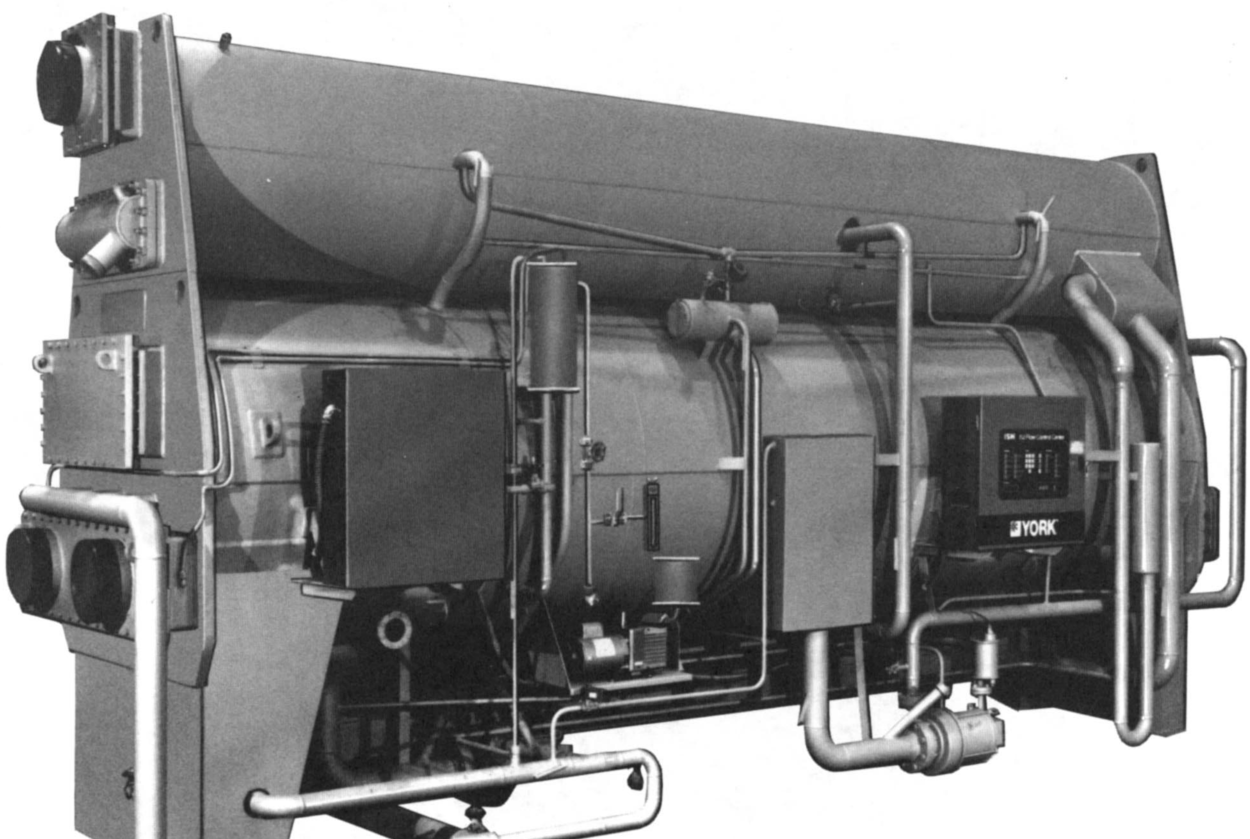
YORK®

ABSORPTION LIQUID CHILLERS

SERVICE INSTRUCTION

Supersedes: Nothing | 1094 | Form 155.16-M3.1

MODELS YIA 1A 1A THRU YIA 14F 3A



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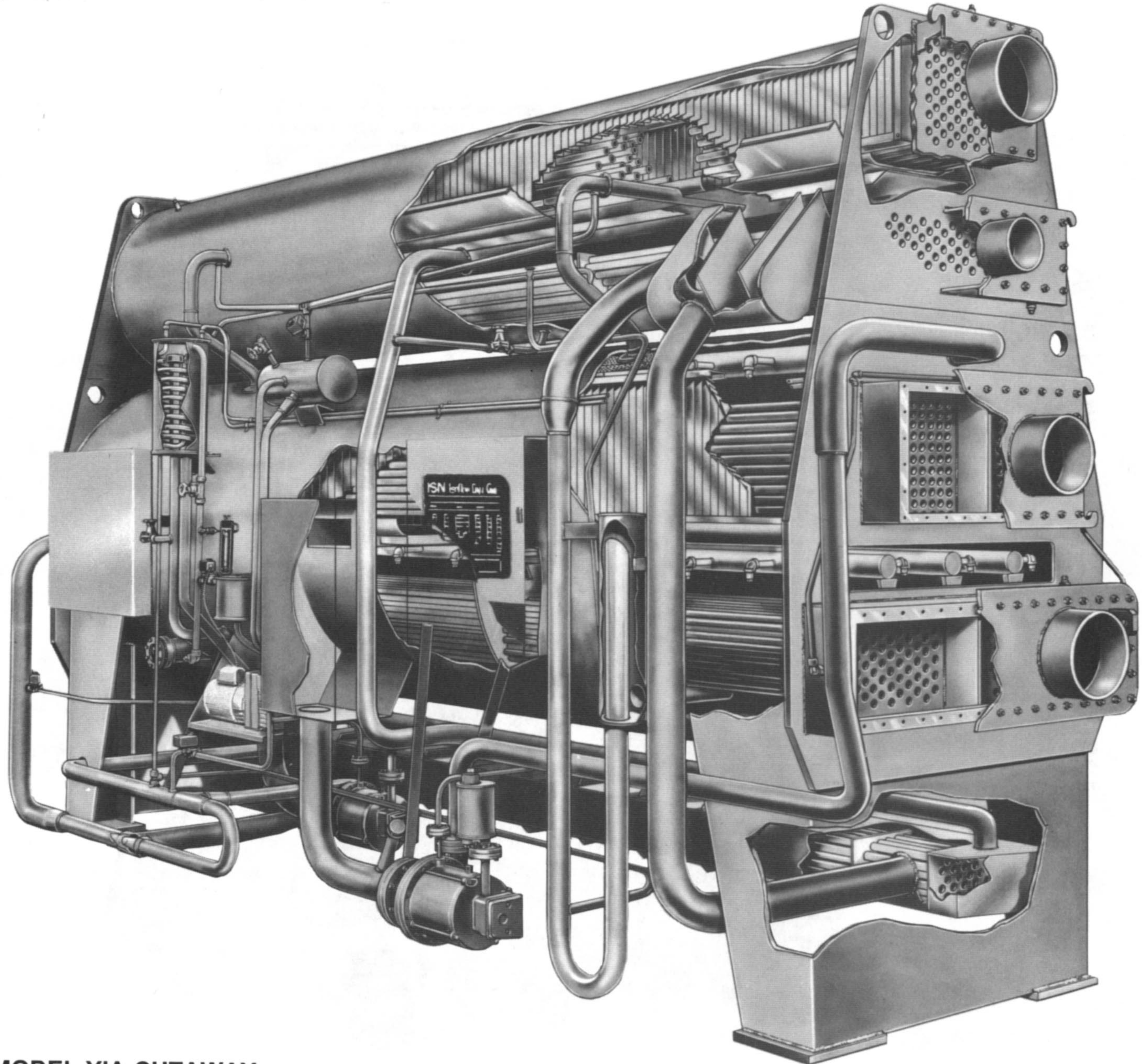

MODEL YIA CUTAWAY

12267

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INTRODUCTION

GENERAL

This introduction provides detailed servicing procedures supported with graphical illustrations of all servicing areas on the IsoFlow unit. The data presented in this instruction are considered proprietary to York personnel except in the case where the customer has accepted the responsibility for servicing and maintaining the operating efficiency of the unit.

The IsoFlow unit is a completely self-contained, forced circulation refrigeration system using steam or hot water as the activating medium. Water is used as the refrigerant and lithium bromide salt is used as the absorbent. The system consists of a generator-condenser shell assembly mounted on top of an absorber-evaporator shell assembly, solution pump, refrigerant pump, purge pump, and interconnecting piping. See Figure 1 for system component locations.

An IsoFlow Unit is a relatively simple cycle which will give reliable performance providing it is properly maintained. The system must be maintained tight and free of non-condensibles. The oil in the vacuum pump must be changed to provide efficient purging. The steam and water supply must be furnished at design conditions. Cooling water must be conditioned to prevent excessive fouling of the tubes. The chromate content and the pH of the solution must be checked to insure that the proper amount of corrosion inhibitor is present. The pumps and line valve diaphragms must be maintained and the tubes within the shells kept clean. Contact York Division before undertaking any procedure which requires opening up the system. It is York's recommendation that all such servicing be performed by or under the supervision of a York International Service Representative.

SERVICE AND MAINTENANCE

LOCATING AND REPAIRING SYSTEM LEAKS

A. BREAKING SYSTEM VACUUM

CAUTION: Before admitting nitrogen pressure to the system, be certain that solenoid 1 SOL in the pump motor coolant circuit is energized. Disconnect the solenoid leads in the junction box and connect them to the 120 volt source. Refer to Figure 2.

1. Before any part of the refrigerant or solution circuits is opened for any reason, the system vacuum must be broken with the water pumped dry nitrogen.

2. Nitrogen is a non-combustible gas which will provide protection against rust forming on the internal surfaces while the system is open.

3. The regulator on the nitrogen cylinder should be set to maintain a slight flow (about 1 psig) of nitrogen through the system while the system is open for repairs.

4. If a pump or a valve is removed for replacement or repair, a temporary cover should be installed over the opening.

   To admit nitrogen to the system, it is only necessary to connect the regulating valve on the nitrogen cylinder to the absolute pressure gauge connection by means of copper tubing. Be sure to purge the air from the nitrogen connection before tightening the flare nut at the absolute pressure gauge valve. Then adjust the nitrogen regulating valve (not to exceed 5 psig) and open the absolute pressure gauge valve.

B. REMOVING THE CHARGE

1. Connect a cylinder of water pumped nitrogen to the absolute pressure gauge connection and break the system vacuum as outlined under Breaking System Vacuum.

2. When a slight pressure (1 or 2 psig) exists within the system, connect a clean hose to the system service valves at the lowest point in the system.

3. Open the valves and force the charge into a clean storage drum.

   CAUTION: Be sure the nitrogen pressure does not exceed 10 psig.

4. When the charge is completely drained, adjust the nitrogen regulating valve to maintain about 1 psig pressure within the system and close the system valves.

5. Remove small Allen type plug from the end bell of each motor. This will permit drainage of the motor coolant so that this circuit can be leak checked properly. After the coolant has all drained out, replace the Allen type plugs using 1/2″ Teflon tape (part no. 044-01702).

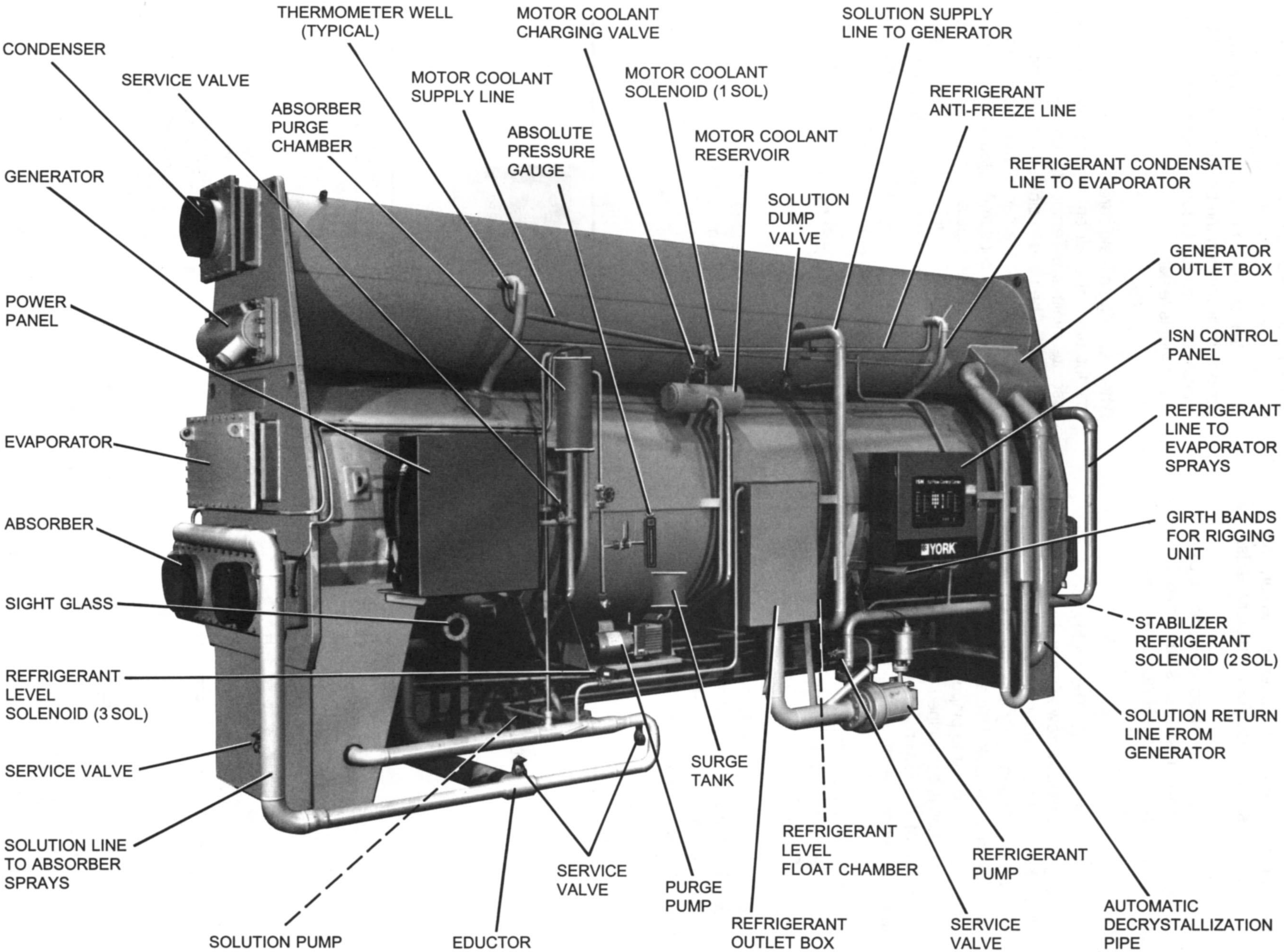


FIG. 1 – MODEL YIA ABSORPTION UNIT, FRONT VIEW

C. LEAK DETECTION AND REPAIR

1. Drain the water from the condensing water, chilled water and steam heads/or hot water heads.

2. Break the vacuum as described above using nitrogen and then pressurize steam units to 15 psig with Refrigerant-22 or Helium. Pressurize hot water units to 10 psig.

