TRANE

General Service Bulletin

RTHA-SB-19

Library	**Service Literature**
Product Section	**Refrigeration**
Product	**Rotary Liquid Chillers**
Model	**RTHA**
Literature Type	**General Service Bulletin**
Sequence	**19**
Date	**November 1993**
File No.	**SV-RF-RLC-RTHA-SB-19-1193**
Supersedes	**Original**

Literature Change History

Original

Subject: RTHA bF2 Low Oil Flow Diagnostic.

Introduction:

The purpose of this service bulletin is to provide troubleshooting information for those RTHA units that have bF2 nuisance trips.

Discussion:

This service bulletin covers possible causes of a bF2 diagnostic and solutions to eliminate the nuisance trips.

Note: The Trane Company urges all HVAC servicers, working on Trane equipment and other manufacturer's products, to make every effort to eliminate, if possible, or vigorously reduce emissions of CFC, HCFC and HFC refrigerants to the atmosphere resulting from installation, operation, routine maintenance, or major service on this equipment. Always act in a responsible manner to conserve refrigerants for continued use, even when acceptable alternatives are available.

bF2 Nuisance Trips

The diagnostic code "bF2" indicates a "low oil flow" condition. This service bulletin is to inform the operator of the different causes of this diagnostic. It also explains the appropriate troubleshooting procedures for determination and elimination of "bF2" nuisance trips.

The RTHA uses various devices to detect "loss of oil flow". The first RTHA's used an oil flow switch. Current units use a differential pressure switch. All of the units with extended shells and all of the 380 ton and 450 ton units use an additional system for oil return. This system is referred to as the "active oil return system", which can also produce a "bF2" diagnostic.

Below is a description of the various items that can contribute to the "bF2" nuisance trips. The causes are separated according to the different devices used on the units.

Causes of "bF2" on units with an oil flow switch.

1. Insufficient pressure to close the switch.

2. Defective oil flow switch.

3. Defective 1U3 module.

4. Oil screen plugged.

Causes of "bF2" on units with a differential pressure switch.

1. A pressure drop greater than 50 psid across hydraulic line.

2. Oil screen left in the hydraulic line after the retrofit from an oil flow switch to a differential pressure switch was completed.

3. Improperly calibrated differential pressure switch.

4. Loose or incorrect wiring of the switch.

5. Defective 1U3 module.

6. Defective differential pressure switch.

7. Chattering or defective 2k2 auxiliary contacts.

Causes of "bF2" on units with the active oil return system.

Note: If the red LED in the 6U6 module (active oil return module) is **de-energized** when the bF2 occurs, the problem is NOT associated with the Active Oil Return System.

If the red LED is energized when a bF2 diagnostic occurs, then a few possible causes for the diagnostic are listed below.

Note: When the 6U6 module takes the unit off line, the white "RESET" button needs to be depressed and the chiller switch needs to be toggled to bring the unit back on line.

1. Incorrect refrigerant charge.

2. Incorrect oil charge.

3. Incorrectly wired 6U6 module.

4. Closed service valve on active oil return line.

5. Defective normally-open solenoid valve on the active oil return line.

6. Defective optical sensor.

7. Defective 6U6 module.

8. Insufficient oil return.

Below are troubleshooting procedures to determine what is tripping the unit on the bF2 diagnostic.

Check-out Procedure for Oil Flow Switch.

The oil flow switch is designed to be open when the unit is off and to close within 30 seconds after start-up. If this is not occurring, the oil flow switch needs to be replaced with a differential pressure switch. Refer to RTHA-SB-11 for the change-out procedures.

Note: Also refer to RTHA-SB-9 for the information on the oil screen. The oil screen must be removed when installing the differential pressure switch.

If the oil flow switch appears to be operating correctly, remove the oil screen. If the unit continues to trip off line, check the 1U3 module. Refer to RTHA-SB-5A for the check-out procedures.

Note: Record the "A" (operating) code that alternates with the "bF2" diagnostic. If the "A" code is A7C (STOP) or any other STOP/RESET mode, then the 1U3 module needs to be replaced.

