SECTION 5 – MAINTENANCE

GENERAL

The maintenance requirements for YR Chillers is shown below. The procedure is given in the left- hand column and the frequency required is marked with an "X" shown in the right-hand columns. Refer to the note at the bottom of the form to maintain warranty validation.

TABLE 8 – OPERATION / INSPECTION / MAINTENANCE REQUIREMENTS FOR YORK YR CHILLERS

PROCEDURE	DAILY	WEEKLY	MONTHLY	YEARLY
Record operating conditions (on applicable Log Form)	X			
Check oil levels	X			
Check refrigerant levels		X		
Check oil return system operation			X	
Check operation of motor starter			X	
Check oil heater operation			X	
Check three-phase voltage and current balance			X	
Verify proper operation/setting/calibration of safety controls[1]			X	
Verify condenser and evaporator water flows			X	
Leak check and repair leaks as needed[1]			X	
Check and tighten all electrical connections				X
Megohm motor windings				X
Replace oil filter and oil return filter/driers				X
Clean or backflush heat exchanger (SSS Applications)				X
Replace coolant (After cleaning Hxer , SSS Applications)				X
Replace or clean starter air filters if applicable				X[2]
Perform oil analysis on compressor lube oil[1]				X
Perform refrigeration analysis[1]				X
Perform vibration analysis				X
Perform Eddy current testing and inspect tubes [3]				X
Clean tubes				X[2]

For operating and maintenance requirements listed above, refer to appropriate service literature, or contact your local YORK Service Office.

[1] This procedure must be performed at the specified time interval by an Industry Certified Technician who has been trained and qualified to work on this type of YORK equipment .A record of this procedure being successfully carried out must be maintained on file by the equipment owner should proof of adequate maintenance be required at a later date for warranty validation purposes.

[2] More frequent service may be required depending upon local operating conditions.

[3] More frequent service may be required depending upon water quality.

TABLE 9 – MAINTENANCE SCHEDULE

MAINTENANCE	HOURS OF OPERATION (MAXIMUM x 1,000)										
	2	5	10	20	30	40	50	60	70	80	90
CHANGE OIL*		X			X			X			X
CHANGE FILTER, OIL	X	X	X	X	X	X	X	X	X	X	X
OIL ANALYSIS	X	X	X	X	X	X	X	X	X	X	X
VIBRATION ANALYSIS	X		X		X		X		X		X

* Or as required, as indicated by oil analysis.

COMPRESSOR OIL

Yearly oil analysis is recommended to verify the continued use of the compressor oil.

CAUTION

It is very important to take the oil sample after the oil filter. The oil sample should not be left open to the atmosphere for more than 15 minutes since it will absorb moisture from the atmosphere and may yield erroneous results.

Compressor oil should be changed when the oil analysis indicates the oil has moisture and acid numbers are in excess of the limits set in Table 10.

TABLE 10 – COMPRESSOR OIL LIMITS

YORK OIL TYPE	MOISTURE CONTENT (by Karl Fisher) ppm	TAN (Total Acid Number) mgKOH/ml
H	LESS THAN 300 PPM	LESS THAN 0.5

The YORK YR Chiller Compressors use rolling element bearings (ball and roller bearings); no sleeve bearings are used. Oil analysis that include metals may cause confusion when the results are compared to other equipment that utilize different bearing types. Iron and copper are examples of metals, which will appear in oil analysis that include metals. Other metals that may appear are Titanium, Zinc, Lead, Tin and Silicon. These metals should be ignored and are acceptable in quantities of less than 100 ppm. If an oil analysis should indicate high levels of Iron (more than 300 ppm) combined with Chromium and Nickel (more than 50 ppm), consult your local YORK Service Office – this could indicate bearing damage and wear.

Changing Compressor Oil

Compressor oil is changed by draining oil from the oil separator into a refrigerant recovery container. The oil separator is under positive pressure at ambient temperatures. Connect one end of a refrigeration charging hose to the service valve located at the bottom of the oil separator; connect the other end to an approved refrigerant recovery cylinder. Open the valve and drain the oil from the oil separator.

CHARGING UNIT WITH OIL

The Oil Charge

YORK oil types approved for YR Chillers and the quantity of oil required is listed in Table 11.

TABLE 11 – YORK OIL TYPE FOR R-134a

COMP. SIZE	OIL TYPE	SYSTEM QUANTITY (GAL)
T0	H	9
T1	H	9
T2	H	15
T3	H	15

Oil Level

The YR chiller does not have an oil pump. System oil flow is dependant on the pressure differential between the condenser and evaporator. Therefore, the oil flow rate, and oil level in the separator will vary as the system pressures and slide valve position change. It is normal for the oil level to be at the bottom of the lower sight glass or near the top of the upper sight glass located on the separator, depending on conditions. Oil should NOT be added unless the oil level cannot be seen in the lower sight glass. Oil also should NOT be removed unless the oil level is above the upper sight glass. The following paragraphs outline procedures to be followed:

Start-up

1. *Oil level cannot be seen in either sight glass on oil separator:*

   For chillers shipped with a factory charge of oil and refrigerant and no oil level is obvious at start-up, a qualified technician should add only enough oil to create a visible level in the bottom of the lower sight glass. Start the chiller and run a load condition greater than 65% full load amps [FLA] but less than 80% FLA for a minimum of 1 hour and observe the oil level. The oil level should become visible in either the bottom or top sight glass depending on conditions. A qualified technician should then remove the approximate amount added to start the chiller.

2. *Oil level above the upper sight glass:*

   Conditions can exist where the evaporator pressure is higher than the condenser pressure. This occurs when the evaporator (or chilled) water loop is warmer than the condenser (or cooling tower) water loop. This can cause refrigerant in the oil separator to condense, creating a liquid level (oil and refrigerant mixture) that exceeds the top of the upper sight glass. When the chiller motor is not running, a qualified technician should confirm that the oil heater is in proper working condition and is energized. If it is the first startup for the cooling season, the technician should confirm the oil heater has been energized for at least 24 hours prior to start up. During start-up, the chiller should be manually unloaded until a discharge superheat temperature (displayed on the "COMPRESSOR SCREEN" of the OptiView control center) of 18°F (-8°C) or greater is maintained and liquid level drops below the top of the upper sight glass on the oil separator. The chiller should continue to be held in a "part-load" operation until the foaming in the oil separator is minimized. The chiller can then be returned to "automated" slide valve position or "load control" to meet the cooling load requirements.

