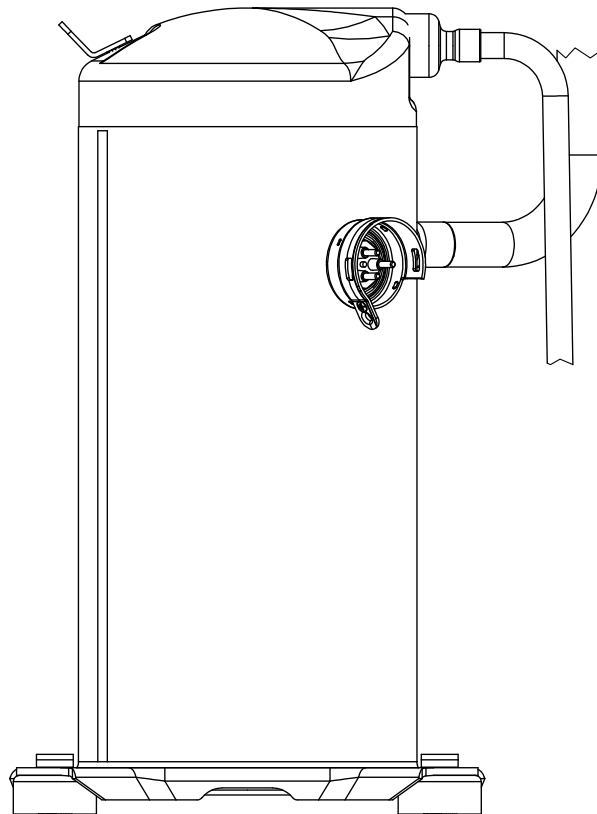

REPLACEMENT PROCEDURE

R-22 and R-410A Compressors



MIS-4444



Bard Manufacturing Company, Inc.
Bryan, Ohio 43506
www.bardhvac.com

Manual: 2100-003F
Supersedes: 2100-003E
Date: 5-10-05

CONTENTS

General Information 1

Three Phase Scroll Compressor Start Up Information ... 1
Suction and Discharge Tube Brazing 2
Conclusion 6
Compressor Replacement Procedure for Systems
Containing R-410A Refrigerant..... 8
Equipment Required 8
Leak Detectors..... 8
Removing the Detective Compressor..... 8
Brazing Joints on New Components 8
Evacuation 8
R410-A System Charging..... 8

FIGURES

Figure 1 Brazing Diagram..... 5
Figure 2 Typical A/C Filter-Drier Locations 7
Figure 3 Typical Self-Contained H/P Filter-Drier
Locations 7
Figure 4 Typical Split System H/P Filter-Drier
Locations 7

TABLES

Table 1 Air Conditioner Liquid Line Filter-Driers
(Directional) 5
Table 2 Heat Pump Liquid Line Filter-Driers
(Bidirectional)..... 5
Table 3 Suction Line Filter Driers 5
Table 4 Additional Refrigeration Requirements 6

Before replacing any compressor, make absolutely sure that it is the compressor that is at fault. Problems with the external electrical components are many times diagnosed as a faulty compressor.

Please note the information below on three phase scroll compressors.

Three Phase Scroll Compressor Start Up Information

Scroll compressors, like several other types of compressors, will only compress in one rotational direction. Direction of rotation is not an issue with single phase compressors since they will always start and run in the proper direction.

However, three phase compressors will rotate in either direction depending upon phasing of the power. Since there is a 50-50 chance of connecting power in such a way as to cause rotation in the reverse direction, verification of proper rotation must be made. Verification of proper rotation direction is made by observing that suction pressure drops and discharge pressure rises when the compressor is energized. Reverse rotation also results in an elevated sound level over that with correct rotation, as well as substantially reduced current draw compared to tabulated values.

Verification of proper rotation must be made at the time the equipment is put into service. There is no negative impact on durability caused by operating three phase Compliant Scroll compressors in the reversed direction. However, after several minutes of operation the compressor's internal protector will trip.

Reverse operation for over 1 hour may have a negative impact on the bearings.

NOTE: *Some units are equipped with a phase monitor that will automatically govern whether the compressor contactor can be activated. Check the unit wiring diagram and installation instructions.*

All three phase ZR*3 and ZP compressors are wired identically internally. As a result, once the correct phasing is determined for a specific system or installation, connecting properly phased power leads to the same Fusite terminals should maintain proper rotation direction.

