insulation of sufficient thickness to prevent sweating which may damage property or present a hazard to personnel.
- 5- Piping must be a continuous loop with purge valves or Hoffman automatic air vents installed at high points.
- 6- Expansion tanks are normally not required and their use is dependent on the peculiarities of the job.

7- A continuous and steady fluid flow through the chillers heat exchanger is necessary for proper system operation. If the fluid is being used to cool more than (1) process or machine, bypass circuits may be required.

8- Field supplied flow controls, meters or gauges may be required for proper operation.

9- An installer supplied strainer or filter is required in the return fluid line at the chiller. The fineness of the strainer mesh or the filtering medium used is dependent on local conditions. **Failure to provide a strainer or filter will void all warranties.**

Split condenser systems only

Refrigeration Piping: All packaged chillers leave the factory with the refrigeration side fully piped & charged.

Split systems require interconnecting refrigeration piping between the compressor/evaporator section and the condenser section. Both sections leave the factory charged with refrigerant. Their combined charge is indicated on the compressor/evaporator data tag. Additional refrigerant will have to be added in the field due to the interconnecting piping. The discharge and liquid lines in both sections have shutoff valves with capped service connections. Never uncap these service connections without checking the shutoff valves to be sure that they are fully closed and the units are ready for piping. To prevent moisture in the air from condensing inside the tubes, never leave refrigerant lines open when they are not being worked on, especially overnight. This is especially important with POE oils due to their hygroscopic nature. Copper tubing must be (TYPE L) refrigeration grade (ACR). When using high temperature solders, always pass dry nitrogen through the lines to prevent scaling. Interconnecting line size should never be based on the lead sizes at the compressor/evaporator section and the condenser section.

Notes:

Section #3 – Installation & Setup (continued)

(Things you NEED to know)

Refrigeration Liquid Line - split systems :

- 1- Liquid lines should be kept as short and direct as possible.
- 2- They should be sized for low pressure drop to prevent liquid flashing. The height of liquid risers must be taken into account.
- 3- Do not run liquid lines through heated spaces. At best, this will result in a loss of sub-cooling. At worst, the liquid refrigerant may flash.
- 4- Do not insulate liquid lines. Liquid refrigerant moving through the line will normally be warmer than the surrounding air. Un-insulated lines will allow for some heat exchange between the refrigerant and ambient air. This increased sub-cooling will result in slightly increased capacities.
- 5- Brace liquid lines securely to prevent damage to the line due to liquid hammer. Liquid lines have a tendency toward substantial motion when valves are suddenly opened or closed. The bigger & longer the line, the more pronounced the problem. This is caused by the shock of the liquid column impinging on the next closed valve or on the first bend in the line that it encounters and is a major cause of joint failure.

Refrigeration Discharge Line - split systems :

- 1- Discharge lines should be kept as short and direct as possible.
- 2- They should be sized for low pressure drop in order to minimize the effect of pressure drop on system capacity.
- 3- These lines should not be insulated except to prevent injury to personnel who may come in contact with them.
- 4- Horizontal lines should be pitched downward in the direction of flow to prevent oil from flowing back to the compressor during an off cycle.
- 5- Vertical lines require a trap at the base of the riser as well as an inverted trap at the top. The inverted trap should be the highest point in the discharge line and should have access valve installed to allow for purging of non condensable from the system. For vertical runs greater than 10-12 ft, additional traps should be used at 10 ft. intervals.
- 6- Systems using unloading compressors may require the use of double risers.

7- Line pulsation is an inherent characteristic in systems utilizing reciprocating compressors. Additional line support may be required to prevent transmission of vibration & movement in the line.

Compressor Oil Charge: All units using R407C leave the factory with mineral oil installed to the proper level in the compressor. Compressors intended for use with R134A, R404A & R507, are shipped with polyolester oil. For Copeland compressors which have an oil sight glass, the proper level is between 1/2 to 3/4 up the sight glass. These levels should be observed at start-up & when the system is operating. Add or remove oil from the system as necessary to maintain these levels. Always remember that too much oil is just as detrimental to a system as not enough.

In the absence of a visible oil leak, low oil level generally indicates one or more of the following problems:

- 1- Oil was not at the proper level to begin with.
- 2- Refrigerant lines are not properly pitched. This rarely is a problem with factory piping & is usually encountered with field piping on split systems. The usual causes are:
 - A- Failure to pitch piping in direction of flow.
 - B- Excessively large lines which allow refrigerant in velocities to drop below the point where oil is not returned to the compressor crankcase.
 - C- Failure to provide traps in vertical risers.
- 3- Low refrigerant mass flow.
- 4- A system component such as the suction accumulator having a plugged up oil return.

Excessively high oil levels are generally caused by one or more of the following:

- 1- Oil was not at the proper level to begin with.
- 2- Oil was simply added to the system due to a low sight-glass without looking for the cause.

Notes:

Section #3 – Installation & Setup (continued)

(Things you NEED to know)

3- A compressor change out using a compressor with a full oil charge. Replacement compressors generally contain no oil or have a reduced charge.

The following oils have been approved by Copeland for use with their compressors.

Mineral Oil: Witco, Suniso 3GS
Texaco, Capella WF32
Witco, Calumet RO15

Polyolester Oil: Mobile, EAL ARCTIC 22CC
ICI, Emkarate RL 32CF

Alkyl benzene's & alkyl benzene/mineral oil mixes are not covered in this manual since their primary purpose is for use with interim refrigerant blends which are not covered.

Leak Testing (Refrigeration Side): Prior to commissioning, the entire system must be leak tested. Due to their greater sensitivity, electronic leak detectors are recommended. Carefully leak test both factory and field made joints including condenser coils. Although each unit is factory leak tested, joints do loosen and sometimes break during shipment.

As with electrical connections, gasketed and flared joints may loosen after a short running time. Approximately 1 to 2 weeks after placing a system into operation, return to again leak check the various joints. Tighten or repair as necessary.

Leak Testing (Chilled Fluid Side): After initially filling the system with WATER ONLY, turn on all pumps & allow the fluid to circulate. The entire system should be checked for leaks, paying special attention to joints and seals. Approximately 1 to 2 weeks after placing a system into operation, return and again leak check the various joints. Tighten or repair as necessary.

If site is going to run glycol, it is advisable to add glycol to the system AFTER chiller and leak checks are performed. If climate conditions exist were running water only for testing can create the potential for freeze, the factory will reimburse customer to repair chiller fluid leaks in accordance to the factory labor allowance chart provided within this booklet.

Important: While initial commissioning and commissioning of your new system(s) is being performed, the system(s) should NEVER be left un-attended while running for at least two hours during first operational test of system.

Evacuation (Refrigeration Side): Evacuating a system to remove moisture and non condensable gases is necessary if it has been opened to the atmosphere. With split systems, provisions should be made to evacuate the interconnecting discharge and liquid lines prior to opening the shutoff valves provided in each section.

Non condensables trapped in the system will increase condensing pressures above what would be normal for a particular operating condition. This causes the system to run inefficiently and may cause nuisance trips on high pressure. Moisture will chemically react with refrigerant and oil in the system creating acids and sludge which in turn will corrode the system internally. This problem can be especially severe with POE oils. Proper evacuation will eliminate these problems.

CAUTION: Do not attempt to use the refrigeration compressor to evacuate the system. Do not start the compressor while in a vacuum.

Connect a deep vacuum pump to both high and low sides of the system with copper tube or vacuum hoses. The larger the tube or hose diameter the better. **In no case** should the inside diameter of the tube or hose be smaller than the vacuum pump's service port. A vacuum gauge capable of showing pressure in microns must be attached. Ordinary charging manifold gauges are not satisfactory! This gauge should be attached to the system as far from the vacuum pump connections as possible. Some gauges of this type may be damaged if exposed to pressures greater than atmospheric. Be sure that the system pressure is below one atmosphere before exposing the gauge to system pressure.