Operation:

1. *Oil should be visible in both sight glasses of the oil separator (oil level above the upper sight glass):*

   If the chiller operates in a low discharge superheat (refer to the *Troubleshooting* Section in this manual) condition for an extended period of time refrigerant can again condense in the oil separator. The chiller should be unloaded and held in a slide valve position that allows the discharge superheat to increase above 18°F (-8°C). The chiller should continue to be held in a slide valve position until the level drops below the top of the upper sight glass and foaming is minimized. The chiller can then be loaded normally as the building/process load requires.

2. *Oil level cannot be seen in either sight glass on the oil separator (oil level is below lower sight glass):*

   If no oil level is in either sight glass (oil level below lower sight glass) a problem may exist with the oil return system. A qualified technician should add only enough oil to create a visible level in the bottom of the lower sight glass. Start the chiller and run a load condition greater than 65% full load amps [FLA] but less than 80% FLA for a minimum of 1 hour and observe the oil level. The oil level should become visible in either the bottom or top sight glass depending on conditions. A qualified technician should then remove the approximate amount added to start the chiller. Refer to the *Troubleshooting* Section in this manual.

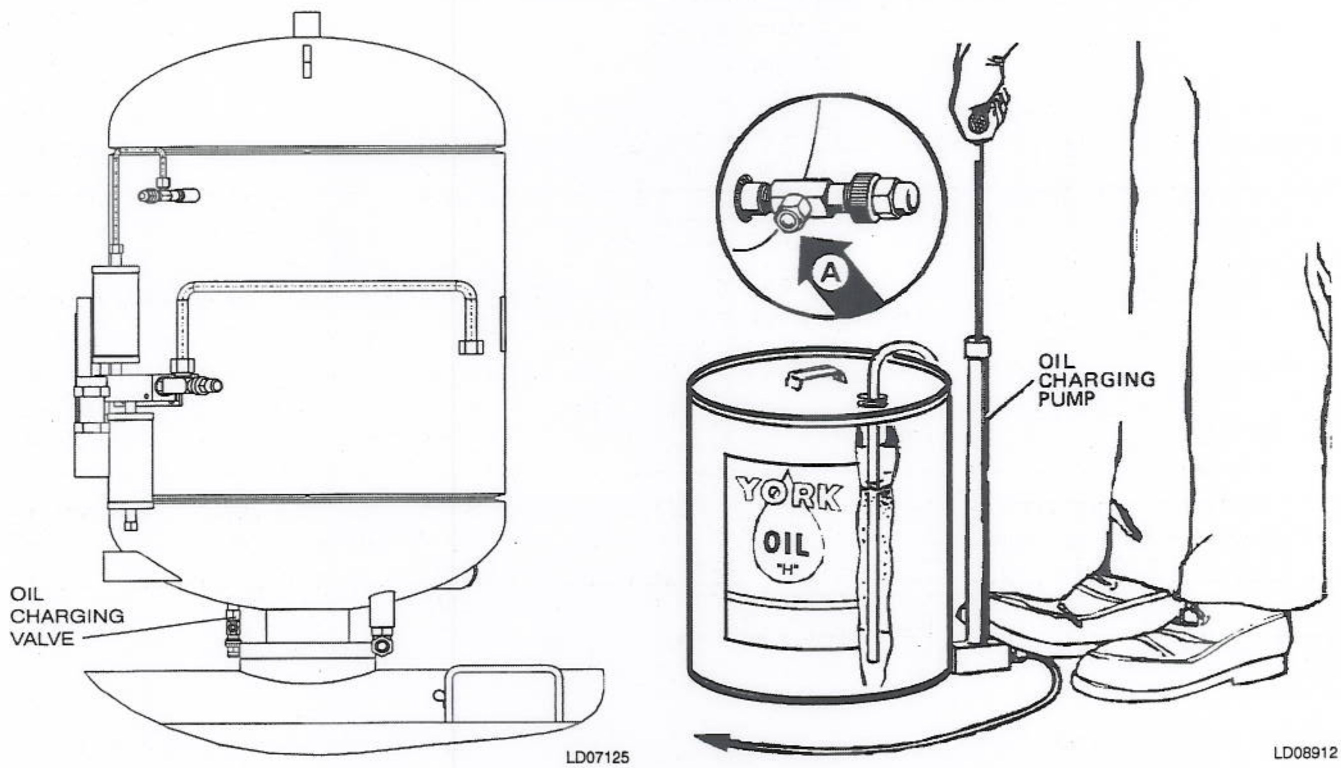

FIG. 20 – CHARGING OIL

Oil Charging Procedure

> **NOTE:** ***YORK H Oil is used in T0 through T3 units.***

The oil should be charged into the oil separator using the YORK Oil Charging Pump – YORK Part No. 070-10654. To charge oil, proceed as follows:

1. The unit should be shut down.

   Note: If charging oil to restore the correct level – the unit may be kept in operation.
2. Immerse the suction connection of the oil charging pump in a clean container of new oil and connect the pump discharge connection to the oil charging valve. Do not tighten the connection at the charging valve until after the air is forced out by pumping a few strokes of the oil pump. This fills the lines with oil and prevents air from being pumped into the system.
3. Open the oil charging valve and pump oil into the system until oil level in the oil separator is about midway in the upper sight glass. Then, close the charging valve and disconnect the hand oil pump. see Figure 20.
4. As soon as oil charging is complete, close the power supply to the starter to energize the oil heater. This will keep the concentration of refrigerant in the oil to a minimum.
5. The immersion oil heater will maintain the oil temperature between 105°F (40°C) and 115°F (46°C).