The direction of rotation of the motor may be changed by reversing any two line connections to the unit.

Step 1 If the compressor tries to start and cycles on the internal overload:

1. Measure line voltage at the unit terminals at the moment of start. It must be within the operation voltage range as shown on the unit serial plate. If it is less than the minimum voltage shown, check all electrical connection and branch wire size.
2. Check to determine whether the run capacitor is good and of the correct rating. Replace the capacitor if in doubt.
3. If a start capacitor and start relay are employed, check out these components for correct rating and functionality.
4. If there are no starting components used on the system, connect a start kit of the correct size temporarily to the compressor circuit. If the compressor motor now starts and runs okay, install start kit permanently.

If the compressor does not try to start and blows fuses:

- A. Remove the wiring from the compressor terminals and check for ground between each terminal and the compressor housing.
- B. Check for continuity between the common terminal "C" and run terminal "R", and between the common terminal "C" and start terminal "S". If either one of these checks show continuity and the other does not, one of the motor windings is open. If neither show continuity and a check between terminal "R" and terminal "S" show continuity, both motor windings are intact and the internal overload is open. (Normally, any time the compressor housing is cool enough to hold your hand tight against, the overload should be closed.)

Step 2 It is essential to establish the type of compressor failure that has occurred before any further work can take place.

1. If there was a mechanical failure that would cause a no pump condition (any situation where the motor starts and runs okay but little or no refrigerant is pumped), the system cleanup procedure can be bypassed. Replace the compressor and proceed to Step 6.

If the compressor failure resulted from some form of an electrical failure, the compressor has undergone a burnout condition of some degree of magnitude. It is essential to determine the type and extent of the burnout before the new compressor is installed.

- A. Through the service ports, sample the refrigerant for the characteristic acrid odor of a burnout.

WARNING

Smell cautiously as the gas could be toxic and highly acrid.

Failure to do so can result in serious injury or death.

- B. Recover the system refrigerant charge using correct recovery procedures and send the refrigerant to any authorized reclaim facility.

CAUTION

Avoid getting the refrigerant in eyes or on skin.

Failure to do so can result in personal injury.

- C. Remove the burned compressor. Use rubber gloves when handling contaminated parts if there is any likelihood of contacting the oil or sludge.
- D. If the discharge line shows no evidence of sludge and the suction stub is likewise clean, or perhaps has some light carbon deposits, the burnout occurred while the compressor was not rotating. Contaminants are, therefore, largely confined to the compressor housing and a single installation of liquid and suction line filter-driers will probably suffice to clean up the system.
- E. If the sludge is evident in the discharge line (and very likely also found in the suction line) the compressor motor burned while running. Sludge and acid has been pumped throughout the system and several changes of the liquid and suction filter-driers will probably be necessary to cleanse the system.

Step 3 Systems suffering running burnouts will also require additional cleansing of various piping and components, and even this may not rule out the possibility of having to replace these components.

1. An extensive burnout condition may clog the screen and/or the capillary tubing, orifice or TXV requiring replacement.
2. The reversing valve may become inoperative or sluggish due to sludge and acid action attacking the moving parts and their bearing surfaces.
3. It is highly probable that the accumulator bleed orifice would be plugged on a severe burnout, and is recommended that the accumulator be replaced as it is practically impossible to ensure the reliability and performance of the accumulator even though it has been flushed out.

Step 4 An evaluation should be made to determine what system fault caused the burnout and take the necessary steps to correct that situation.

1. Check all electrical components (capacitors, relays, overload, etc. where applicable). Check the contacts of the compressor contactor.
2. Install the new compressor. Make sure that the replacement compressor is exactly the same as the defective one, or a substitute authorized by the factory.

The following information is to be noted for installation of the replacement compressor.

Suction and Discharge Tube Brazing

Compliant scroll compressors have copper plated steel suction and discharge tubes. These tubes are far more rugged and less prone to leaks than copper tubes used on other compressors. Due to different thermal properties of steel and copper, brazing procedures may have to be changed from those commonly used.