A bE8 code (oil flow switch closed) can also be produced by a defective oil flow switch. This diagnostic will only occur if the switch is closed at start-up. If this does occur, replace the oil flow switch with the differential pressure switch.

Check-out Procedure for the Differential Pressure Switch.

The differential pressure switch monitors the pressure drop across the oil filter, the oil line service valve and the master solenoid. A high pressure drop is recognized as a restriction. This switch is normally closed and will open at a pressure drop of 50 psid, or greater.

The following steps need to be followed to determine the exact cause of the nuisance trips.

1. Check the pressure drop across the hydraulic line. This is done by taking a pressure reading at the sump of the oil tank, then subtract the pressure reading taken from the angle valve located at the top of the compressor.

Note: An inaccurate reading will be obtained if the Schrader valve near the load and unload solenoids is used. Be sure to take the second reading from the angle valve.

The pressure difference should not exceed 50 psid at full load. The standard pressure drop on units with a new oil filter ranges between 25-40 psid.

If the pressure drop exceeds 50 psid, change the oil filter and take the two pressure readings again. If the pressure drop remains above 50 psid, the hydraulic line needs to be inspected for restrictions.

2. Verify that the oil screen was removed from the hydraulic line, if applicable. Refer to RTHA-SB-9 for further details on the oil screen.

3. Verify the calibration of the switch. The switch is normally closed and must open at 50 psid. Manually check the calibration of the switch by performing a bench test on the switch.

If the switch is out of calibration, adjust the thumb screw on the differential pressure switch. Then re-connect the switch and restart the unit.

If the calibration is correct, reconnect the switch and continue to the next step.

4. Verify that all wiring on the switch is correct and all connections are tight.

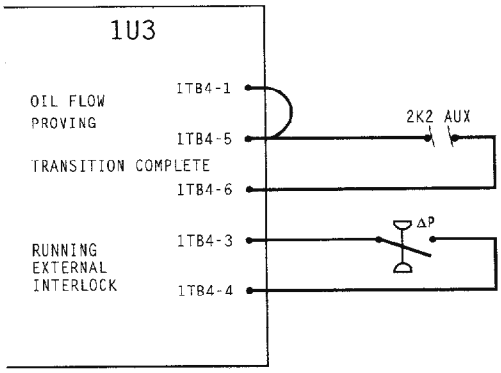
5. Record the "A" (operating code) code that alternates with the "bF2" diagnostic. If the "A" code is A7C (STOP) then the 1U3 module must be replaced.

Note: The bF2 diagnostic should only be generated if the unit is in a run mode.

6. If none of the above steps eliminate the bF2 nuisance trips, then the differential pressure switch needs to be rewired. This is done to help distinguish what is actually causing the trips.

WARNING: To prevent injury or death, disconnect the electrical power source before proceeding.

Figure 1
Differential Pressure Switch Rewiring for Units Without Active Oil Return



For units without active oil return, refer to Figure 1 and follow the procedures below:

a. Remove the Delta-P switch from 1TB4-1 and 1TB4-5 and place a jumper between these two terminals.

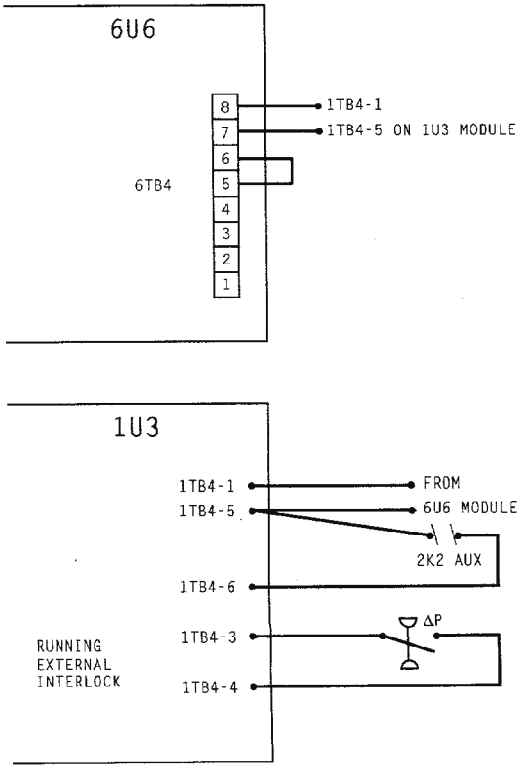
b. Change the Delta-P switch from normally-closed to normally-open.