OIL TEMPERATURE CONTROL

Automatic oil temperature control is accomplished by liquid being injected into the compressor / motor assembly. A solenoid valve will be opened when the discharge temperature increases to 160°F (71°C).

OIL FILTER

A single oil filter is provided as standard equipment and dual oil filter arrangements are available as optional equipment. The oil filter(s) are a replaceable 3 micron cartridge type oil filter. Use only YORK approved oil filter elements. See Figure 21.

The oil filter element should be changed after the first 200 hours of operation and then as necessary thereafter. Always replace the oil filter element and O-ring on a yearly maintenance schedule.

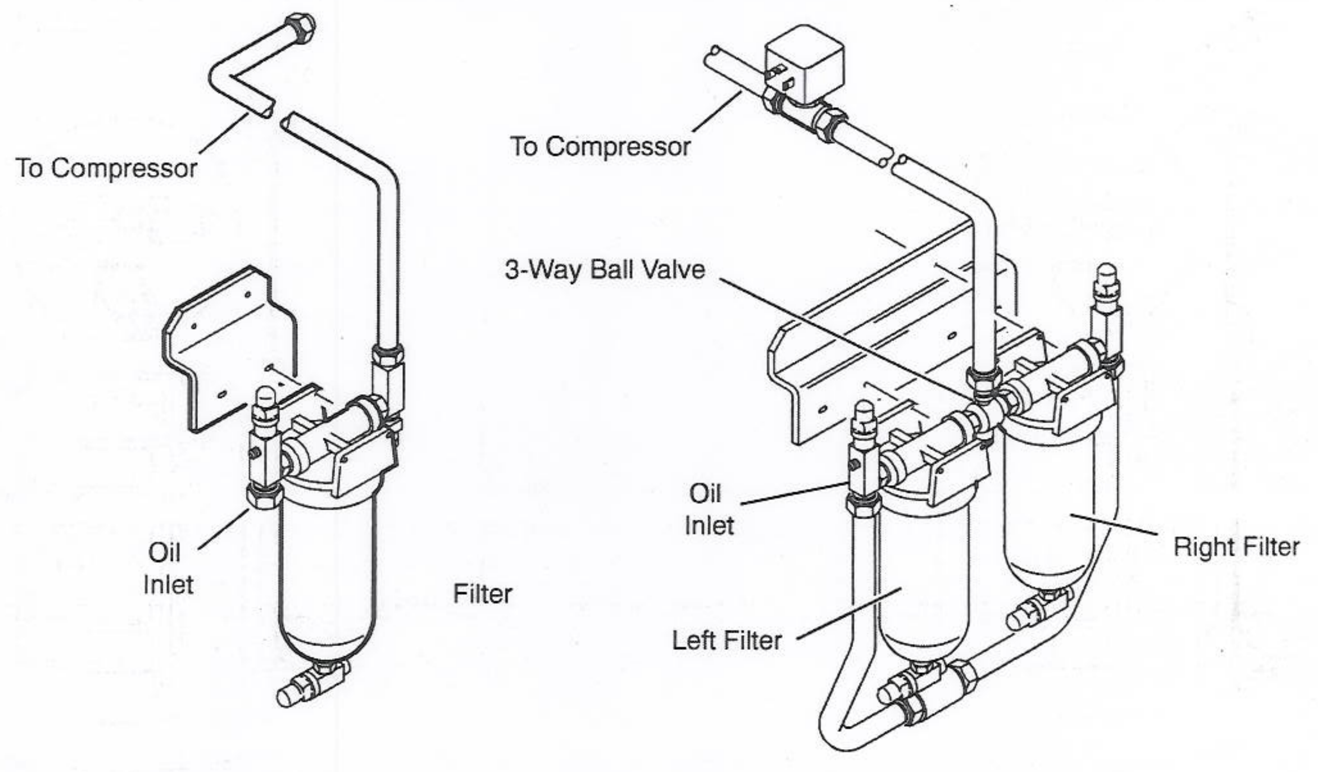

FIG. 21 – OIL FILTERS

The YORK control panel will automatically display the message "DIRTY OIL FILTER" when the differential pressure reaches 15 PSID across the oil filter. A safety shutdown will be initiated if the oil pressure differential pressure reaches 25 PSID. The control panel will display the message "CLOGGED OIL FILTER"

OIL FILTER REPLACEMENT

Single Oil Filter

The chiller must be OFF. Turn the rocker switch to the OFF position; turn the circuit breaker to the OFF position to prevent the chiller from being accidentally started.

1. Close the hand isolation valves on the inlet and outlet oil lines going to and from the oil filter.
2. Relieve the refrigerant pressure and oil in the oil filter and the oil lines through the pressure access port fitting, located on the top of the filter housing. Connect a refrigeration pressure hose to the pressure access port and drain the oil and refrigerant into a suitable refrigerant recovery container.
3. Position a container to collect the oil (less than 2 quarts, 1.9 liters). Loosen and remove the drain nut at the bottom of the oil filter housing; drain the oil into the container.
4. Unscrew the oil filter bowl locking nut.
5. Remove the oil filter element.
6. Install a new element.
7. Install a new O-ring on the top of the oil filter bowl.
8. Tighten the oil filter bowl locking nut.
9. Open the hand isolation valves.
10. The chiller is ready to be restarted.

Dual Oil Filters (Optional)

The dual oil filter option allows one oil filter to be isolated and changed with the chiller in operation.

1. Isolate the left hand filter by turning the valve stem parallel with the valve body. 90° counter clockwise. Refer to Figure 22.

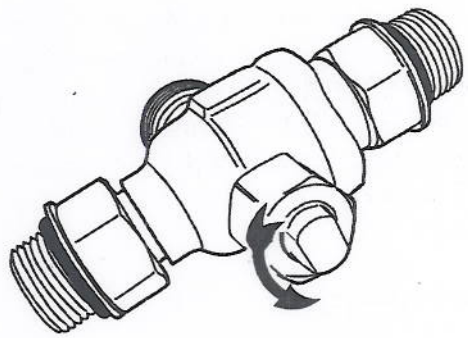

FIG. 22 – DUAL OIL FILTER ISOLATION VALVE

2. Isolate the right hand filter by turning the valve stem 1/4 turn clockwise.

CAUTION

Do not force the valve stem past the stop. Damage to the Isolation Valve will occur.