CAUTION

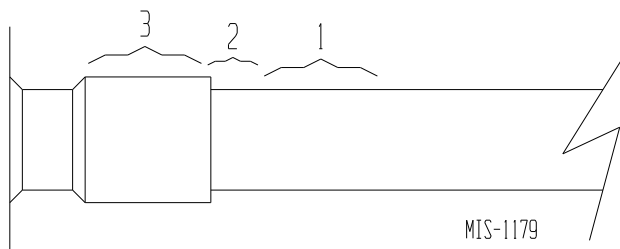
Ensure that there is no internal pressure in the system prior to applying heat to disconnect a joint.

Failure to do so can result in personal injury.

- To disconnect: Heat joint areas 2 and 3 slowly and uniformly until braze material softens and the tube can be pulled out of suction fitting (see Figure 1).
- To connect:
 - Recommended brazing materials: silfos with minimum 5% silver or silver braze material with flux.

- Re-insert tube into fitting.
- Heat tube uniformly in area 1 moving slowly to area 2. When joint reaches brazing temperature, apply brazing material.
- Heat joint uniformly around the circumference to flow braze material completely around the joint.
- Slowly move torch into area 3 to draw braze material into joint.
- **Do not overheat joint.**

Figure 1
Brazing Diagram



3. Install liquid line and suction line filter-driers as selected from Table 1 based upon line size and unit BTU size.

IMPORTANT

Heat pump units require a different liquid line filter -drier than air conditioners. The 5201-009 or 5201-010 bidirectional liquid line filter-drier must be used on heat pumps, and if desired, could also be used on air conditioners. Under no circumstances should the 5201-001 or 5201-002 directional filter-driers be used on heat pumps as shown in Figures 3 and 4 on page 7.

TABLE 1
Air Conditioner Liquid Line Filter-Driers (Directional)

Unit Size	Line Size	Part Number	Model Number
0-36,000 BTU	3/8"	5201-001	C-083S
37-60,000 BTU	3/8"	5201-002	C-163S

TABLE 2
Heat Pump Liquid Line Filter-Driers (Bi-Directional)

Unit Size	Line Size	Part Number	Model Number
0-36,000 BTU	3/8"	5201-009	BFK-083S
37-60,000 BTU	3/8"	5201-010	BFK-163S

TABLE 3
Suction Line Filter-Driers

Unit Size	Line Size	Part Number	Model Number
0-24,000 BTU	1/2"	5201-003	C-164-ST-HH
25-31,000 BTU	5/8"	5201-004	C-165-ST-HH
32-37,000 BTU	3/4"	5201-005	C-166-ST-HH
38-60,000 BTU	3/4"	5201-007	C-306-ST-HH
38-60,000 BTU	7/8"	5201-008	C-307-ST-HH

CAUTION

Suction line filters are not acceptable substitutes for filter-driers

Failure to do so can result in unit damage or personal injury.

4. Figures 2, 3 and 4 on page 7 illustrate the recommended locations for both the liquid line and suction line filter driers on both air conditioning and heat pump systems. It is imperative that the filter-driers be installed as shown for the heat pumps to ensure adequate protection and so that there is no reverse flow of refrigerant through the filter-drier.

Step 6 Evacuate the system to less than 1000 microns using a good vacuum pump and an accurate high vacuum gauge. Operate the pump at 1000 microns, or less, for 1 hour and then allow the system to stand for 30 minutes to be sure the vacuum is maintained.

NOTE: *At no time use the compressor to evacuate the system or any part of it.*

Step 7 Charge the system with the specified quantity of refrigerant and place in operation.

1. Self-contained unit: The unit serial plate lists the total amount of refrigerant required for recharge. See also Step 3 below.
2. Split-system units: The unit serial plate refers you to a system charge table located elsewhere in the unit. Using specific model number for indoor and outdoor units, and the length of the interconnection tubing, determine the **total** system charge. There is a blank on the serial plate for this to be marked and is supposed to be done by the original installer. See also Step 3 below.

TABLE 4
Additional Refrigerant Requirements

Part Number	Model Number	Oz. of R-22
5201-001	C-063S	8
5201-002	C-163S	10
5201-009	BFK-083S	7
5201-010	BFK-163S	13

3. The addition of liquid line filter-driers to any system requires additional refrigerant. This is shown in Table 4 and applies to **each** liquid line filter-drier used.

