REFRIGERATION PARTS SOLUTION

"Do It Yourself" Kit
Assembly and Installation Manual

System 2M: Water-Cooled Condensing Unit with Holdover Plate Evaporator

Part Number 011-0410

Manual Version 2.0 - October 2008

TABLE OF CONTENT

List of Parts: Complete List (included with Kit)

Item	Part No.	Qty	Description
1	010-1120	1	Mounting Kit for Danfoss Compressor
2	010-1180	1	Danfoss BD80F Compressor (mm)
3	010-1185	1	12/24v Power Module for BD80F
4	012-1005	1	Circle Water-Cooled Condenser
5	015-0280	1	SS Mounting Bracket for Danfoss Thermostat
6	015-0282*	1	Danfoss Refrigerator Thermostat Service Pack
7	015-1510	1	200 –150 PSIG Pressure Switch (High)
8	017-0032	1	30 amp/#10 AWG Terminal Block – 6 pos, #8 Screw
9	017-0093	2	30 amp Terminal Block Jumper - #8 Screw
10	017-1002	1	40 amp DC Relay (SPST) – 12vdc
11	017-2011	1	10 amp Waterproof In-Line Fuse Holder (With Fuse)
12	018-0101**	1	Holdover Plate – 16” x 11” x 1 1/2”, Refrigerator Temp.
13	020-0032	1	Sporlan Filter-Dryer – C-032
14	025-0031	1’	Copper Tubing – 3/16" OD
15	025-0032	16’	Copper Tubing – 1/4” OD
16	025-0033	16’	Copper Tubing – 3/8” OD
17	025-0202	3	Copper Union - 3/8"
18	025-0422	3	Copper Long Radius Union Elbow - 3/8”
19	025-0502	1	Copper 45° Union Elbow – 3/8”
20	025-0601	1	Copper Street Elbow - 1/4”
21	025-0622	1	Copper Long Radius Street Elbow - 3/8”
22	025-0701	1	Copper Standard Tee - 1/4”
23	025-0702	1	Copper Standard Tee - 3/8”
24	027-0001	5	Heavy Duty Flare Nut - 1/4”
25	027-0002	2	Heavy Duty Flare Nut – 3/8”
26	027-0006	1	Reducing Flare Nut – 3/8” x 1/4”
27	027-0007	1	Reducing Flare Nut – 1/2” x 3/8”
28	055-0003	1	Mini SS Hose Clamp – 1/4” Band Width
29	055-0020	1	SS Mounting Bracket for Water-Cooled Condenser
30	055-0036	3’	Tube Insulation - 3/8” ID x 3/8” Thick
31	055-0105	1	SS Mounting Base Plate
32	070-0100	1	Shurflo Circulating Pump - .5 gpm, 12 vdc
33	070-0303	1	Shurflo Hose Barb Connector – 3/8” Elbow
34	070-0304	1	Shurflo Hose Barb Connector - 3/8” Straight
35	075-0200	1	Receiver, 3.5" x 7.5" x 1/4" flare - 2 lb.
36	077-0150	1	Sight Glass SA12S – 1/4” Solder x 1/4” Solder
37	079-0661	1	Swaging Tool - 1/4"
38	079-0803	2	Stay-Brite #8 Solder – 3’
39	079-0806	1	Stay Clean Flux Paste – 4 oz Jar
40	079-2001	1	SS Tube/Fitting Brush – 1/4” OD
41	079-2002	1	SS Tube/Fitting Brush – 3/8” OD
42	079-2010	1	Abrasive Cleaning Pad – 6” L x 4” W
43	095-0000	1	TN2 Thermostatic Expansion Valve – R134a
44	095-0001	1	OX - Danfoss Orifice

Item	Part No.	Qty	Description
45	096-0034	1	Schrader Valve Access Port – 1/4" OD Stem
46	096-0035	1	Schrader Valve Access Port – 3/8" OD Stem
47	096-0040	1	Base Valve – 1/4" Male Flare
48	096-0041	1	Base Valve – 3/8" Male Flare
49	211-0082	1’	Tinned Primary Wire, Red – 18 AWG
50	211-0533	2’	Tinned Primary Wire, Red – 12 AWG
51	211-0552	1’	Tinned Primary Wire, Yellow – 12 AWG
52	240-0001	12'	Safety Duplex Tinned Cable – 18/2
53	290-0001	6	Insulated Female Spade Electrical Terminal – 22-18 ga.
54	290-0011	4	Insulated Female Spade Electrical Terminal – 12-10 ga.
55	290-0102	4	Insulated #8 Ring Electrical Terminal – 22-18 ga.
56	290-0112	2	Insulated #8 Ring Electrical Terminal – 16-14 ga.
57	290-0122	6	Insulated #8 Ring Electrical Terminal – 12-10 ga.
58	290-0212	3	Adhesive Lined Heat Shrink Butt Connector – 16-14 ga.
59	400-0010	2	Hex Head Mounting Bolt – 18-8 SS, 5/16-24 x 1/2”
60	400-0011	2	Flat Washer – 18-8 SS, 5/16"
61	400-0012	2	Lock Washer – 18-8 SS, 5/16"
62	400-0131	8	Nylock Nut – 18-8 SS, 8-32
63	400-0291	1	Hex Nut – 18-8 SS, 3/8-16
64	400-0322	6	Phillips Pan Head Machine Screw – 18-8 SS, 8-32 x 1/2”
65	400-0324	2	Phillips Pan Head Machine Screw – 18-8 SS, 8-32 x 1”
66	400-0451	1	Lock Washer – 18-8 SS, 3/8"
67	400-0901	1	Saddle Mount - #10
68	400-0911	15	Standard Cable Tie – 7 1/2"
69	NA	1	CD Manual

*** For freezer application, the system uses a freezer designated thermostat and the part number is 015-0283. It is interchangeable with 015-0282 in the manual.**

**** Upgrade for this item is part number 018-0102, 018-0103, or 018-0104. An addendum manual that replaces pages 30 – 35 in this manual is required for proper assembly and installation.**

Required Tools

The following tools are required and are not included with the kit.

- #11 X-acto blade and handle
- Assorted open end and adjustable open end wrenches
- Bubble solution leak detector
- Electric drill and assorted drill bitts
- Flaring tool and tubing vise
- Hammer
- Heat gun or matches
- Medium Phillips screwdriver
- Nitrogen or CO2 tank with regulator
- Pencil and marking pen
- Pliers
- Propane torch
- Refrigeration service manifold gauge set
- Scale with 1 oz. accuracy
- Service wrench (1/4” square opening)
- Tape measure
- Tubing cutter
- Vacuum pump
- Wire crimping pliers
- Wire cutter and stripper

Additional Required Parts

The following parts are required and are not included with the kit.

Item	Qty	Description
1	tbd	Acetone or Similar Cleaning Solvent
2	1	Ball Valve (For Inlet Through Hull Fitting)
3	4	Bolts, Washers and Nuts – 1/4" diameter (To Mount Condensing Unit)
4	1	Cotton Rag
5	1	DC Breaker - 30 amp (Labeled "Refrigeration")
6	tbd	Electrical Supply Wiring & Electrical Terminals (Select Wire Gauge Appropriate for Distance & Terminals Appropriate for Wire Gauge)
7	tbd	Foam Tube or Adhesive Tape Insulation (To Insulate Suction Line)
8	tbd	Heat Shrink Tubing
9	4	Hose Barb Fitting - 3/8" OD (For Water Strainer & Through Hull Fittings)
10	8	Mini SS Hose Clamp – 1/4" Band Width (To Fit Water Hose)
11	tbd	Nylon Reinforced Vinyl Water Hose (Or Similar) - 3/8" ID
12	tbd	Oil (For Flared Connection Seals)
13	1	Raw Water Strainer – 3/8"
14	2 lbs	Refrigerant - R134a (and Refrigerant Can Tap Adapter if Using Disposable Cans)
15	tbd	Safety Duplex Tinned Cable – 14/2 (For Water Pump)
16	tbd	Spray Foam or Plumbers Putty
17	2	SS Screws - #8 x 1/2" (To Mount Thermostat Bracket)
18	2	Through Hull Fitting
19	8	Wood or Sheet Metal Screws (To Mount Holdover Plate)
20	4	Wood or Sheet Metal Screws (To Mount Water Pump)

Preparation: Tubing & Fitting Procedures

Please read the following section carefully before proceeding with the assembly and installation of the kit. Proper understanding of copper tubing and fitting preparation is essential for the successful building of this kit.

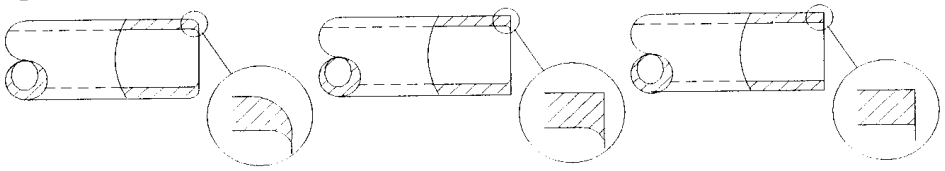
Procedure for **Cutting** tubing:

The copper tubing should be unrolled, and the cut made on a straight section. Place the tubing cutter around the tubing and tighten the blade adjustment knob until the cutting blade begins to bite into the tubing. Roll the cutter around the tubing once or twice, and then tighten the knob about a half turn. Repeat rolling the cutter around the tubing, tightening the knob each turn or two until the tubing is cut through.

Procedure for **De-burring** tubing:

Use the tip of a #11 X-acto™ blade to reach inside the end of the copper tubing and cut out the ridge or burr by rotating the blade around the inside of the tubing. Keep the shavings out of the tubing. When completed, there should not be any ridges around the rim of the cut edge of the tubing.

De-burring



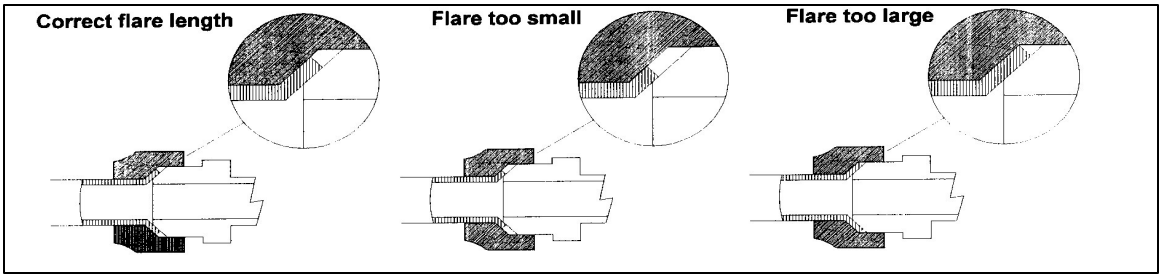
The proper de-burred tubing should resemble the diagram on the right (pictured above).

Procedure for **Bending** tubing:

Straighten the tubing by holding one end on a flat surface and unrolling the vertically positioned coil against the flat surface. Tubing benders are available, but the small diameter tubing included in the kit is relatively easy to bend by hand. Try to make large radius bends, and decrease the radius gradually and evenly until the bend is a good fit in the installation. Avoid over-bending and re-bending any section excessively. Often it is better to solder a straight section to the compressor and then bend it, using the compressor solder fitting to hold one end of the tube. The copper tubing should be bent carefully, and as little as possible. Repeated re-bending of the tubing will cause it to "work harden" and resist further bending. With repeated bending in the same location, the tubing will get very stiff and will reach a point that it will kink or break.

Procedure for **Flaring** tubing:

After the copper tubing has been de-burred, fit a flare nut over the end of the tubing with the open or large side of the nut facing the end of the tubing. Place the end of the tubing in the tubing vise, with about 3/16" of the tubing extending past the end of the vise. Tighten the vise firmly so the tubing cannot move. Attach the flaring tool over the tubing in the vise so that the cone will enter the tubing as the handle tightens. Tighten the flaring tool until the cone is against the end of the tubing. Tighten another two turns, and remove the flaring tool. Inspect the flare for size. A proper sized flare will just cover the entire bevel of the male flare fitting. If the flare is not large enough, slightly enlarge the flare using the flaring tool until it is the right size. Remove the flaring tool and tubing vise.



The diagram on the right and center (pictured above) are incorrect. The proper flare should resemble the diagram on the left.

Procedure for **Cleaning** tubing and fittings:

Clean the copper tubing after cutting and de-burring by using a piece of abrasive cleaning pad (also known as Scotch-Brite™ pad). Wrap the pad around the end of the tubing, and rotate the pad back and forth until the copper is shiny, bright, and clean. Avoid having dust from the pad enter the tubing end.

Use the SS tube/fitting brush to clean the inside of the female copper solder fittings. Insert the brush into the fitting while rotating the brush clockwise. Always turn the brush clockwise, and scrub the inside of the fitting with the brush until it is shiny, bright, and clean. Avoid having contaminates enter the end.