FILTER DRIER REPLACEMENT

The filter driers should be changed annually or when excessive amount of oil is indicated in the refrigerant charge.

When the filter driers require changing the chiller must be shut off.

1. Close the service isolation valves identified in schematic drawing, Figure 16.
2. Carefully remove the insulation on the filter driers located on the eductor block.
3. Relieve the pressure from the circuit using the pressure access fitting located on the side of the eductor block. Connect a refrigeration pressure hose to the pressure access port and drain the oil and refrigerant into a suitable refrigerant recovery container.
4. Loosen the Rota-Lock® Nuts at each end of the filter driers. Remove the filter driers.
5. Teflon® seal washers are used to seal the filter drier connections. These washers must be replaced when the filter driers are replaced.
6. Tighten the Rota-Lock® Nuts at each end of the three filter driers to a torque of 60 ft.-lb. (81 N·m)
7. Evacuate the air from the oil filter to 500 microns PSIG.
8. Open the five hand isolation valves. The chiller is now ready to be placed back into service.

DETERMINING CORRECT REFRIGERANT CHARGE LEVEL

The refrigerant charge level is correct when the measured evaporator approach and discharge refrigerant gas superheat are within the values listed in Table 12.

CAUTION

IMPORTANT: The chiller must be at design operating conditions and full load operation before the correct refrigerant charge level can be properly determined.

Liquid refrigerant will be visible in the evaporator sight glass. The refrigerant level cannot be properly determined by viewing the liquid refrigerant level in the evaporator sight glass.

All YR Chillers shipped Form 1 are charged with the correct amount of refrigerant. Under some operating conditions the chiller may appear to be overcharged or undercharged with refrigerant. Consult with the YORK Factory prior to removing or adding refrigerant. The liquid line isolation valve may have to be partially throttled to prevent overfeeding the evaporator in some applications and under certain operating conditions.

Definitions:

Evaporator Approach = (S.E.T) - (L.E.L.T)
Discharge Superheat = (C.D.G.T) - (S.C.T)

Where:

S.E.T. = Saturated Evaporator Temperature
L.E.L.T. = Leaving Evaporator Liquid Temp.
C.D.G.T. = Compressor Discharge Gas Temp.
S.C.T. = Saturated Condensing Temperature

These values can be obtained from the OptiView Control Center. Refer to OptiView Control center Operating Instructions, Form 160.81-O1.

REFRIGERANT CHARGING

Should it become necessary to add refrigerant charge to a YORK YR Chiller; add charge until the evaporator approach and refrigerant gas discharge superheat are at within the values listed in Table 12.

A charging valve is located in the liquid line below the evaporator. The size of the charging connection is ¾ inch male flare. Purge air and non-condensables from the charging hose. Only add new refrigerant, or refrigerant that has been tested and certified to meet American Refrigeration Institute Standard (ARI-700).

TABLE 12 – REFRIGERANT CHARGE LEVEL

CONDITION	R-134a REFRIGERANT
COMFORT COOLING APPLICATIONS	
EVAPORATOR APPROACH	1°F-5°F
DISCHARGE SUPERHEAT	12°F-18°F
BRINE (ICE MAKING) APPLICATIONS	
EVAPORATOR APPROACH	4°F-8°F
DISCHARGE SUPERHEAT	24°F-36°F

REFRIGERANT LEAK CHECKING

Periodic refrigerant leak checking must be part of a comprehensive maintenance program. Leak check the entire chiller using a calibrated electronic leak detector.

Use a soap solution to confirm leaks that are found using the electronic leak detector.

Check refrigerant relief valve piping and tube rolled joints as part of the comprehensive refrigerant leak checking program.

Repair leaks before adding refrigerant.

PRESSURE CONNECTIONS

All threaded pressure connections used on the YORK YR Chillers are SAE straight thread, O-ring face seal type fittings or Primore Rotalock® fittings.

The O-ring straight thread fittings and O-ring face seal fittings are designed and used in accordance with SAE J1926 and J1453. Should it become necessary to remove a fitting, the O-ring(s) should be replaced. Make certain to use only neoprene replacement O-rings. O-rings can be ordered from the local YORK Service Office.

Pipe sealant compounds are not required with SAE type O-ring fittings. The O-ring seal accomplishes the pressure sealing. Lubricate the O-ring with compressor oil prior to assembly.

All filter driers and angle shut off valves use Primore Rotalock® fittings. These fittings use a Teflon® fiber seal washer. The Teflon® fiber seal washers should be replaced each time the filter driers are changed.

CONDENSERS AND EVAPORATORS

General

Maintenance of condenser and evaporator shells is important to provide trouble free operation of the unit. The water side of the tubes in the shell must be kept clean and free from scale. Proper maintenance such as tube cleaning, and testing for leaks, is covered on the following pages.

Chemical Water Treatment

Since the mineral content of the water circulated through evaporators and condensers varies with almost every source of supply, it is possible that the water being used may corrode the tubes or deposit heat resistant scale in them.

Reliable water treatment companies are available in most larger cities to supply a water treating process which will greatly reduce the corrosive and scale forming properties of almost any type of water.

As a preventive measure against scale and corrosion and to prolong the life of evaporator and condenser tubes, a chemical analysis of the water should be made, preferably before the system is installed. A reliable water treatment company can be consulted to determine whether water treatment is necessary, and if so, to furnish the proper treatment for the particular water condition.

CLEANING EVAPORATOR AND CONDENSER TUBES

Condenser Tubes – The standard condenser tubes used in YORK YR Chillers are internally enhanced copper tubes.

CAUTION

If the equipment is located in an unheated area that is susceptible to freezing, the water must be drained from the condenser to prevent tube failure from freezing.

Proper condenser water treatment can eliminate or significantly reduce the formation of scale on the waterside of the condenser tubes.