Notes:

Section #3 – Installation & Setup (continued)

(Things you NEED to know)

Manually open all service valves as required. Operate the vacuum pump until a pressure of 500 microns is attained. Close the vacuum pump service valves so as to isolate the pump from the condensing unit and turn it off. Perform a vacuum decay test by monitoring system pressure for approximately 1/2 hour. It should not rise more than 250 microns. Rising pressure indicates either a small leak which was not found during leak testing or moisture in the system.

If a leak is suspected, it must be found and corrected as indicated under leak testing above, **before** proceeding any further. Ultrasonic leak detectors are available which “listen” for the high frequency sound of gas rushing into or out of a system and do not require re-pressurizing the system with a combination of refrigerant and dry nitrogen.

If moisture in the system is the problem, continued evacuation is necessary. Due to the low boiling point of water at very low pressures, freezing of moisture may occur, especially when using a pump of excessive capacity. This can reduce system pressure so rapidly that freezing occurs unless special precautions are taken. These precautions include introducing dry nitrogen into the system to maintain pressure or using sun lamps to maintain temperatures above freezing. Simply running the vacuum pump to rid the system of moisture, once it has frozen, will greatly prolong the evacuation process.

Refrigerant Charging: Once leak testing and evacuation are complete, refrigerant charging may commence. Always refer to the unit nameplate as to the type and amount of refrigerant required.

Always use a charging manifold with gauges along with a scale to charge refrigerant into a system.

When initially charging a system that is in a vacuum, liquid refrigerant can be added directly into the high side while the compressor is off. Never liquid charge into the low side without taking special precautions as indicated further on in this section. As much refrigerant as possible should be charged in this manner since it is the fastest method available. Chilling the receiver (when provided) and warming the refrigerant cylinder will maximize the amount of refrigerant charged. Receivers can be chilled by using either liquid or dry ice packed into a insulating blanket which has been wrapped around the receiver. Refrigerant cylinders can be heated using sun lamps or a warm water bath. Do **not** use a torch or heat gun since these can cause cylinder pressures to increase significantly in a very short time span.

CAUTION: Cylinder pressures must be closely monitored whenever a refrigerant cylinder is being heated in ANY manner. Allowing pressures to exceed those for which the cylinder is rated, may result in the cylinder rupturing with related injury and/or property damage.

Once system and tank pressures have equalized, other slower methods must be employed to finish charging the system. The method chosen depends on the refrigerant involved.

“Pure” refrigerants such as R134A and R22 as well as Azeotropic blends such as R507 can be vapor charged into the low side. Never attempt to vapor charge into the system high side. This will result in the refrigerant cylinder being charged by the system rather than the other way around. Cylinders can quickly be over pressurized causing them to rupture with resultant injury and property damage.

Zeotropic blends such as R404A as well as near Azeotropic blends should generally not be vapor charged due to fractionation. This is the process where the most volatile component(s) in the blend begin to boil first thereby leaving higher concentrations of the least volatile component(s) behind. This does not present a problem if the entire contents of the refrigerant cylinder is to be used since at this point all the refrigerant has boiled off returning the mixture to its original proportions. If all the refrigerant in a cylinder is to be used, vapor charging is permissible although it is probably not a good habit to get into. When in doubt as to the type of blend being used, refer to a current pressure - temperature chart. If the saturated temperature column for a particular refrigerant shows distinctly different bubble and dew points, it is either a zeotrop or near azeotrop. These types of refrigerants should be liquid charged as this process prevents fractionation. Once liquid charging into the high side is complete, start the compressor and begin liquid charging the low side. When doing this, a throttling valve must be used to insure that the liquid flashes to vapor before entering the compressor. Pure refrigerants and azeotrops may also be charged in this manner.

Notes:

Section #3 – Installation & Setup (continued)

(Things you NEED to know)

Fractionation is a concern with system leaks. The problem is negligible in areas of the system where the refrigerant is in a totally liquid or vapor phase. However if the leak occurs in a heat exchanger where phase changes are normally encountered, the problem can be significant. In these cases, the refrigerant component(s) which are most volatile will be released first leaving behind high concentrations of the least volatile. This will eventually affect system performance to the point where water or glycol temperature cannot be maintained. The effects of fractionation become more significant with increased refrigerant glide. Therefore the problem is more pronounced with zeotropes than with near azeotropes. If leaks are small and corrected early, simply topping off is acceptable. However with systems having repeated or large leakages it may be necessary to completely evacuate and recharge.

The amount of refrigerant required to charge a system depends on the particular components used to make up the system. In addition, the type and combination of head pressure control being used must be considered. No head pressure control or condenser fan control by itself requires no additional refrigerant. Flooding types of head pressure control may require a significant amount of additional refrigerant. The exact amount being dependent on the condenser coil design as well as the minimum head pressures required for proper expansion valve operation. Combining fan control and flooding type controls can significantly reduce the amount of additional refrigerant required.

ES/EST system charging: As with all SmartFreeze, the ES/EST split systems come with a full factory charge. After run testing at the factory, valves are closed at the condenser and the chiller unit to hold the factory charge. Once the line set is field installed, tested with a nitrogen holding charge and evacuated to at least 200 microns, the refrigerant holding valves can be opened.

ON ALL ES/EST SYSTEMS: Additional refrigerant will need to be added to the system to account for the additional liquid line that has been field installed. Please see the table below to determine the additional refrigerant needed:

Notes: 1. The number of additional pounds indicated on the table above are per 100 linear feet of pipe. For example: An R-22 system with a 50' x 5/8 OD liquid line will require and additional 5.9 lbs of refrigerant (11.8 / 2 = 5.9). 2. On due stage systems the amounts above are per ckt.

LLTube OD	3/8	1/2	5/8	7/8	1-1/8	1-3/8	1-5/8
R22 /lbs	3.9	7.4	11.8	24.4	41.6	63.5	90
R404A /lbs	3.4	6.4	10.3	21.2	36.1	55	78

ES/EST with flooded condenser control for low ambient operation

Some applications require additional protection from low (0F) to very low (-30F) ambient conditions. In these cases, a flooded condenser control with a refrigerant receiver would be recommended.

Flooded condenser control operation: At approximately 180 PSI, the flooded condenser valve will begin to reduce the normal flow of refrigerant from the condenser outlet to the receiver causing liquid refrigerant to backup into the condenser coil. This process increases the amount of liquid in the condenser coils and reduces the vapor area. The net result of this is a reduction in the amount of coil surface area available to condense compressor gas thus increasing compressor head pressure.

To achieve effective flooded condenser control there **MUST BE** an adequate volume of refrigerant in the system. In event that there is not enough refrigerant volume in the system, the receiver will most likely be starved causing bubbling at the TXV inlet. This condition will cause abnormally low suction pressures and will result in intermittent (usually and night) low pressure lockout of the micro processor.

Flooded condenser charging procedure:

*** It is always best to perform these steps when the ambient is as close to 70F as possible.

Step #1: Load in the additional refrigerant required for the length and OD size of your liquid line. If not, this must be done before continuing.

Step #2: Look up your ES/EST chiller model on from the chart below and make a note of the **ADDITIONAL per ckt** charge need to achieve 100% condenser flooding.

<u>Model No.</u>	<u>R22 Fldg Charge</u> <u>100% full - lbs.</u>
36S2	13.1
48S2	16.0
60S2	21.4
75S2	26.2
90S2	26.2
120S2	42.8
72D2	9.8
96D2	19.9
120D2	18.6
150D2	39.8
180D2	39.8
240D2	39.8
180M2	21.4

Section #3 – Installation & Setup (continued)

(Things you NEED to know)

Note: For refrigerants other than R22 use the following multipliers to determine the 100% flooding charge.

R134A	1.01
R404A/R507	.89

Step #3: In order to continue to the next step, all compressors with un-loaders need to be set for full load and hot gas bypass valve coil ckts need to be disconnected. Failure to do so can result in gross errors.

Step #4: Locate the table in the back of this booklet with the title “Appendix One” figure 1.

1. Determine your “System Evaporating Temperature F.”: On tank model chillers this will be your design chiller leaving water temperature (LWT) minus 15F. On non-tank model chillers this will be your design chiller leaving water temperature minus 10F. **Example: And EST system with a design LWT of 65F will have a System Evaporating Temperature of 50F.**
2. Under “Minimum Ambient Temperature F.” locate the desired ambient temperature that this chiller will be operating in.
3. Using the Minimum Ambient Temperature and the System Evaporating Temperature, locate the percentage of total flooded charge in the table.