Procedure for **Fluxing** tubing:

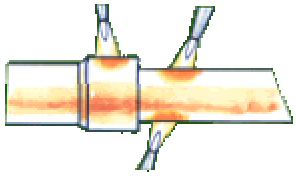
Once the copper tubing is clean, wipe a very small amount of flux over the end of the male tubing being soldered. Only the smallest film of flux is required to protect the tubing until soldering. Do not apply any flux to the inside of the female fitting; there will be enough flux from the male fitting.

Procedure for **Soldering** tubing:

After the copper tubing has been cut, de-burred, cleaned, and fluxed, fit the pieces together. Light the propane torch and adjust to a "medium" flame. The point of the inner blue flame is where the torch is hottest.

Start heating the tubing, first applying the flame at a point just adjacent to the fitting. Work the flame alternately around the tubing and fitting until both reach soldering temperature (as indicated by the flux becoming clear and fluid) before applying the solder.

Move the flame to the fitting and apply solder with a wiping motion directly on the connection to ensure that it flows evenly into the joint. Spread the molten solder evenly around the entire fitting. Do not keep adding solder and heat in an attempt to "fill the joint" as this can allow liquid solder to flow into the system. A properly soldered joint requires very little solder.



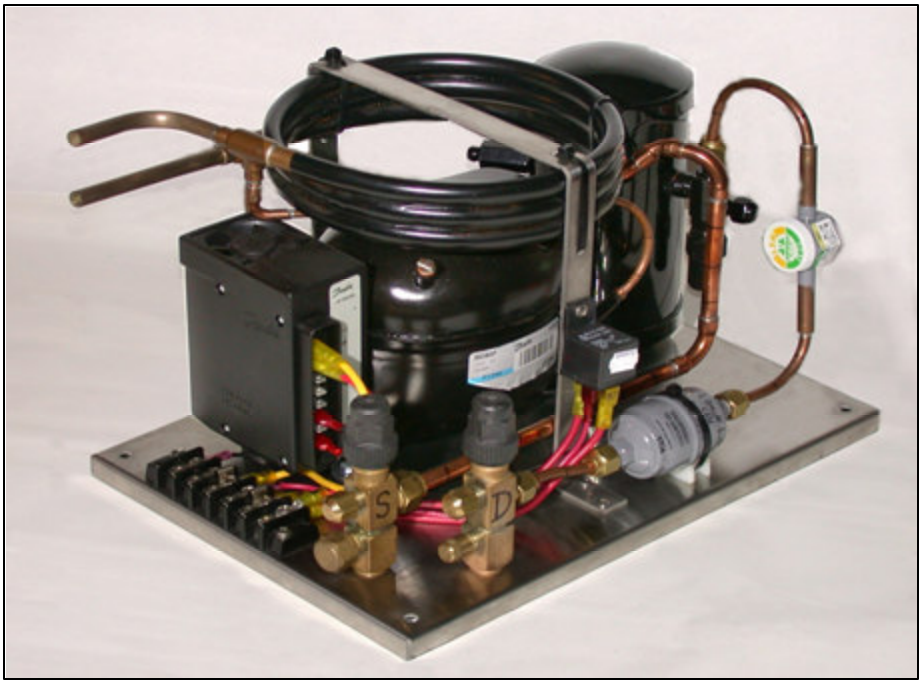
Sweep the flame back and forth along the axis of assembled joint...tubing and fitting...to achieve uniform heat in both parts. Avoid overheating the copper tubing. If the tubing starts turning a dark color and/or begins smoking, it is best to let it cool, re-clean and re-flux the tubing before re-soldering. After the joint is soldered, with the tubing still warm, thoroughly clean the joint of all excess flux using a water-moistened rag.

Tubing Reference Lines:

In the following Assembly Instructions, some photos show lines on the tubing. These lines are one inch apart, and are useful as a visual reference for bending and routing of the tubing.

Introduction to the Condensing Unit

The condensing unit houses the most essential component of the refrigeration system, the compressor. The compressor is the most vital component as it is the "heart" that pumps the refrigerant throughout the system. A Danfoss BD series compressor powers this DC DIY Kit as it has proven to be the most reliable and efficient compressor for small DC refrigeration systems.



Paired together with the compressor on the base plate is the condenser. The external water pump moves water through the condenser, cooling the hot compressed refrigerant gas supplied from the discharge port of the compressor. This cooling causes the refrigerant vapor to condense into a liquid that collects in the receiver, also located on the base plate.

The compressor pushes the liquid refrigerant from the receiver past the sight glass and filter-dryer. The refrigerant then continues through the high side (discharge) base valve on the condensing unit and 1/4" copper tubing to the thermostatic expansion valve. The thermostatic expansion valve is the metering device that regulates the amount of refrigerant flowing into the holdover plate. This creates high-pressure on the condensing unit side of the thermostatic expansion valve and low-pressure on the holdover plate side of the thermostatic expansion valve. As the refrigerant moves from the high-pressure side to the low-pressure side, the refrigerant evaporates and absorbs heat from the solution in the plate, eventually freezing it. The compressor pulls the refrigerant vapor back from the holdover plate through the low side (suction) base valve and into the compressor, which compresses it again, and the process continues. This difference in pressure is the key to the whole refrigeration process.

List of Parts: Condensing Unit Mechanical Assembly

Item	Part No.	Qty	Description
1	010-1120	1	Mounting Kit for Danfoss Compressor
2	010-1180	1	Danfoss BD80F Compressor (mm)
3	010-1185	1	12/24v Power Module for BD80F (3-pin)
4	012-1005	1	Circle Water-Cooled Condenser
5	015-1510	1	200 –150 PSIG Pressure Switch (High)
6	017-0032	1	30 amp/#10 AWG Terminal Block – 6 pos, #8 Screw
7	017-1002	1	40 amp DC Relay (SPST) – 12vdc
8	020-0032	1	Sporlan Filter-Dryer – C-032
9	025-0031	1’	Copper Tubing – 3/16" OD
10	025-0032	16’	Copper Tubing – 1/4” OD
11	025-0033	16’	Copper Tubing – 3/8” OD
12	025-0202	1	Copper Union - 3/8"
13	025-0422	1	Copper Long Radius Union Elbow -3/8”
14	025-0502	1	Copper 45° Union Elbow – 3/8”
15	025-0601	1	Copper Street Elbow - 1/4”
16	025-0622	1	Copper Long Radius Street Elbow - 3/8”
17	025-0701	1	Copper Standard Tee - 1/4”
18	027-0001	5	Heavy Duty Flare Nut - 1/4”
19	027-0002	1	Heavy Duty Flare Nut – 3/8”
20	055-0020	1	SS Condenser Bracket for Water-Cooled Condenser
21	055-0105	1	SS Mounting Base Plate
22	075-0200	1	Receiver, 3.5" x 7.5" x 1/4" flare - 2 lb.
23	077-0150	1	Sight Glass SA12S – 1/4” Solder x 1/4” Solder
24	079-0661	1	Swaging Tool – 1/4"
25	079-0803	1	Stay-Brite #8 Solder – 3’
26	079-0806	1	Stay Clean Flux Paste – 4 oz Jar
27	079-2001	1	SS Tube/Fitting Brush – 1/4” OD
28	079-2002	1	SS Tube/Fitting Brush – 3/8” OD
29	079-2010	1	Abrasive Cleaning Pad – 6” L x 4” W
30	096-0034	1	Schrader Valve Access Port– 1/4" OD Stem
31	096-0040	1	Base Valve – 1/4" Male Flare
32	096-0041	1	Base Valve – 3/8" Male Flare
33	400-0010	2	Hex Head Mounting Bolt – 18-8 SS, 5/16-24 x 1/2”
34	400-0011	2	Flat Washer – 18-8 SS, 5/16"
35	400-0012	2	Lock Washer – 18-8 SS, 5/16"
36	400-0131	8	Nylock Nut – 18-8 SS, 8-32
37	400-0291	1	Hex Nut – 18-8 SS, 3/8-16
38	400-0322	6	Phillips Pan Head Machine Screw – 18-8 SS, 8-32 x 1/2”
39	400-0324	2	Phillips Pan Head Machine Screw – 18-8 SS, 8-32 x 1”
40	400-0451	1	Lock Washer – 18-8 SS, 3/8"
41	400-0901	1	Saddle Mount - #10
42	400-0911	4	Standard Cable Tie – 7 1/2"

During the assembly process of the condensing unit, be aware that the oil used in the compressor is very *hygroscopic*. The oil will absorb moisture (humidity) out of the air and this moisture will form compounds that cannot be removed by evacuation. These compounds are acidic, and will diminish the life of the compressor. Try to limit the total time that the compressor oil is exposed to open air to 15 minutes or less. Always keep the compressor caps on the fittings until right before soldering the connections to them. Also note to keep all open fittings capped once they have been soldered onto the compressor.

Assembly Instructions: Condensing Unit (Mechanical)

1. Mount the 3/8" male flare suction base valve (096-0041) in the square hole on the mounting base plate (055-0105) that is closest to the middle of the short edge of the base plate. Label the valve with "S" to identify as the suction valve before mounting. The base of the valve has a square cutout on the bottom that fits in the square hole of the base plate and prevents the valve from turning on the base. Position the valve so the two flare fittings are pointing as shown. Attach the valve using the 5/16-24 x 1/2" hex head mounting bolt (400-0010), 5/16" lock washer (400-0012), and 5/16" flat washer (400-0011) to hold it in place from underneath the base plate. Tighten firmly using an appropriately sized wrench.

2. Mount the 1/4" male flare discharge base valve (096-0040) in the remaining square hole on the base plate (055-0105). Label the valve with "D" to identify as the discharge valve before mounting. The base of the valve has a square cutout on the bottom that fits in the square hole of the base plate and prevents the valve from turning on the base. Position the valve so the two flare fittings are pointing as shown. Attach the valve using the 5/16-24 x 1/2" hex head mounting bolt (400-0010), 5/16" lock washer (400-0012), and 5/16" flat washer (400-0011) to hold it in place from underneath the base plate. Tighten firmly using an appropriately sized wrench.

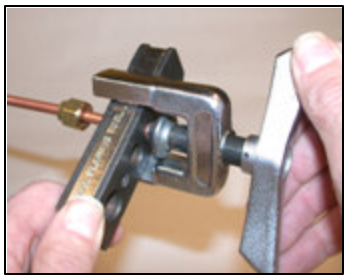
3. Locate the mounting kit for the compressor (010-1120) and remove the contents from the bag. Install the four rubber feet into the four large holes in the metal base that is attached to the bottom of the compressor (010-1180). Install the rubber grommets with a twisting motion. The thicker side of the rubber feet will be on the bottom. Retain the bolts, sleeves and nuts for mounting of the compressor to the base plate (055-0105) in the next step.

4. Mount the compressor (010-1180) on the base plate (055-0105) using the fasteners retained from Step 3. Position the compressor so that the access tubes (3 in total) are facing towards the middle of the base plate and are facing the base valves. This will position the electrical connections on the compressor to the left as shown in the photo. The sleeves fit into the rubber mounting feet from the top and the flat washers go on top of the rubber mounting feet and sleeves. Insert the bolts through the washers, sleeves and base, attach the nuts and tighten firmly using two wrenches.

5. Mount the receiver (075-0200) in the largest round hole on the base plate (055-0105). Attach the receiver using the 3/8-16 hex nut (400-0291) and 3/8” lock washer (400-0451) to hold it in place from underneath the base plate. Position the receiver so that the King valve points to the corner of the base plate behind the base valves as shown. Tighten firmly using an appropriately sized wrench.

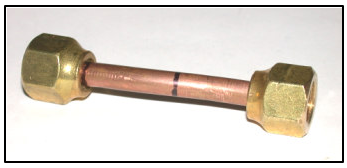
6. Locate the #10 saddle mount (400-0901), and attach it through the hole in the base plate (055-0105). The hole is about 6” from the discharge base valve. Mount with an 8-32 x 1/2" Phillips Pan head machine screw (400-0322) and 8-32 Nylock nut (400-0131). Align the saddle mount as shown. This will be used to hold down the filter-dryer (020-0032) in a later step.

7. Cut a piece of 1/4" copper tubing (025-0032) 5" long to connect the King valve on the receiver (075-0200) to the sight glass (077-0150). De-burr both ends of the tubing and clean both ends with the abrasive cleaning pad (079-2010). Place a 1/4" heavy duty flare nut (027-0001) over one end of the tubing, and flare the end. Apply flux (079-0806) on the other end of the tubing.