NOTE: For an R-410A system, charge quantity shown on unit rating plate includes liquid line filter-drier.

Step 8 After the system is charged and placed in operation, immediately check the pressure drop across the suction line filter-drier. This will serve two purposes:

1. Verify that the drier selection was correct; that is, large enough.
2. Serve as a base point to which subsequent pressure checks can be compared.

Because the permissible pressure drop across the drier is relatively small, it is suggested that a differential pressure gauge be use for the measurement.

After the system has been operating for an hour or so, measure the pressure drop across the suction line filter-drier.

The maximum pressure drop for a permanent installation is 3 psig. In the case of a cleanup of a standing burnout, little change should be noted and, in most cases, the pressure drop will be less than the maximum allowable 3 psig.

On the other hand, where a severe running burnout has occurred, an increased pressure drop will be measured. Change the suction filter-drier and the liquid line filter-drier whenever the pressure drop approaches or exceeds that allowed for temporary operation during cleanup, 15 psig. Keep changing both the suction and liquid line filter-driers until the pressure drop stabilizes at a figure equal to or below that permitted for permanent operation in a system, 3 psig. At this point, it is the service person's option as to whether to leave the suction drier in the system or remove it from operation.

Conclusion

If the system is to be opened to permit permanent removal of the suction filter-drier, the liquid line filter-drier should be changed once more.

The above procedure for the cleanup of hermetic systems after burnout through the use of suction line filter-drier will prove satisfactory in most instances provided the system is monitored and kept clean by repeated drier changes, if such are needed. The failure to follow these minimum cleanup recommendations will result in an excessive risk of a repeat burnout.

FIGURE 2
Typical Air Conditioner Filter-Drier Locations

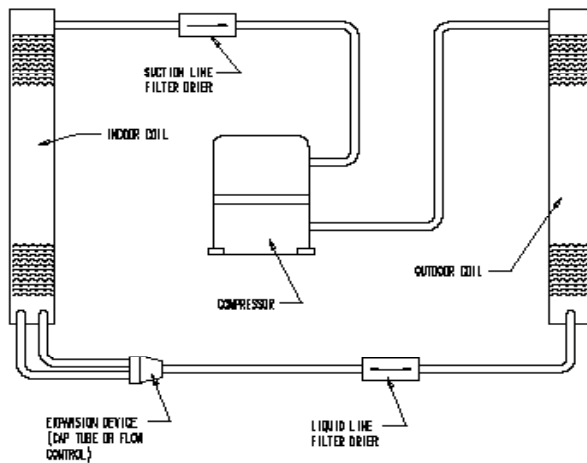


FIGURE 3
Typical Self-Contained Heat Pump Filter-Drier Locations

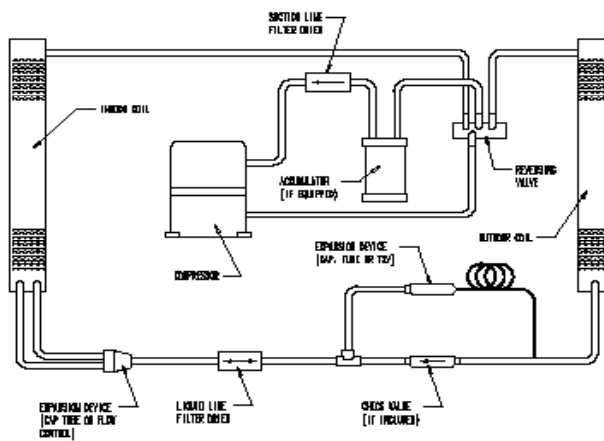
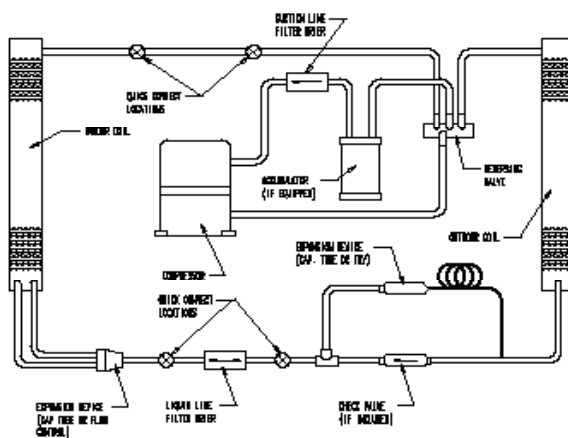


FIGURE 4
Typical Split System Heat Pump Filter-Drier Locations



Compressor Replacement Procedure for Systems Containing R-410A Refrigerant

Equipment Required

R-410A has an ozone depletion potential of zero, but must be reclaimed due to its effect on global warming.