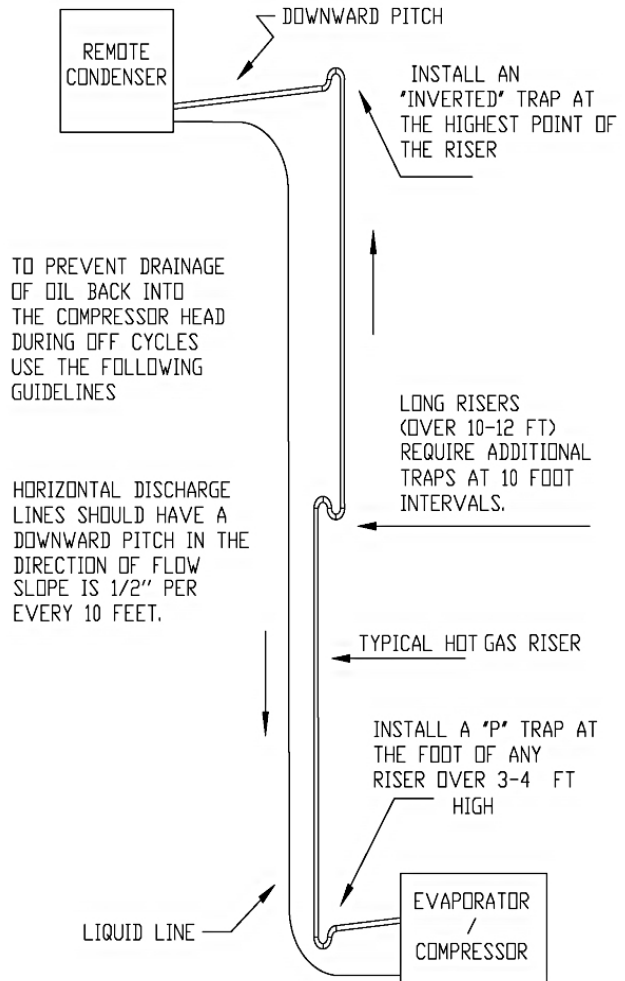
Step #5: Determine the pounds of refrigerant needed to achieve proper condenser flooding for your conditions by multiplying the percentage from step 4 –3 by the 100% flooded charge you determined in step #2.

Example of steps 1-5: EST180D with a design leaving water temp of 55F and a design Minimum Ambient Temperature of –20F. Your System Evaporating Temperature would be 40F (55F– 15F). Using the table in Appendix One” figure 1 your percentage of 100% flooding is 79%. From the table above (Step 2) 100% flooding for a 180D2 chiller is an **ADDITIONAL** 39.8 lbs PER CKT. Determine the additional **per ckt** charge by multiplying 39.8 x .79 = 31.44 lbs.

Split system line sizing: Installing and sizing the interconnecting piping between the ES/EST chiller and the remote CS condenser is extremely important. Deficiencies can result in considerable capacity reductions as well as potential compressor damage do to poor oil return.

For a basic idea of common piping payout, please an image has been provided to the right >

For recommended remote condenser line sized, please refer to Appendix Two in the back of this booklet.



Section #3 – Installation & Setup (continued)

(Things you NEED to know)

Rigging: Fork lifts or dollies are required for moving this equipment. When lifting from above, always use sufficiently long spreader bars to avoid lifting damage.

Unit Location (General information): Units must be positioned with sufficient clearance on all sides for proper inspection, maintenance and air flow.

On units with air cooled condensers, care must be taken to ensure an ample supply of fresh, clean air. When installing these units indoors, an intake and exhaust air system capable of handling 1,000 CFM per compressor horsepower must be supplied. In all cases, caution must be taken to avoid locating units in restricted spaces where heat build up at the condenser can occur. Locating units so that the air discharge from one blows into the air intake of another must be avoided. Avoid low overhangs which may cause discharge air to be recirculated through the condenser. One condenser height is the minimum distance that the condenser face may be located from a wall or obstruction. When placing (2) units side by side so that the condensers face one another, use twice the tallest condenser height as the minimum distance between units.

On air cooled units located outdoors & intended for year round operation, special attention must be paid to prevailing wind direction during colder weather. Cycling or reducing the speed of the condenser fan as a means of head pressure control can be totally ineffective when wind is blowing through the condenser. This is normally not a problem with optional flooding types of head pressure control.

Failure to follow these instructions will cause the unit to run inefficiently and may cause nuisance trips on various safety controls.

Inside vs. outside installation: Air-cooled condenser chillers require sufficient air volume to maintain design capacity and reliable operation. The SmartFreeze chiller works best when installed outside where adequate supply of ambient air is available at all times. If this is not possible, with certain precautions, it can be located inside.

Free air circulation: The space temperature in which the chiller is placed is also an important factor in the capacity and efficiency of the chiller. The ambient air temperature in the space must not exceed 105° F. For each 5° F rise in temperature above 95>F, a loss of approximately 6% capacity will result.

Condenser discharge air must be vented to the outside air space to prevent re-circulation. Installation of sheet metal ducts to the chiller cabinet is not recommended as **the direct drive condenser fan motors have not been designed to**

overcome additional external static pressure that a ducted system would produce.

There must be a minimum of Ten (10) feet of clearance between the condenser discharge and any permanent overhead structure. There must be a minimum of twelve feet clearance between the condenser discharge and any other air conditioning or refrigeration condenser discharges.

To assure proper condenser air intake, there must be a minimum of four (4) feet clearance around the entire cabinet.

NOTE: Some city codes will require special clearance requirements that may not be consistent with the above factory recommendations. In cases where local code requirements conflict in such a way that it may impact the chiller operation in a negative way, please contact the factory for assistance prior to installation.

Freeze protection: A glycol solution will be needed if freezing is a threat. Consult the section regarding freeze protection in the proceeding pages.

High ambient operation: Air temperatures over 105 ° F will definitely retard performance and cause high head pressures. All SmartFreeze come equipped with an accumulator to help counteract problems that can occur during high ambient operation. Contact SmartFreeze if problems related to high temperature extremes persist.

Notes:

Section #3 – Installation & Setup (continued)

(Things you NEED to know)

Water header system: A header system is a distribution and circulation piping system. This system is the single most important part of a successful chilled water system. The best, most expensive chiller will not perform if the water delivery system is not properly engineered. We cannot emphasize enough the importance of this aspect of the installation.

The header system consists of a supply header and a return header. They are more than just pipes because they must work as a system to distribute the water flow in equal volume and pressure along their full lengths. To accomplish this task, it is necessary that their size be adequate to avoid any restrictions, and that there be connecting bypass line between them at the opposite end from the chiller.

***** Installation of Hoffman #79 (or equal) automatic air vents at high points on the chiller water supply and return headers is highly recommended *******

Connections to the equipment:

1. **DO NOT REDUCE THE LINE SIZE** below the size of the connection.
2. Put thermometers and ball valves in the lines feeding to each heat exchanger for balancing the flow and future servicing.
3. It is recommended to consult with a qualified mechanical engineer to assist with proper connection, piping installation and pipe sizing.

Water in: This is the warm return header connection. SmartFreeze recommends the installation of an additional external water filter on the “Water in” side of the system. This filter must be sized properly to provide adequate flow at the design system flow rate and pressure. It is also recommended to install a bypass to allow return to the chiller while the external filter is being serviced.

Water out: This is the chilled water supply header connection. SmartFreeze recommends installation of a strainer of filter at the inlet of your process. Although the chiller may be protected by the “Water in” filter recommended above, protecting your process equipment from pipe debris is also a good practice.

System pump prime: If your chiller has been equipped with an integrated “System Pump” it will be necessary to perform a one time “Prime” of the pump. This can be achieved by installing a tee and valve assembly on the inlet side of the chiller that a garden hose can be attached to. The prime process may need to be repeated several times until the pump reaches full pumping capacity.