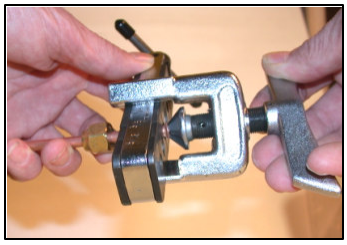
8. Cut a piece of 1/4" copper tubing (025-0032) 3 1/4" long to be used to connect the sight glass (077-0150) to the filter-dryer (020-0032). De-burr both ends of the tubing and clean both ends with the abrasive cleaning pad (079-2010). Place a 1/4" heavy duty flare nut (027-0001) over one end of the tubing, and flare the end. Apply flux (079-0806) on the other end of the tubing.

9. Cut a piece of 1/4" copper tubing (025-0032) 2 1/4" long to be used to connect the filter-dryer (020-0032) to the discharge base valve (096-0040). De-burr both ends of the tubing and clean both ends with the abrasive cleaning pad (079-2010). Place a 1/4" heavy duty flare nut (027-0001) over one end of the tubing, and flare the end. Place a 1/4" heavy duty flare nut (027-0001) over the other end of the tubing, and flare this end.

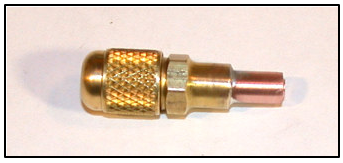


10. Cut a piece of 1/4" copper tubing (025-0032) 8" long to be used to connect the condenser (012-1005) to the 1/4" copper tee (025-0701). De-burr and clean both ends of the tubing with the abrasive cleaning pad (079-2010) and apply flux (079-0806) to one end of the tubing.

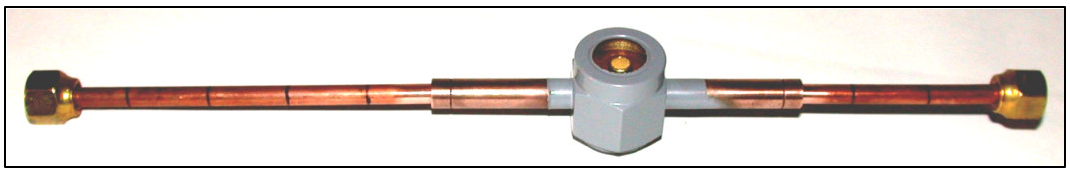
11. Cut a piece of 1/4" copper tubing (025-0032) 6" long to be used to connect the 1/4" copper tee (025-0701) to the receiver (075-0200). De-burr and clean both ends of the tubing with the abrasive cleaning pad (079-2010). Place a 1/4" heavy duty flare nut (027-0001) over one of the ends and flare the end of the tubing. Apply flux (079-0806) on the other end of the tubing.



12. Cut the copper stem on the 1/4" Schrader valve service port (096-0034) so that 1/2" of stem remains beyond the end of the brass fitting. Remove the cap and the Schrader valve core with the valve core tool and set aside until Step 14. De-burr the stem, clean the stem with the abrasive cleaning pad (079-2010) and flux (079-0806) the end of the stem. This Schrader valve service port will connect to the high-pressure switch (015-1510) in a later step.

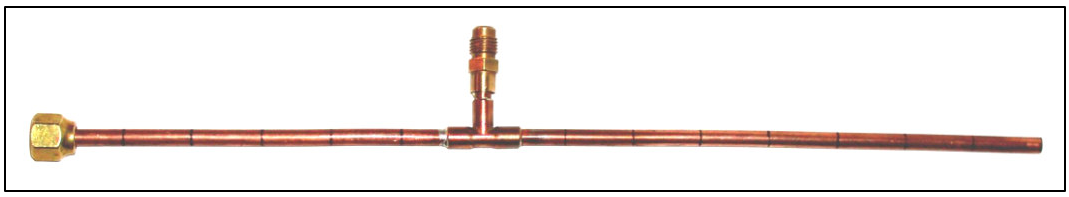


13. Locate the sight glass (077-0150) and use the 1/4" SS tube/fitting brush (079-2001) to clean the inside of both ends. Use the abrasive cleaning pad (079-2010) to clean the shoulder of the ends of the sight glass. Insert the cleaned and fluxed end of the 5" tube from Step 7 into one end of the sight glass, and insert the cleaned and fluxed end of the 3 1/4" tube from Step 8 into the other end of the sight glass.



With the assembly in a horizontal position, solder both joints of the sight glass.

14. Locate the 1/4" copper tee (025-0701) and use the 1/4" SS tube/fitting brush (079-2001) to clean the inside of the fitting. Insert one cleaned and fluxed end of the 8" tubing from Step 10 into one "arm" of the 1/4" tee. Insert the cleaned and fluxed end of the 6" tubing from Step 11 into the other "arm" of the 1/4" tee. Insert the cleaned and fluxed end of the 1/4" Schrader valve service port (096-0034) from Step 12 into the "stem" of the 1/4" copper tee. With the assembly in a horizontal



position, solder all three joints of the fitting. When the fitting has cooled, replace the Schrader valve (removed in Step 12) in the Schrader valve service port.

15. Cut a piece of 3/8" copper tubing (025-0033) 8" long. De-burr both ends of the tubing and clean both ends with the abrasive cleaning pad

(079-2010). Place a 3/8" heavy duty flare nut (027-0002) over one of the ends and flare the end.

16. Cut a piece of 3/8" copper tubing (025-0033) 3 3/4" long and another piece 1 1/2" long. De-burr both ends of the tubing and clean both ends of both pieces of tubing with the abrasive cleaning pad (079-2010).

17. 

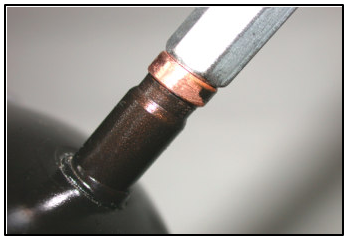
Locate the 3/8" copper long radius union elbow (025-0422). Clean the inside of both ends of the fitting with 3/8" SS tube/fitting brush (079-2002). Locate the 8" tubing piece from Step 15. Flux (079-0806) the un-flared end and insert into one end of the 3/8" copper long radius union elbow. Locate the 3 3/4" tubing piece from Step 16. Flux one end of the tubing and insert into the other end of the 3/8" copper union elbow. Solder the two ends of the copper union elbow where they join the copper tubing.

18. 

Locate the 1/4" copper tubing (025-0032) and use a pair of pliers to squeeze flat the end of the tubing. Squeeze about 1/4" of the end flat and bend over slightly as shown in the photo on the right. Clean the

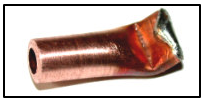
end of the tubing with the abrasive cleaning pad (079-0210). Apply a small amount of flux (079-0806) and solder the flattened tip of the tubing as shown in the photo on the left. Measure 3/4" from this bent and soldered end of the tubing and cut with a tubing cutter. This fitting will serve to plug the extra suction connection on the compressor.

19. Remove the aluminum cap on the compressor suction tube that is nearest to the end with the electrical contacts with a pair of pliers. Use a hammer and the 1/4" swaging tool (079-0661) to enlarge the tube to 1/4", the size of the copper tubing that will be soldered to it.

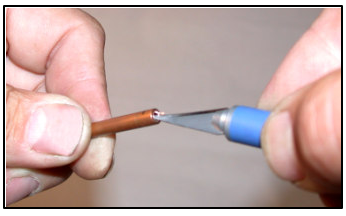


Align the swaging tool carefully and strike firmly and squarely with the hammer several times until the swage tool bottoms out against the shoulder of the tube. Remove the swage tool from the compressor suction tube. **It is very important to limit the exposure of the oil to the atmosphere to 15 minutes or less, as the oil is very hygroscopic and will absorb moisture (humidity) out of the air.** The moisture will react with the oil and form acidic compounds that cannot be removed by evacuation and will diminish the life of the compressor.

20. Use the 1/4" SS tube/fitting brush (079-2001) to clean the inside of the compressor suction tube. Only twist the brush clockwise. Clean the edge or shoulder of the suction tube with the abrasive cleaning pad (079-2010). Twist the corner of a clean cotton rag into a point. Moisten the rag point with a solvent such as Acetone, and twist the point of the rag in the compressor suction tube to clean any oily film from the inside of the compressor suction tube. Repeat as necessary to remove all oil or oily film from the inside of this tube. Clean, flux (079-0806), and insert the end of the cut and soldered copper fitting from Step 18 into the compressor suction tube and solder. Avoid overheating the fitting or the tubing. Only use a minimum amount of solder to make this connection and do not allow solder to enter the compressor.

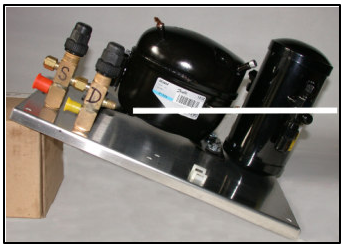


21. Cut a piece of 3/16" copper tubing (025-0031) 11" long and de-burr. Clean both ends of the tubing with the abrasive cleaning pad (079-2010), and apply a small amount of flux (079-0806) to one end.



22. Remove the cap covering the compressor discharge tube that is closest to the label and use the 1/4" SS tube/fitting brush (079-2001) to clean the inside of the compressor discharge tube as in Step 20. Only twist the brush clockwise. Twist the corner of a clean cotton rag into a point. Moisten the rag point with a solvent such as Acetone, and twist the point of the rag in the compressor suction tube to clean any oily film from the inside of the compressor discharge tube. Repeat as necessary to remove any oil or oily film from the inside of this tube. Use the abrasive cleaning pad to clean the shoulder of the discharge tube on the compressor. Apply a small amount of flux to the shoulder of the discharge tube.

23. Lift the short side of the base plate (055-0105), (the end with the base valves) and rest it on a box or other object about four inches high to tilt the compressor so that the compressor discharge tube is horizontal. This will prevent excess solder from running down into the compressor and plugging it. Bend the 3/16" tubing from Step 21 just enough to clear the King valve on the receiver. Now insert the cleaned, fluxed end of the 3/16" tubing into the compressor discharge tube and solder. Avoid overheating the fitting or the tubing. Plug up the end of the 3/16" tubing to prevent the exposure of compressor oil to atmosphere. Only use a minimum amount of solder to make this connection. If solder is allowed to enter the discharge tubing of the compressor, it may plug the compressor and ruin it. *Damage of this sort is not warranted in any way by RParts*.



24. Rest the base plate (055-0105) flat after soldering. When the solder joint on the compressor (010-1180) has cooled, gently bend the 3/16" discharge copper tubing up vertically, and then bend it over the top of the compressor diagonally, towards the opposite corner of the base plate. Make large radius bends and avoid kinking the tubing.

25. Connect the flare nut on the "L" shaped tubing piece prepared in Step 17 to the suction base valve. Tighten the flare nut securely with the appropriate sized wrenches so that the short leg of the "L" is pointing up vertically, parallel to the receiver. Align the long leg of the "L" to be parallel with the long dimension of the base plate and level with the horizontal plane.

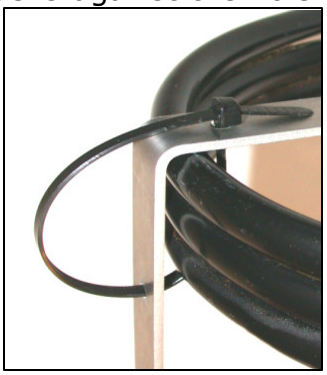
26. Clean the inside of one end of a 3/8" copper union (025-0202) with the 3/8" SS tube/fitting brush (079-2002). Locate the 1 1/2" piece of copper tubing from Step 16. Apply flux (079-0806) on one end the tubing and insert into one end of the copper 3/8" union. Solder the joint together.

27. Remove the cap covering the remaining compressor suction tube and remove all paint from the exterior of the tube stub with the 3/8" stainless steel tube/fitting brush (079-2002). Clean the suction tube stub with the abrasive cleaning pad (079-2010), and apply a small film of flux (079-0806) to the exterior of this stub.

28. Clean the inside of other end of the 3/8" union that is attached to the 3/8" tubing prepared in Step 26 with the 3/8" SS tube/fitting brush (079-2002). Fit the union over the cleaned and fluxed compressor suction tube and solder the joint. Do not allow solder to enter the compressor. When the parts have cooled, clean the short piece of the 3/8" copper tubing with the abrasive cleaning pad (079-2010), and apply a small film of flux (079-0806) to the exterior of the tubing.

29. Locate the 3/8" copper long radius street elbow (025-0622). Clean the inside of the female end of the elbow with the 3/8" SS tube/fitting brush (079-2002). Clean the outside of the male end of the elbow with the abrasive cleaning pad (079-2010) and apply flux (079-0806) after cleaning. Locate the 3/8" copper 45° union elbow (025-0502). Clean the inside of both ends of this fitting with the 3/8" SS tube/fitting brush (079-2002). Flux the end of the short leg of the "L" shaped piece attached in Step 25. Attach the female end of the 3/8" copper long radius street elbow to the short leg of the "L". Attach the 3/8" copper 45° union elbow to the male end of the long radius street elbow, and to the piece of 3/8" copper tubing attached to the compressor suction port in Step 28. Swivel the elbows as necessary to obtain the alignment that will fit. Solder these three joints in place.