Maintain a minimum condenser water flow rate through the tubes of at least 3.33 ft./sec. (1 meter/sec.). Through tube water velocity should not exceed 12 ft./sec. (3.6 meter/sec.).

Condenser tubes must be maintained to provide proper chiller operation. Condenser Approach Temperature is a useful tool to monitor the performance of the condenser. By recording and logging the Condenser Approach Temperature as part of the chiller maintenance program, this will provide a warning that the waterside condenser tubes are fouled and require cleaning.

Condenser Approach Temperature is the difference between the Condenser Leaving Water Temperature and the Saturated Condensing Temperature.

If the approach increases above 10°F (5.6°C), or during the annual condenser inspection and the tubes are observed to be fouled, the tubes will require cleaning. For condenser fluids other than water consult with the local YORK Field Service Office for the correct condenser approach.

CONDENSER WATER SIDE TUBE CLEANING PROCEDURE

Two methods are used for waterside tube cleaning to remove the scale; chemical and mechanical cleaning procedures. The composition of the scale will determine which method will be most effective to remove the scale and dirt.

Consult with the local YORK Field Service Office for a recommendation of the method(s) used in the local area.

Chemical Cleaning Procedure

Chemical cleaning is an effective method to remove scale from internally enhanced copper tubes. However, a company knowledgeable with the chemical cleaning procedure should be contracted or consulted. Follow the chemical cleaning company recommendations concerning solution cleaning strength and time duration of the cleaning process.

CAUTION

Serious damage to the condenser tubes will result if the chemical cleaning procedure is improperly applied.

NOTE

Mechanical tube cleaning must always follow a chemical cleaning procedure.

When chemical cleaning of the condenser tubes is required, it may be necessary to calculate the internal volume of the waterside condenser tubes. This information is necessary to properly mix the correct concentration of cleaning solution.

Standard materials of construction for YORK YR Chiller condensers is copper tubes and mild carbon steel water boxes.

The internal volume (waterside) of the condenser can be calculated as follows:

$$\text{Volume } (in^3) = N * L * 0.30680 \ in^3/in$$

Where: N = Number of Condenser Tubes
L = Length of each Tube in inches

To convert in^3 to gallons, divide the Volume (in^3) by 231 in^3/gallon.

Mechanical Cleaning Procedure

1. Drain the water from the condenser.
2. Remove the water boxes from both ends of the condenser. Use proper lifting equipment when removing the water boxes. Use caution not to damage the threads on the mounting studs that are welded to the tube sheet.
3. Select a tube cleaning brush for 5/8 inch I.D copper condenser tubes. If tubes other than 5/8 inch copper are used, select a tube cleaning brush that is made for the tube size. Generally, brushes made of hard plastic or brass bristled wires are preferred for cleaning copper tubes.
4. Attach the tube cleaning brush to the end of a cleaning machine or cleaning rod.
5. Flush the condenser with clean water to remove the debris.
6. Replace the water box gasket with a new gasket and reassemble the water boxes onto the condenser.

EVAPORATOR TUBES

The standard evaporator tubes used in YORK YR Chillers are internally enhanced copper tubes.

CAUTION

If the equipment is located in an unheated area that is susceptible to freezing, the water must be drained from the evaporator to prevent tube damage from freezing.

Maintain evaporator water or brine flow rates through the evaporator tubes that the chiller was designed for. Refer to the engineering data on the sales order form for the correct flow rates.

Generally, the water or brine that is circulated through the evaporator is part of closed loop circuit that is treated with chemicals to prevent the formation of scale and debris.

Evaporator

It is difficult to determine by any particular test whether possible lack of performance of the water evaporator is due to fouled tubes alone or due to a combination of troubles. Trouble which may be due to fouled tubes is indicated when, over a period of time, the cooling capacity decreases and the split (temperature difference between water leaving the evaporator and the refrigerant temperature in the evaporator) increases. A gradual drop-off in cooling capacity can also be caused by a gradual leak of refrigerant from the system or by a combination of fouled tubes and shortage of refrigerant charge. An excessive quantity of oil in the evaporator can also contribute to erratic performance.

If cleaning of the evaporator tubes is required, follow the condenser cleaning procedure.

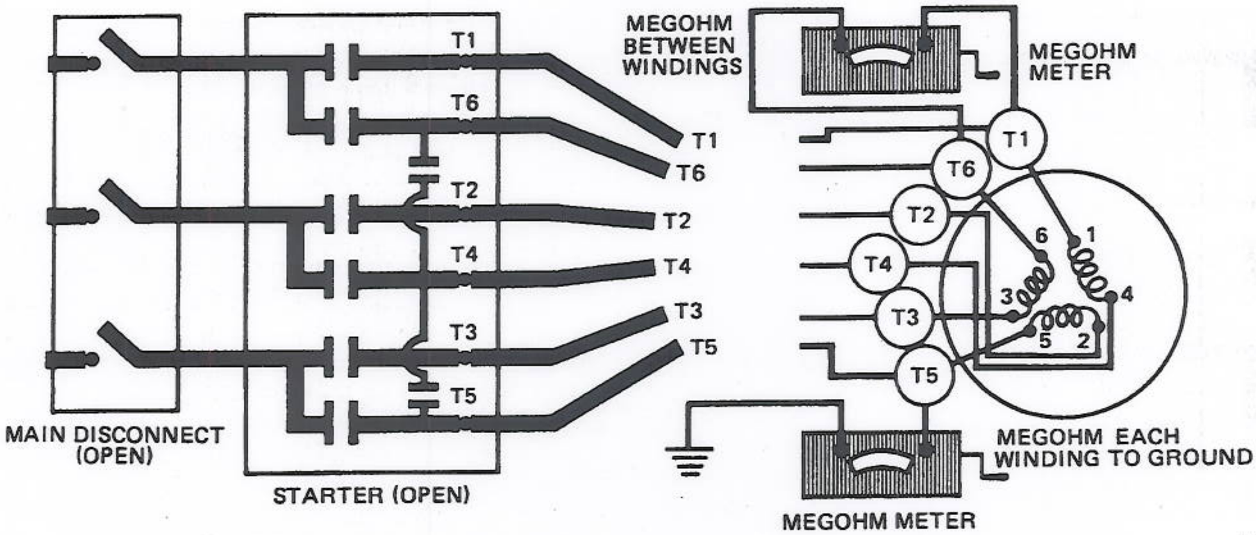

FIG. 23 – DIAGRAM, MEGOHM MOTOR WINDINGS

MEGOHM THE MOTOR

Make certain that the motor disconnect switch (circuit breaker) is in the open position. Megohm the motor as follows:

1. Use a megohm meter to verify the minimum motor and wiring insulation resistance. Megohm between phases and each phase to ground, Refer to Figure. 23, Diagram, Megohm Motor Windings.
2. If insulation resistance values fall to the left of the curve, remove external leads from the motor and repeat test.