Wiring (General information):

All field wiring must conform to the requirements of the equipment as well as all applicable national and local codes.

Use only copper conductors that are properly sized to handle the load. Always consult the unit electrical nameplate. Since equipment is continuously being updated, do not rely on catalog information unless it has been verified.

Always refer to the unit electrical nameplate for sizing conductors, disconnects and fusing. Units are factory wired so that a single power source can be brought to the unit. This may not always be the case with non standard units. Consult the wiring diagram affixed to the inside of the control panel door.

Electrical connections have been securely tightened at the factory. They DO loosen during shipment and again during initial periods of operation. All connections should be checked and tightened as necessary prior to commissioning and again after the system has been operating for 1 to 2 weeks. To avoid injury, always disconnect power before conducting tightness checks.

Disconnect switches, either fused or non fused, are optional items when the system is purchased and normally are not factory supplied. They must be field supplied and installed as required by applicable national and local electric codes.

Section #3 – Installation & Setup (continued)

(Things you NEED to know)

Electrical connection: A separate supply circuit with a fused disconnect is required. A SmartFreeze chiller is equipped with a terminal block for easy high voltage tie in. It is recommended that a qualified technician perform the installation of the high voltage wiring. Great care must be taken to properly size the conductors and install the various electrical components outside the chiller.

Three phase chillers:

Pumps have been set up for proper rotation during test - check that they are rotating in the proper direction after power connections are completed. If your three phase service uses a “Stinger Leg”, this leg of power MUST be connected to the T-2 terminal.

Note: Equipment failures due to improper electrical hookup or supply voltage will not be covered by the SmartFreeze factory warranty.

24 volt control system: Your SmartFreeze chiller comes equipped with analogue controls. This system has been designed for simplicity of operation and tested for reliability. Below, is a list of the major control components as well as a brief description of their function in the system:

Low ambient fan controls (optional): The system comes equipped with two independent fan controls. The purpose of this control is to cycle the condenser fans to maintain the high side system pressure between 150 psig, and 275 psig, in cold low ambient conditions.

Primary low ambient control (optional) : An electronic proportional control that responds to compressor discharge pressure. This control is designed to modulate the fan. This device is factory set and should not require field calibration.

Compressor hot gas bypass: This system will be automatically activated 90 seconds from compressor commissioning This device will self regulate based on compressor suction pressure. This device is factory set and should not require field calibration during commissioning UNLESS you are setting this chiller up for glycol operation. If you system requires setup for glycol operation, please contact the factory for guidance.

Water flow safety switch: This safety control protects the chiller barrel from rupture in the event of water flow failure. As part of field commissioning and commissioning of your new equipment calibration of the Water Flow Switch is consider a common practice. It is VERY important to field verify that the flow switch opens in the event that there is low or no fluid

flowing through the chiller systems evaporator. Failure to do so can cause damage to your system that is not covered under the manufactures limited warranty. **Compressor time delay:** The compressor (non-adjustable) time delay is to prevent short cycling and compressor burnout due to continuous starting and stopping for periods of low or no cooling load conditions. **As of November of 2003, the compressor time delay is built into the chillers micro-processor controllers firmware.**

Note: In the event of condenser fan replacement NEVER use a sleeve bearing style fan. SmartFreeze recommends to always use Factory certified replacement parts.

Notes:

Section #4 – Pre-start things to know

Scroll compressors

The Copeland scroll compressor is uniquely different than normal reciprocating compressors. Their operating characteristics and requirements represent a departure from reciprocating technology.

CAUTION!!

Avoid contact with the top of the compressors during operation; they become very hot and can cause uncomfortable burns.

Proper electrical phasing of the power to the compressor is critical for proper operation and reliability of the scroll.

Correct rotation of the scroll must be established before the chiller is started, the electrical sequence of the power supply must be correct. The compressor motors are internally connected for clockwise rotation with the inlet power supply phased A, B, C.

To confirm phase sequence of A, B, C, use an Associated Research Phase indicator or equivalent.

It is highly recommended that a qualified technician make the connections of line power to the chiller.

The scroll compressor is designed to accommodate liquids (**both oil and refrigerant**) and solid particles without causing compressor damage, there are some characteristic noises that differentiate it from those typically associated with a reciprocating compressor. These sounds (described below) are characteristic and do not indicate the compressor is defective.

Low suction pressure at start up: The initial flow rate of the compressor is low due to the low condensing pressure, causing a low differential across the expansion valve, which results in low capacity and suction pressure. The compressor will rattle until the suction pressure climbs and the flow rate is increased.

Flutter at shutdown: When the compressor gas expands and causes the rotation until the check valve closes.

During normal operation there are no unusual noises other than those above.

WARNING!!

DO NOT PUMP DOWN THE SCROLL COMPRESSOR INTO A VACUUM.

Scroll compressors can pull internally low vacuums when the suction side is closed. This may cause the internal fusite terminal to arc resulting in compressor damage or failure. It

may also trip the circuit breakers or blow fuses.

Since the scroll compressor does not use suction or discharge valves, it is not necessary to perform a pump down. To hold a vacuum could damage a scroll compressor.

The proper procedure for checking a scroll compressor is:

1. Verify the power input is correct and phased properly.
2. With the compressor running, measure the suction and discharge pressure to see if they fall within the normal operating range of the unit.
3. Check the oil's appearance for discoloration. If the oil is dark and smells burnt, it overheated because of:
 - a. extremely high condensing pressure
 - b. the motor is burnt out
 - c. metal flakes indicate mechanical failure
4. Check the acidity of the oil with an acid test kit. A reading exceeding 05 mg OHM/g will verify a motor burnout.
5. Excessive amp draw can be caused by excessive condensing pressure or low power voltage coming to the unit. Discolored oil and vibration could result.
6. Low suction pressure can be caused by a plugged screen on the compressor suction inlet. A plugged screen will cause a low oil condition (measured at the oil charging valve). Rattling sounds, and an open winding thermostat could also result. Low load will also cause low suction pressure.
7. Excessive vibration and/or loss of pressure differential usually indicate mechanical failure.
8. Reversed phase rotation will cause:
 - Low current draw
 - Suction and discharge pressures nearly the same.
 - Rattling sound.

Reversed rotation for 15 to 30 minutes will result in the motor windings overheating. In which case, the motor winding thermostats will open. This will result in the compressor stopping. Continued reverse operation of a scroll compressor WILL cause eventual compressor failure. Such failures are NOT covered under the manufactures limited warranty.

Compressor motor winding thermostat: Each motor winding thermostat is a pilot duty designed to stop the compressor operation. The winding becomes hot due to rapid cycling, loss of charge, extremely low suction temperature, or reverse phase rotation.

Section #5 – Start-UP things to know

PLEASE REVIEW THE FOLLOWING INFORMATION BEFORE TURNING THE MICRO-PROCESSOR ON.