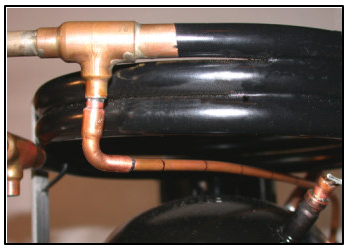
30. Locate the circle condenser (012-1005), condenser bracket (055-0020), and two 7 1/2" cable ties (400-0911). Position the condenser bracket so that the tabs are facing downward and point to the right. Center the condenser in between the bracket with the connection tubes facing you and butt the condenser to the underside of the bracket. The condenser and condenser bracket assembly will look like the photo shown above when completed. Insert one of the cable ties through one of the holes located on the top horizontal section of the condenser bracket as shown in the photo to the left. Pull the cable tie all the way down until the locking end of the cable tie is against the hole. Wrap the cable tie down and around the condenser. Pass the tip of the cable tie through the top hole of the vertical leg of the condenser bracket, insert the tip through the locking end of the cable tie as shown in the photo to the right, and cinch it up tight. Repeat this step with the other cable tie on the other side of the condenser and condenser bracket. Trim the excess length of the cable ties flush with the locking end of the cable tie.



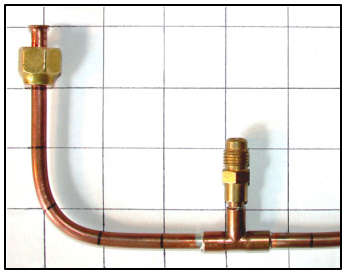
31. 

Position the condenser and bracket assembly over the compressor with the condenser connection tubes pointing away from the receiver and align the condenser bracket holes with the holes in the base plate (055-0105). Mount the bracket assembly to the base plate using 8-32 x 1/2" Phillips Pan head machine screws (400-0322) from the top, and 8-32 Nylock nuts (400-0131) on the underside of the base plate. There are 4 holes in total. Tighten the nuts on the screws using the appropriate sized screwdriver and wrench. If necessary, adjust the position of the condenser in the bracket by sliding the condenser in the cable ties until the water connections on the condenser are parallel with the long side of the base plate, and the condenser tubing is about 1/4" from the receiver.

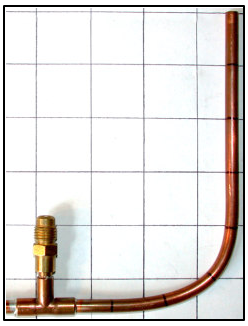
32. 
Clean the male end of the 1/4" copper street elbow (025-0601) with the abrasive cleaning pad (079-2010), and clean the female end with the 1/4" SS tube/fitting brush (079-2001). Locate the 1/4" copper tubing (025-0032) and de-burr; clean and flux one end of 1/4" copper tubing. Insert the fluxed end of this tubing into the female end of the street elbow and solder. When cool, measure, cut, and de-burr the 1/4" copper tubing, leaving 3/8" of tubing extending beyond the female end of the street elbow.

33. 
After the elbow assembly from Step 32 has cooled, clean the end of the 3/16" discharge tubing on the compressor with the abrasive cleaning pad and clean the inside of the condenser inlet (shown on the right) with the 1/4" SS tube/fitting brush (079-2001). Locate the elbow assembly from Step 32 and clean the 3/8" long piece of 1/4" tubing with the abrasive cleaning pad (079-2010), and clean the inside of the male end of the 1/4" copper street elbow (025-0601) with the 1/4" SS tube/fitting brush. Flux (079-0806) the 1/4" tubing on the elbow assembly, flux the end of the 3/16" compressor discharge tube, and connect the elbow section between the end of the compressor discharge tube and condenser inlet fitting. Bend the discharge tubing as necessary to get a good fit. When the fitting is in place, solder both the discharge and inlet ends of the elbow assembly.

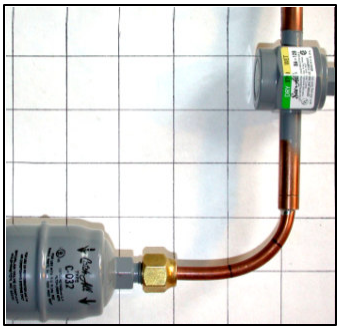
34. Locate the pieces assembled in Step 14. The 1/4" heavy duty flare nut (027-0001) will connect to the inlet of the receiver (075-0200). Remove the cap covering the 1/4" male flare fitting on the inlet of the receiver. Position the base plate at the edge of the worktable to allow the long tubing piece to extend below the base plate. Loosely fit the flare nut on the assembly to the receiver connection, and carefully bend the assembly to fit between the base plate and receiver inlet. Use the black lines on the photo as a guide for the correct bending location. (The lines are one inch apart).



35. After bending the tubing to fit correctly, attach the 1/4" heavy duty flare nut (027-0001) to the flare fitting on the inlet of the receiver (075-0200). Position the tubing on the compressor side of the condenser bracket as shown in the photo to the right and tighten the flare nut slightly with a wrench. Bend the tubing with the open end upwards to join with the condenser (012-1005) outlet. The correct bend dimensions are visible in the photo to the left. Adjust the bend to meet up with the condenser outlet fitting. When the bend is correct, tighten the flare nut on the receiver tightly using two wrenches. Clean the outlet of the water-cooled condenser with the 1/4" SS tube/fitting brush (079-2001). Clean the end of the bent 1/4" tubing, flux (079-0806), and insert into the condenser discharge fitting and solder as shown in the photo to the left.



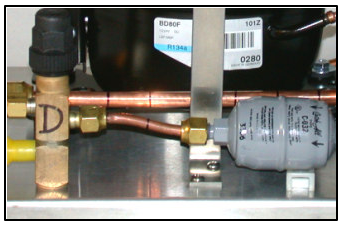
36. Attach the 1/4" heavy duty flare nut (027-0001) on the short end of the tubing assembly prepared in Step 13 to the inlet of the filter-dryer (020-0032). Tighten slightly with a wrench. Hold the sight glass (077-0150) tightly and bend the tubing gradually towards the filter drier with the glass side of the sight glass towards the filter-dryer. The bend should be close to the sight glass end of the tubing, as shown in the photo. Use the black lines in the photo as a guide for the correct bending location. (The lines are one inch apart).



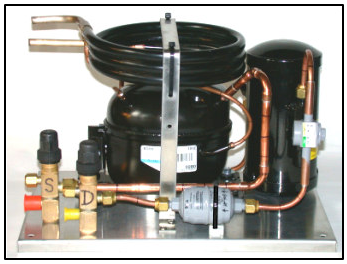
37. Remove the 1/4" female flare nut attached to the male flare fitting of the receiver discharge valve (King valve). Retain this flare nut for use in a later step.

38. Attach the 1/4" heavy duty flare nut (027-0001) on the long end of the sight glass assembly to the discharge fitting (King valve) on the receiver. The filter-dryer (020-0032) will be above the compressor as shown in the photo to the right. Bend the filter-dryer and sight glass (077-0150) over in a 180° bend so that the filter-dryer will sit in the saddle mount (400-0901), with the seam of the filter-dryer on the base valve side (front) of the saddle mount. Make the bends gently, and try not to re-adjust the bends much as the copper will work harden and become more difficult to bend. The sight glass should be facing the base valve end of the condensing unit as shown in the photo to the left.

39. Remove the filter-dryer (020-0032) from the sight glass assembly, and attach one of the 1/4" heavy duty flare nuts (027-0001) of the 2 1/4" tubing piece assembled in Step 9 to the filter-dryer discharge end. Attach the other 1/4" heavy duty flare nut (027-0001) of the 2 1/4" piece to the 1/4" male flare fitting at the back of the discharge base valve (096-0040). Tighten both 1/4" flare nuts tightly with two wrenches. Bend the tubing down slightly on the discharge valve end, and bend the other end of the 2 1/4" tubing piece up, so the filter-dryer will fit into the saddle mount (400-0901) and align horizontally, parallel with the base plate. Make the bends in the tubing a short distance from the flare nuts, so that the nuts are not stressing the tubing where it enters the flare nut.

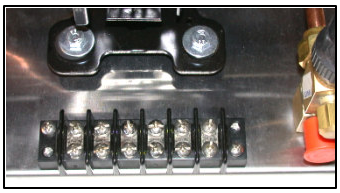


40. Re-attach the filter-dryer (020-0032) to the 1/4" heavy duty flare nut (027-0001) on the sight glass assembly, and use two wrenches to tighten the flare nut firmly on the filter-dryer. Now, using two wrenches, check the tightness of all six flare connections on the condensing unit and assure that they are all very tight. Insert a cable tie (400-0911) through the saddle mount (400-0901) and around the filter-dryer and back into the cable tie end. Cinch the cable tie up tight and trim off the excess wire tie length.



41. Wrap a cable tie (400-0911) around the condenser (012-1005) and wrap it through the "arch" of 3/8" suction line tubing near where it goes into the compressor, as shown in the photo to the right. Complete the loop with the cable tie and snug it up, just enough to bring the condenser tubing about 1/4" from the copper suction line. Trim off the excess cable tie length.

42. Attach the 30 amp terminal block (017-0032) using two 18-8 SS, 8-32 x 1" Phillips Pan head machine screws (400-0324), and two 8-32 Nylock nuts (400-0131) to the base plate (055-0105) immediately in front of the compressor electrical terminals. With a screwdriver holding the screw from above, tighten the nuts beneath the base plate with a wrench.



43. Using a 8-32 x 1/2" Phillips Pan head machine screw (400-0322) and a 18-8 SS, 8-32 Nylock nut (400-0131), attach the 40 amp relay (017-1002) to the outside of the condenser bracket vertical leg near the filter-dryer. The relay terminals should face down.

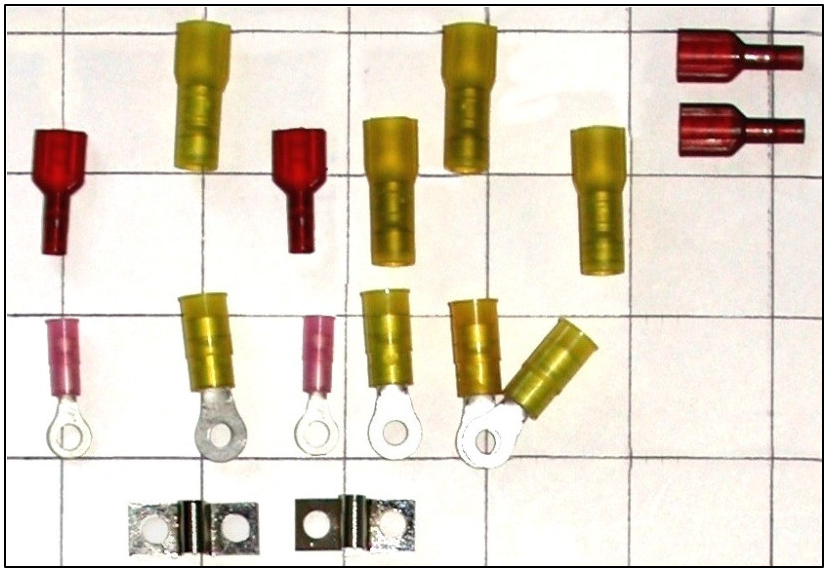
44. Locate the high-pressure switch (015-1510) and thread it on to the 1/4" male flare fitting on the 1/4" Schrader valve service port (096-0034) assembled in Step 14, and installed in Step 35. Tighten the high-pressure switch tightly using two wrenches. Use a wrench to prevent the 1/4" Schrader valve service port from turning and distorting the tubing it is attached to.

45. Attach the compressor power module (010-1185) plug to the three compressor pins on the end of the compressor that has the module mounting bracket. Orient the plug so that the wires come off the top of the plug. Push this plug firmly onto the pins of the compressor. Remove the module mounting screw located on the side of the module mounting bracket from the flange of the bracket on the compressor. Orient the plastic housing of the module over the flange on the condenser side of the module mounting bracket. The module will fit around this flange, and the screw hole on the compressor will align with the screw on the compressor module mounting bracket. Attach the module housing over the bracket, insert the screw through the hole in the module housing and into the threaded hole in the bracket on the compressor, and tighten the screw with a screwdriver.

This completes the Mechanical Assembly of the Water-Cooled Condensing Unit. Proceed to the Electrical Assembly section of the Water-Cooled Condensing Unit.

When moving the condensing unit, lift by the base, or lift by the condenser bracket. <u>Never</u> attempt to lift the condensing unit by the tubing.