3. Leak test the entire unit. Thoroughly check all valves, gasket joints, screw joints and welds. Use a G.E. Model H2 electronic leak detector set at .025 ounce/year sensitivity to determine the general location of the leak. Use a soap solution with a little glycerin added to pinpoint the leak after a general location is determined. Check for possible tube leaks at the lower drain connection of all steam and water heads.

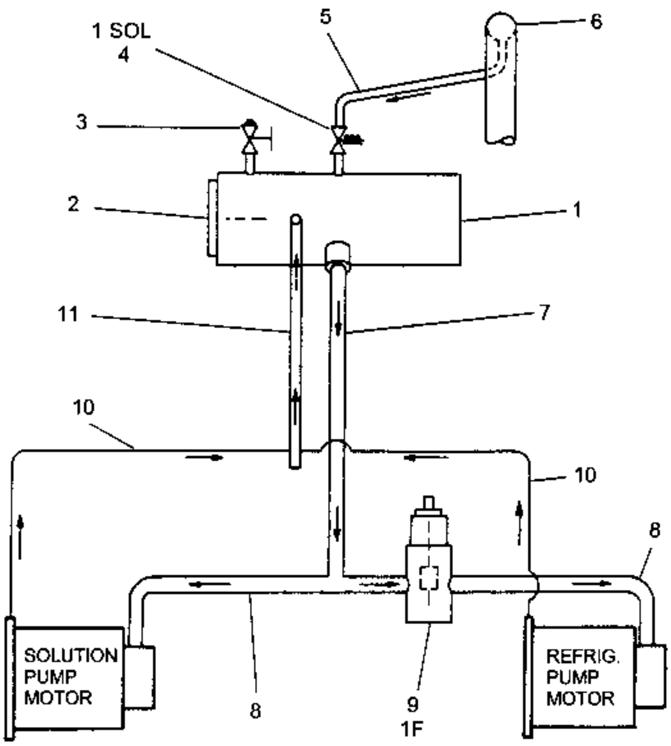
   NOTE: Leak detectors should be checked regularly with a G.E. Halogen Leak Standard Type LS-20.

4. If the valves are exposed to an atmosphere containing Refrigerant-22 or Helium, it can get into the bonnet through the vent hole and pocket between the bonnet and the diaphragm. The grease would absorb the refrigerant and when probing with a leak detector at the vent hole, a false indication of a leaking diaphragm may appear. In this case, it is necessary to blow uncontaminated air through the bonnet to clear out the pocket and recheck before concluding that the diaphragm is leaking.

5. When repairing a leak, care must be exercised to limit the amount of air entering the system to an absolute minimum. Temporary covers or plastic sheets must be used to close the openings while making repairs. At the same time water pumped nitrogen must be constantly bled into the system with the pressure regulator set so as to have positive nitrogen flow through any and all openings. The purpose of the nitrogen flow is to prevent any air from entering the system and thus protect the interior surfaces from corrosion.

6. Repeat the Refrigerant-22 or Helium test at 10 psig.

7. If no further leaks are found, evacuate the system preparatory to charging. Refer to the Operating Manual, Form 155.16-O3.1, for evacuation procedure and for charging procedure.



ITEM NO.	DESCRIPTION
1	Coolant Reservoir
2	Magnetic Strainer
3	Coolant Fill Valve
4	(1 SOL) Coolant Solenoid Valve
5	Coolant Makeup Line
6	Condensate Drain
7	Coolant Supply Header
8	Motor Coolant Suction
9	(1F) Float Switch
10	Motor Coolant Discharge
11	Coolant Return Header

FIG. 2 – HERMETIC PUMP MOTOR COOLING DIAGRAM

PUMP-MOTOR MAINTENANCE AND SERVICE

This section includes maintenance and service of the pumps, motors, seals, motor coolant system and all appurtenant parts of these components.

A. DESCRIPTION

1. Pump Seals – The pump seals are John Crane, Type 2 Single Mechanical Seals as shown in Figures 3, 4 and 5. It is recommended that seals on both solution and refrigerant pumps be replaced whenever leakage is evident. To replace a seal, follow the procedure outlined below.

   a. Refrigerant pump seal leakage would probably not be evident during refrigerant pump operation. Leakage would be evident by loss of refrigerant level in the motor coolant reservoir, where rapid refrigerant loss would be experienced during the shutdown. (A faulty solenoid, 1 SOL would produce the same effect with rapid evaporation during shutdown.)

   b. Refrigerant flow from the coolant circuit to the main refrigerant could proceed only to the condition of level to the main refrigerant. At shutdown the main refrigerant level should be up into the refrigerant pan (not visible). Gradually, the main refrigerant will evaporate and be absorbed into the solution, and the level will be reduced to a point below the motor coolant reservoir center line. When the unit is improperly charged with refrigerant the coolant level could drop below the operating level of the 1 SOL float switch during prolonged operation at low load conditions. Correcting the unit refrigerant charge should correct this condition.

   c. Refrigerant in the motor coolant circuit may also drop below the float setting of float switch (1 F) by leakage during shutdown through a refrigerant seal, so that starting difficulties would be experienced.

   d. If coolant loss during shutdown is experienced, first determine if the solenoid valve 1 SOL is operating properly. Listen for the audible click as the power is placed across the solenoid leads. If the click is not experienced, pressurize the system with nitrogen and remove the solenoid valve bonnet, and replace the necessary faulty parts. If an audible click is heard, a

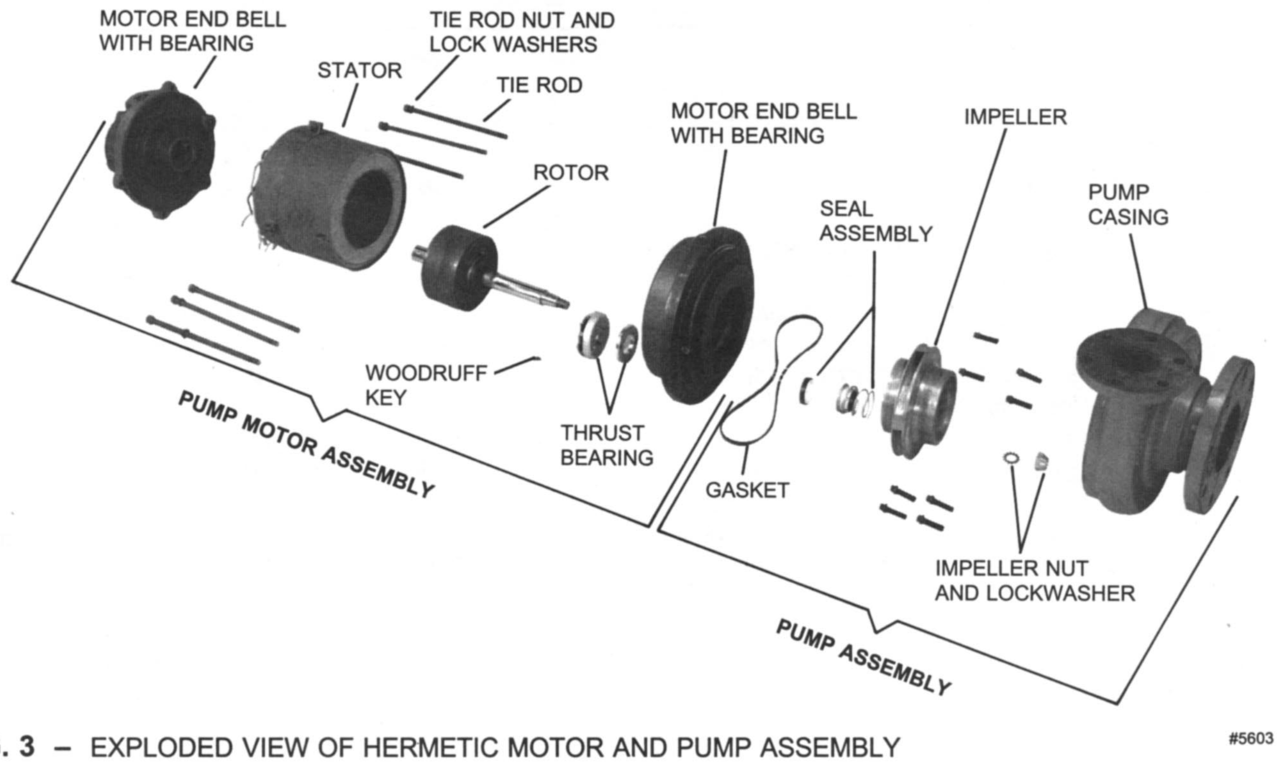


FIG. 3 – EXPLODED VIEW OF HERMETIC MOTOR AND PUMP ASSEMBLY

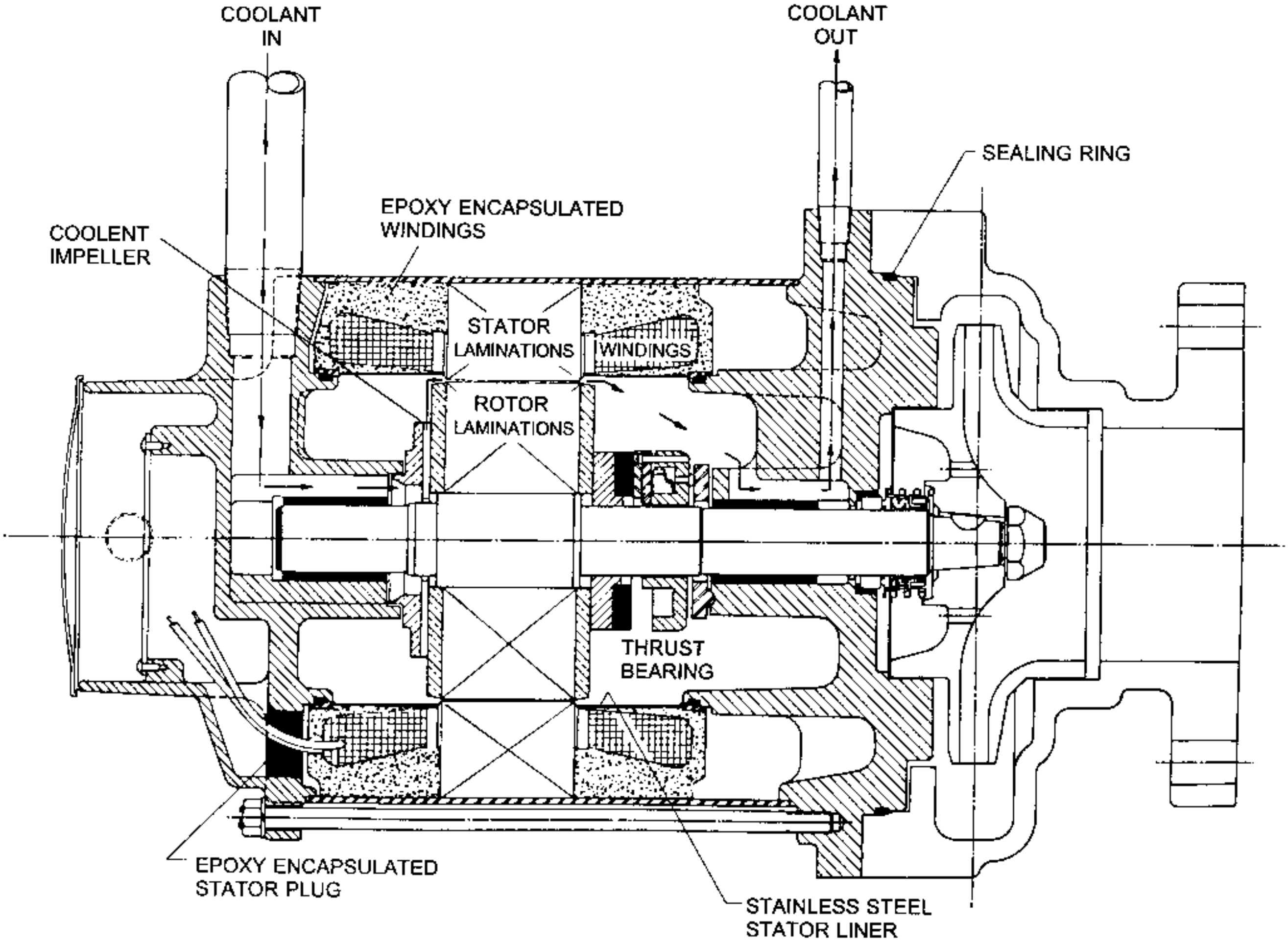


FIG. 4 – HERMETIC MOTOR AND PUMP ASSEMBLY SECTIONAL VIEW

leaking solenoid is still a possibility and should be examined as above, before laying the blame to a faulty pump seal.