c. Rewire the Delta-P switch to the "Running External Interlock" terminals, 1TB4-3 and 1TB4-4.

d. Restore power and proceed to Step 7.

For units with active oil return, refer to Figure 2 and follow the procedures below:

Figure 2
Differential Pressure Switch Rewiring for Units With Active Oil Return



a. Disconnect power.

b. Remove the Delta-P switch from 6TB4-5 and 6TB4-6 on the active oil return module (6U6) and place a jumper between these two terminals.

c. Change the Delta-P switch from normally-closed to normally-open.

d. Rewire the Delta-P switch to the "Running External Interlock" terminals, 1TB4-3 and 1TB4-4 on the 1U3 module. Additional wire may be required.

e. Restore power and proceed to Step 7.

7. With the differential pressure switch re-wired to the "Running External Interlock" terminals, monitor the next diagnostic that occurs.

If a "bF1" (Running External Interlock) diagnostic occurs, the pressure drop across the hydraulic line and the switch itself needs to be re-checked. This diagnostic confirms that the differential pressure switch actually opens.

If the bF2 occurs, the problem is not associated with the switch. Therefore, the 2k2 auxiliaries need to be tested and the 1U3 module needs to be re-tested. If the unit has active oil return, verify that the active oil return system is not taking the unit off-line. See page 2.

8. If the 1U3 module continues to check out correctly, verify that the 2k2 auxiliaries located between 1TB4 5 & 6 on the 1U3 module are the correct contacts. The contacts should have a Cutler Hammer part number of C320KR1.

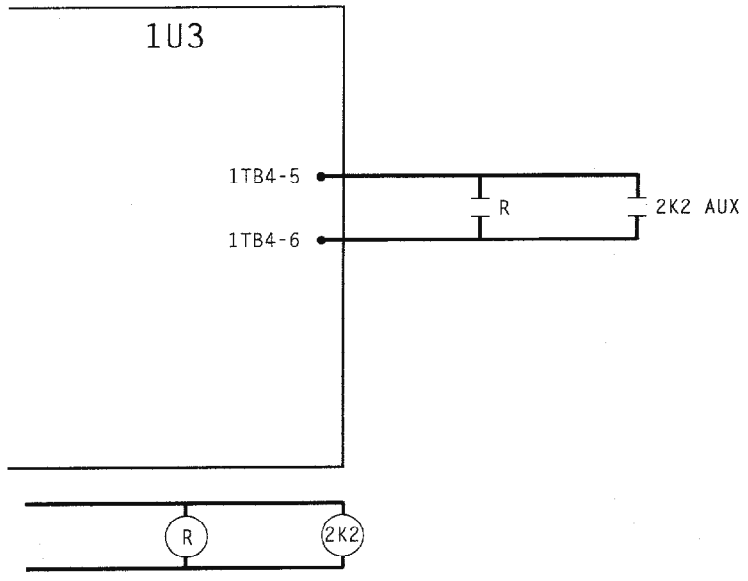
9. Move the 2k2 contacts to the bottom of the stack of auxiliaries, if possible. This will allow the sensitive 2k2 contacts to be the first to receive the motion from the contactor.

If the nuisance "bF2" diagnostics still occur an additional relay must be added.

10. The additional relay must have contacts rated for a dry DC circuit. RLY-847 can be used for this purpose.

Wire the relay coil in parallel with the 2k2 contactor coil, with the N.O. contacts of the relay wired in parallel with the 2k2 auxiliary contacts. Refer to Figure 3 for details.

Figure 3
Additional Relay to
Eliminate Chattering of 2K2 Aux.