List of Parts: Condensing Unit Electrical Assembly



Item	Part No.	Qty	Description
1	017-0093	2	30 amp Terminal Block Jumper - #8 Screw
2	211-0082	1’	Tinned Primary Wire, Red – 18 AWG
3	211-0533	2’	Tinned Primary Wire, Red – 12 AWG
4	211-0552	1’	Tinned Primary Wire, Yellow – 12 AWG
5	290-0001	4	Insulated Female Spade Electrical Terminal – 22-18 ga.
6	290-0011	4	Insulated Female Spade Electrical Terminal – 12-10 ga.
7	290-0102	2	Insulated #8 Ring Electrical Terminal – 22-18 ga.
8	290-0122	4	Insulated #8 Ring Electrical Terminal – 12-10 ga.

Assembly Instructions: Condensing Unit (Electrical)

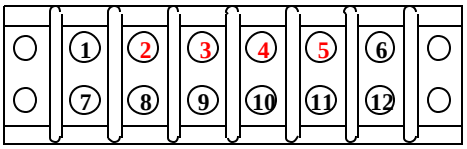
1. Cut the following lengths of wire:
   A. Two 8” lengths of 12 gauge red wire (211-0533)
   B. One 6” length of 12 gauge red wire (211-0533)
   C. One 8 1/2” length of 18 gauge red wire (211-0082)
   D. One 8” length of 12 gauge yellow wire (211-0552)
   E. One 2” length of 16 gauge wire cut from one lead of the high-pressure switch (015-1510)

2. Strip 3/8” of insulation from both ends of each wire from Step 1. Crimp one 12-10 gauge insulated #8 ring electrical terminal (290-0122) on one end of each of the 12 gauge wires. Crimp one 12-10 gauge insulated female spade electrical terminal (290-0011) to the

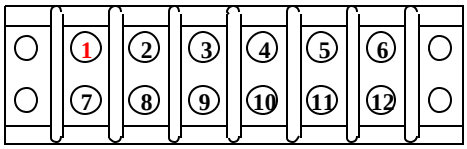
other end of each of the 12 gauge wires. Crimp one 22-18 gauge insulated #8 ring electrical terminal (290-0102) to one end of the red 18 gauge wire, and crimp one 22-18 gauge insulated female spade electrical terminal (290-0001) to the other end of the red 18 gauge wire. Crimp one 22-18 gauge insulated female spade terminal (290-0001) to each end of the 2" length of 16 gauge wire (cut from 015-1510).

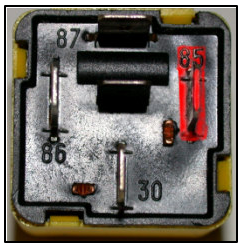
3. Cut one wire on the high-pressure switch (015-1510) so that 9" of wire remains attached to the high-pressure switch, and cut the other wire of the high-pressure so that 15" of wire remains attached to the high-pressure switch. Crimp a 22-18 gauge insulated #8 ring electrical terminal (290-0102) to the 9" length and crimp a 22-18 gauge insulated female spade electrical terminal (290-0001) to the 15" wire.

4. Connect the 30 amp terminal block jumpers (017-0093) to the terminal block (017-0032) terminals. One jumper goes under terminal block terminal screws #**2** and **3**; the other terminal block jumper goes under terminal block terminal screws #**4** and **5** as shown in red in the diagram above.

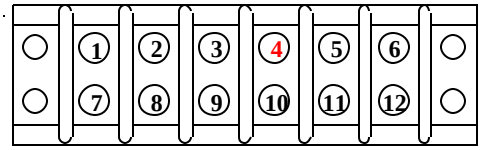


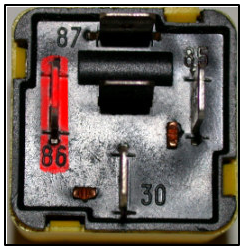
5. Connect the insulated #8 ring electrical terminal attached to the 9" high-pressure switch lead to terminal block terminal screw #**1**, as shown in red in the diagram above. Connect the insulated female spade electrical terminal attached to the 15" high-pressure switch lead to terminal **85** on the 40 amp DC relay (017-1002) that is attached to the condenser mounting bracket as shown in red in the photo to the left.



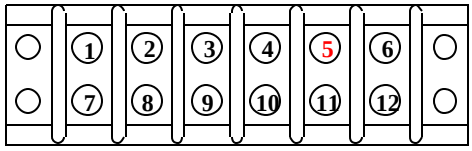


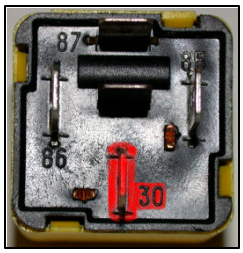
6. Connect the insulated #8 ring electrical terminal attached to the 8 1/2" red 18 gauge wire from Step 2 to terminal block terminal screw #**4** as shown in red in the diagram above. Connect the insulated female spade electrical terminal attached to the other end of the 8 1/2" length of red 18 gauge wire to terminal **86** on the 40 amp DC relay (017-1002), that is attached to the condenser mounting bracket as shown in red in the photo to the left.



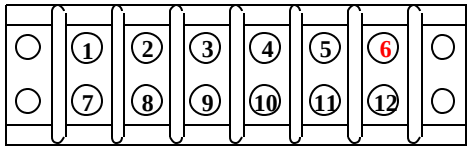


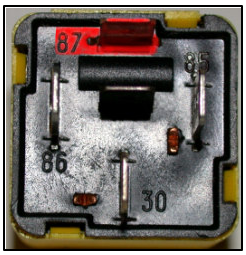
7. Connect the insulated #8 ring electrical terminal attached to the 8" red 12 gauge wire from Step 2 to terminal block terminal screw #**5** as shown in red in the diagram above. Connect the insulated female spade electrical terminal attached to the other end of the 8" length of red 12 gauge wire to terminal **30** on the 40 amp DC relay (017-1002) that is attached to the condenser mounting bracket as shown in red in the photo to the left.



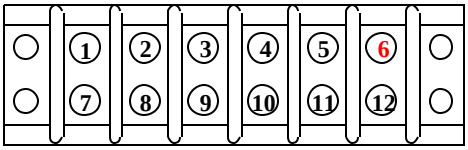


8. Connect the insulated #8 ring electrical terminal attached to the other 8" red 12 gauge wire to terminal block terminal screw #**6** as shown in red in the diagram above. Connect the insulated female spade terminal attached to the other end of the 8" length of red 12 gauge wire to terminal **87** on the 40 amp DC relay (017-1002) that is attached to the condenser mounting bracket as shown in red in the photo to the left.

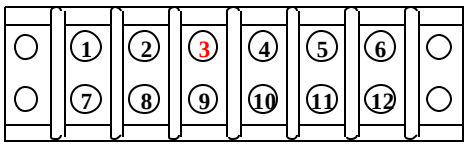




9. Connect the insulated #8 ring electrical terminal attached to the 6" red 12 gauge wire to terminal block terminal screw #**6** as shown in red in the diagram above. Connect the insulated female spade terminal attached to the other end of the 6" length of red 12 gauge wire to the large "**+**" terminal on the power module for the compressor (010-1185) as shown in red in the photo to the left.



10. Connect the insulated #8 ring electrical terminal attached to the 8" yellow 12 gauge wire to terminal block terminal screw #**3** as shown in red in the diagram above. Connect the insulated female spade terminal attached to the other end of the 8" length of yellow 12 gauge wire to the large "**-**" terminal on the power module for the compressor (010-1185) as shown in red in the photo to the left.



11. Connect one insulated female spade electrical terminal on the 2" black wire to the "**T**" terminal on the power module (010-1185) for the compressor. Connect the other insulated female spade electrical terminal on the 2" black wire to the "**C**" terminal on the power module for the compressor as shown in red in the photo to the right.

This completes the Electrical Assembly of the Water-Cooled Condensing Unit. Proceed to the Introduction to the Holdover Plate & Thermostat section.

When moving the condensing unit, lift by the base, or lift by the condenser bracket. Never attempt to lift the condensing unit by the tubing.

Introduction to the Holdover Plate & Thermostat

The holdover plate is best thought of as a "captive" block of ice. The refrigerant evaporates in the holdover plate tubing as it passes through the thermal expansion valve, freezing the solution within the plate. The thermostatic expansion valve is the metering device that regulates the amount of refrigerant flowing into the holdover plate. The expansion valve is where high-pressure liquid refrigerant on the condensing unit side of the thermostatic expansion valve becomes low-pressure vapor on the holdover plate side of the thermostatic expansion valve. As the refrigerant moves from the high-pressure side to the low-pressure side, the refrigerant evaporates and absorbs heat from the solution in the plate, eventually freezing it. If the compressor is considered the "heart" of the system, then the expansion valve is considered the "brain" as it is the key element in regulating the right amount of refrigerant into the holdover plate tubing.

While the compressor is off, the frozen solution in the plate will cool the interior and the contents of the insulated box as the solution thaws. After the solution thaws, the thermostat turns the compressor on the condensing unit back on, re-freezing the solution in the plate, and the process continues.

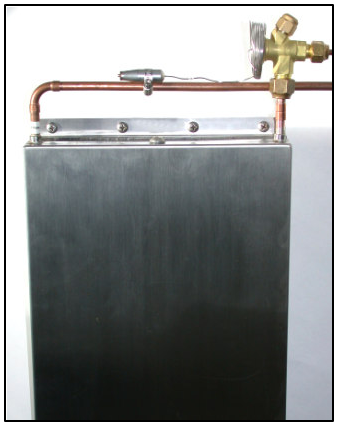
List of Parts: Holdover Plate & Thermostat Assembly

Item	Part No.	Qty	Description
1	015-0280	1	SS Mounting Bracket for Danfoss Thermostat
2	015-0282	1	Danfoss Refrigerator Thermostat Service Pack
3	018-0101	1	Holdover Plate – 16" x 11" x 1 1/2" Refrigerator Temp.
4	025-0032	12'	Copper Tubing -1/4" OD
5	025-0033	12'	Copper Tubing -3/8" OD
6	025-0202	2	Copper Union – 3/8"
7	025-0422	2	Copper Long Radius Union Elbow – 3/8"
8	027-0006	1	Reducing Flare Nut - 3/8" x 1/4"
9	027-0007	1	Reducing Flare Nut - 1/2" x 3/8"
10	055-0003	1	Mini SS Hose Clamp – 1/4" Band Width
11	055-0036	3'	Tube Insulation - 3/8" ID x 3/8" Thick
12	095-0000	1	TN2 Thermostatic Expansion Valve – R134a
13	095-0001	1	OX - Danfoss Orifice
14	Not Included	tbd	Spray Foam or Plumbers Putty
15	Not Included	2	SS Screws - #8 x 1/2" (To Mount Thermostat Bracket)
16	Not Included	8	Wood or Sheet Metal Screws (To Mount Holdover Plate)

REFER TO THE ADDENDUM MANUAL AND SKIP PAGES 30 – 35 BELOW FOR DUAL-CIRCUIT HOLDOVER PLATE UPGRADE.

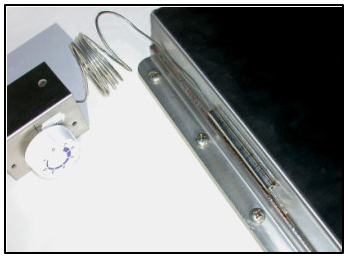
Assembly & Installation Instructions: Holdover Plate & Thermostat

1. Determine the best placement of the holdover plate (018-0101) in the insulated box. Mount the plate with the tubes up or with the "In" tube oriented on the bottom if the plate is mounted sideways. To determine which tube is the "In" line and which is the "Out" line, insert a clean, straight, foot-long implement into the holdover plate tubes. The side in which the implement can only enter 5-6" into the tube is the "In" tube and the side in which the implement can go in further then 5-6" is the "Out". Mount the plate high in the box to help convective airflow inside the box. Consider tubing access and tubing runs both inside and outside the box. Tubing runs and plate placement should not obstruct access to loading and unloading the box with food or placement of food in the box. Dry fit the holdover plate in the chosen location, and determine the best location for the thermostatic expansion valve tubing to the plate, liquid line routing to the expansion valve, and suction line tubing from the plate back out the hole in the insulated box. The photo shown above reflects one way the holdover plate can be configured.



Connect the thermostatic expansion valve (TXV), (095-0000) to the holdover plate tube marked "In". If the insulated box does not already have a designated hole for the refrigerant lines and electrical wires, create the hole before mounting the holdover plate. It is best to exit the lines near the top of the refrigerator box. Feed the evaporator lines through the hole in the insulated box. Place the holdover plate into position in the box and mark the position of the mounting holes by using the holes in the plate as a guide. Remove the holdover plate and drill the necessary pilot holes in the box liner. Use bronze or stainless steel screws for temporary attachment of the holdover plate to the wall of the insulated box. Remember not to drill too deep and puncture the insulation if vacuum insulation panels are used.