1. **Technical Qualifications: DO NOT ATTEMPT COMMISSIONING ON YOUR CHILLER UNLESS YOU HAVE BEEN PROPERLY TRAINED TO DO SO.** SmartFreeze provides fee based Factory Commissioning Services. For more information you should review the information provided within this booklet or consult with your Smart Family sales representative.
2. **Commissioning Authorization Request Form:** Within this booklet you will find a Commissioning Authorization Form. Please complete the form and fax to Smart Family before beginning commissioning.
3. **Commissioning Checklist:** Within this booklet you will find a commissioning check list that must be followed. If you have ANY questions contact SmartFreeze Support before you begin.
4. **Compressor oil levels:** If your chillers compressor is equipped with a crankcase oil sight glass make sure to check it. The compressor oil is at the proper level in the oil sight glass (when provided) for the compressor being used. For Copeland compressors, the oil should be between 1/2 to 3/4 up the sight glass. Once your compressor has been started it is very important to monitor compressor oil levels.
5. **Compressor shipping spacers (Semi-Hermetic only):** Shipping spacers on spring mounted compressors have been removed, the neoprene washers used to properly center the compressor foot on its mounting spring & stud have been properly installed & the mounting nut & washer are reinstalled to allow the compressor to “float”.
6. **Compressor crankcase warm-up:** If you are starting your chiller in ambient temperatures below 40F, you must leave the power on and micro-processor off for a least FOUR HOURS prior to commissioning.
7. **Scroll compressor rotation:** It recommended that you disable your compressors by safely removing fuses or disconnecting the compressors contactor 24V coil wire and checking pump rotation if your chiller is so equipped. If your pumps are turning the correct rotation then your scroll compressor should also be turning in the correct direction. After performing this check if your scroll makes a strange noise you must independently verify proper rotation.
8. **Rotolock connections:** Depending on the type and size of your chiller refrigeration components such as receivers and compressors are connected using rotolock connectors. It is common for such connections to become loose during shipment. Prior to starting your chiller ALL rotolock connections should be check for tightness. **IMPORTANT:** Make sure to use a backup wrench on stationery side of a rotolock connection. Failure to do so can result in breakage.
9. **Service valves:** Depending on the type and size of your chiller refrigeration components, such as receivers and compressors can be equipped with stem type service valves. In order to ship your chillers the U.S Department of Transportation (DOT) requires that all service valves be shipped in the closed position. As such prior to commissioning all stem service valves must be fully back seated to allow refrigerant to flow through. It is also VERY important to tighten the stem service valve packing once the valve has been back seated. Once back seat has been performed and packing's have been tightened remember to replace and tighten the plastic service cap on the valve.
10. **Fluid leaks:** Your chiller was inspected for fluid leaks prior to shipping. As part of the commissioning process you must inspect your chillers fluid system for leaks.
11. **Refrigerant leaks:** Your chiller was inspected for refrigerant leaks prior to shipping. As part of the commissioning process you must also inspect your chillers refrigeration system for leaks. SmartFreeze recommends the use of soap bubbles or an electronic leak detector.
12. **Monitoring the chiller during commissioning:** NEVER leave your chiller running unattended during commissioning.
13. **Adjustment of controls:** The following adjustable controls and valves must be checked with an appropriate gauge and/or thermometer. Many are optional items which may not be included in your system.
 - Condenser Fan Control
 - Heat Tape Freeze Protection Thermostat
 - Low Pressure Freeze Control
 - Thermostat & Stage Module
 - Freeze Control Thermostat
 - Discharge Bypass Valve
 - Head Pressure Control Valves
 - Thermostatic Expansion Valves
 - Water Regulating Valve
14. **Operational Check:** Once the system has operated for 2 or 3 hours without any sign of problems, it may be left operating overnight. The following day, recheck the system as follows:
 - Check both high and low side pressures. If they are not within appropriate ranges, determine the cause and correct.
 - Check sight glass for signs that additional refrigerant is required. Before adding any refrigerant, leak check the entire system correcting any leaks that may be found.
 - Check compressor oil level where appropriate. Add or remove oil as necessary.
 - Check evaporator superheat and readjust expansion valve as required.

Section #5 – Start-UP things to know (continued)

15. **Power checks:** Check voltage and amperage at the compressor power terminals. Voltage must be within $\pm 10\%$ of the nominal as indicated on the unit nameplate. If it is outside of this limit, contact the local power company. If amperage is excessive, the cause must be determined and corrective action taken. With a three phase line, the load must be balanced at each phase.

16. **Safety checks:** Check all safety and operating controls for proper operation.

17. **Low ambient controls:** Check all head pressure controls for proper operation. This may not be possible during warm weather and it will be necessary to wait until ambient falls below 70°F.

18. **Transformer's:** The control circuit transformer is used to step down the system voltage to 24 VAC used to power the control circuit. Additional transformers may be used to power selected components as shown on the wiring diagram. Systems intended for use on 208-230V electric service, the transformer leaves the factory wired for 230V on the primary side. Some transformers must be rewired when used on a 208V network. Always check the wiring of the transformer primary circuit before energizing.

19. **Water Flow Switch:** A differential pressure switch normally mounted on the back of the control panel in the compressor compartment. A safety device used to sense flow through the heat exchanger. It is adjustable from 1 to 10 psid and will shut down all refrigeration if flow rates drop for any reason.

20. **System Controls, Mechanical:** One or more piping diagrams are supplied in the envelope that contained these instructions and should be referred to while reading these instructions.

21. **Discharge Bypass Valve:** A modulating control valve which opens on a decrease in suction pressure and can be set to automatically maintain a desired minimum vaporating pressure regardless of the evaporator load. The valves normally used have an adjustment range of 0 - 80 psig. Other ranges are available and may be used depending on application. The valve is factory set to maintain a minimum evaporating temperature of 34°F for most applications. Do not reset to a lower pressure when chilling ordinary water unless specially designed heat exchangers are used. For applications using glycol solutions, this valve can be safely reset to maintain a lower minimum pressure. The exact setting will be dependent on the type and concentration of glycol used. To reset the valve, the following procedure should be followed.

A- Remove the cap and insert a 5/16 allen wrench into the adjusting screw. Turning this screw clockwise will increase the setting and counter clockwise will lower the setting.

B- A high evaporator load is initially required to raise the evaporator pressure above the desired setting.

C- Slowly decrease the load until the regulating valve begins to open. A hissing sound and/or an accompanying temperature rise at the outlet connection will indicate that the valve has opened.

D- Note the evaporator pressure when the valve opens. This is the current pressure setting of the valve.

E- Turn the adjusting screw as required and repeat steps 21C through 21D to determine the new valve setting.

F- Repeat this procedure until the valve is set at the proper pressure for the service required.

22. **Head Pressure Control Valve - adjustable:** This system uses a combination of Sporlan ORD/ORI valves. The ORD/ORI valve is adjustable over a range of 65 to 225 psig and is located in the liquid line between the condenser and receiver. Due to its wide adjusting range, it can be used with most commonly used refrigerants. The valve will throttle and restrict the flow of liquid refrigerant from the condenser. This causes liquid refrigerant to back up in the condenser, reducing active condenser surface and raising the condensing pressure. Adjusting the valve is done by removing the cover over the adjusting screw and turning it clockwise to raise pressure and counter clockwise to reduce pressure. The ORD valve is a non adjustable pressure differential check valve located in a bypass line between the systems discharge line and the receiver inlet. As the ORI valve restricts flow from the condenser, it creates a pressure differential across the ORD valve. This allows the ORD valve to bypass hot gas directly into the receiver, warming the liquid refrigerant and thereby maintaining a constant pressure at the expansion valve.

Head Pressure Control Valve - non adjustable: This system uses a Sporlan OROA valve which is factory set to maintain 180 psig discharge pressure with R22, R404A and R507. The valve used with R134A is set to maintain 100 psig. It does this by limiting the flow of liquid refrigerant from the condenser, thus flooding it, while regulating the flow of hot gas around the condenser to the receiver to maintain a constant pressure at the expansion valve.

23. **Thermostatic Expansion Valve:** A modulating valve used to meter refrigerant into the evaporator in response to the imposed load. It does this by maintaining a constant superheat of the refrigerant vapor at the suction outlet of the evaporator. The lower the superheat, the more efficiently the evaporator is operating. From a practical standpoint, we recommend a superheat of 8° - 10°F at the evaporator. To adjust superheat, remove nut covering the adjusting stem. Turning the stem clockwise will increase superheat and slightly decrease the valves capacity. Turning the stem counter clockwise has the opposite effect. Keep in mind that superheat cannot be adjusted when the system is in a pull down mode.