2. Motor Bearings – These machines are equipped with Franklin Electric motors of a hermetic design. It is not necessary to lubricate the bearings since this is done automatically when the run-around motor coolant system is properly filled. For this reason, motors should never be operated without adequate liquid level in the motor coolant circuit. Neither journal nor thrust bearings can be replaced in the field. Therefore, should either require replacing, the motor must be returned to York and the replacement motor mounted in its place.

3. Motor Coolant System Strainer – The strainer, which is located in the motor coolant reservoir, consists of both a screen and a permanent magnet core. Together, these elements remove all particals from the motor coolant system which may be injurious to bearings, seals and other system components. To enable this strainer to continue to function in a proper manner, it must be cleaned whenever the system is pressurized for maintenance. To clean the strainer, follow the procedure outlined under Section B.1 Cleaning the Strainer. Refer to Figure 6.

4. Motor Coolant Float Switch – The motor coolant float switch is mounted in the motor coolant line near the refrigerant pump. It is designed to protect the motor windings and bearings from inadequate cooling and lubrication due to low water level. For this reason, the float and guide rod must be cleaned and the float checked for freedom of movement during maintenance. To clean and check the float, follow the procedure outlined on page 9. Refer to Figure 7.

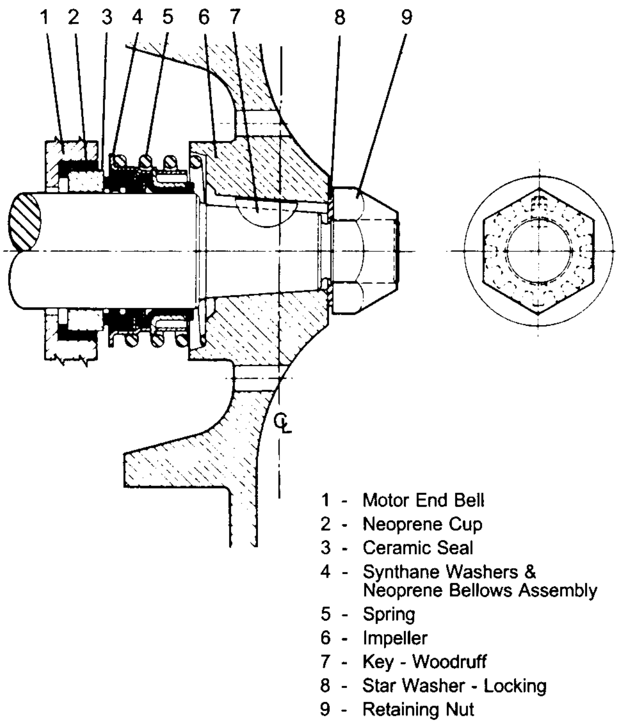


FIG. 5 – SHAFT EXTENSION AND SEAL ASSEMBLY

5. Pump Casing and Impeller – The pump casings and impellers are cast in high grade, durable materials that are designed to last the life of the equipment under normal conditions.

B. PROCEDURES

Threaded joints made up at the factory and sealed with grade AVV086 Loctite, must be heated in order to disassemble.

CAUTION: *Valves with joints made up with AVV-086 Loctite must have the bonnets and diaphragms removed before heating to avoid damage.*

When making up a joint with Loctite, apply 3 beads lengthwise about 120° apart, on the clean threaded surface.

CAUTION: *Do not use Grade AVV086 Loctite on threaded plugs, motor coolant nipples or float switch coupling. For these purposes, use Teflon tape on applications where tape was used originally (as at the 1½ inch NPS threaded sight plugs).*

When using Teflon tape, wrap the tape clockwise on the male thread only, facing the threaded end. Start wrapping 2 threads from the end giving it two layers then cross over and wrap the remaining effective threads with two layers. Use sufficient pull so that the tape is slightly pulled into the threads.

If you screw a plug into a valve, hold the valve firm with one wrench so it does not move while turning the nipple or plug in with the other wrench, otherwise you may cause the Teflon joint to leak.

Teflon is toxic at temperatures above 400°F. Do not heat the Teflon above 400°F. If it is necessary to weld near a Teflon joint, wrap the joint with a soaking wet rag so as not to overheat the Teflon.

If a field repair is required use ½″ wide Teflon tape, York part number 044-01702 (Permacel Ribbon Dope – 3½ to 4 mil thickness). Make sure the threads are good, clean threads.

1. Cleaning the Strainer
   a. Break the system vacuum as outlined under Breaking System Vacuum.
   b. Remove the pipe plug from the bottom of the float switch housing and drain the coolant system charge.
   c. Remove the eight cap screws holding the access cover and slide the strainer-magnet assembly out of the motor coolant reservoir. Using clean water, flush and wipe clean the strainer-magnet assembly.
   d. Using a new access cover gasket, reinstall the strainer-magnet assembly, cap screws, and drain plug.
2. Cleaning the Motor Coolant Float Switch
   a. Following the cleaning of the strainer, disconnect the motor coolant float switch leads in the control panel (from terminals 6 and 7) and the conduit connection at the control panel. Carefully note where these connections are broken so that the control may be properly rewired after servicing of the float is completed. Disconnect the conduit and withdraw it and the two wires from the control panel.
   b. Unscrew the float switch housing. Using clean water, flush and wipe clean the float and guide rod.

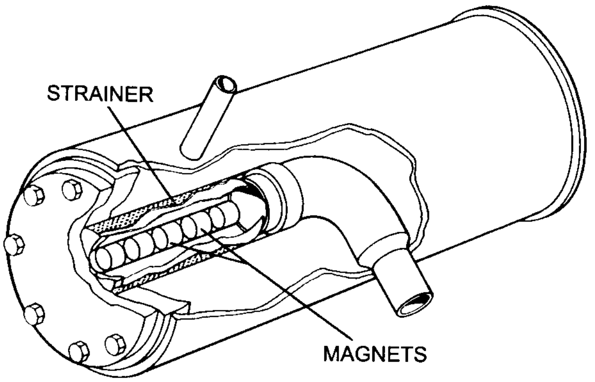


FIG. 6 – EXPLODED VIEW OF MOTOR COOLANT RESERVOIR

c. Attach an electrical continuity checker to the float switch leads. With the float switch assembly held in a vertical position, the continuity checker should indicate an open circuit. With the float assembly retained in its normal, vertical, operating position, slowly lower the float and guide rod assembly into a container of water. By the time the float is submerged the switch should be actuated and the continuity checker should indicate a closed circuit. Slowly withdraw the assembly from the water. By the time the float has cleared the water, the continuity checker should again be indicating an open circuit. If the assembly has been thoroughly cleaned with the float freely movable and the switch does not perform as above described, the contact element must be replaced. This is accomplished by compressing the electrical wire retainer in the top of the float and pulling the contact assembly out of the float well. See Figure 7.

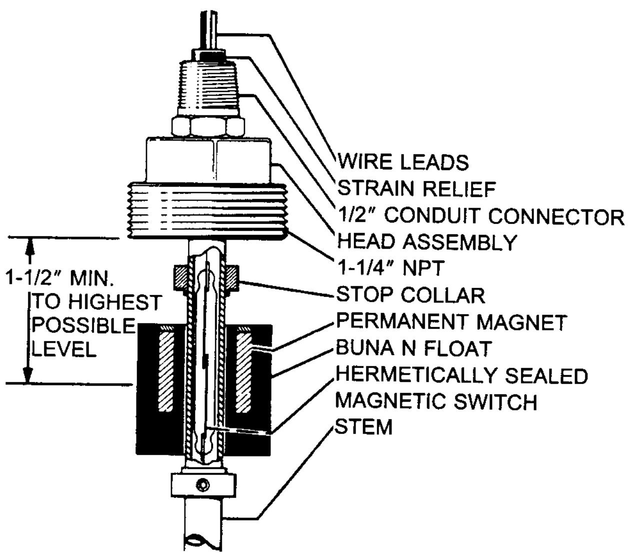


FIG. 7 – EXPLODED VIEW OF MOTOR COOLANT FLOAT SWITCH

d. Replace the float switch housing in its coupling using Teflon tape as described. Re-install the conduit and reconnect the float switch leads to terminals 6 and 7.

e. If seals are to be replaced, proceed with the instructions below. If maintenance and service work other than seal replacement is to be performed, proceed with that work.

f. If no further work is to be performed, leak test the joints that have been disturbed as outlined in Locating and Repairing System Leaks. Recharge the coolant system as outlined in the Operating Manual, Form 155.16-O3.1.

C. SERVICING THE PUMP ASSEMBLIES

General Description – Pump Isolation – On the IsoFlow unit, provision is made to service the pumps and pump motors without removing the refrigerant or solution charges from the unit. This is accomplished by the insertion of inflatable isolation bags into the pump discharge (solution pump only) and suction lines. This is done by the use of standpipes that are installed at an angle in the pipelines. These standpipes are capped for normal operation. See Fig. 8.

To service the pump, a liquid level sight tube is installed at a service valve in the particular solution circuit involved. See Figure 9. The system is charged with nitrogen to atmospheric pressure. The sight tube valve is then opened and the system partially evacuated by using a vacuum pump. Evacuate the system until the liquid level is approximately halfway down the highest standpipe in the circuit to be worked on. This level is shown in the sight tube. The standpipe cap is removed, the airbag stopper is inserted and then the bag is inflated. If the pump assembly to be serviced is the solution pump, the next lowest standpipe is then used. Follow the same procedure until all standpipes in the pump circuit are used. When all bags are installed, the pump assembly to be serviced can be removed. All flanged openings are closed with blank flanges provided in the kit.

After the pump assembly is serviced and reinstalled, the system is returned to normal by regulating the vacuum, removing the bags and capping the standpipes starting with the lowest one first. The system is then completely evacuated to normal operating vacuum.

Pump Isolation Kits are available from York and Tables 1 thru 4 show the kit components to be used with the IsoFlow units.

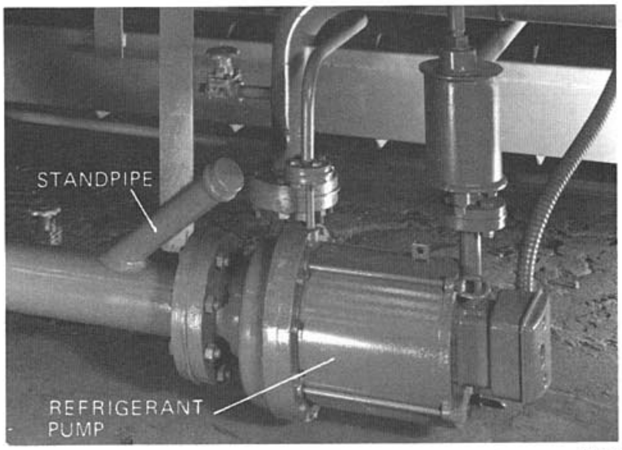


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FIG. 8 – REFRIGERANT PUMP STANDPIPE

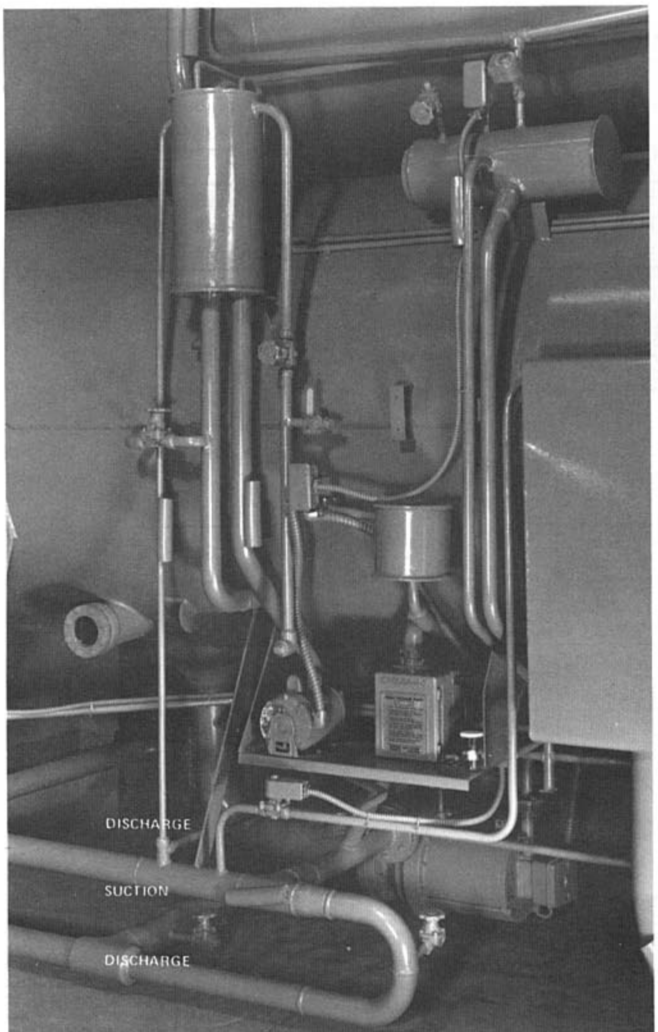

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FIG. 9 – LIQUID LEVEL SIGHT TUBE

Solution Pump Isolation – The procedure to be followed in servicing a solution pump is as follows:

1. Connect one end of the sight tube to the access valve in the solution pump suction line.
2. Tape the opposite end of the sight tube to the purge vapor line with the top about one foot above the centerline of the lower shell.
3. Break the unit vacuum with water-pumped dry nitrogen to atmospheric pressure. (Energize the coolant solenoid, 1 SOL, before breaking the vacuum.)
4. Measure the centerline height of each standpipe (two on some units, three on others) from the floor.
5. Mark these heights on the sight tube with masking tape, measuring from the floor. See Figure 9.
6. Open the sight tube access valve. The solution will rise in the sight tube to the liquid level inside the unit.
7. Start the vacuum pump and pull a slight vacuum on the unit until the level in the sight tube drops to the first (upper) tape mark. Then close the unit hand valve to the vacuum pump.
8. The pipe cap on the highest standpipe can now be removed and the proper size bag installed. See Tables 1 thru 4.
9. Check the bag before installing it in the standpipe. See Figure 10. Check the following:
   a. Hose clamp is tight around rubber stem.
   b. Schrader valve is tight.
   c. Seal cap assembly is positioned up near the tee (within 1 or 2 inches).
   d. Bag is completely deflated.
10. With the bag covering folded as neatly as possible into the folds of the rubber balloon, roll the bag tightly along the vertical axis. See Figure 11.
11. Insert the bag into the standpipe with a twisting and downward motion until the bag is completely within the pipe. Exert a downward force on the bag with the tubing until it bottoms, and then withdraw it about half the pipe diameter. This will properly locate the bag. See Figure 12.
12. Inflate the bags to 12 psig with the hand pump provided.