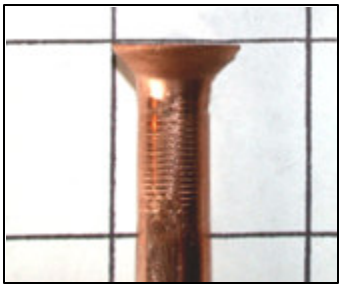
2. Determine a location inside or outside of the box for the thermostat and mounting bracket (015-0282 and 015-0280). The thermostat sensing capillary tube must be able to reach and fit into the thermostat well on the end of the holdover plate opposite the tubing end. Choose the route of the thermostat capillary tube in an out of the way place between the thermostat bracket and the holdover plate sensing well.

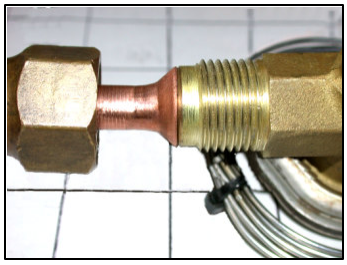


When the locations have been determined, remove the holdover plate, and cut, clean, and solder the appropriate fittings to the plate. It may be necessary to dry fit the plate and components in the box several times to determine the proper tubing lengths and orientation during the assembly and soldering in these next steps.

3. The 3/8" refrigerant "In" tube on the holdover plate will connect to the thermostatic expansion valve (095-0000) with a length of 3/8" copper tubing (025-0033) and the 1/2" x 3/8" reducing flare nut (027-0007).

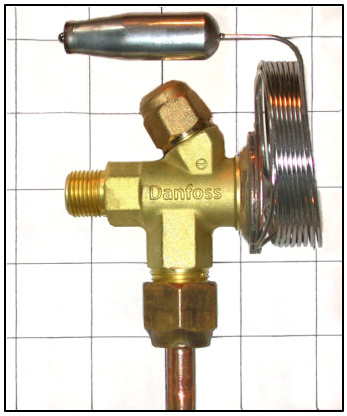
Begin by measuring for the appropriate length of 3/8" tubing (025-0033) to fit between the expansion valve and the holdover plate. Retain this measurement for Step 4. De-burr the end of the tubing. Slip the 1/2" x 3/8" reducing flare nut (027-0007) over the end of the 3/8" tubing, and flare. This flare needs to be much larger than other flares performed in prior steps, so more of the tubing needs to be protruding from the flaring





vise. About 1/4" of tubing should extend beyond the end of the flaring vise before beginning the flare. It is essential to apply a bit of oil to the flaring tool cone when making this flare. Check the size of the flare with the size of the male flare fitting on the discharge side of the thermostatic expansion valve, and increase the flare size as necessary. This flare will require more turns of the flaring tool to make the larger flare required for this fitting. The copper will work harden during the flaring process, and a tear may develop as the flare gets larger. If a tear occurs, cut the flare off; de-burr the end and re-flare until completing the flare properly. It may be helpful to heat the copper end where the flare is being made with the propane torch until the copper begins to change color. This will anneal the copper, which makes it softer so the flare will be easier to make. Remember to use oil on the flaring cone. Anneal the end of the flare after forming it, so the copper will be soft enough to seal and be leak free after tightening the flare nut in the next step.

4. After successfully forming this flare, cut the tubing piece measured in Step 3 from the tubing roll. De-burr, clean, and flux (079-0806) the end of the piece of 3/8" tubing (with reducing flare nut attached). Clean and flux the 3/8" refrigerant "In" line on the holdover plate. Clean both ends of a 3/8" copper union or long radius union elbow (025-0202 or 025-0422) with the 3/8" SS tube/fitting brush (079-2002). Insert the ends of the cleaned and fluxed tubing into the cleaned 3/8" union, and solder. Place a small amount of oil on the backside of the large copper flare, between the copper tubing and brass of the flare nut. This will help the flare nut tighten properly and form the copper seal against the male portion of the flare fitting. Attach the thermostatic expansion valve to the reducing flare nut, and tighten firmly using two wrenches. Be sure to align the TXV properly when tightening the flare nut.



5. Mount the plate in the box with the eight fasteners at the most convenient step for this particular installation. It may be easier to make most connections before the final mounting of the plate.

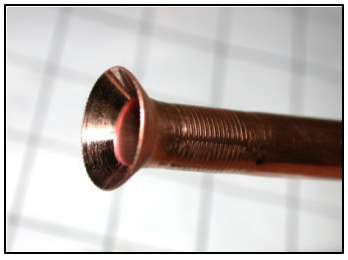
6. Determine the lengths of 1/4" copper tubing (025-0032) and 3/8" copper tubing (025-0033) necessary to make the run from the condensing unit location to the holdover plate location in the insulated box. After determining the tubing lengths, cut the 1/4" tubing and the 3/8" tubing to their correct lengths. The 3/8" tubing will be the

holdover plate suction line and the 1/4" tubing will be the refrigerant discharge liquid line to the holdover plate thermostatic expansion valve. Avoid re-bending as much as possible to keep the tubing from work hardening. De-burr the ends of the tubing. Insert both tubing lengths into the hole in the insulated box, and route in an appropriate manner along the chosen tubing pathway to join up with the connections on the holdover plate.

7. Clean and flux (079-0806) the de-burred 3/8" copper tubing suction line end and the holdover plate 3/8" refrigerant "Out" tube. Clean a 3/8" copper union or long radius union elbow (025-0202 or 025-0422) with the 3/8" SS tube/fitting brush (079-2002). Insert the union fitting over the holdover plate refrigerant "Out" line, and insert the suction line into the union fitting and solder both union ends. It may be necessary to provide heat shielding inside of the box while making this solder connection. A wet rag placed behind a piece of sheet metal and taped to the wall of the box behind the fitting being soldered works well as a heat shield.

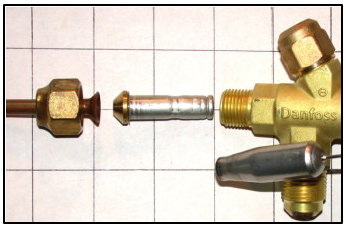
8. Gently unroll the TXV sensing bulb tubing coil, and position the sensing bulb on the length of 3/8" copper tubing soldered to the holdover plate refrigerant "Out" connection not too far from the connection. The sensing bulb tubing coil must not be damaged or broken. If broken, the TXV will be ruined. *Damage of this sort is not warranted in any way by RParts*. Discard the bulb clamp that was included with the TXV. Locate the mini SS hose clamp (055-0003) included in the kit. Secure the sensing bulb with the mini SS hose clamp on a horizontal section of the suction line within 6 inches of the plate, and inside of the insulated box. The bulb should be clamped firmly with the hose clamp, near the "10" or "2" o'clock location on the tubing. The hose clamp should be tightened firmly enough so that the sensing bulb cannot be rotated on the tubing. The sensing bulb must have good contact with the suction line so it can accurately sense the temperature of the suction line, which controls the action of the valve and regulates the refrigerant flow into the holdover plate.

9. Slip the 3/8" x 1/4" reducing flare nut (027-0006) over the end of the 1/4" tubing inside of the box, and flare the end of it similar to the flare connection made in Step 3. Be sure to oil the flaring cone when making this flare, and heat the tubing to anneal it during and after the flaring process. After forming the flare properly, apply a small amount of oil to the backside of the flare, where the brass nut and copper tubing will

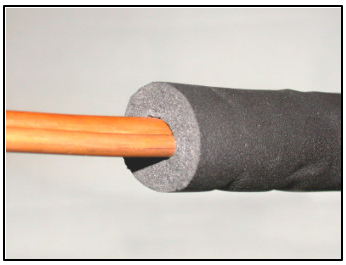


touch during the tightening of the flare nut. This will help the flare nut tighten properly and form the copper seal around the brass bevel of the male side of the flare fitting.

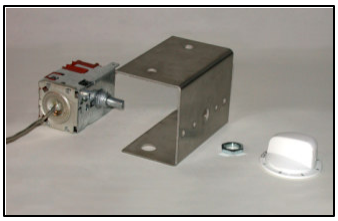
10. Remove the TXV orifice (095-0001) from the plastic container and insert it into the inlet of the TXV (095-0000). Bend the 1/4" tubing as necessary to align the reducing flare nut on the 1/4" copper liquid line with the inlet on the TXV and tighten the flare nut until it is hand tight. Then use two wrenches to firmly tighten the flare nut and make a leak free connection.



11. Route the 1/4" and 3/8" tubing from the box exterior through the boat and to the condensing unit location. Be sure to seal the hole in the box to prevent leakage of cold air. Seal the hole with a small quantity of spray foam insulation from a can (not included), or with plumber's putty (not included) after wiring the thermostat in Step 2 of the Installation Instructions: Electrical Connections section. Route the tubing so there is no possibility of chafing, crushing, kinking or other damage. Insulate the suction line with the 3/8" ID x 3/8" thick tube insulation (055-0036). Additional tube or adhesive tape insulation (not included) may be required for more humid weather. Procedures for addressing the humidity will be addressed in a later step. Before slipping the tubing insulation over the copper tubing lines, tape both ends closed to prevent insulation debris from entering the lines. The liquid line does not need to be insulated separately from the suction line, but it can be insulated in the same tubing insulation as the suction line if the lines are close enough together. Insulating the liquid line with the suction line will increase efficiency of the system, as the suction gas flowing back to the condensing unit will cool the warm liquid refrigerant flowing to the thermostatic expansion valve.



12. Now mount the thermostat bracket (015-0280) at the location determined in Step 2. There are two sets of holes in the stainless steel bracket. The larger ones are for screwdriver access to tighten the screws that mount the bracket on the wall or inner liner of the refrigerator box. The thermostat assembly can also be mounted outside the box as long as the capillary tube attached to the thermostat reaches inside the box and can be attached to the holdover plate. Once the bracket is mounted, attach the thermostat (015-



0282) to the bracket. Mount the thermostat as shown in the photo above so that the small indexing pin next to the knob shaft enters the small indexing hole in the bracket next to the hole for the shaft. **The indexing pin on the thermostat must enter the indexing hole**. If the pin is bent, the thermostat will be damaged and may not work. *Damage of this sort is not warranted in any way by RParts*. Tighten the nut with a wrench, mount the knob on the shaft and affix the index label to the knob. Assure that the knob is turned counter-clockwise where it clicks to the "Off" position.

13. Prepare for the attachment of the capillary tube from the thermostat to the holdover plate by gently unrolling the small tubing and routing it in an out of the way location to the small tube attached to the holdover plate end opposite the end with the tubing connections. The end of the thermostat sensing tube must fully insert into the tube on the holdover plate to accurately sense the plate temperature. The thermostat tubing must not be damaged or broken. If broken, the thermostat will be ruined. *Damage of this sort is not warranted in any way by RParts*.

This completes the Holdover Plate and Thermostat Assembly and Installation. The assemblies are now ready for connection to the condensing unit and leak testing. Proceed to the Introduction to the Installation Process section.

Introduction to the Installation Process

Understanding the operation of the base valves is important prior to starting the installation process. Read the base valve section below before proceeding to the installation instructions.

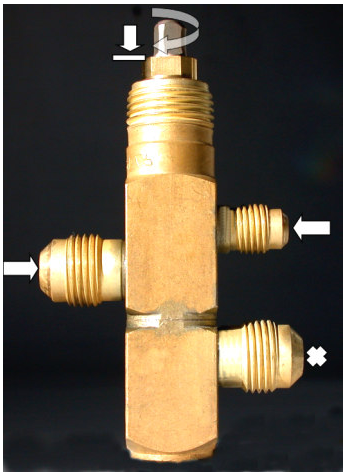
Base Valve Operation

When the stem on the base valve is turned fully counter-clockwise (CCW), referred to being "back-seated", the top fitting (service port) is closed. When the stem is turned fully clockwise (CW), referred to being "fore-seated", the bottom fitting is closed. When the valve is between the "fore-seated" and "back-seated" positions, referred to being in the "service position", all three fittings are open to each other.

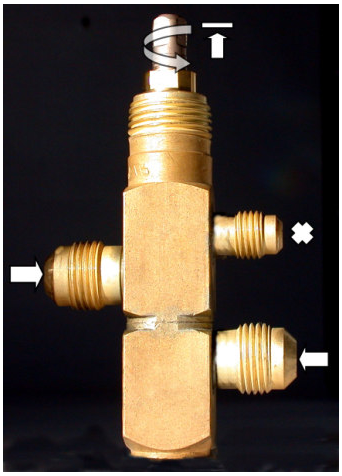
To prevent the escape of refrigerant or contamination from air, do not move the base valve stem from the "back-seated" position (CCW) unless there is a cap or a service hose attached to the service port (top) fitting. Do not move the base valve from "fore-seated" (CW) unless the line set or a cap is attached to the lower fitting, again, to prevent the escape of refrigerant or

the entry of air.