NOTE

Motor is to be megged with the starter at ambient temperature after 24 hours of idle standby.

CHECKING SYSTEM FOR LEAKS

Leak Testing During Operation

The refrigerant side of the system is carefully pressure tested and evacuated at the factory.

After the system is in operation under load, the high pressure components should be carefully leak tested with a leak detector to be sure all joints are tight.

If a leak exists, frequent purging will be required or refrigerant will be lost.

If any leaks are indicated, they must be repaired immediately. Usually, leaks can be stopped by tightening flare nuts or flange bolts. However, if it is necessary to repair a welded joint, the refrigerant charge must be removed. (See the "*Handling Refrigerant for Dismantling and Repair*" Section of the *Maintenance* Section in this manual).

Conducting R-134a Pressure Test

With the R-134a charge removed and all known leaks repaired, the system should be charged with a small amount of R-134a mixed with dry nitrogen so that a halide torch or electronic leak detector can be used to detect any leaks too small to be found by the soap test.

To test with R-134a, proceed as follows:

1. With no pressure in the system, charge R-134a gas and dry nitrogen into the system through the charging valve to a pressure of 150 PSIG.
2. To be sure that the concentration of refrigerant has reached all parts of the system, slightly open the oil charging valve and test for the presence of refrigerant with a leak detector.
3. Test around each joint and factory weld. It is important that this test be thoroughly and carefully done, spending as much time as necessary and using a good leak detector.
4. To check for refrigerant leaks in the evaporator and condenser, open the vents in the evaporator and condenser heads and test for the presence of refrigerant. If no refrigerant is present, the tubes and tube sheets

may be considered tight. If refrigerant is detected at the vents, the heads must be removed, the leak located (by means of soap test or leak detector) and repaired.

5. When absolute tightness of the system has been established, blow the mixture of nitrogen and refrigerant through the charging valve.

EVACUATION AND DEHYDRATION OF UNIT

Vacuum Dehydration

Should the chiller be opened to the atmosphere for lengthy repair or service, follow the Vacuum Dehydration Guidelines to ensure that all air, moisture and non-condensable gases are removed prior to placing the chiller into service.

Vacuum Testing

After the pressure test has been completed, the vacuum test should be conducted as follows:

1. Connect a high capacity vacuum pump, with indicator, to the system charging valve as shown in Figure 24 and start the pump. (See "Vacuum Dehydration".)
2. Open wide all system valves, including the purge and gauge valves. Be sure all valves to the atmosphere are closed.
3. Operate the vacuum pump in accordance with VACUUM DEHYDRATION until a wet bulb temperature of +32°F (0°C) or a pressure of 5 mm Hg is reached. Refer to the *Systems Pressures* Table in the *Installation* Section of this manual for corresponding values of pressure.
4. To improve evacuation circulate hot water (not to exceed 125°F (52°C)) through the evaporator and condenser tubes to thoroughly dehydrate the shells. If a source of hot water is not readily available, a portable water heater should be employed. DO NOT USE STEAM. A suggested method is to connect a hose between the source of hot water under pressure and the evaporator head drain connection, out the evaporator vent connection, into the condenser head drain and out the condenser vent. To avoid the possibility of causing leaks, the temperature should be brought up slowly so that the tubes and shell are heated evenly.
5. Close the system charging valve and the stop valve between the vacuum indicator and the vacuum pump (See Fig. 16.). Then disconnect the vacuum pump leaving the vacuum indicator in place.
6. Hold the vacuum obtained in Step 3 in the system for 8 hours; the slightest rise in pressure indicates a leak or the presence of moisture, or both. If, after 8 hours the wet bulb temperature in the vacuum indicator has not risen above 40°F or a pressure of 6.3 mm Hg, the system may be considered tight.

NOTE

Be sure the vacuum indicator is valved off while holding the system vacuum and be sure to open the valve between the vacuum indicator and the system when checking the vacuum after the 8 hour period.

7. If the vacuum does not hold for 8 hours within the limits specified in Step 6 above, the leak must be found and repaired.

To avoid the possibility of freezing liquid within the evaporator tubes when charging an evacuated system, only refrigerant vapor from the top of the drum or cylinder must be admitted to the system pressure until the system pressure is raised above the point corresponding to the freezing point of the evaporator liquid. For water, the pressure corresponding to the freezing point is 57.5 PSIG for R-134a (at sea level).

While charging, every precaution must be taken to prevent moisture laden air from entering the system. Make up a suitable charging connection from new copper tubing to fit between the system charging valve and the fitting on the charging cylinder. This connection should be as short as possible but long enough to permit sufficient flexibility for changing cylinders. The charging connection should be purged each time a full container of refrigerant is connected and changing containers should be done as quickly as possible to minimize the loss of refrigerant.

CHECKING THE REFRIGERANT CHARGE DURING UNIT SHUTDOWN

The refrigerant charge is specified for each chiller model. Charge the correct amount of refrigerant and record the level in the evaporator sight glass.

The refrigerant charge should always be checked and trimmed when the system is shut down.

The refrigerant charge level must be checked after the pressure and temperature have equalized between the condenser and evaporator. This would be expected to be 4 hours or more after the compressor and water pumps are stopped. The level should be at the center of the upper sight glass.