TABLE 1 – ISOLATION BAG KIT COMPONENT DATA – SOLUTION PUMP – 60 Hz WITH OR WITHOUT SOLUTION VALVE

Unit Size	Bag Size			Pump Conn Line Size		Blank Flanges										Bolt Dia	
						Suction					Discharge						
YIA	Suc	Dis # 1 (Upper)	Dis # 2 (Lower)	Suc	Dis	Dia	No. Holes	Hole Size	Hole Circle	Thick-ness	Dia	No. Holes	Hole Size	Hole Circle	Thick-ness	Suc	Dis
1A1	4	2-1/2	2	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
1A2	4	2-1/2	2	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
2A3	4	2-1/2	2	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
2A4	4	2-1/2	2	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
2B1	4	2-1/2	2	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
3B2	4	2-1/2	2	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
3B3	4	2-1/2	2	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
4B4	4	2-1/2	2	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
4C1	4	2-1/2	2	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
5C2	4	2-1/2	2	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
5C3 6C4 7D1	See Below																
7D2	6	3	2-1/2	6	3	11	12	3/4	9-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
8D3	6	3	2-1/2	6	3	11	12	3/4	9-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
8E1	6	3	2-1/2	6	4	11	12	3/4	9-1/2	3/8	9	8	3/4	7-1/2	3/8	5/8	5/8
9E2	6	3	2-1/2	6	4	11	12	3/4	9-1/2	3/8	9	8	3/4	7-1/2	3/8	5/8	5/8
10E3	6	3	2-1/2	6	4	11	12	3/4	9-1/2	3/8	9	8	3/4	7-1/2	3/8	5/8	5/8
12F1	6	3-1/2	3-1/2	6	4	11	12	3/4	9-1/2	3/8	9	8	3/4	7-1/2	3/8	5/8	5/8
13F2	6	3-1/2	3-1/2	6	4	11	12	3/4	9-1/2	3/8	9	8	3/4	7-1/2	3/8	5/8	5/8
14F3	6	3-1/2	3-1/2	6	4	11	12	3/4	9-1/2	3/8	9	8	3/4	7-1/2	3/8	5/8	5/8
60 HERTZ WITH SOLUTION VALVE																	
5C3	6	3	2-1/2	6	3	11	12	3/4	9-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
6C4	6	3	2-1/2	6	3	11	12	3/4	9-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
7D1	6	3	2-1/2	6	3	11	12	3/4	9-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
60 HERTZ WITHOUT SOLUTION VALVE																	
5C3	4	2-1/2	2	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
6C4	4	2-1/2	2	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
7D1	4	2-1/2	2	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2

TABLE 2 – ISOLATION BAG KIT COMPONENT DATA – SOLUTION PUMP – 50 Hz WITH OR WITHOUT SOLUTION VALVE

SOLUTION PUMP																	
Unit Size	Bag Size			Pump Conn Line Size		Blank Flanges – 1/4" Thick										Bolt Dia	
						Suction					Discharge						
YIA	Suc	Dis # 1 (Upper)	Dis # 2 (Lower)	Suc	Dis	Dia	No. Holes	Hole Size	Hole Circle	Thick-ness	Dia	No. Holes	Hole Size	Hole Circle	Thick-ness	Suc	Dis
50 HERTZ: SAME AS 60 HERTZ EXCEPT AS NOTED BELOW																	
50 HERTZ WITH SOLUTION VALVE																	
5C3	6	3	2-1/2	6	3	11	12	3/4	9-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
50 HERTZ WITH OR WITHOUT SOLUTION VALVE																	
6C4	6	3	2-1/2	6	3	11	12	3/4	9-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
7D1	6	3	2-1/2	6	3	11	12	3/4	9-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
8E1	6	3	2-1/2	6	3	11	12	3/4	9-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
9E2	6	3	2-1/2	6	3	11	12	3/4	9-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
10E3																	
ABS	4	3	–	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
GEN	4	2-1/2	–	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
12F1																	
ABS	4	2-1/2	–	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
GEN	6	3-1/2	–	6	3	11	12	3/4	9-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
13F2																	
ABS	4	3-1/2	–	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
GEN	6	3-1/2	–	6	3	11	12	3/4	9-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
14F3																	
ABS	4	3-1/2	–	4	2	9	8	3/4	7-1/2	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
GEN	6	3-1/2	–	6	3	11	12	3/4	9-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2

TABLE 3 – ISOLATION BAG KIT COMPONENT DATA – REFRIGERANT PUMP – 60 Hz

Unit Size	Bag Size	Pump Conn Line Size		Blank Flanges										Bolt Dia	
				Suction					Discharge						
YIA	Suc	Suc	Dis	Dia	No. Holes	Hole Size	Hole Circle	Thick-ness	Dia	No. Holes	Hole Size	Hole Circle	Thick-ness	Suc	Dis
1A1	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
1A2	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
2A3	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
2A4	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
2B1	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
3B2	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
3B3	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
4B4	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
4C1	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
5C2	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
5C3	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
6C4	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
7D1	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
7D2	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
8D3	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
8E1	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
9E2	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
10E3	6	6	3	11	12	3/4	7-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
12F1	6	6	3	11	12	3/4	7-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
13F2	6	6	3	11	12	3/4	7-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
14F3	6	6	3	11	12	3/4	7-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2

TABLE 4 – ISOLATION BAG KIT COMPONENT DATA – REFRIGERANT PUMP – 50 Hz

Unit Size	Bag Size	Pump Conn Line Size		Blank Flanges										Bolt Dia	
				Suction					Discharge						
YIA	Suc	Suc	Dis	Dia	No. Holes	Hole Size	Hole Circle	Thick-ness	Dia	No. Holes	Hole Size	Hole Circle	Thick-ness	Suc	Dis
1A1	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
1A2	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
2A3	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
2A4	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
2B1	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
3B2	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
3B3	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
4B4	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
4C1	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
5C2	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
5C3	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
6C4	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
7D1	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
7D2	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
8D3	4	4	2	9	8	3/4	6	3/8	6	6	5/8	4-3/4	3/8	5/8	1/2
8E1	6	6	3	11	12	3/4	7-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
9E2	6	6	3	11	12	3/4	7-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
10E3	6	6	3	11	12	3/4	7-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
12F1	6	6	3	11	12	3/4	7-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
13F2	6	6	3	11	12	3/4	7-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2
14F3	6	6	3	11	12	3/4	7-1/2	3/8	7-1/2	6	5/8	6	1/2	5/8	1/2

C. SERVICING THE PUMP ASSEMBLIES (Cont'd.)

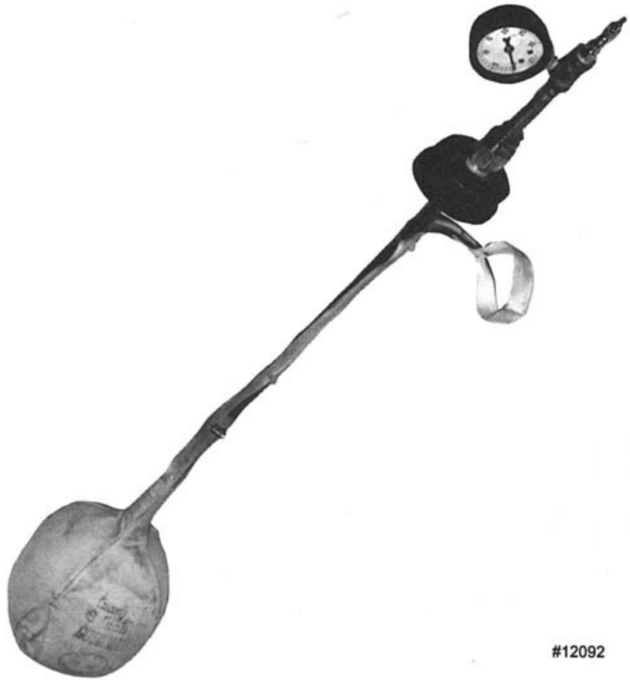


FIG. 10 – ISOLATION BAG

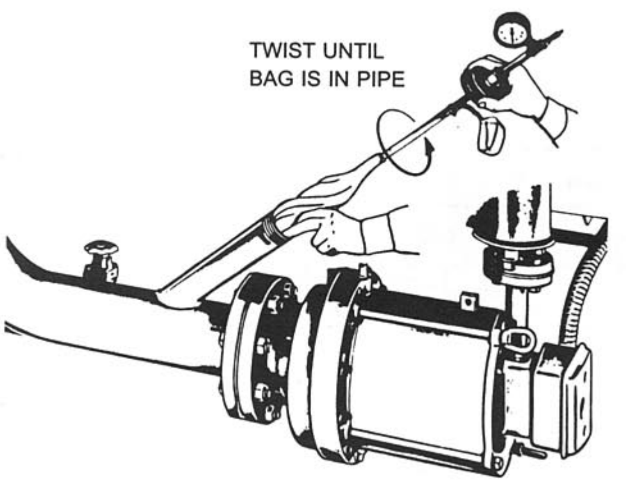


FIG. 11 – ISOLATION BAG INSERTED IN STANDPIPE

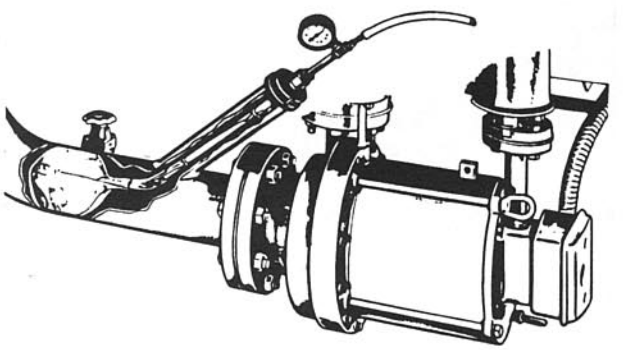


FIG. 12 – ISOLATION BAG LOCATED IN PIPE

13. Loosen the packing nut on the stem of the bag assembly and slide the cap down to the top of the standpipe. Place the pull-strap in the standpipe. Screw the cap in place. Do not tighten the cap and packing nut on the stem of the assembly at this time.

14. Proceed with the installation of the remaining bag(s) (depending on the unit model) by repeating steps 7 through 13.

15. Tighten the caps and packing nuts on all bags at this time.

16. Since some solution will remain in the solution pump suction line and in the pump itself, provisions should be made to catch this when the flanges are parted. Some of this may be drained from the service valve located on the pump discharge line. An alternate method could be removal by use of a small pump. The suction line of the pump could be placed down in the standpipe of the suction line and the liquid pumped into a container. This liquid must be poured back into the standpipe after the new pump is installed. If not, the bags will be drawn back toward the pump when the bag is deflated and this can cause difficult removal.

    The water from the motor coolant circuit can be discarded but it must be replaced before the unit is started again.

17. Install blank flanges (provided) over pipe openings left by pump removal.

Refrigerant Pump Isolation – The procedure to be followed in servicing a refrigerant pump is as follows:

1. Connect one end of the sight tube to the access valve in the refrigerant pump suction line.

2. Take the opposite end of the sight tube to a convenient location on the unit piping, at a point about 1 foot above the centerline of the lower shell.

3. Break the unit vacuum, with water-pumped dry nitrogen, to atmospheric pressure. (Energize the coolant solenoid, 1 SOL, before breaking the vacuum.)

4. Measure the centerline height of the standpipe from the floor.

5. Mark this height on the sight tube with masking tape, measuring from the floor.

6. Open the sight tube access valve. The water will

rise in the sight tube to the liquid level inside of the unit.

7. Start the vacuum pump and pull a slight vacuum on the unit until the level in the sight tube drops to the tape mark. Then close the unit valve to the vacuum pump.

8. Remove the pipe cap from the standpipe and install the proper size bag, see Tables 1 thru 4. (4 or 6 inches, to match suction line size).

9. Check the bag before installing it in the standpipe. See Figure 10. Check the following:

   a. Hose clamp is tight around rubber stem.

   b. Schrader air valve is tight.

   c. Seal cap assembly is positioned up near the tee (within one or two inches).

   d. Bag is completely deflated.

10. With bag covering folded as neatly as possible into the folds of the rubber balloon, roll the bag tightly along the vertical axis. See Figure 11.

11. Insert the bag into the standpipe with a twisting and downward motion until the bag is completely within the pipe. Exert a downward force on the bag with the tubing until it bottoms, and then withdraw it about half the pipe diameter. This will properly locate the bag. See Figure 12.