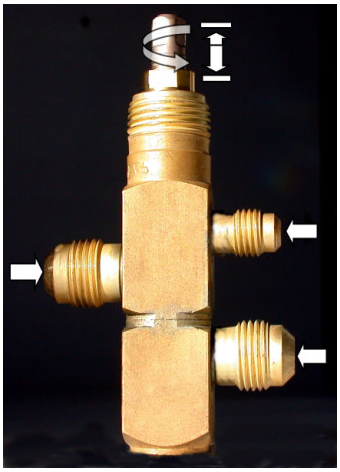
After the unit is assembled, the base valves should be "fore-seated" (CW), and caps put on the top fittings. This will prevent excessive exposure to the air as well as keeping foreign objects from entering the system.



Fore-Seated
(Clockwise, CW)



Back-Seated
(Counter-clockwise, CCW)



Service
(CCW + 1/2 CW)

When the unit is being leak tested, evacuated, charged, or otherwise being serviced, the base valve stem cover should be removed, the valve should be "back-seated" (CCW), the base valve service port caps removed, and the gauge set hoses attached. Then the base valves are turned one-half turn (CW) from "back-seated" (CCW), to the "service position". The system can be pressurized for leak testing, evacuated with the vacuum pump, and charged with refrigerant when the valve is in the "service position" and the service manifold hoses are attached.

When the system is installed and running, <u>both service valves should be "back-seated" (CCW).</u> The service port caps and the valve stem caps should be in place and tight.

List of Parts: Installation Process

Item	Part No.	Qty	Description
1	---	1	Completed Condensing Unit
2	---	1	Completed Holdover Plate Assembly
3	---	1	Completed Thermostat Assembly
4	017-2011	1	10 amp Waterproof In-Line Fuse Holder (With Fuse)
5	025-0702	1	Copper Standard Tee - 3/8”
6	027-0002	1	Heavy Duty Flare Nut – 3/8”
7	Step 37	1	Heavy Duty Flare Nut – 1/4”
8	070-0100	1	Shurflo Circulating Pump - .5gpm, 12 vdc
9	070-0303	1	Shurflo Hose Barb Connector – 3/8” Elbow
10	070-0304	1	Shurflo Hose Barb Connector - 3/8” Straight
11	096-0035	1	Schrader Valve Access Port – 3/8" OD Stem
12	240-0001	12’	Safety Duplex Tinned Cable – 18/2
13	290-0001	2	Insulated Female Spade Electrical Terminal – 22-18 ga.
14	290-0102	2	Insulated #8 Ring Electrical Terminal – 22-18 ga
15	290-0112	2	Insulated #8 Ring Electrical Terminal – 16-14 ga.
16	290-0122	2	Insulated #8 Ring Electrical Terminal – 12-10 ga.
17	290-0212	3	Adhesive Lined Heat Shrink Butt Connector – 16-14 ga.
18	400-0911	7	Standard Cable Tie – 7 1/2”
19	Not Included	1	Ball Valve (For Inlet Through Hull Fitting)
20	Not Included	4	Bolts, Washers and Nuts – 1/4” diameter (To Mount Condensing Unit)
21	079-0880 Not Included	1	Bubble Solution Leak Detector
22	Not Included	1	DC Breaker - 30 amp (Labeled "Refrigeration")
23	Not Included	tbd	Electrical Supply Wiring & Electrical Terminals (Select Wire Gauge Appropriate for Distance & Terminals Appropriate for Wire Gauge)
24	Not Included	tbd	Foam Tube or Adhesive Tape Insulation (To Insulate Suction Line)
25	Not Included	tbd	Heat Shrink Tubing
26	Not Included	4	Hose Barb Fitting - 3/8” OD (For Water Strainer & Through Hull Fittings)
27	055-0003 Not Included	8	Mini SS Hose Clamp – 1/4” Band Width (To Fit Water Hose)
28	Not Included	tbd	Nylon Reinforced Vinyl Water Hose (Or Similar) - 3/8” ID
29	Not Included	1	Raw Water Strainer – 3/8”
30	Not Included	tbd	Safety Duplex Tinned Cable – 14/2 (For Water Pump)
31	Not Included	2	Through Hull Fitting
32	Not Included	4	Wood or Sheet Metal Screws (To Mount Water Pump)

Installation Instructions: Condensing Unit

1. Mount the condensing unit on a dry, level, and sturdy platform, solidly attached to the vessel where vibrations will not resonate or amplify noise with 1/4" bolts, washers, and nuts (not included). Securely bolt the unit to the platform through the four holes on the corners of the base plate (055-0105). It may be mounted in any alignment, either fore and aft or athwart ship. The base must be horizontal and parallel to the waterline when the boat is at rest. Position the unit to allow access for attachment of the refrigerant lines, electrical wires, water hoses, and service gauge hoses.

   Assure that the area is well ventilated. Although the condenser is water-cooled, the compressor will produce heat and ventilation is important for cool air to flow in and warm air to flow out of small spaces.

Installation Instructions: System Connection

1. The suction line from the holdover plate to the condensing unit will sweat in humid weather unless it is insulated. Use foam tube insulation or foam adhesive tape insulation (not included) to insulate the suction line. The insulation tube or tape should be pushed up against the tubing access hole butted against the outside of the insulated box and cover the suction line all the way to the condensing unit with no breaks, gaps, or open seams. More than one layer of insulating tape may be necessary in hot, humid climates.

2. At the end of the tubing near the condensing unit, slide a 3/8" heavy duty flare nut (027-0002) onto the 3/8" suction line tubing and flare the end of the tubing. This flare nut will attach to the 3/8" suction base valve (096-0041) on the condensing unit. Slide the 1/4" flare nut removed from the receiver in the Condensing Unit Mechanical Assembly Instructions (Step 37) onto the end of the 1/4" tubing and flare the end of the tubing. This flare nut will attach to the 1/4" discharge base valve (096-0040) on the condensing unit.

3. Attach the 3/8" suction line tubing to the suction (low-pressure side) base valve (096-0041) on the condensing unit. This is the valve nearest to the terminal block on the condensing unit. Connect the 3/8" suction line flare nut (027-0002) to the bottom 3/8" male flare fitting of the suction base valve. Hold the base valve with a large adjustable wrench while tightening the flare nut <u>firmly</u> using the correct size

open-end wrench.

4. Attach the 1/4" discharge line tubing to the discharge (high-pressure side) base valve (096-0040) on the condensing unit. This is the valve connected to the tube attached to the filter-dryer. Connect the 1/4" discharge line flare nut (from Step 37) to the bottom 1/4" male flare fitting of the discharge base valve. Hold the base valve with a large adjustable wrench while tightening the flare nut firmly using the correct size open-end wrench.

5. Cut the 3/8" suction line a few inches from where it is attached to the suction base valve (096-0041). Clean, de-burr, and flux (079-0806) both cut ends of this tubing.

6. Cut the copper stem on the 3/8" Schrader valve access port (096-0035) so that 1/2" of stem remains beyond the end of the brass fitting. Remove the cap and the Schrader valve core with the valve core tool and set aside until Step 7. De-burr the stem, clean the stem with the abrasive cleaning pad (079-2010) and flux (079-0806) the end of the stem.

7. Locate the 3/8" copper standard tee (025-0702) and use the 3/8" SS tube/fitting brush (079-2002) to clean the inside of the fitting. Insert one cleaned and fluxed end of the suction tubing cut in Step 5 into one "arm" of the 3/8" tee. Insert the other cleaned and fluxed end of the suction tubing cut in Step 5 into the other "arm" of the 3/8" tee. Insert the cleaned and fluxed end of the 3/8" Schrader valve access port (096-0035) from Step 6 into the "stem" of the 3/8" tee. With the assembly in a horizontal position, solder all three joints of the fitting. When the fitting has cooled, replace the Schrader valve (removed in Step 6) in the valve access port. This access port allows evacuation of the line set and evaporator independently of the condensing unit.

Installation Instructions: Leak Testing

1. Assure that both valves on the refrigeration service manifold gauge set are shut, fully clockwise (CW). Attach the suction hose (blue) of the refrigeration manifold gauge set to the service port (top connection) on the condensing unit suction base valve (labeled "S"), (096-0041). Attach the discharge hose (red) of the refrigeration manifold gauge set to the service port (top connection) on the condensing unit discharge base valve (labeled "D"), (096-0040). Remove the black plastic service valve caps and open the service valves by turning the 1/4" square valve stem fully counter-clockwise (CCW) to the "back-seated" position, and then 1/2 turn clockwise (CW) from fully "back-seated", to the "service position". Attach the center service hose (yellow) of the refrigeration manifold gauge set to the low-pressure side of the regulator attached to the nitrogen (or CO2) bottle. Open the valve on the nitrogen (or CO2) tank counter-clockwise (CCW), and adjust the regulator to allow 125 psig to enter the yellow hose.

2. Slowly open both knobs of the refrigeration service manifold gauge set counter-clockwise (CCW) and allow the nitrogen (or CO2) to enter the refrigeration circuit. Allow the nitrogen (or CO2) to enter until the pressure equalizes and both gauges read the same. If necessary, adjust the nitrogen (or CO2) regulator pressure so the gauges read 125 psig. Close both manifold valves fully clockwise (CW) and observe the pressures over a period of several hours or overnight. Close the valve on the nitrogen (or CO2) tank clockwise (CW).

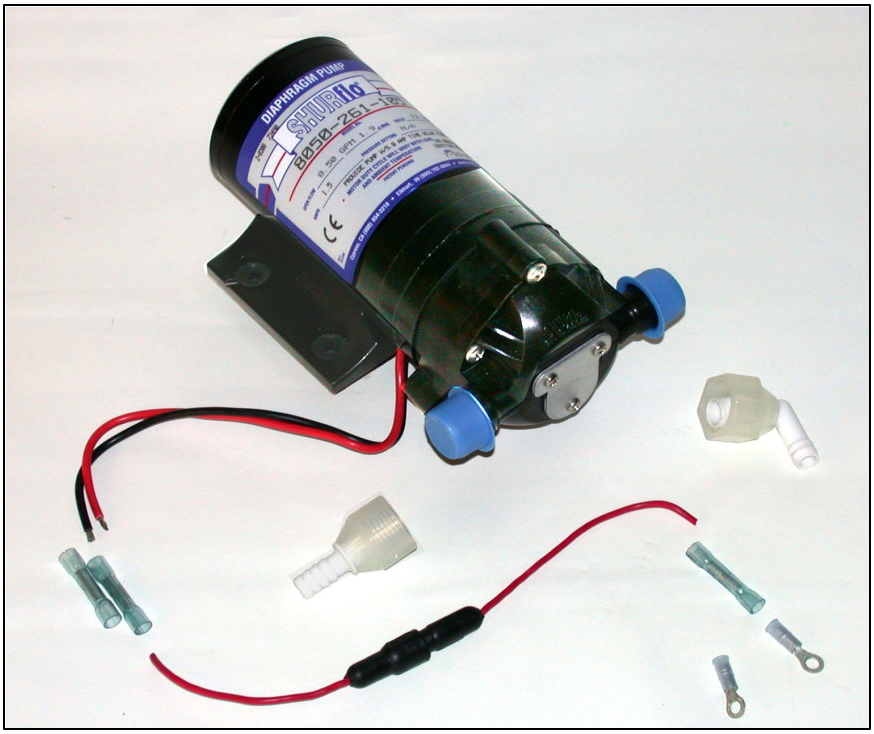
3. If either gauge quickly loses pressure, listen and try to hear where the leak is. If a gauge slowly loses pressure, apply a bubble solution leak detector to all solder and flare joints to try to find the source of the leak. Tighten the fitting or re-solder the connection to fix the leak(s). **The nitrogen pressure must be released before solder repairs are attempted.** Re-pressurize and leak test again after repairing leak(s)

4. If the gauge readings remain the same for an hour or so, the system is probably leak-free. If the nitrogen (or CO2) pressure is left in the system overnight and there is a temperature drop, some of the nitrogen (or CO2) will dissolve in the refrigerant oil and the pressure on the gauges will drop slightly, usually only a pound or two.

5. After finding and repairing all of the leaks and verifying that the system is **leak-free**, release the pressure through the hose connections. The base valves should be fully "back-seated" (CCW), the hoses removed, and the service port caps attached and tightened.

Installation Instructions: Condenser Water Pump

The condenser circulating water pump connects to a source of strained water through 3/8" flexible hose, circulates the water via the 3/8" hose through the condenser, and returns it to the source. The source can be the water the boat is floating in, or it can be a fresh water tank in the boat. The water pump connects to 12-volt DC power through wires connected to the condensing unit. The water pump runs whenever the compressor is running. A high-pressure switch on the condensing unit will shut off the compressor and water pump if the water flow stops or if the water pump fails.