Charge the refrigerant in accordance with the method shown under "Refrigerant Charging." The refrigerant level should be observed and the level recorded after initial charging.

HANDLING REFRIGERANT FOR DISMANTLING AND REPAIRS

If it becomes necessary to open any part of the refrigerant system for repairs, it will be necessary to remove the charge before opening any part of the unit.

Condenser – In a condenser, trouble due to fouled tubes is usually indicated by a steady rise in head pressure, over a period of time, accompanied by a steady rise in condensing temperature, and noisy operation. These symptoms may also be due to foul gas buildup. Purging will remove the foul gas revealing the effect of fouling.

Tube Fouling

Fouling of the tubes can be due to deposits of two types as follows:

1. Rust or sludge – which finds its way into the tubes and accumulates there. This material usually does not build up on the inner tube surfaces as scale, but does interfere with the heat transfer. Rust or sludge can generally be removed from the tubes by a thorough brushing process.
2. Scale – due to mineral deposits. These deposits, even though very thin and scarcely detectable upon physical inspection, are highly resistant to heat transfer. They can be removed most effectively by circulating an acid solution through the tubes.

TUBE CLEANING PROCEDURES

Brush Cleaning of Tubes

If the tube 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 or nylon 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.

The tubes should always be brush cleaned before acid cleaning.

Acid Cleaning of Tubes – If the tubes are fouled with a hard scale deposit, they may require acid cleaning. It is important that before acid cleaning, the tubes be cleaned by the brushing process described above. If the relatively loose foreign material is removed before the acid cleaning, the acid solution will have less material to dissolve and flush from the tubes with the result that a more satisfactory cleaning job will be accomplished with a probable saving of time.

COMMERCIAL ACID CLEANING

In many major cities, commercial organizations now offer a specialized service of acid cleaning evaporators and condensers. If acid cleaning is required, YORK recommends the use of this type of organization. The Dow Industries Service Division of the Dow Chemical Company, Tulsa, Oklahoma, with branches in principal cities is one of the most reliable of these companies.

TESTING FOR EVAPORATOR AND CONDENSER TUBE LEAKS

Evaporator and condenser tube leaks in R-134a systems may result in refrigerant leaking into the water circuit, or water leaking into the shell depending on the pressure levels. If refrigerant is leaking into the water, it can be detected at the liquid head vents after a period of shutdown. If water is leaking into the refrigerant, frequent purging will be necessary and system capacity and efficiency will drop off sharply. If a tube is leaking and water has entered the system, the evaporator and condenser should be valved off from the rest of the water circuit and drained immediately to prevent severe rusting and corrosion. If a tube leak is indicated, the exact location of the leak may be determined as follows:

1. Allow the system to warm up until a substantial pressure is reached for testing. Dry nitrogen (pressure not to exceed 12 PSIG (83kPa)) may be admitted to the unit to increase pressure in the shell. Remove the heads and listen at each section of tubes for a hissing sound that would indicate gas leakage. This will assist in locating the section of tubes to be further investigated. If the probable location of the leaky tubes has been determined, treat that section in the following manner (if the location is not definite, all the tubes will require investigation).

2. Wash off both tube heads and the ends of all tubes with water.

NOTE

Do not use carbon tetrachloride for this purpose since its fumes give the same flame discoloration that the refrigerant does.

3. With nitrogen or dry air, blow out the tubes to clear them of traces of refrigerant laden moisture from the circulation water. As soon as the tubes are clear, a cork should be driven into each end of the tube. Repeat this with all of the other tubes in the suspected section or if necessary, with all the tubes in the evaporator or condenser. Allow the evaporator or condenser to remain corked up to 12 to 24 hours before proceeding. Depending upon the amount of leakage, the corks may blow from the end of a tube, indicating the location of the leakage. If not, if will be necessary to make a very thorough test with the halide torch.
4. After the tubes have been corked for 12 to 24 hours, it is recommended that two men working at both ends of the evaporator carefully test each tube – one man removing corks at one end and the other at the opposite end to remove corks and handle the test torch. 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 5 seconds – this should be long enough to draw into the detector any refrigerant gas that might have leaked through the tube walls. A fan placed at the end of the evaporator opposite the detector will assure that any leakage will travel through the tube to the detector.
5. Mark any leaking tubes for later identification.
6. If any of the tube sheet joints are leaking, the leak should be indicated by the detector. If a tube sheet leak is suspected, its exact location may be found by using a soap solution. A continuous buildup of bubbles around a tube indicates a tube sheet leak.

COMPRESSOR

Maintenance for the compressor assembly consists of checking the operation of the oil return system and changing the dehydrator, checking and changing the oil, checking and changing the oil filters, checking the operation of the oil heater and observing the operation of the compressor.

Internal wearing of compressor parts could be a serious problem caused by improper lubrication, brought about by restricted oil lines, passages, or dirty oil filters. If the unit is shutting down on High Oil Temperature (HOT) or Low Oil Pressure (LOP), change the oil filter element. Examine the oil filter element for the presence of foreign material. If foreign material is noticeable and the same conditions continue to stop the unit operation after a new filter element is installed, notify the nearest YORK office to request the presence of a YORK Service representative.

VIBRATION ANALYSIS

Vibration analysis performed at yearly intervals is a useful diagnostic that can detect internal damage to rotating machinery and component parts. Contact the local York Field Office for the Vibration Analysis Service.

ELECTRICAL CONTROLS

For information covering the MicroComputer Control Center operation, refer to Form 160.81-O1.1 and Wiring Diagrams, Forms 160.81-PW2, or 160.81-PW1.

The operating points of the pressure and temperature cut outs are shown in the Wiring Diagrams. These diagrams also contain a starting and stopping sequence and timing sequence diagram.

Preventive Maintenance

It is the responsibility of the owner to provide the necessary daily, monthly and yearly maintenance requirements of the system. **IMPORTANT – If a unit failure occurs due to improper maintenance during the warranty period; YORK will not be liable for costs incurred to return the system to satisfactory operation.**

In any operating system it is most important to provide a planned maintenance and inspection of its functioning parts to keep it operating at its peak efficiency. Therefore, the following maintenance should be performed when prescribed.