12. Inflate the bag to 12 psig with the handpump provided.

13. Loosen the packing nut on the stem of the bag assembly and slide the cap down to the top of the standpipe. Place the pull-strap in the standpipe. Screw the cap in place. Then tighten packing nut on the stem of the assembly.

14. Break the system vacuum, using water pumped nitrogen, to atmospheric pressure. This is required to eliminate air entering the system through the discharge line when the flanges are broken (on refrigerant pump only).

15. Since some refrigerant will remain in refrigerant pump suction line and in the pump itself, provisions should be made to catch this when the flanges are parted. Some of this may be drained from the service valve located on the pump discharge line.

16. Remove the complete pump assembly and install the blank flanges on the pipe openings left by pump removal. Flanges are provided in the kits.

NOTE: On IsoFlow models, refrigerant at times will have Lithium Bromide in it – Do Not Discard.

An alternate method could be removal by use of a small pump. The suction line of the pump could be placed down in the standpipe of the suction line and liquid pumped into a container. This liquid must be poured back into the standpipe after the new pump is installed. If not, the bags will be drawn back toward the pump when the bag is deflated and this can cause difficult removal.

The water from the motor coolant circuit can be discarded but it must be replaced before the unit is started again.

D. REMOVING THE PUMP ASSEMBLY

Disconnect the electrical leads from the pump motor. Mating leads must be clearly marked to ensure that they are reconnected properly. This will provide proper pump rotation when reinstalling the pump assembly.

When this is accomplished, you are ready to break the flanges on the pump assembly.

After the pump is removed, the blank flanges and gaskets (provided) must be installed on the inlet and outlet flanges of the unit, using the bolts from the pump assembly. Position flanges so that the drain plugs are at the bottom. Petcocks or small valves can be installed in the drain openings, in place of plugs, if desired. Also, seal off coolant lines using blank flanges and gaskets (provided).

Next, loosen the packing nut on the stem of each bag assembly and slide the cap down to the top of the standpipe, putting end of pull strap down into pipe. Screw the cap in place using Teflon tape on the threads. Then tighten the packing nut on the stem of the assembly.

This will ensure that no liquid will be lost due to a bag breaking or leaking and that no air will enter the system.

E. REMOVING THE PUMP CASING

Remove cap screws holding the motor to the pump. Match mark the motor end bell and pump casing. Using the proper size jackbolts in the holes provided, apply even pressure to force the pump casing off of the motor end bell.

F. REMOVING THE SEAL

1. Remove the impeller nut (left hand thread) and lock washer. Hold the impeller with a strap wrench.

2. Remove the impeller and Woodruff key. Be sure to see that the claws of the puller arms catch the back of the impeller at the webs. Do no hold the impeller and hit the shaft with a hammer to remove the impeller.

3. Remove the spring, bellows assembly and ceramic seat, being careful not to score the shaft.

G. INSTALLING THE NEW SEAL

1. Thoroughly clean the inside surface of the stationery seal housing. Polish the surface of the shaft with crocus cloth.

2. The following describes the shaft seal and impeller installation:

   a. Assemble in a clean area.

   b. Clean the surface of motor shaft extension and machined recess for cup seat assembly, of all dirt, dust and foreign matter.

   c. Place the motor in a vertical position with shaft extension up. During assembly, do not jar the shaft in any way as this will damage the motor bearings.

   d. Apply a thin film of P-80 Rubber Lubricant, York Part Number 044-01711, to the outside edges of neoprene cup seat, inside of neoprene shaft bellows, and the surface of the shaft. (Use P-80 Lubricant only.)

   CAUTION: When proceeding beyond this point, do not delay in completing steps e through k, otherwise the seal may not seat properly.

   e. Install neoprene cup and ceramic seat assembly into recess with care to avoid damage.

   f. Slide Synthane sealing washer and neoprene bellows assembly over shaft assembly so that sealing washer is seated against ceramic seat.

   g. Install Woodruff key.

   h. Install stainless steel spring to seat on bellows retainer flange.

   i. Slide pump impeller onto shaft extension, thus compressing spring.

   j. Hold impeller in place against taper and install lockwasher and nut.

   k. Tighten impeller nut, which has left hand threads. Hold the impeller with a strap wrench when tightening.

   l. Rotate impeller by hand to ensure that the impeller does not rub on any adjacent motor end bell surfaces.

H. LEAK TESTING THE NEW SEAL

1. With the motor on its side and the motor coolant connections upward, fill motor with clean water.

2. Allow motor to stand for ten minutes. If the seal is properly installed, there should be no loss of water level. If there is a loss, the impeller and seal should be removed, inspected, cleaned and re-installed.

I. INSTALLING THE MOTOR

1. If a replacement motor is to be installed, remove the two short, flanged lengths of coolant line from the old motor and install them on the replacement motor, making sure to align bolt holes with those on mating flanges.

2. Thoroughly clean the motor coolant flange faces. Use new gaskets for these flanges and a new pump motor sealing ring.

3. The following procedure describes the pump-motor assembly procedure:

   a. Motor end bell must be free from dirt or foreign matter.

   b. Pump flange mating surface to motor end bell must be free from dirt and foreign matter.

   c. Apply a thin film of P-80 Rubber Lubricant, York Part Number 044-01711, to surface on pump flange where rubber sealing ring on motor end bell will slide during assembly.

   d. Install rubber sealing ring into machined groove on motor end bell, making certain it is well seated. Care must be taken to ensure no injury to seal ring.

   e. Install two (2) guide pins in tapped holes in pump casing.

   f. After pump casing is in desired position relative to motor end bell, slide pump casing and motor end bell together, using guide pins to assure proper alignment.

   g. Do not exceed tightening torque of 17 to 20 foot-pounds for 3/8 and 35 to 40 foot-pounds for 5/8 inch, 12-point cap screws.

   h. If the rubber sealing ring is seated properly, the machined edge of pump casing flange will be flush against the motor end bell flange.

4. Connect the electrical leads in the motor in proper sequence to obtain correct voltage and direction of rotation when the pump assembly is re-installed. Improper rotation will result in very little pressure being developed and pump will be noisy.

J. INSTALLING THE PUMP ASSEMBLY

1. Before removing the blank flanges from suction and discharge lines, make sure the bags are inflated to 12 psig. During the time the bags are installed, there will be slight leakage past them. This amount is small but should be considered before draining these sections, if the time interval has been long. Remove the drain plugs from the flanges (or open petcock or valve, if these have been installed) and drain and save any liquid which may have leaked past the bags. After draining, the flanges may be removed. Remove the blank flanges installed on the motor coolant connections.

2. Install the pump assembly using new suction, discharge and motor coolant gaskets.

K. REMOVING THE ISOLATION BAGS

1. After installing the pump assembly and bolting is completed, <u>check the level of the sight tube with the centerline of the lowest standpipe</u>. Adjust if necessary by pulling a vacuum on the unit if too high or pressurizing with nitrogen if too low. Loosen the packing nut on the seal cap assembly; unscrew the cap and slide it up to the tee. <u>Pour in some of the liquid collected earlier until the level is about half way up in the standpipe</u>. This will prevent the bag from being forced back past the standpipe when deflating, which can cause difficulty in removal. Release the pressure in the bag and remove, using pull strap if necessary to overcome any excessive tightness. Using Teflon tape, screw on the permanent pipe cap and tighten. If the assembly being serviced is the solution pump, raise the level in the sight tube to the second mark by breaking the vacuum with nitrogen. Pour more of the remaining solution into the second standpipe until the level is about half way up the standpipe. Then remove the second bag and cap the standpipe using Teflon tape.

   Follow the same procedure where a third standpipe is used.

2. After all bags are removed, proceed with evacuation. Energize 1 SOL per CAUTION note on page 4 to assure complete evacuation.

TUBE LEAKAGE AND REPAIR

If a leak test indicates leaks at the lower drain valve on the head of the generator, evaporator, condenser or absorber, the exact location of the leak may be determined as follows:

A. PROCEDURE

1. Prepare the unit as outlined in section, Leak Detection and Repair.

2. Remove the heads and interfering piping where the vent test indicated a leak.

3. To test for leaking tubes, blow the moisture from the tubes with air or dry nitrogen. When the tubes are clear, insert a cork in each end of all tubes to be tested. Allow all tubes to remain corked up for a period of 12 to 24 hours before proceeding. If the leak is sufficiently large, pressure build-up in the tube may blow a cork locating the leak immediately. If not, it will be necessary to make a very thorough test of each tube with the leak detector.

4. After the tubes have been corked up for 12 to 24 hours without a cork having been blown, it is recommended that two men, working at both ends of the cooler, carefully test each tube. One man removing corks at one end and the other man at the opposite end to remove corks and handle the leak detector. Start with the top row of tubes in the section being investigated. Remove the corks at the ends of one tube simultaneously and insert the exploring tube for a minimum of 1 minute. This should be long enough to draw into the detector any refrigerant gas that might have leaked through the tube wall. A fan placed at one end of the shell opposite the detector and blowing into the tube will assure that any leakage will travel through the tube to the detector. Caution should be taken so that there is no gas in the atmosphere to falsely indicate a leak.

   NOTE: Leak detectors should be checked regularly with a G.E. Halogen Leak Standard Type LS-20.

5. Check all tubes and mark any leaking tubes for later identification.

B. REPLACING TUBES

Tubes are expanded in the heads. If replacement is necessary, they can be removed by following well established methods using hand tools or as described below.

NOTE: The tube holes in the generator heads are grooved for expansion sealing of the tubes.

The tube holes in the head of the condenser, evaporator and absorber are not grooved, instead, Loctite Grade AV (10-10) is applied by placing a total of two drops, one each 1/8 inch to the right and left of top of vertical center. Use sparingly. This quantity should be sufficiently encircle the tube at the face of the tube head.

CAUTION: Do not apply sealing compound to more tubes than will be expanded within 15 minutes.

After roll expanding the last tube in the shell, and before pressurizing, allow a minimum time of thirty (30) minutes for curing the sealing compound before any pressure or vacuum is created within the shell. Follow the procedure below.

1. Release the pressure.

2. The tubes to be replaced are loosened in the tube sheet at one end only by first providing a start with a caulking chisel. The chisel is held at about a 45 degree angle and tapped lightly with a hammer to provide the "start". See Figure 13.

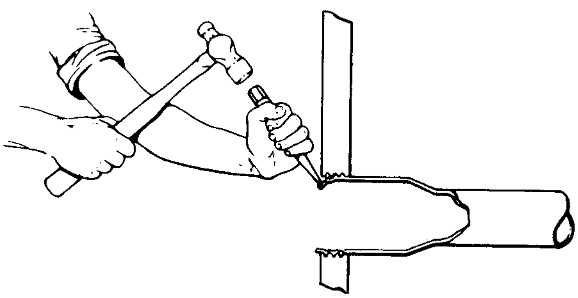


FIG. 13 – STEP (2) IN TUBE REMOVAL

3. This is followed by tapping and Airetool Tube Collapser with a hammer. See Figure 14. Enter the point of this tool into the "start" provided in Step (2). Do not omit Step (2) as the tube sheet hole may be scratched or gouged making it difficult or impossible to tightly expand the new tube. Tap the tube collapser far enough to loosen the tube from the tube sheet.

4. Turn the spear of the Jenny into the other end of the tube. Use a crescent wrench to get a firm hold on the tube. This will ensure that the spear will not pull out of the tube when the tube is being extracted. See Figure 15.

AIRETOOL MFG. CO. TUBE COLLAPSER

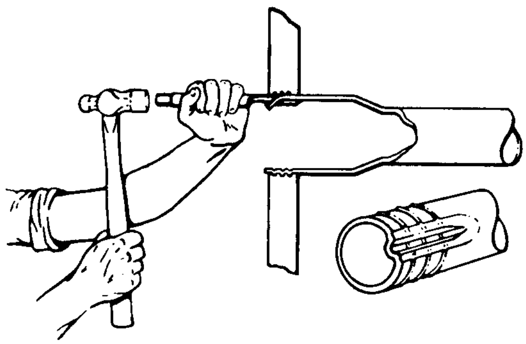


FIG. 14 – STEP (3) IN TUBE REMOVAL – END VIEW OF TUBE SHOWS EFFECT ON TUBE

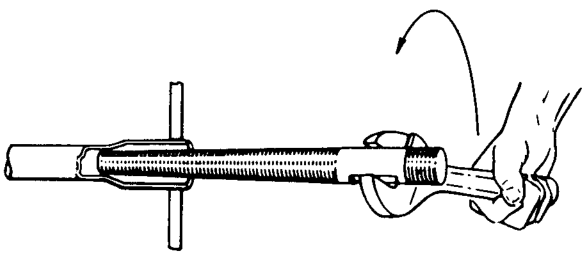


FIG. 15 – STEP (4) IN TUBE REMOVAL

One man can be loosening the tubes in the tube sheet at one end as described in Steps (2) and (3) while two other men are using the Jenny at the other end to remove the loosened tubes.

C. TUBE PULLER

Though other efficient tools may be available, the Jenny Tube Puller offers an expedient, economical means of removing all or just a few tubes. Designed for pulling 5/8, 3/4, and 1 inch tubes, the tube puller utilizes hydraulic pressure to free rolled tube joints, facilitating quick, easy removal of tubes through their own sheet holes. The pulling capacity is 30 tons and the ram travels 6 inches. Easily assembled, the principal components of the unit consist of a reservoir, hose, pump, double-acting ram and a selector valve. Adapter, horseshoe lock and spear are required attachments. See Figure 16.