The gauge manifold set is specially designed to withstand the higher pressure associated with R-410A. Manifold sets are required to range up to 800 psig on the high side and 250 psig on the low side with a 250 psig low side retard.

All hoses must have a service rating of 800 psig. (This information will be indicated on the hoses.)

Vacuum pump and micron gauge must be used when evacuating a system to 500 microns.

Leak Detectors

An electronic leak detector capable of detecting HFC refrigerant can be used with R-410A refrigerant.

Removing the Defective Compressor

Before opening the system, it is important to remove all refrigerant from both the high and low sides. If the refrigerant charge is removed from a scroll-equipped unit from one side only, it is very possible that the other side of the system could remain pressurized. If a brazing torch is then used to disconnect tubing, the pressurized refrigerants and oil mixture could ignite when it escapes and contacts the brazing flame. It is important to check both the high and low pressure sides with manifold gauges before unbrazing. It is recommended that the compressor tubing be cut, rather than unbrazed.

Brazing Joints on New Components

It is important to flow nitrogen through the system while brazing all joints. Nitrogen displaces the air and prevents the formation of copper oxides in the system. If allowed to form, the copper oxide flakes can later be swept through the system and block screens such as those protecting capillary tubes, thermal expansion valves and accumulator oil return holes. Any blockage of oil or refrigerant may cause damage to the compressor—resulting in failure.

R-410A compressors use polyolester oil. Polyolester oil is hygroscopic. It will rapidly absorb moisture. **With this in mind, limit an open system to atmospheric 15 minutes or less.**

Evacuation

An evacuation to 500 microns is usually sufficient to remove moisture from a system using R-22 and mineral oil lubricant. A 500-micron evacuation, however, will not separate moisture from polyolester oil (POE) in R-410A systems.

In addition to a 500 micron evacuation, the liquid line filter drier (R-410A compatible) must be replaced any time the system is open. When removing a filter drier from a system, do not use a torch; use a tubing cutter to avoid releasing moisture back into the system.

Older R-22 leak detectors, as well as halide torch leak detectors, will not detect leaks in R-410A systems. Never use air and R-410A to leak check, as the mixture may become flammable at pressures above 1 atmosphere. A system can be safely leak-checked by using nitrogen or a trace gas of R-410A and nitrogen.

IMPORTANT: Always use a pressure regulator with nitrogen and a safety valve down stream set at no more than 150 psig.

R-410A System Charging

Even though R-410A has a very small fractionation potential, it cannot be ignored completely when charging. **To avoid fractionation, charging of an air conditioner or heat pump system incorporating R-410A shall be done with “liquid” to maintain optimum system performance.** To ensure that the proper blend composition is charged into the system, it is important that liquid only be removed from the charging cylinder. Some cylinders supplied by manufacturers have dip tubes, which allow liquid refrigerant to be removed from the cylinder when it is in the upright position. Cylinders without dip tubes have to be tipped upside down in order for liquid to be removed. The service technician must differentiate between which type of charging cylinder they are using to avoid removing vapor refrigerant instead of liquid refrigerant to avoid fractionation and for safety concerns.

Connect the gauge manifold to the high and low side. Allow liquid to enter the high side only. The high side will hold 80-100% of the total charge. When liquid stops flowing, close high side port. The remainder of the charge will be added to the low side. Keep in mind two issues: First, never start the compressor with less than 55 psig of suction pressure. Secondly, make sure the liquid is throttled, thus vaporized into the low side of the system to avoid compressor damage. A throttling valve can be used to ensure that liquid is converted to vapor prior to entering the system. Proper manipulation (restricting) of the manifold gauge set can also act as a throttling device to insure liquid is not entering the compressor.

Recharge system with quantity stated on unit rating plate.