24. **Water Regulating Valve:** An optional modulating type valve used with water cooled condensers to maintain a constant head pressure. The valve senses discharge pressure and modulates the flow of water through the condenser in response to this pressure. Turning the adjusting stem on top of the valve will increase or decrease the system's discharge pressure

Section #6 – Freeze Protection

WARNINGS:

- 1. TO PREVENT POSSIBLE WATER FREEZE UP OF THE CHILLER EVAPORATOR COIL, DO NOT SET THE TEMPERATURE CONTROL (THERMOSTAT) BELOW 45 F. WITHOUT A MINIMUM OF 30% OF APPROVED GLYCOL AND WATER MIXTURE IN THE WATER SYSTEM.**
- 2. AUTOMOTIVE "ANTI-FREEZE" CONTAINS ADDITIVES THAT ARE NOT DESIGNED TO OPERATE WITH A CHILLER. USE OF SUCH PRODUCTS IN YOUR EQUIPMENT WILL DAMAGE COMPONENTS IN YOUR SYSTEM. SUCH DAMAGE IS NOT COVERED UNDER YOUR FACTORY LIMITED WARRANTY. ONLY USE THERMALSTAR (OR EQUAL) REFRIGERATION GRADE GLYCOLS ON SMARTFREEZE CHILLER SYSTEMS.**
- 3. GLYCOL OF THE APPROPRIATE CONCENTRATION SHOULD BE ADDED TO YOUR CHILLER SYSTEM WHEN THE CHILLER IS LOCATED OUTDOORS AND EXPOSED TO FREEZING TEMPERATURES.**
- 4. SMARTFREEZE CHILLERS ARE TESTED USING WATER. ONCE GLYCOL IS ADDED TO YOUR CHILLER SYSTEM, IT IS MOST LIKELY THAT YOUR CHILLERS SAFETY CONTROLS WILL NEED TO BE RE-CALIBRATED IN THE FIELD BY A QUALIFIED TECHNICIAN.**
- 5. USE OF GLYCOL IN A CHILLER WILL REDUCE ITS CAPACITY. CARE MUST BE TAKEN WHEN SIZING THE CAPACITY OF A CHILLER TO ADEQUATELY COMPENSATE FOR GLYCOL RELATED CAPACITY LOSS.**
- 6. ONCE GLYCOL HAS BEEN ADDED AND YOUR CHILLER HAS BEEN PROPERLY CALIBRATED TO SAFELY RUN GLYCOL, CARE MUST BE TAKEN WHEN ADDING WATER TO THE PROCESS LOOP. ADDING WATER WILL DILUTE GLYCOL FREEZE PROTECTION. ANY TIME WATER IS ADDED TO A GLYCOL SYSTEM, THE FREEZE POINT OF PROCESS FLUID MUST BE RE-CHECKED. IF FREEZE POINT HAS INCREASED ABOVE DESIREABLE LEVELS, ADDITIONAL GLYCOLS WILL NEED TO BE ADDED TO SYSTEM.**
- 7. ALWAYS CONSULT THE GLYCOL MANUFACTURES MSDS, DATASHEETS AND FREEZE TABLES PRIOR TO INSTALLATION.**
- 8. ALWAYS CONSULT YOUR LOCAL MUNICIPALITY AS NEEDED TO MAKE SURE THE GLYCOL PRODUCT(S) YOU ARE CONSIDERING USING COMPLY WITH ALL LOCAL CODES AND PRODUCT SAFETY STANDARDS.**

Glycol operation setup: Setting up your chiller to operate properly with glycol can be a challenge. Below, are some basic steps that should be considered.

- 1. Adjustment to Differential Pressure Flow-switch:** As glycol is added to your process loop viscosity will change. As viscosity of the process fluid changes the pressure drop across your chillers evaporator (i.e. chiller barrel) will also change. SmartFreeze uses a highly reliable pressure differential flow switch that reads pressure drop across your chillers evaporator. After adding glycol to your process loop it is common for your chillers micro-processor to start showing "Low-Flow" errors. When this happens your chillers refrigeration system will NOT RUN. To correct this problem the switch must be calibrated as follows:
 - **Locate switch:** The differential pressure flow switch is located in the compressor compartment. It is a blue box with a chrome tower on the top and bottom.
 - **Bleed air:** With the pump running, using the proper sized wrench, bleed the air from the high and low side of the switch feed tubes. Note: In many cases simply bleeding air will resolve the "Low-Flo" error.
 - **Calibration:** Removing cover will expose an aluminum arm. At the end of that arm is a RED NUT that requires a 5/16 wrench to adjust. Turning the nut CW will increase sensitivity and CCW will decrease sensitivity.
- 2. Adjust Hot Gas Bypass:** If your application requires process fluid to be lower than 45F, you will need to adjust your chillers hot gas bypass system.
- 3. Pump flow and amp draw adjustments:** After adding glycol pump amp draw needs to be re-verified. Pumps should NEVER be operated at amperages in excess of the "SF-AMPS" indicated on pump motors nomenclature sticker. If pump amps do exceed motor SF AMPS rating flow through the pump will need to be reduced.
- 4. Optional Adjustable flooded condenser valves (semi-hermetic systems only):** Unlike the Scroll compressor model chillers that have fixed flooded condenser valves, all standard Semi-Hermitic equipped chillers come with adjustable valves. If your chiller will be operating in ambient temperatures below 40F outside temperature, adjustment of the flooded valve may be needed to maintain compressor head pressure.

Section #6 – Freeze Protection (continued)

Glycol operation setup (continued): Setting up your chiller to operate properly with glycol can be a challenge. Below, are some basic steps that should be considered.

4. Adjustment to thermal expansion valves A modulating valve used to meter refrigerant into the evaporator in response to the imposed load. It does this by maintaining a constant superheat of the refrigerant vapor at the suction outlet of the evaporator. The lower the superheat, the more efficiently the evaporator is operating. From a practical standpoint, we recommend a superheat of 8° - 10°F at the evaporator. To adjust superheat, remove nut covering the adjusting stem. Turning the stem clockwise will increase superheat and slightly decrease the valve capacity. Turning the stem counter clockwise has the opposite effect.

IMPORTANT NOTE: DO NOT ATTEMPT TO FIELD ADJUST THE CHILLERS THERMAL EXPANSION UNLESS YOU ARE QUALIFIED TO DO SO. THIS MEANS YOU HAVE A SOLID WORKING KNOWLEDGE OF THE REFRIGERATION CYCLE AND EXTENSIVE EXPERIENCE AT MEASUREING OPERATIONAL SUPERHEAT AND SUBCOOLING. INCORRECT ADJUSTMENT OF A THERMAL EXPANSION VALVE CAN CAUSE SEVERE DAMAGE TO YOUR CHILLERS REFRIGERATION SYSTEM

Under some chiller operating conditions, adjustment to the thermal expansion valve at the time of startup is needed after glycols is introduced to the system.

SMARTFREEZE ONLY RECOMMENDS THERMALSTAR BRAND GLYCOLS FOR ITS CHILLER SYSTEMS.

Volume %		Volume %	Freeze pt
<u>ThermalSTAR</u>		<u>PG - TS</u>	<u>TS degF</u>
0.0		0.0	32.0
5.0		4.8	29.3
10.0		9.6	26.2
15.0		14.3	23.2
20.0		19.1	19.6
25.0		23.9	15.1
30.0		28.7	9.5
35.0		33.4	3.9
40.0		38.2	-4.1
45.0		43.0	-13.6
50.0		47.8	-23.0
55.0		52.5	-36.2
60.0		57.3	-51.9
65.0		62.1	<-60
70.0		66.9	<-60
75.0		71.6	<-60
80.0		76.4	<-60
85.0		81.2	<-60
90.0		86.0	<-60
95.0		90.7	<-60

Section #7 – Periodic Maintenance

MONTHLY

1. Check for foreign debris in the condenser coil inlets of an air cooled chiller.
2. Visually inspect for water leaks and proper tank level
3. Inspect solder joints for evidence of oil or water leaks.
4. Check electrical connections and components.
5. Listen for excessive vibrations or motor noise.
6. Check system fluid for proper glycol percentage.
7. Check the liquid line sight for bubbles.
8. Check the compressor oil level in sight glass if equipped.
9. Check fan and pump rotation for free rotation and correct direction.

YEARLY

In addition to above:

1. Tighten all electrical connection screws.
2. Check the glycol solution for cleanliness. Drain and refill with clean solution if excessive sludge or dirt is present. Flush the system prior to refilling.
3. Check motor amp draws and voltage supplies. Make sure they are within name plate rating.
4. Check operating pressures of the refrigeration system.
5. Check super heat and sub cooling.
6. Inspect for leaks with a sensitive electronic leak detector.
7. Check for excess wear or burned contacts on motor starters replace if in doubt.
8. Wash out the condenser coils of an air cooled system.
9. Check the operation of the safety devices and thermostat.
10. Ensure that the pipe insulation is dry and not broken down.
11. Check mechanical mounts and vibration isolators for wear.
12. Remove and clean Magnetic Flow Switch.