R = Additional relay with a dry DC circuit rating.

Check-out Procedure for the AOR (Active Oil Return) System.

The complete operation of this system is outlined in RTHA-IOM-1A. This check-out procedure is only applicable if the red LED is energized when the unit trips on a bF2 diagnostic.

Note: If the red LED is NOT energized, refer to the beginning of this bulletin for more information.

1. Verify the refrigerant level, according to either RTHA-SB-6 or RTHA-SB-6A. Correct the charge if necessary and re-run the unit.

Note: An overcharge of refrigerant will cause liquid carry-over, which will wash the oil out of the oil tank. Typically if this is occurring, the discharge superheat is extremely low and the oil tank turns cold at full load conditions.

Note: With an undercharge of refrigerant, the compressor will be unable to bring a sufficient amount of oil-rich refrigerant back to the compressor, to maintain a satisfactory oil level in the oil tank.

If the charge is correct, proceed with the next step.

2. Verify the oil level according to RTHA-IOM-1A. Correct the oil charge, if necessary, and re-run the unit.

If the oil level is correct proceed to step 3.

3. Verify the AOR service valve is completely opened. The AOR service valve is located on the AOR line leaving the discharge line. The valve is upstream of the AOR solenoid valve.

4. Verify the operation of the optical sensor. This is most effectively done by removing the sensor from the hydraulic line. Use the steps below to verify the operation:

a. Turn unit off, but leave power connected.

WARNING: To prevent injury or death due to electrocution, take extreme care when performing service procedures with electrical power energized.

b. Valve off the entire hydraulic line, as if changing the oil filter.

c. Unscrew the optical sensor from the line but leave the wires connected to the 6U6 module.

d. Submerge the sensor in a cup of oil. Place the wires in first to avoid causing an air pocket around the sensor.

Note: The test is most accurate when using a dark cup.

e. Record the voltages on 6TB4 between 1 & 2, 2 & 4, and 1 & 4. Refer to table 1 for the proper voltages.

Table 1
Optical Sensor Voltages

6TB4	1 & 2	2 & 4	1 & 4
Oil	≥11 vdc	≤.7 vdc	11 vdc
No Oil	≤.7 vdc	≥11 vdc	11 vdc

f. Remove the sensor from the oil and record the new voltage readings.

5. If the voltages do not correspond, check the wiring. If the wiring is correct, replace the optical sensor.

Note: Two types of optical sensors have been used on the RTHA units. One sensor is brass with four wire leads. The other is steel with three wire leads. Refer to Figure 6.

If the sensor is operational, re-install it, open all valves, and proceed with the next step.

6. Check the normally-open solenoid on the AOR system.

7. If no problem with the system has been found by this step, monitor the machine and take an oil level reading before clearing the next bF2 diagnostic.

If the oil level is satisfactory, replace the 6U6 module.

If the oil level is below the recommended level, the eductor system needs to be modified. Refer to the following section for the details regarding the retrofit procedures.

AOR Modification Procedures

Each tonnage range receives a different modification. Units manufactured after serial number U93F**** do not need this modification.

180-215 ton units:
1. Add one eductor.
2. Re-wire the 6U6 module.

255-300 ton units:
1. Move one eductor.
2. Re-wire the 6U6 module.

380-450 ton units:
1. Add slide stop in compressor.
2. Move one eductor.
3. Re-wire the 6U6 module.

The modifications for the different tonnage ranges are outlined below:

Adding or Moving an Eductor

Note: This process requires an ASME welder and an ASME inspector in most states. U-1 forms can be obtained, if necessary, by contacting Technical Support in Pueblo.

Note: Refer to Figures 4 and 5 for eductor dimensions and tubing.