When ordering spears, please specify tube sheet thickness, tube metal, outside diameter and AWG (Gauge) of tubes to be pulled.

When retubing a complete tube bundle, inspect the tube support holes for concentricity. If egg-shaped or if holes are larger than 0.785 inch diameter, the tube supports must be replaced.

New tubes are inserted and can best be expanded with an electronic or pneumatic tube roller with the device set to cut off the motor at a predetermined torque setting. The torque setting is arrived at by the following example of calculation. Set the torque control to give the expansion calculated. See Figure 17.

Example: Expander Setting For Generator, Condenser, Absorber and Evaporator Tube Ends. This is merely an example. The values shown are not necessarily correct.

Diameter of Tube Hole = .760″
Tube End Wall Thickness = .035″
Double Wall Thickness = .070″
Subtract Double Thickness From Inside Diameter of Tube Hole = .760″–.070″=.690″ inside dia. of tube.
5% of Double Wall Thickness = .05 x .070″=.0035″
Original Tube Inside Dia. = .690″ + .0035″=.6935″ expanded. Set machine to give you this.

Refer to York Regional or District offices for information concerning tube expansion.

SOLUTION CHEMISTRY – CHECK OF INHIBITOR CONTENT AND pH

A. INTRODUCTION

The purpose of this test is to make certain that the Lithium Chromate inhibitor is present in the required concentration and that the proper pH is maintained – insuring efficient and trouble-free operation. The Lithium Bromide solution should be checked with the test kit at either of the following intervals: at the beginning of each operating season, prior to the end of each operating season, or whenever the yellow color is depleted.

These checks can be made by qualified York regional representatives or by customers who have purchased the test kit (part number 026-18304) and who have received the detailed instructions.

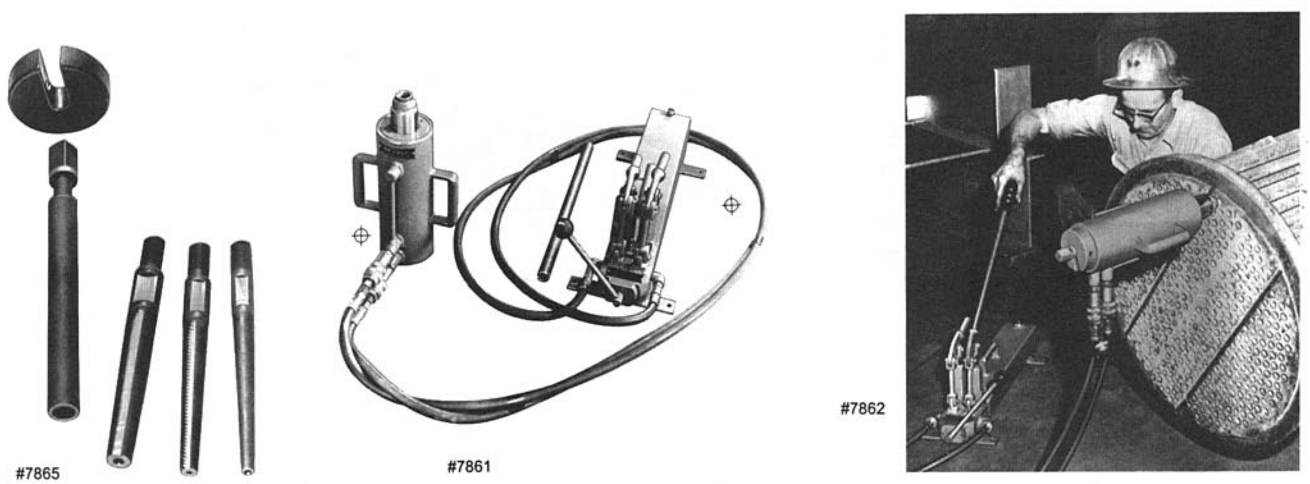
B. PROCEDURE FOR OBTAINING LITHIUM BROMIDE SAMPLES

The system should be in operation for at least two weeks before sampling and for several hours on the day the sample is removed from the machine.

Occasionally, it may be impractical to operate a system before sampling, such as winter shutdown. In such cases, samples can be obtained using the following procedure. The samples taken using this procedure may not be completely homogenized or fully representative of the total system solution.

To obtain a sample, proceed as follows:

1. Operate the system with the steam supply off. The cooling tower and chilled water need not be circulated.
2. Open the refrigerant by-pass valve and allow the refrigerant to dump into the solution circuit.
3. Circulate the charge for at least 30 minutes to mix the solution.



NOTE: Tube bundles of the shells of absorption units are not removable. The photo in this illustration merely shows the application of the tube removal equipment.

FIG. 16 – TUBE REMOVAL EQUIPMENT

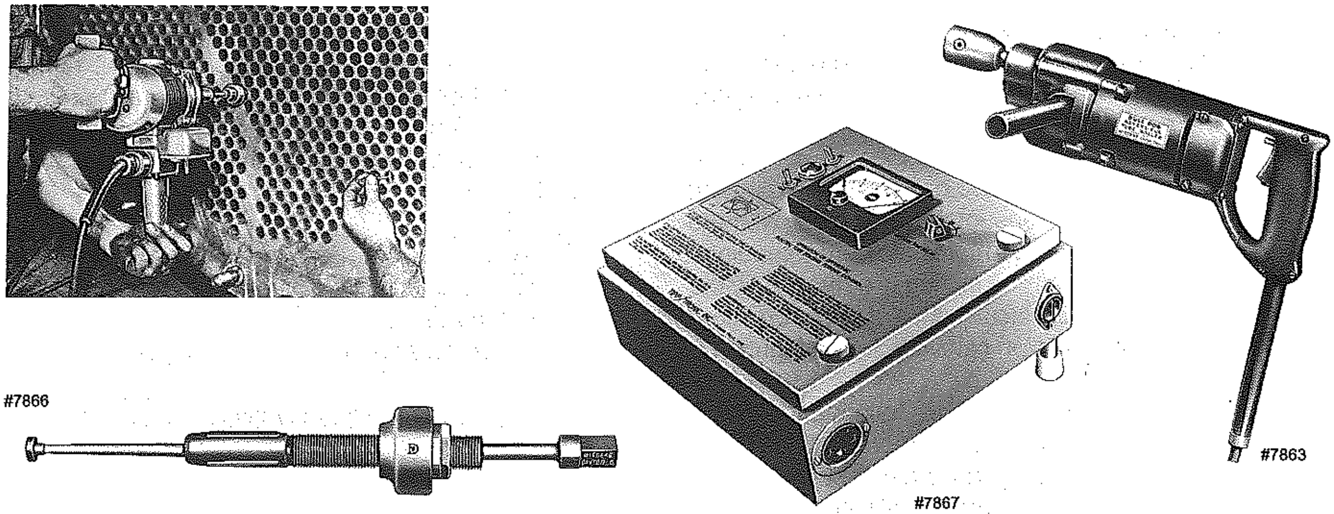


FIG. 17 – TUBE ROLLING TORQUE CONTROL

4. Withdraw a 1 quart sample from one of the system drain valves. Use a vacuum flask and two vacuum hoses to get the sample. Connect one hose to the vacuum pump service connection and the other to a drain valve.

   Pull a vacuum on the flask for approximately ten minutes and then slowly open the heat exchanger valve. Solution will flow into the flask. If it does not, close the valve and check for leaks before opening again. The flask must be under greater vacuum than the unit in order to withdraw a sample.

5. After the sample has been collected, close the drain valve and remove the hose from the purge pump to break the vacuum in the flask.

C. LITHIUM CHROMATE INHIBITOR AND ALKALINITY TESTS

The following tests apply to solution containing 54% by weight Lithium Bromide (specific gravity = 1.60 at room temperature). Samples can be adjusted to this concentration by boiling off water on an electric hot plate. Alternatively, solutions having concentrations other than 54% can be tested. However, a multiplication factor based on actual Lithium Bromide content must be applied. These calculations are described in Step g (C1) and in Step h (C2) below.

1. Lithium Chromate Inhibitor Test (Sample must be cooled to room temperature)

   a. Add 9 ml of distilled water to a graduated cylinder. Use a calibrated medicine dropper to deliver 1 ml of the sample to the cylinder. Place a thumb over the neck of the cylinder and shake to mix the solution.

   b. Filter the solution if it is cloudy using filter paper and funnel.

   c. Pour the mixture into an empty test tube and fill to the mark.

   d. Compare the intensity of the yellow color of this solution with color standards. Choose the standard which most closely matches.

      Estimates can be made between consecutive standards to provide additional points of reference. Note that the standards are marked with the numbers 1000, 500, 250, 125 and 0. Colors which fall in between can be estimated as 750, 375, 188 and 63.

   e. The following table shows the relationship between the standard number, the required inhibitor conditions and the actual Lithium Chromate content of the charge as determined by the color comparison.

Standard Number	Estimated Standard Number	Required Additions, Pounds Chromate Per 30 Gallon Drum of 54% LiBr	Approximate Percent By Weight Lithium Chromate
1000	–	Too much inhibitor Send sample to York	0.50
–	750	Lithium Chromate content satisfactory	0.375
500	–	Lithium Chromate content satisfactory	0.25
–	375	0.25	0.188
250	–	0.50	0.125
–	188	0.625	0.094
125	–	0.75	0.063
–	63	0.875	0.032
0	–	1.00	Zero

f. A curve shown in Figure 18 can be used to facilitate the determination of the number of pounds Lithium Chromate needed per 30 gallon drum of 54% LiBr. Table 5 gives the number of drums of LiBr in the model YIA-1A1 thru YIA-14F3 units.

g. Table 5 and Figure 18 apply only to samples that have been adjusted to 54% Lithium Bromide. They can be used for concentrations other than 54%, but a mathematical correction must be made.

A multiplication factor is obtained by dividing 54 by the sample's Lithium Bromide content as determined by a hydrometer reading. A specific gravity chart is provided in Figure 19 to facilitate this determination. The factor is applied to the standard numbers chosen in Step d (C1). Then, Steps e or f (C1) can be followed in the usual way.

Example: Specific Gravity = 1.38 = 40% LiBr
Color Number = 500
$\frac{54}{40}$ = 1.35 (Multiplication factor)
500 x 1.35 = 675 (adjusted color no.)

Conclusion: Reference Figure 18 shows that no inhibitor adjustment is needed.

Example: Specific Gravity = 1.53 = 50% LiBr
Color Number = 125
$\frac{54}{50}$ = 1.08 (Multiplication factor)
125 x 1.08 = 135 (adjusted color no.)

Conclusion: Reference Figure 18 shows that 0.73 pounds of inhibitor are required for each 30 gallon drum of 54% LiBr in the system.

h. When adding Lithium Chromate to the system, do not add it directly to the solution. First, add it to the refrigerant circuit, then gradually work this into the Lithium Bromide solution by cracking the refrigerant dump valve.

The inhibitor can be added at the service valve on the discharge side of the refrigerant pump. Since the pressure at this point is above atmospheric pressure when the pump is operating, the pump must be off when the inhibitor solution is added.

After the Chromate solution is drawn into the system, follow with one quart of water to flush the Chromate out of the charging valve. Then restart the system pumps and gradually bleed refrigerant into the solution.

TABLE 5 – SYSTEM CHARGE REQUIREMENTS

UNIT YIA	Solution Charge		Refrig. Charge Gallons	Alcohol Charge 2-Ethyl–1-Hexanol Quarts	Alcohol Addition as Required, Quarts
	30 Gal. Drums	10 Gal. Drums			
1A1	3	2	22	1-1/2	1/2
1A2	4	1	33	1-1/2	1/2
2A3	4	2	37	1-1/2	1/2
2A4	5	2	41	1-1/2	1/2
2B1	6	1	52	2	1
3B2	7	1	56	2	1
3B3	8	–	62	2	1
4B4	9	–	69	2	1
4C1	9	1	57	3	1
5C2	11	–	63	3	1
5C3	12	–	72	3	1
6C4	13	2	85	3	1
7D1	13	2	96	4	1-1/2
7D2	15	1	108	4	1-1/2
8D3	17	–	121	4	1-1/2
8E1	21	–	141	5	1-1/2
9E2	23	2	162	5	1-1/2
10E3	26	–	183	5	1-1/2
13F1	30	–	179	6	2
13F2	33	2	199	6	2
14F3	37	1	225	6	2

*Solution available in following drum sizes, 30 gallon Part No. 044-01268; 10 gallon Part No. 044-01745. Alcohol, 2 Ethyl-1-Hexanol, 1 quart, Part No. 044-01202.

i. One quart of Lithium Chromate solution (Part Number 044-01651) contains one pound of Lithium Chromate.

2. Alkalinity Test (Sample must be cooled to room temperature)

   a. Add 10 ml of distilled water to the plastic beaker.

   b. Add 2 ml of Lithium Bromide solution using the calibrated medicine dropper. Filter the entire solution, if it is cloudy, using filter paper and funnel.

   c. Add 2 drops of phenolphthalein indicator solution.

   d. Stir contents of beaker with the glass stirring rod. If solution becomes red in color, continue with test. If it does not turn red, send a sample to York for immediate analysis and recommendations.

   e. Add 0.1N hydrochloric acid dropwise to beaker. Count each drop added and stir after each addition.

   f. Take note of the number of drops of acid required to destroy the red color.

   g. If more than 15 drops are used, send sample to York for analysis and recommendations. If 1 to 15 drops are required, the alkalinity and pH of the charge are satisfactory.