OTHER MAINTENANCE ITEMS

These maintenance items are for other Smart Family products that may be installed with your package chiller. **These items if applicable should be checked monthly unless otherwise specified below.**

SmartFreeze filter bypass assemblies - Optional:

1. Check system filter housing for cracks.
2. Check system filter housing for leaks.
3. Check filter pressure differential gauge(s). On most filter models, if the differential pressure exceeds 10 PSI, the filter cartridge needs to be replaced. **Contact SmartFreeze (281-540-2805) to order a replacement. Make sure to have the filter housing model number available when you call.**

SmartFreeze process drops - Optional:

1. Check assembly for any signs of cooling fluid leakage
2. Check in-line flow meter for debris that may be caught on or near the stainless steel slide.
3. Check coloration of cooling fluid.
4. Check return-side stainless steel in-line strainer for any debris that may restrict flow. Note: To perform this check, the system must be shut down. Close the supply and return side isolation valves at the top of the drop. Using the drain down valve at the bottom of the return side drop, drain the cooling fluid out of the line before opening in-line strainer. Make sure to reinstall the strainer basket and seal cap immediately. This check should be performed quarterly minimum.
5. Check condition of the supply and return pressure and temperature gauges.
6. Check supply drop circuit setter to make sure that the flow adjustment knob moves freely. Note, before moving the adjustment knob, make sure to note the original setting.
7. Once all check item have been performed, check drop for any potential leaks, re-set the circuit setter, open the main supply and return valves at the top of drop and restart your system.

Closed loop fluid testing and treatment

Most chiller systems are initially filled with municipal (main) water as a matter of convenience and overall costs. Although main water may be safe to drink, there is a multitude of bacteria and minerals that, if left un-checked, will cause considerable problems with any closed loop chiller application.

Section #7 – Periodic Maintenance (continued)

To prevent fluid related problems with you new closed loop chiller equipment, SmartFreeze highly recommends the following:

1. Have the condition of your system fluid checked by a qualified lab, a minimum of four times per year. If your area has a history of water quality related issues, testing may be required more often.
2. Based on the lab results, contract with a qualified company to provide products and services to properly maintain the quality of your closed loop fluid.
3. Create a fluid maintenance log that should contain copies of lab results, MSDS information on products used and notations of the types, amounts and dates chemicals were added to the system.

Here are some of the most common test parameters and the recommended ranges.

Common test parameters	Targets
pH	9.5—10.5
Specific Conductance micromhos, 18° C	3500 or below
Total Iron as Fe, ppm	1 ppm or below
Copper as Cu, ppm	1 ppm or below
Sodium Nitrite as NaNO ₂ , ppm	150 ppm max (See note 1)
Molybdenum as Mo, ppm	15—30 ppm
Reserve Alkalinity	(See note 2)

Notes:

1. Based on using 800 ppm or greater is appropriate if a straight nitrite-based product is used. However, we recommend against using a straight nitrite product in chilled water systems, because it promotes the proliferation of nitrifying bacteria.
2. Reserve alkalinity is a pertinent value only if glycol is used in the loop. If glycol is used in any of your loops, you may want to include glycol in your parameters, but list a recommended value only as operating conditions dictate for proper freeze protection or something similar.
3. Systems shipped after 4/1/13 are equipped with a Magnetic Flow Switch. Fluid quality must be maintained for proper operation. Switch should be removed and cleaned every 24 to 36 months minimum.

Notes:

Appendix One

Minimum Ambient Temperature (F)	Low Temp Chiller					High Temp Chiller				
	System Evaporating Temperature (F)									
	-35	-25	-15	-5	0	10	20	30	40	50
70	62	49	35	15	40	24	0	0	0	0
60	76	65	56	45	60	47	33	17	20	4
40	86	80	74	68	76	68	60	50	52	42
20	90	86	82	78	83	77	72	65	66	59
0	92	89	86	82	87	83	78	73	73	68
-20	94	91	88	86	91	87	82	77	79	73
-40	97	94	92	90	94	89	84	81	79	77

Note: The numbers in the table above are percentages of 100% condenser flooding

Appendix Two

RECOMMENDED REMOTE CONDENSER LINE SIZES

Net Evaporator Capacity BTUs	Total Equivalent Length FEET	R-134a		R-22		R507 & R-404A	
		Discharge Line (O.D.)	Liquid Line (O.D.)	Discharge Line (O.D.)	Liquid Line (O.D.)	Discharge Line (O.D.)	Liquid Line (O.D.)
3000	50	3/8	3/8	3/8	3/8	3/8	3/8
	100	1/2	3/8	3/8	3/8	3/8	3/8
6000	50	1/2	3/8	3/8	3/8	1/2	3/8
	100	1/2	3/8	1/2	3/8	1/2	3/8
9000	50	5/8	3/8	1/2	3/8	1/2	3/8
	100	5/8	3/8	1/2	3/8	5/8	3/8
12000	50	5/8	3/8	1/2	3/8	1/2	3/8
	100	7/8	3/8	5/8	3/8	5/8	3/8
18000	50	7/8	3/8	1/2	3/8	5/8	3/8
	100	7/8	1/2	5/8	3/8	5/8	1/2
24000	50	7/8	1/2	5/8	3/8	7/8	3/8
	100	7/8	1/2	5/8	1/2	7/8	1/2
36000	50	7/8	1/2	7/8	1/2	7/8	1/2
	100	1 1/8	5/8	7/8	1/2	7/8	1/2
48000	50	1 1/8	1/2	7/8	1/2	7/8	1/2
	100	1 1/8	5/8	7/8	1/2	1 1/8	5/8
60000	50	1 1/8	1/2	7/8	1/2	7/8	1/2
	100	1 3/8	5/8	7/8	5/8	1 1/8	5/8
72000	50	1 1/8	5/8	7/8	1/2	1 1/8	5/8
	100	1 3/8	7/8	1 1/8	5/8	1 1/8	5/8
90000	50	1 3/8	5/8	7/8	5/8	1 1/8	5/8
	100	1 3/8	7/8	1 1/8	5/8	1 3/8	7/8
120000	50	1 3/8	7/8	1 1/8	5/8	1 1/8	5/8
	100	1 5/8	7/8	1 1/8	7/8	1 3/8	7/8
180000	50	1 5/8	7/8	1 3/8	7/8	1 3/8	7/8
	100	2 1/8	1 1/8	1 3/8	7/8	1 5/8	7/8
240000	50	1 5/8	7/8	1 5/8	7/8	1 5/8	7/8
	100	2 1/8	1 1/8	1 5/8	7/8	1 5/8	1 1/8
300000	50	2 1/8	1 1/8	1 5/8	7/8	1 5/8	1 1/8
	100	2 1/8	1 1/8	1 5/8	1 1/8	2 1/8	1 1/8
360000	50	2 1/8	1 1/8	1 5/8	7/8	2 1/8	1 1/8
	100	2 5/8	1 3/8	2 1/8	1 1/8	2 1/8	1 3/8
480000	50	2 1/8	1 1/8	2 1/8	1 1/8	2 1/8	1 1/8
	100	2 5/8	1 3/8	2 1/8	1 1/8	2 1/8	1 3/8
600000	50	2 5/8	1 3/8	2 1/8	1 1/8	2 1/8	1 3/8
	100	3 1/8	1 5/8	2 1/8	1 3/8	2 5/8	1 5/8
720000	50	2 5/8	1 3/8	2 1/8	1 3/8	2 1/8	1 5/8
	100	3 1/8	1 5/8	2 5/8	1 3/8	2 5/8	1 5/8
840000	50	2 5/8	1 3/8	2 1/8	1 3/8	2 5/8	1 5/8
	100	3 1/8	1 5/8	2 5/8	1 5/8	2 5/8	2 1/8
960000	50	3 1/8	1 3/8	2 5/8	1 3/8	2 5/8	1 5/8
	100	3 1/8	2 1/8	2 5/8	1 5/8	3 1/8	2 1/8
1080000	50	3 1/8	1 5/8	2 5/8	1 3/8	2 5/8	2 1/8
	100	3 5/8	2 1/8	2 5/8	1 5/8	3 1/8	2 1/8
1200000	50	3 1/8	1 5/8	2 5/8	1 5/8	2 5/8	2 1/8
	100	3 5/8	2 1/8	3 1/8	1 5/8	3 1/8	2 1/8
1440000	50	3 1/8	1 5/8	2 5/8	1 5/8	3 1/8	2 1/8
	100	3 5/8	2 1/8	3 1/8	2 1/8	3 5/8	2 5/8
1680000	50	3 5/8	2 1/8	2 5/8	1 5/8	3 1/8	2 1/8
	100	4 1/8	2 1/8	3 1/8	2 1/8	3 5/8	2 5/8

REQUEST FOR START UP

To request start up, please complete ALL information below. Fax to SmartFreeze at least **TEN** days prior to commissioning date at 281-540-2805.