1. Recover refrigerant (refrigerant can be stored in the condenser if the unit has isolation valves).

2. Weld couplings to the evaporator shell, as follows:

a. On 180 ton and 215 ton units, weld a 3/4-inch coupling to the top of the evaporator, 4.5 inches from the suction connection. Also, weld a 1/2-inch coupling 9 inches from the tube sheet and 5.5 inches down from the center of the weld, on the side closest to the condenser shell. Use a 0.19-inch fillet weld on both couplings.

b. On the 255 ton to 450 ton units, weld a 1/2-inch coupling 9 inches from the tube sheet and 6.8 inches down from the center of the weld, on the side closest to the condenser shell and re-use the 3/4-inch coupling that is already mounted on the top of the evaporator. Use a 0.19-inch fillet weld on the coupling.

c. Leak test the coupling welds.

d. Drill a 0.85-inch hole through the 3/4-inch coupling and a 0.70-inch hole through the 1/2-inch coupling. **Use a drill stop to prevent damage to the tubes.**

3. On all units, re-drill the holes in the existing couplings to the largest size possible without damaging the threads of the couplings. **Use a drill stop to prevent damage to the tubes.**

4. Screw the 1/2-inch MPT of the eductor into the 1/2-inch coupling on the side of the evaporator. Use 7/8-inch copper tube between the 3/4-inch male connection of the eductor and the 3/4-inch coupling on top of the evaporator. See Figure 5.

5. On the 180-215 ton units, modify the condenser motive line by adding a 1/2 x 5/8 x 1/2-inch tee with a 45 degree flare downstream of the solenoid and a 1/2-inch copper line. Refer to Figure 5.

6. On the 180-215 ton units, use 1/2-inch copper tubing between the 1/2-inch tee and the inlet of the eductor (1/4-inch FPT).

7. On the 255-450 ton units, plug the old weld coupling, which is no longer being used, and re-use the interconnecting piping between the eductor.

8. Leak test the system.

9. Evacuate the evaporator to 500 microns and recharge the unit.

WARNING: To prevent injury or death, disconnect the electrical power source before proceeding.