   NOTE: It is important that the medicine dropper, funnel, beaker, stirring rod, graduated cylinder and empty test tube be cleaned with water and dried after each test to avoid contamination. If the medicine dropper in the hydrochloric acid bottle becomes damaged, it is important that it be replaced by one having similar delivery. Each drop delivers approximately 0.1 ml solution. Replacement with a dropper having a different delivery will result in errors.

   h. *The above test applies only to samples that have been adjusted to 54% Lithium Bromide.* However, the multiplication factor described in Step g (C1) can be used for samples having concentrations other than 54%. The multiplica-

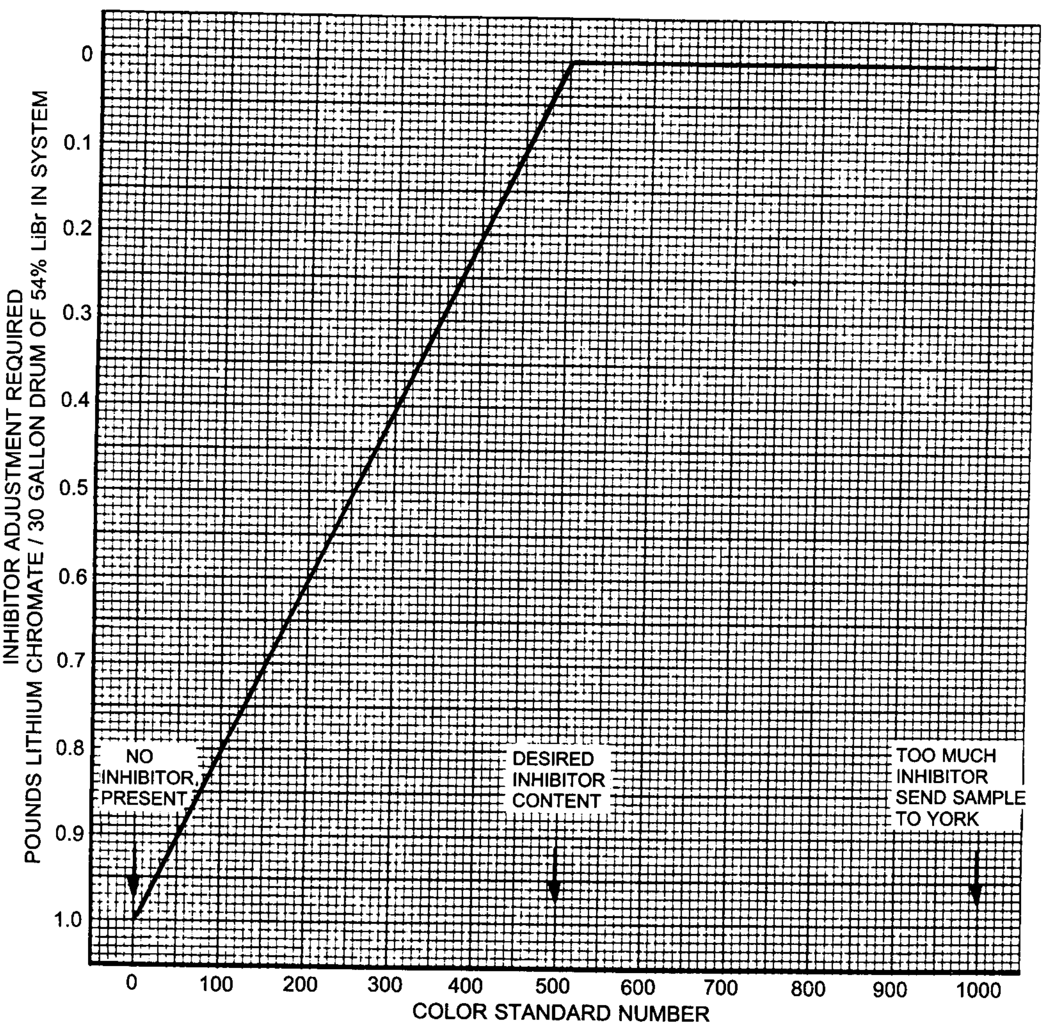


FIG. 18 – LITHIUM CHROMATE NEEDED PER 30 GALLON DRUM OF 54% LiBr IN SYSTEM

tion factor is applied directly to the number of drops determined in Step f (C2).

Example: Number of Drops = 15
Multiplication Factor = 1.35
Adjusted Number of Drops =
15 x 1.35 = 20.2 drops

Conclusion: Since this is more than 15 drops as indicated in Step g (C2), send sample to York.

Example: Number of Drops = 2
Multiplication Factor = 1.08
Adjusted Number of Drops =
2 x 1.08 = 2.16 drops

Conclusion: Therefore the alkalinity and pH of the charge are satisfactory.

D. GENERAL

The tests are intended for the routine control of inhibitors and pH in Lithium Chromate inhibited absorption systems. Whenever corrosion in the system appears to be excessive, submit samples to York recommended test lab for additional tests. Proceed as follows:

1. Withdraw a 1 quart solution sample from the system as described above, item (B). Note: Prior operation required before taking sample.

2. Using the filter paper and funnel supplied in the Test Kit, filter approximately 3 oz. of the sample and put it into a small polyethylene bottle having a tight, leakproof cap.

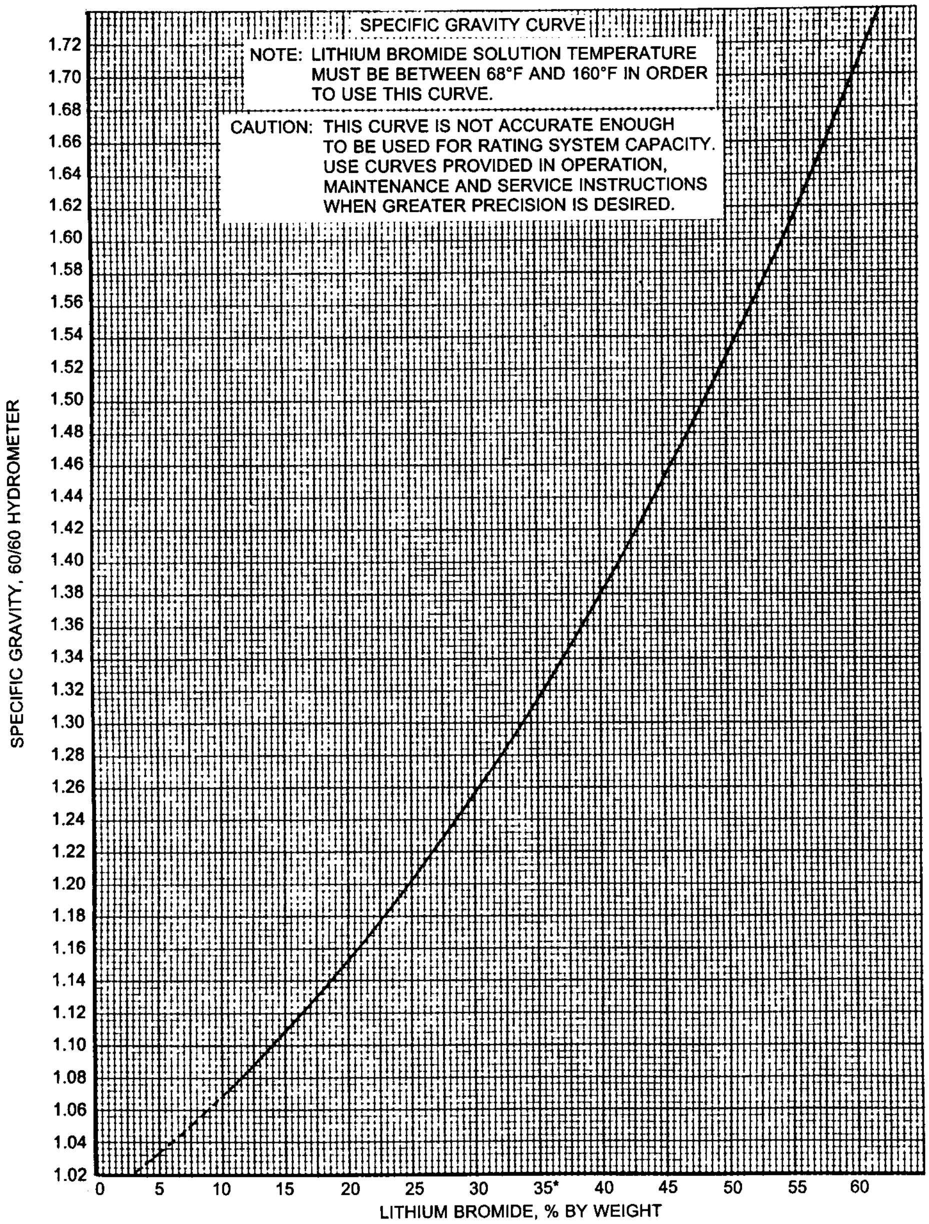


FIG. 19 – SPECIFIC GRAVITY CURVE

3. Immediately place the remainder of the sample into a quart polyethylene bottle having a tight, leakproof cap.

4. Label both the filtered and unfiltered samples, giving the following details:

   a. Date

   b. Job Name

   c. Weight of Charge (Drums of Lithium Bromide; Gallons of Water)

   d. Unit Model Number

   e. State length of operating period just prior to taking the sample

      (1) ______ days prior operation for the season
      (2) ______ hours prior operation on the day samples are taken.

   f. Has there been any history of operating difficulties such as leaks, etc. If so, give detailed description.

5. Carefully pack the samples to insure against spilling or breaking and forward to test lab.

MAINTENANCE OF VALVES

A. GRINNEL/SAUNDERS DIAPHRAGM TYPE STOP VALVE – Refer to Figure 20.

It is necessary to pull up on the bonnet bolts occasionally to maintain a tight seal.

It is necessary to keep the open end of the valves plugged.

1. Diaphragm Replacement – Valve diaphragm replacement is a function of valve usage. See Table 6.

   It is recommended that the diaphragm of the purge valve be replaced every 2 to 3 years. The remainder of diaphragm type valves should have the diaphragm replaced when overhaul of the system requires removal of the solution charge.

   a. Remove the bonnet bolts and lift the valve bonnet off the body.

   b. Unscrew the diaphragm from the compressor by turning it counter-clockwise.

TABLE 6 – GRINNEL/SAUNDERS DIAPHRAGM TYPESTOP VALVES

	Quan.	Size (In.)	Models YIA
Soln From Heat Exchanger	1	1/2	1A1 – 14F3
Soln To Heat Exchanger	1	1/2	1A1 – 14F3
Shell Purge (Service)	1	3/4	8E1 – 14F3
To Absorber Spray Header	1	1/2	1A1 – 14F3
Refrigerant Pump Disch	1	1/2	1A1 – 14F3
Motor Cooling Reservoir	1	1/2	1A1 – 14F3
Purge Absrb to Purge Pump	1	3/4	1A1 – 14F3
Generator Pump	1	3/4	1A1 – 14F3
Hand Auxiliary Purge	1	3/4	1A1 – 8D3
Refrigerant Suction	1	1/2	1A1 – 14F3

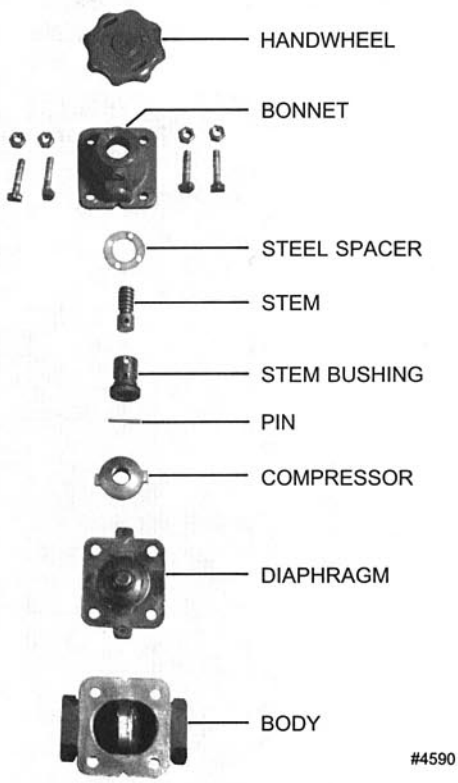


FIG. 20 – EXPLODED VIEW OF DIAPHRAGM TYPE VALVE

   c. Turn the new diaphragm into the compressor, hand-tight, until the bolt holes in the diaphragm and the bonnet flange register; then back off one-half turn.

   d. Replace the bonnet on the body and tighten the bonnet bolts hand-tight.

   e. Close the valve fully; back off one-quarter turn of the handwheel; then tighten the bonnet bolts with a wrench.

   f. Open the valve and if necessary, retighten the bonnet bolts.

g. Lubricate the working parts outside the fluid flow path.

B. SOLENOID TYPE VALVE

1. General – Including available sales options, there may be as many as seven solenoid valves on an IsoFlow Model:

1 SOL Motor Coolant Solenoid
2 SOL Stabilizer Refrigerant Solenoid
3 SOL Refrigerant Level Solenoid
4 SOL Steam/Hot Water Shutoff Valve Solenoid (By Others)
5 SOL Purge Solenoid
6 SOL Steam Condensate Drain Valve Solenoid (Steam Units Only)

The following procedure applies to the indicated solenoid valve when replacing other components besides the coil:

a. 3 SOL – Break the vacuum.

b. 4 SOL and 5 SOL – Break the vacuum and remove the charge.

c. 1 SOL – Be sure the hand purge valve is closed before repairing.

When it is necessary to break the vacuum to atmospheric pressure to service the valve, refer to section Breaking System Vacuum. For leak testing, after installing the valve, refer to section, Leak Detection and Repair.