1. Locate or supply an appropriate through hull fitting with a ball valve and 3/8" hose barb. This through hull should be far enough below the water line to remain submerged at all angles of heel. Attach the 3/8" nylon reinforced vinyl water hose (or similar) to this hose barb with a mini SS hose clamp. Mount the strainer with 3/8" hose connections inline with this inlet water hose, and connect the appropriate 3/8" hose from the through hull 3/8" hose barb to the 3/8" strainer inlet fitting securely with another mini SS hose clamp.

2. Mount the Shurflo circulating water pump (070-0100) to the boat on a horizontal floor or shelf, or vertical bulkhead with four wood or sheet metal screws. Vertical mounting requires that the motor be above the pump head.

3. Connect another length of 3/8" hose from the 3/8" strainer exit fitting to the pump inlet 3/8" hose barb (070-0304 or 070-0303). Attach and tighten the mini SS hose clamps to secure the hose ends to the fittings. Attach 3/8" hose to the pump discharge 3/8" hose barb (070-0303 or 070-0304) and run this hose in a professional manner through the boat to the condensing unit. Connect the hose to the 3/8" lower water inlet of the water-cooled condenser (012-1005) on the condensing unit. Secure both ends of this hose to the pump and condenser with mini SS hose clamps.

4. Attach another length of 3/8" hose to the upper 3/8" water outlet of the water-cooled condenser (012-1005) and secure with a mini SS hose clamp. Run the 3/8" condenser discharge hose through the boat in a professional manner to a 3/8" fitting on an overboard discharge through hull, preferably just above the water line. Secure this hose with another mini SS hose clamp. Assure that all hose clamps are properly tightened, and that the hose run is secure and free of chafe points that might damage the hose.

Installation Instructions: Electrical Connections

Pick the correct gauge for the electrical supply wiring from the following chart based on the round trip distance from the distribution panel breaker to the condensing unit location and back.

0-10'	10'-15'	15'-20'	25--40'
10 AWG	8 AWG	6 AWG	4 AWG

Longer runs will require heavier wire. To retain the reliability of this RParts system, it is important that all connections are made properly using a high strand count, 100% tinned, marine-grade wire and high quality tin plated wire terminals.

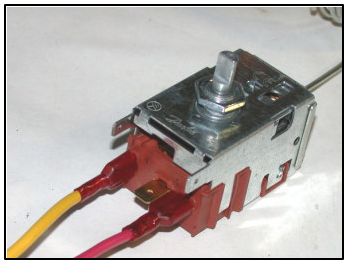
Use appropriate sized terminals for all connections and make good crimp connections. The non-heat shrink terminals have two crimp connections, one for the electrical connection, and one for a mechanical connection to the insulation on the wire. Use the correct part of the wire-crimping tool to crimp each connection. It is advisable to use adhesive lined heat shrink tubing over marine grade terminals.

1. Supply Wiring

Attach the appropriate wire ring terminal (not included) to the correct gauge red wire (not included) and connect to the load side of an unused 30-amp DC breaker labeled "Refrigeration" (not included) in the distribution panel of the boat. Attach the appropriate wire ring terminal (not included) and connect the yellow or black wire (not included) to a 12-volt DC negative buss or connection at the distribution panel. Run these wires in a professional manner through the boat to the condensing unit. Strip the wire ends and attach the 12-10 gauge insulated #8 ring electrical terminals (290-0122) to the wires. Supply wires of a different size than 12-10 gauge will require appropriate sized #8 ring terminals that are not included with the kit. Connect the insulated #8 ring electrical terminal on the yellow or black wire to terminal 9 on the condensing unit terminal block (017-0032). Connect the insulated #8 ring electrical terminal on the red wire to terminal 10 on the condensing unit terminal block.

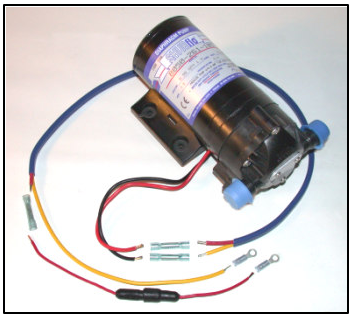
2. Thermostat Wiring

Measure the distance from the thermostat connection tabs on the thermostat to the condensing unit terminal block (017-0032) and cut the appropriate length of the 18/2 safety duplex tinned cable (240-0001) that is supplied with the kit. Remove three inches of the outer insulation from both ends of the 18/2 cable. Strip 3/8" of the inner insulation off the 18 gauge wires on both ends for each wire (total of four). Crimp two 22-18 gauge insulated female spade electrical terminals (290-0001) on one end of the stripped wire ends. Attach one female spade terminal to the tab on the thermostat (015-0282) marked "3" and one female spade terminal to either of the two thermostat tabs marked "4". Run the wire along the same route as the copper tubing to the condensing unit. Attach two 22-18 gauge insulated #8 ring electrical terminals (290-0102) to the stripped end of the 18/2 wires. Attach these terminals to the condensing unit's terminal block terminals 7 and 8. Tie the thermostat wiring to the refrigerant line set with cable ties (400-0911) every 18 inches. NOTE: Seal the access hole in the insulated box with a small quantity of spray foam insulation from a can (not included), or with plumber's putty (not included) once the thermostat wiring has been routed through the hole.



3. Condenser Water Pump Wiring

Strip 3/8" of insulation from each of the two leads on the water pump (070-0100). Crimp a 16-14 gauge adhesive lined heat shrink butt connector (290-0212) on the end of each wire. Strip 3/8" of insulation on one end of each of the two 14 ga. wires in the duplex cable (not supplied) that will connect the pump to the condensing unit. Crimp these wires in the 16-14 gauge adhesive lined heat shrink butt connectors (290-0212) that are attached to the pump wires. Maintain the polarity of the pump wires, red (+) to red (+), black or yellow (-) to black or yellow (-). Heat the adhesive lined heat shrink butt connector with a heat gun or match to shrink the tubing to the wire insulation and seal the connection. Run the pump wires in a professional manner along the same route as the water line from the pump to the condensing unit. Tie the water pump wiring to the condenser water supply tubing with cable ties (400-0911) every 18 inches.



Strip 3/8" of insulation on the other end of each of the two 14 ga. wires in the duplex cable (not supplied) that will connect the pump to the condensing unit. Crimp a 16-14 gauge insulated #8 ring electrical terminal (290-0112) to the end of the yellow or black wire (-). The black or yellow wire attaches to terminal #8 on the condensing unit terminal block (017-0032). Crimp a 16-14 gauge adhesive lined heat shrink butt connector (290-0212) to the end of the red (+) wire. Strip 3/8" of insulation from both ends of the 10 amp waterproof in-line fuse holder (017-2011), and insert one end of the fuse holder wire into the blue 16-14 gauge adhesive lined heat shrink butt connector (290-0212) that is attached on the end of the red wire. Crimp this connection and heat the adhesive lined heat shrink tubing on this terminal to seal the connection. Crimp a 16-14 gauge insulated #8 ring electrical terminal (290-0112) to the other end of the fuse holder. This terminal attaches to terminal 12 on the condensing unit terminal block.

4. Electronic Control Module Wiring

All electronic control wiring was completed previously in the condensing unit assembly section.

Now that the complete system has been installed, connected, and proven leak free, it is time to evacuate and charge the system with refrigerant. Please see the section on evacuating and charging and read it completely before beginning.

REFRIGERATION PARTS SOLUTION

"Do It Yourself" Kit
Evacuating and Charging Manual

For all DIY Kits with a Holdover Plate (Thermostatic Expansion Valve Systems)

Manual Version 1.0 - June 2008

List of Parts: Charging System

Item	Part No.	Qty	Description
1	Not Included	1	Refrigerant R134a – 2 lbs. (and Refrigerant Can Tap Adapter if using Disposable Cans)

Required Tools

- Refrigeration service manifold gauge set
- Vacuum pump
- Scale with 1 oz. accuracy

Evacuating Instructions

1. Connect the suction hose (blue) of the refrigeration service manifold gauge set to the service port (top connection) on the suction base valve of the condensing unit. Connect the discharge hose (red) of the refrigeration service manifold gauge set to the service port (top connection) on the discharge base valve of the condensing unit.

2. Open the both base valves on the condensing unit 1 turn clockwise (CW) from fully "back-seated" (CCW).

3. Connect the middle service hose (yellow) of the refrigeration manifold gauge set to the vacuum pump. Plug in the vacuum pump and switch it on. Open the vacuum pump valve between the pump and the yellow hose.

4. Open (CCW) both knobs of the manifold gauge set and allow the vacuum pump to evacuate the refrigerant circuit. The pressure readings on both gauges should go down, the blue gauge should soon show a vacuum, eventually down to 30" Hg.

5. Allow the vacuum pump to run for the amount of time according to the ambient temperature of the refrigeration system environment. Refer to the table below for the recommended evacuation time.

Ambient Temperature	Evacuation Time
Above 80° F./27° C.	1 hour
70° F./21° C.	2 hours
65° F./18° C.	6 hours
60° F./15° C.	24 hours
50° F./10° C.	48 hours

It may be necessary to warm the boat so that the evacuation process can occur in a reasonable amount of time.

6. When the evacuation process is finished, close (CW) both valves on the service manifold. Back seat (CCW) the condensing unit discharge base valve and remove the red hose from the base valve. Replace and tighten the cap for this valve. Remove the yellow hose from the vacuum pump and proceed to the next section.

Charging Instructions

1. Begin by assuring that the thermostat is set to off ("0"), and that the refrigeration service breaker on the electrical distribution panel is "On".

2. Attach the service hose (yellow) of the refrigeration service manifold gauge set to the refrigerant source. Orient the refrigerant container to discharge vapor, and open the valve on the refrigerant container.

3. Slowly open (CCW) the service manifold gauge set valve next to the blue hose and gauge and allow refrigerant vapor to enter the refrigerant circuit. Allow the pressure to equalize through the gauge set. Close (CW) the gauge set valve.

4. Turn the thermostat knob to its middle position (about "3" or "4"). The water pump and the compressor should start. When the compressor starts, the suction pressure gauge (blue) reading will go down.

5. When the gauge reading approaches zero, open (CCW) the service manifold gauge set valve to allow more refrigerant vapor to enter the system. Keep regulating the valve to try to maintain about 10 to 20 psig on the gauge. Add refrigerant slowly. Releasing vapor pressure from the refrigerant container will cause the container to chill, which lowers the pressure. It may be necessary to warm the refrigerant container to speed up the refrigerant transfer from the container to the condensing unit. Keep adding refrigerant while the system is running until 2 lbs (32 oz) of refrigerant has been added. If using small cans, it will be necessary to change cans when one becomes empty. Be sure to close (CW) the service manifold gauge set valve when changing cans and always purge air from the hose after changing to a new can.

6. After adding the full 2 lbs (32 oz) of refrigerant 134a to the condensing unit, close (CW) the service manifold gauge set valve, close the refrigerant cylinder valve, back seat (CCW) the condensing unit suction base valve and remove the hoses from the refrigerant cylinder and base valve. Install the base valve stem covers (plastic) on the base valves and tighten with an appropriate wrench. Install the caps (brass) on the upper ports of the condensing unit base valves and tighten with a wrench. The system is now ready for use. The thermostat should be set to a position that will completely freeze the solution in the plate. The refrigerator plate temperature should get down to about 20° F. Freezer plate temperatures should get down to about 0°F.

This concludes the assembly, installation, and charging of the RParts DIY kit. Please direct any questions, comments, or feedback to the DIY Support Forum at RParts.com (http://www.rparts.com).

RParts
DIY Kits Warranty

LIMITED WARRANTY

RParts DIY kits are warranted with the following conditions.

The warranty covers defects in materials and workmanship of kit components for a period of 6 months from the date of purchase. The warranty is limited to the actual cost of the defective component(s) and does not include coverage for any labor cost incurred in the removal or reinstallation of such component(s). Warranted component(s) shall be repaired or replaced at the sole discretion of the manufacturer. Shipping costs are not included.

This warranty does not include failure due to:

- improper installation
- abuse, misuse or improper maintenance
- rust/corrosion due to water exposure

Components expressly excluded from this warranty are:

- Danfoss power module
- Sea water pump

RParts shall not be liable for consequential damages resulting from the use of this product. Coverage for any incidental damage to vessel, equipment or supplies caused, either directly or indirectly, by the failure of any RParts component is specifically excluded. This warranty is valid only for components included with the kits and does not include RParts equipment or components of other manufacturers used in conjunction with the kits. The coverage herein described constitutes the whole, no other warranty written or verbal is authorized.

To obtain warranty service, obtain a return merchandise authorization (RMA) by sending an email to rma@rparts.com. When making a warranty claim, be sure to detail the problem encountered and include evidence of purchase date along with the order number, your name, address and telephone number.