Figure 4
Coupling Locations on the Evaporator

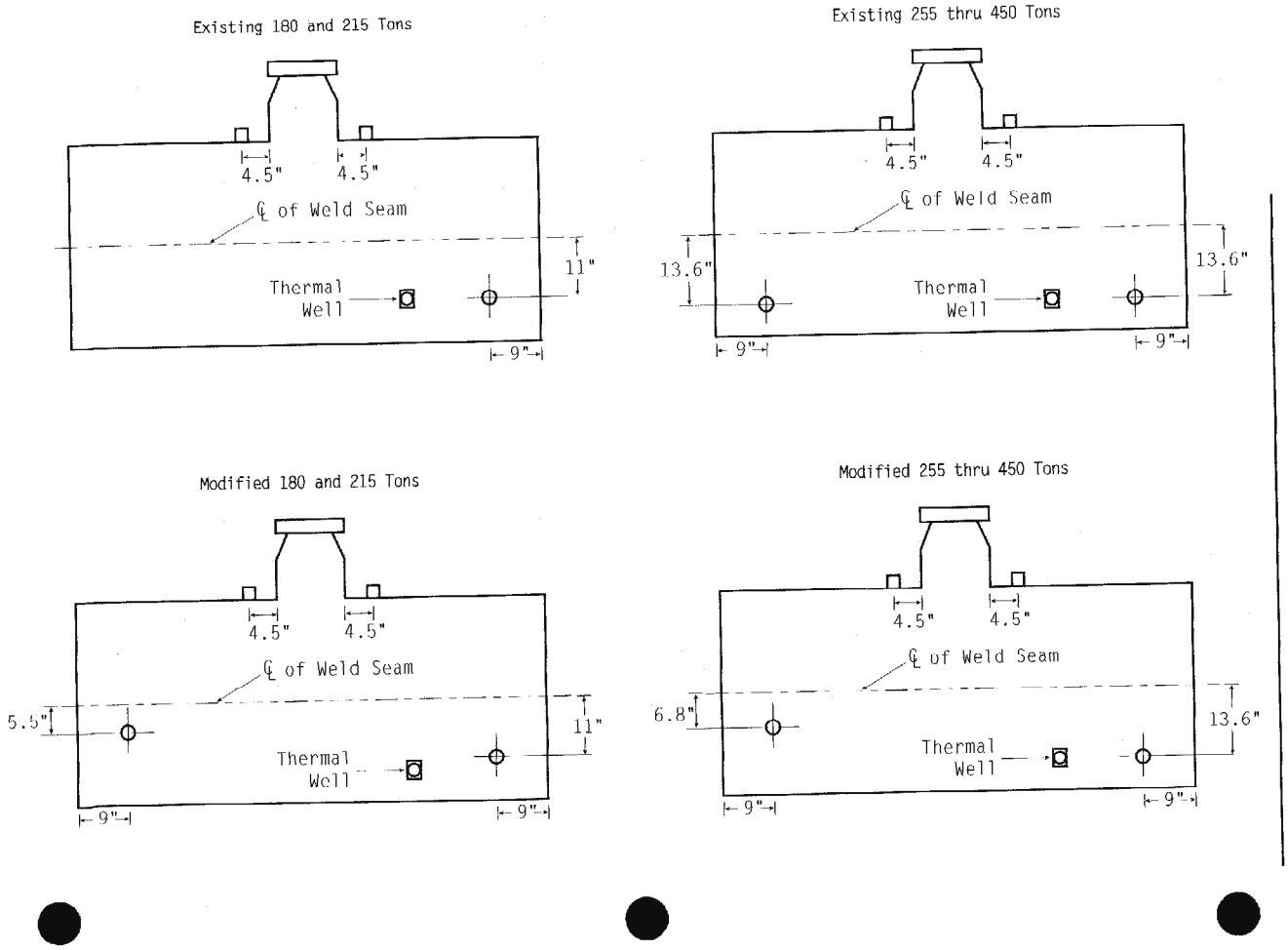
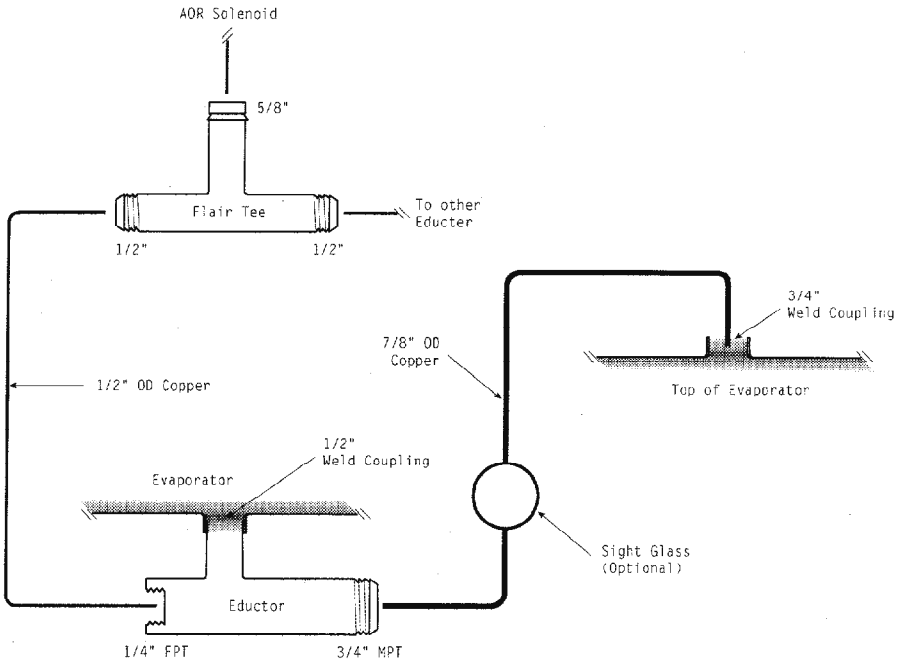


Figure 5
Eductor Tubing



Rewire of the 6U6 Module

Refer to Figure 6.