Note: Failure to return this form to Smart Family could void or delay warranty service and/or delay technical support.

Planned start up date:	Time:
------------------------	-------

Chiller Model Number

Chiller Serial Number

As part of our commitment to quality, start up of the unit by a factory trained representative is available. If this service is needed, please notify SmartFreeze at least ten days prior to the anticipated commissioning date. Upon this request, SmartFreeze will provide a written expense budget to provide this service.

The following items must be completed prior to requesting the start up:

With Power OFF

- The unit is in place
- Electrical is connected
- Main supply voltage has been verified. See units nomenclature
- Main supply power (To Disconnect) has been balance checked
- Piping and tank (if applies) are installed
- *Tank(s) if applies have been filled with water
- Condenser fans spin freely. (air-cooled only)
- This IOM booklet has been reviewed for proper installation requirements
- Glycol has been added to the system. Freeze point is confirmed at _____ F

IMPORTANT: If you are planning a winter outdoor commissioning and there is a possibility of freeze, DO NOT leave system charged with water as damage to components may occur. In these cases glycol should be added pri-

Signed	Date
Name (please print)	Company
Contact person	Phone
Full address of installation site:	



Field Commissioning Checklist (PAGE 1)

Please fax completed form to Smart Family at 281-540-8847 as soon as possible. Complete one form for each system being started. Note: This work should only be performed by a qualified service technician who is familiar with such equipment.

Start up date:	Arrival time:
Technicians Name:	Completion time:
Checked in at site with:	Smart Family billing PO# if applicable:
Full address of installation site:	

Power OFF system checks		<u>***** Important *****</u>
1. Unit Model:		<p>A. Micro-Processor: Prior to turning power on to the chiller, remove the dust cover from the back of the micro-processor controller and tighten ALL wire connections. Make sure to use a flat blade control screw driver that is of the correct size and DO NOT over tighten. When done replace the dust cover before commissioning. Once power is turned on to the chiller you will see SIX RED DOTS. In order to start chiller the power button (upper-right) must be held down firmly for 3-5 seconds.</p> <p>B. Pumps (Lack of fluid): DO NOT TURN THE CHILLER ON UNTIL THE CHILLER IS FULL OF FLUID. When the micro-processor is turned tank re-circulation pumps (STACT models only) will automatically start. Running ANY pump with limited fluid supply WILL cause damage to pumps seals.</p> <p>C. Pumps (Rotation): Once fluid levels are confirmed, pump rotation must be confirmed. Failure to confirm pump rotation WILL result in pump damage.</p>
2. Unit Serial:		
4. Condenser air clearance (TOP):	Feet:___ Inches:___ Open:___	
5. Condenser air clearance (SIDE):	Feet:___ Inches:___ Open:___	
6. Service access clearance (avg. all sides):	Feet:___ Inches:___ Open:___	
7. Chiller disconnect fuses (check):	Proper size:___ Tight:___	
8. Chiller main block fuses (check):	Proper size:___ Tight:___	
9. Check ALL electrical connections (check):	Proper size:___ Tight:___	
10. Check water connections to chiller (check):	Proper size:___ Tight:___	
11. Check condenser fan mounting brackets (check):	Proper size:___ Tight:___	
Power ON <u>compressor OFF</u>		
1. Main power supply voltage and phase:	Volts: _____ Phase: _____	
2. Main system pump rotation & RLA:	Rot.OK: __ Rot.Not Ok: __ RLA ___	
3. Tank pump rotation & RLA:	Rot OK: __ Rot Not Ok: __ RLA ___	
4. Signs of fluid leakage inside the chiller:		

Field Commissioning Checklist (PAGE 2)

Power on <u>compressor OFF</u> (cont.)	
5. With system pump on and running for 30 minutes, clean tank recirc strainer on tank model chillers.	Checked: _____ Clean: _____
6. Check micro processor programming. See page 3-5 of this booklet.	
Power on <u>compressor ON</u>>	
1. Ambient temperature:	DEG(F): _____ or DEG(C): _____
2. What is current freeze point of fluid?	DEG(F): _____ or DEG(C): _____
3. Compressor head pressure:	CKT1(Psi): _____ CKT2(Psi): _____
4. Compressor Suction pressure:	CKT1(Psi): _____ CKT2(Psi): _____
5. Super heat reading:	CKT1(F): _____ CKT2(F): _____
6. Compressor RLA:	COMP1: _____ COMP2: _____
7. Supply voltage on each leg:	L1: _____ L2: _____ L3: _____
8. Visual check of refer pipe connections for signs of leaks (check one):	Found: _____, None found: _____ Make location of any leaks on right>
9. Checked refer service caps for tightness:	All tight: _____, Tightened: _____
10. Condenser fan rotation & RLA:	Rot.OK: __ Rot.Not Ok: __ RLA: _____
11. Tank temperature control set point	Degrees F: _____ .

***** Important *****

After bleeding air from the high side of the pressure differential switch, (number #6 left) calibration must be checked. When barrel or tank recirculation pump is stopped, the micro-processor should indicate "Low-Flo" immediately. When pump is restarted the "Low-Flo" fault should clear automatically.

If the above does not happen the as described, the pressure differential switch must be re-calibrated.

See supplemental information

Notes:

Important: THREE PHASE COMPRESSORS ONLY: On scroll compressor commissioning, there is a 50% chance that compressor rotation may be off. On initial commissioning, if the compressor sounds louder than normal and your suctions and discharge pressures are not within a normal range, there is a high possibility that the compressor is running in reverse. If this is the case, reverse any two legs of power **TO THE COMPRESSOR and attempt to restart. RUNNING A SCROLL COMPRESSOR IN REVERSE FOR AN EXTENDED PERIOD OF TIME WILL CAUSE DAMAGE TO THE COMPRESSOR. SUCH DAMAGE IS NOT COVERED UNDER THE MANUFACTURES WARRANTY.**

Field Commissioning Checklist (PAGE 3)

Site information		Notes:
1. Unit location (check):	Ground pad: _____ Roof: _____	
2. Location of main loop filter (check):	Main loop: _____ Drop: _____	
3. Location of main loop bypass:		
4. Type of main loop bypass used (check):	Hand ball valve: ___ Automatic _____	
5. Main loop insulation (check):	Insulated: ___ Not insulated: _____	
6. Supply pressure at process drop:	PSI: _____ (or) Bar: _____	
7. Return pressure at process drop:	PSI: _____ (or) Bar: _____	
8. Supply temperature at process drop:	Degrees F: ___ (or) Degrees C: _____	
9. Return temperature at process drop:	Degrees F: ___ (or) Degrees C: _____	
10. Flow rate through farthest process drop:	GPM: _____ (or) LPM: _____	

Technicians Signature:		Customers Signature:	
Printed Technicians name:		Printed Technicians name:	
Date:		Date:	

Supplemental Information

For factory replacement parts visit:

<http://www.SmartCoolingProducts.com>

Or Call 281-540-2805

SMART FAMILY



***OF
COOLING PRODUCTS***