Compressor

1. Oil Filter – The oil filter must be changed when the oil pressure drops 30% or semiannually if not required earlier.

   When the oil filter is changed, it should be inspected thoroughly for any metal particles which would indicate possible bearing wear. If metal particles are found this should be brought to the attention of the nearest YORK office for their further investigation and recommendations.

2. Oil Changing – The oil in the compressor must be changed annually, or earlier if it becomes dark or cloudy.

Pressure Testing

The unit should be pressure tested annually. Any leaks found must be repaired immediately.

Evaporator and Condenser

The major portion of maintenance on the condenser and evaporator will deal with the maintaining of the water side of the condenser and evaporator in a clean condition.

The use of untreated water in cooling towers, closed water systems, etc. frequently results in one or more of the following:

1. Scale Formation.
2. Corrosion or Rusting.
3. Slime and Algae Formation.

It is therefore to the benefit of the user to provide for proper water treatment to provide for a longer and more economical life of the equipment. The following recommendation should be followed in determining the condition of the water side of the condenser and evaporator tubes.

1. The condenser tubes should be cleaned annually or earlier if conditions warrant. If the temperature difference between the water off the condenser and the condenser liquid temperature is more than 4° greater than the difference recorded on a new unit, it is a good indication that the condenser tubes require cleaning. They should be cleaned as instructed in the *Maintenace* section of this manual, "*Tube Cleaning Procedures*".
2. The evaporator tubes under normal circumstances will not require cleaning. If, however, the temperature difference between the refrigerant and the chilled water increases slowly over the operating season, it is an indication that the evaporator tubes may be fouling or that there may be a water bypass in the water box requiring gasket replacement.

Oil Return System

1. Clean the strainer in the oil return system semiannually or earlier if the oil return system fails to operate.
2. When the strainer is cleaned, the nozzle of the eductor should be checked for any foreign particles that may be obstructing the jet.

ELECTRICAL CONTROLS

1. All electrical controls should be inspected for obvious malfunctions.
2. It is important that the factory settings of controls (operation and safety) not be changed. If the settings are changed without YORK's approval, the warranty will be jeopardized.

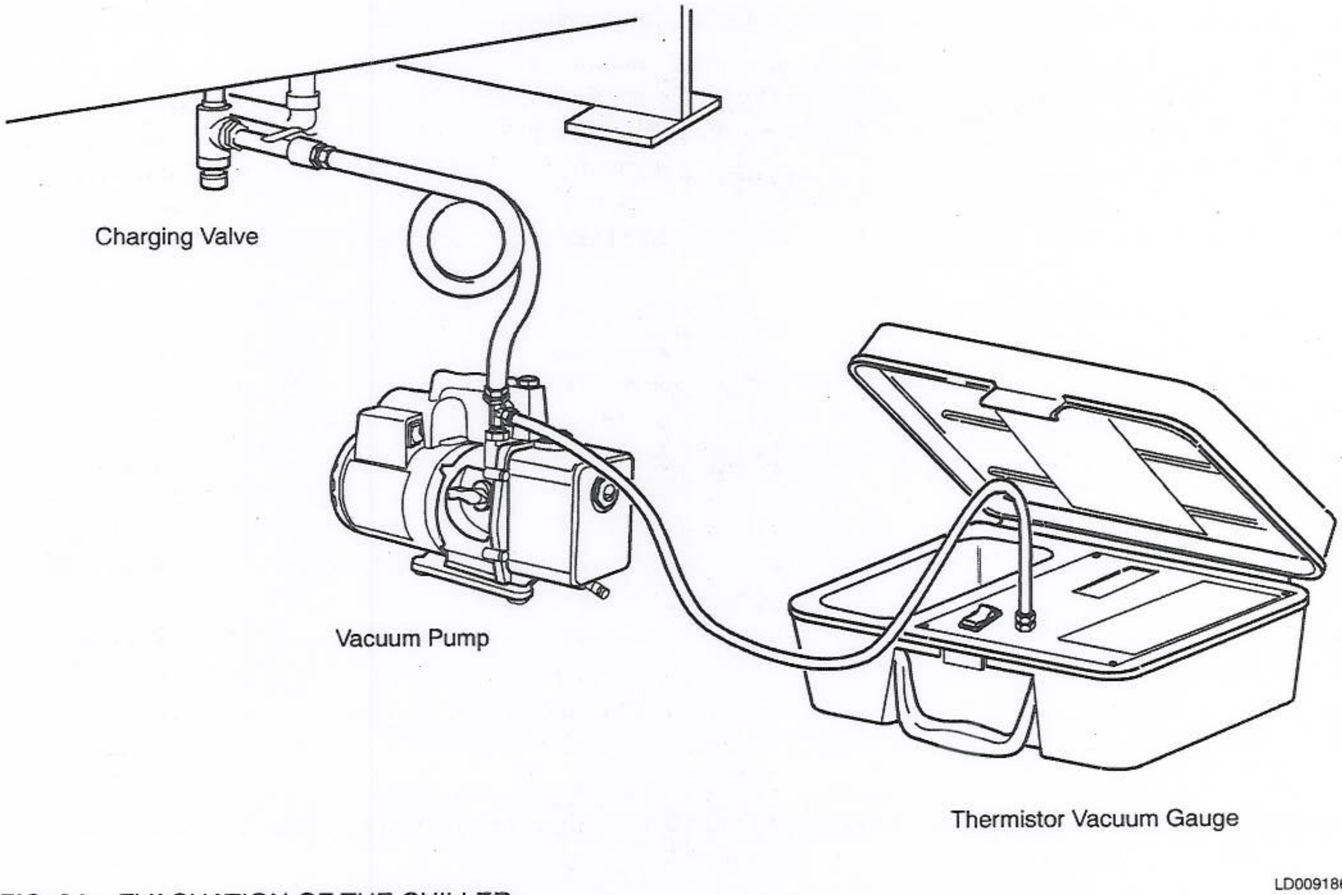

FIG. 24 – EVACUATION OF THE CHILLER