1. Be sure that all power to the Control Panel is de-energized.

2. Disconnect the wire at 6TB3-1 and cap the wire.

3. Install a jumper wire between 6TB3-1 and 6TB3-3.

4. Disconnect the wires at 6TB4-6 and 6TB4-8, tie them together and cap them.

5. Disconnect the wires at 6TB4-5 and 6TB4-7, tie them together and cap them.

6. Install a jumper wire between 6TB4-5 and 6TB4-6. Terminals 6TB4-7 and 6TB4-8 will remain bare.

7. Restore power to the Control Panel.

The re-wire of the 6U6 module will allow the differential pressure switch to continue protecting the unit from a restriction in the hydraulic line. The change is in the operation of the Active Oil Return module (6U6).

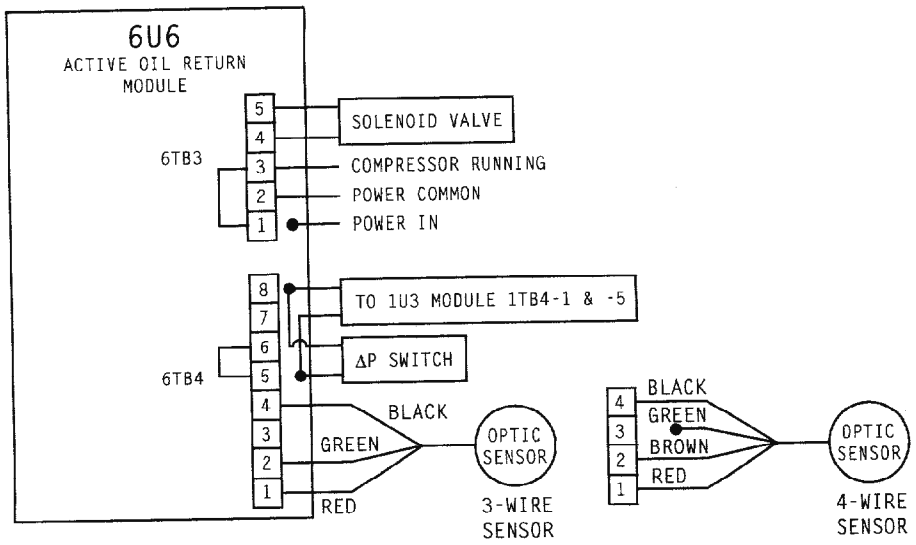
With the modifications to the actual piping completed, the unit will bring more oil and refrigerant back to the compressor. This can cause excessive foaming in the oil tank, confuse the optical sensor and, if the re-wire is not completed, cause the unit to trip off line.

With the re-wire completed, the 6U6 module is capable of going in to and out of active oil return, but when the red LED is energized, the unit will no longer trip off line. If either the red or green LED is energized, the normally-open AOR solenoid valve is de-energized, putting the unit in Active Oil Return.

With the re-wire completed, it is no longer necessary to use the white "RESET" button to clear the red LED. The red LED will be cleared any time the compressor cycles off.

Note: With the re-wire completed, the AOR system can no longer trip the unit off line, but the unit continues to be protected from the loss of oil flow, as all the standard units are, through the operation of the differential switch.

Figure 6
Re-Wiring of the 6U6 Module



Procedure to Add Slide Stop to the Compressor

1. Isolate the charge or remove the charge from the unit.

2. Follow RTHA-SB-15 to disassemble the compressor. The following will need to be removed:

- Oil tank
- Oil separator
- Piston housing

3. Debur the slide stop and carefully insert it into the bottom of the piston housing. Be certain not to scratch the sides of the housing. Scratches will cause a leak path which will alter the loading of the machine.

Note: Be sure not to block the oil port when installing the slide stop.

4. Re-assemble the compressor and re-charge.

Parts Ordering Information

This Service Bulletin is informational only and does not authorize any parts or labor.

The following parts may be needed and may be ordered from La Crosse Service Parts:

Eductor Valve - VAL 4203

Internal Compressor O-Rings for adding slide stop:

Piston Housing O-Ring - RNG 0891

Oil Tank/Rotor Housing O-Ring - RNG 0266

All other parts may be ordered from the parts books, except the compressor slide stop, which is available from Pueblo Tech Support.