2. Disk Type Solenoid Valve – Valves 1 SOL and 3 SOL are constructed in such a way that the valve body is brazed into the respective pipe lines. The top-assembly is constructed in such a way that the Plunger (core), Disk Assembly and Spring can be replaced when necessary, providing that the unit vacuum is broken to atmospheric pressure. Replacement parts kits are available from York and the part numbers are listed in Form 155.16-RP. The valve solenoid coils can be replaced readily by disconnecting their leads, removing the red cap on top of the coil housing and lifting the coil housing and coil from the valve stem. It is not necessary to break the unit vacuum when replacing the coil only. York part numbers for replacement coils are listed in Form 155.16-RP.

3. Diaphragm Type Solenoid Valve – The coils of these valves are readily replaceable; the part number of the replacement coil is listed in the Renewal Parts manual, Form 155.16-RP. Manufacturers instructions should be followed in replacing the coils.

Diaphragm replacement is a function of valve usage. It is recommended that the diaphragm be replaced when overhaul of the system requires removal of the solution charge or when there is an indication of a leak in the diaphragm. Since the two diaphragm-type valves, 4 SOL and 5 SOL, are located below the solution level, it is necessary that the solution charge be removed if the diaphragm is to be replaced. If possible, all service work performed on the unit below the solution level should be done during the same shutdown period to minimize the requirement for solution charge removal. To replace the diaphragm, remove the four cap screws holding the bonnet to the valve body. Replace the valve bonnet sealing ring and diaphragm-stem assembly. Make sure that the sealing ring is properly seated in the sealing ring groove. Replace the bonnet and four cap screws. Tighten the cap screws.

MAINTENANCE OF SIGHT GLASSES

Sight Glasses and gaskets should be replaced during the overhaul period. Figure 21 shows the proper method of assembly for flanged glasses. Screw type sight glasses should be replaced using grade 92-41 Loctite pipe sealant with Teflon, Part No. 013-02023.

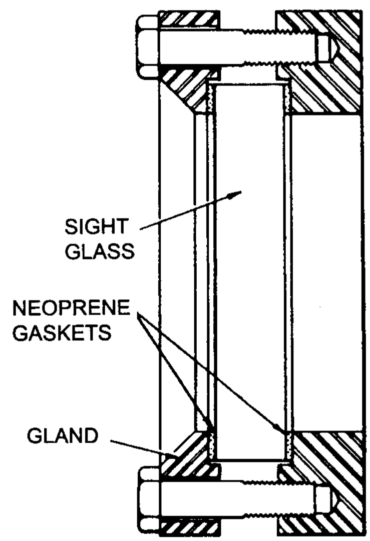


FIG. 21 – SIGHT GLASS ASSEMBLY – ABSORBER SHELL

MAINTENANCE OF PURGE PUMP

(Refer to Figure 22.)

A. SUSPECTED FAILURE

Before shipment, each "Speedivac" pump is individually inspected and tested for performance after a prolonged running-in period, to insure perfect working order. Many cases of suspect pump performance are in fact due to leakage in the vacuum system or unsuspected contamination of the pump oil, and such possibilities should be carefully checked. In any communication regarding "Speedivac" pump, quote the Model Number given on the front of the pump and the Serial Number given on the pulley side of the pump beneath the inlet connection.

B. OIL CHANGING

The pump oil must be replenished or renewed before the level reaches the lower end of the oil sight glass. If the oil is highly contaminated or emulsified, it must be changed.

To drain the oil:

1. Place a container of about one quart capacity beneath the drain plug.
2. Unscrew the drain plug.
3. Allow the oil to drain out completely.
4. Remove the vacuum hose from the suction connection of the pump.
5. Switch on the pump and carefully pour a little clean oil down the vacuum inlet for flushing purposes and allow it to drain from the pump. Switch the pump off.
6. Replace the drain plug.
7. Remove the oil filler plug from the top of the oil box.
8. Refill the pump with York Absorption System Purge Pump Oil, one gallon container, part number 044-02028. This is an inhibited oil.
9. Replace the filler plug.

During early use, a small quantity of sludge consisting of fine graphite dust collects in the pump case. This will not affect the performance of the pump but a change of oil after the first 100 hours of use is recommended. <u>Do not attempt to remove the sludge by pouring volatile cleaning fluids down the vacuum inlet</u>.

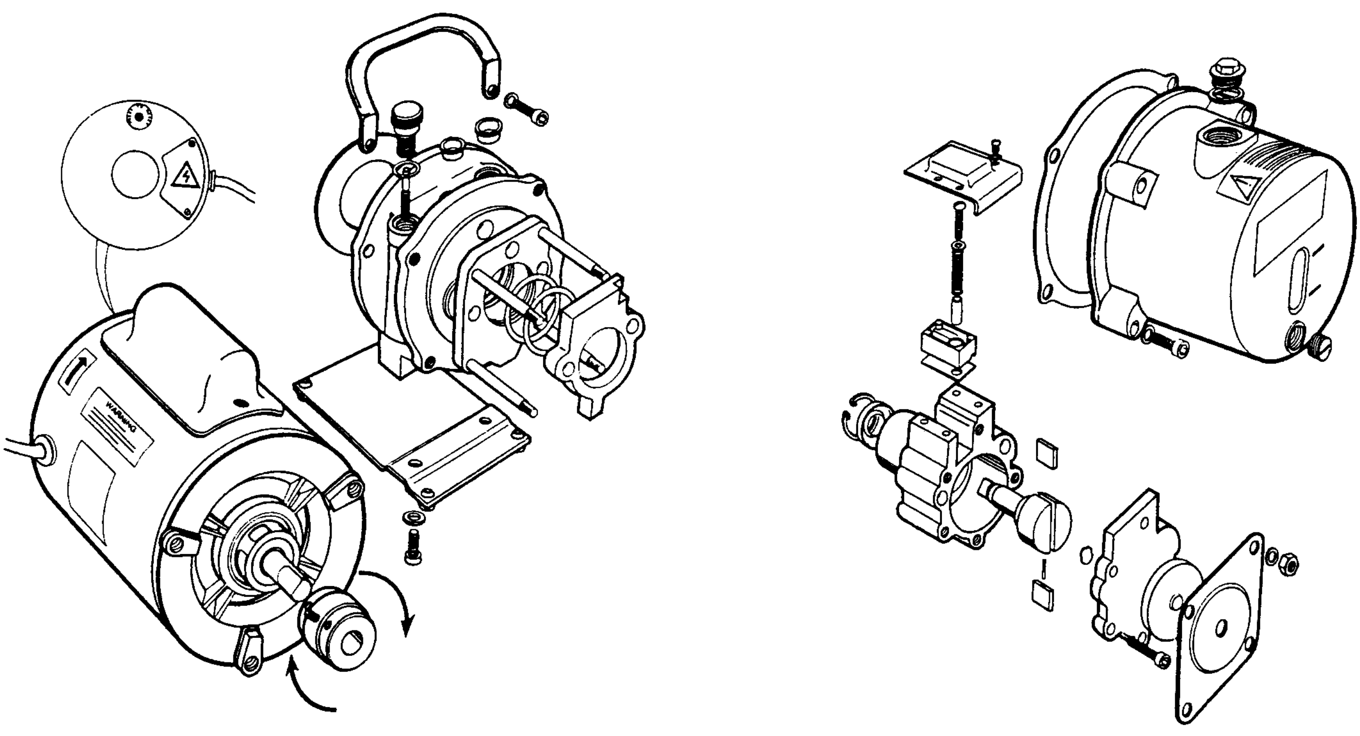


FIG. 22 – EXPLODED VIEW – VACUUM PUMP MODELS – SPEEDIVAV

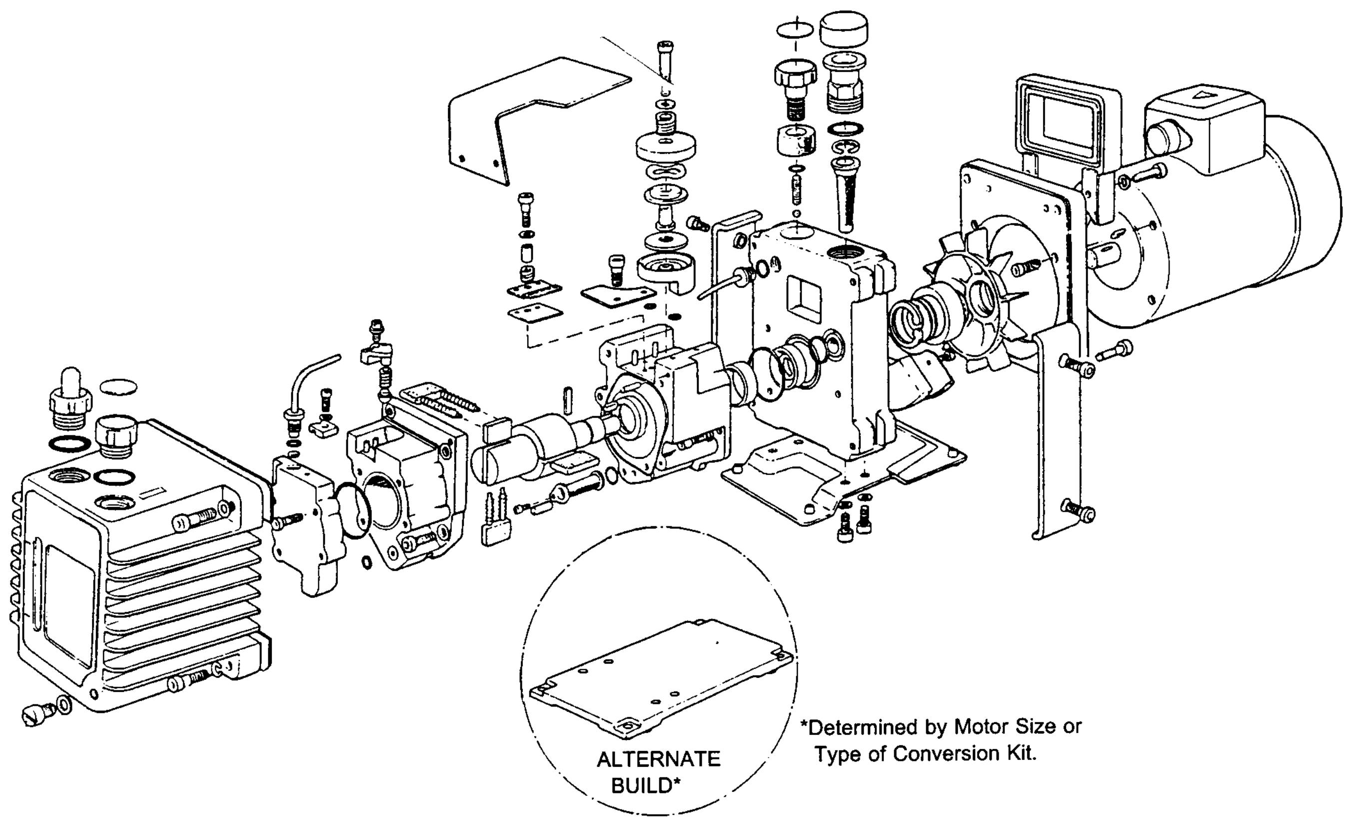


FIG. 23 – EXPLODED VIEW – E1M5 PUMP

CLEANING AND MAINTAINING THE TUBES WITHIN THE SHELLS

A. TUBES

The necessity for tube cleaning will be indicated by a drop in capacity or other symptoms. The frequency of cleaning will vary as influenced by local water characteristics, atmosphere contamination, operating conditions, etc.

In many major cities, reliable commercial organizations are available which offer a specialized service of cleaning water sides of pressure vessels. These organizations will analyze the type of dirt or scale to be removed and then use the proper cleaning solution for the specific job.

Tube fouling is commonly due to deposits of two types as follows:

1. Dirt, rust or sludge which is carried from some other part of the system in to the tubes. This material does not usually build up to coat the entire tube surface, but lies in the bottom of the tubes. When this accumulation of sludge is great enough, water flow through the tubes will be restricted and the heat transfer surface will be reduced. This type of tube fouling is easily visible and can be removed by a thorough brushing with a soft bristle bronze brush as outlined under Brush Cleaning of Tubes.

2. Scale is a hard layer of mineral deposit which precipitates out of the water and forms a hard coating on the inside surfaces of the tubes. This coating is often invisible but always highly resistant to heat transfer.

   The most common types of scale found within the tubes are calcium carbonate, calcium sulfate and silica, although other scales do form, depending upon local water conditions. Since scale is usually invisible when the tubes are wet, it is better to blow the water out of the tubes and then allow the tubes to thoroughly dry before checking for scale.

After the tubes have thoroughly dried, calcium scale will usually show up as a white coating inside the tube; silica scale may not show up at all but they can usually be flaked off the inside of the tube with a small knife.

The only positive method of identifying a scale is a chemical analysis, although an analysis of the water used in a specific system will indicate the type of scale which may be expected to form.

Although other good commercial cleaning agents are available for removing a specific scale, factory experience has been obtained chiefly with commercial inhibited hydrochloric (muriatic) acid which has been proven to be a good cleaning agent for most scales.

When it becomes necessary to clean condenser tubes, the absorber tubes should also be cleaned. If the chilled water system is kept clean during installation and is filled with clean water, it should not be necessary to clean the evaporator tubes.

B. BRUSH CLEANING OF TUBES

If the tube fouling consists of dirt and sludge, it can usually be removed by means of the brushing process. Drain the water sides of the circuit to be cleaned (cooling water or chilled water), remove the heads and thoroughly clean each tube with a soft bristle bronze brush. DO NOT USE A STEEL BRISTLE BRUSH. A steel brush may damage the tubes.

Improved results can be obtained by admitting water into the tube during the cleaning process. This can be done by mounting the brush on a suitable length of 1/8″ pipe with a few small holes at the brush end and connecting the other end by means of a hose to the water supply.

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