

CAUTION: Do not hydro test YORK supplied equipment.

CAUTION: Be sure to use a pressure regulator between any nitrogen bottle and the system being pressurized to prevent over pressure. Otherwise, overpressure may lift the relief valves.

CAUTION: Do not use a halide torch, electronic leak detector or sulfur sticks in a hazardous area. Either will develop local temperatures capable of igniting flammable gases.

CAUTION: Care must be taken not to damage system seal materials or components by using incompatible leak test media. For example, do not use R-22 to leak check ammonia systems. R-22 may react with system oil or elastomers to cause a chemical incompatibility with ammonia. The result may cause the formation of compounds that will be detrimental to operating components. Sulfur sticks may be used to pinpoint leaks in a non-hazardous area. Do not use sulfur sticks in a N.E.C. hazardous area. Litmus paper and soap bubbles may also be used to help pinpoint ammonia leaks. Similarly, do not use propylene to leak test a propane system or vice versa, etc. Contact the factory for guidance.

CAUTION: Relief valves and rupture disks must be removed and their associated connections sealed during pressure/leak testing at any pressure higher than approximately 80% of their set pressure. Otherwise, these devices will open and must be replaced or recalibrated per manufacturer's recommendation.

LEAK TESTING

Following strength testing and prior to commissioning, all refrigerant pipework and vessels should be thoroughly leak tested.

The purpose of the test is to prove the integrity of the installed system prior to evacuation and the introduction of the refrigerant charge. It is not a mechanical strength test and must not be considered as such, since all refrigerant pipework shall have been hydraulically/pneumatically strength tested, cleaned and dried prior to installation.

NOTE: This test shall only be performed prior to the application of insulation on vessel, piping or tubing joints (E.G. flanged, welded, threaded or cinched).

Field Erected Piping

NOTE: If the refrigeration system is completely manufactured and assembled at the factory, the Code pressure test is not required. The Code test was completed at the factory.

Field erected piping is piping that is welded or assembled at the installation site. An example of this is piping that interconnects packages. In such case, the applicable ASME Piping Code requires that the piping shall be tested at a pressure equal to the design pressure of the component with the lowest design pressure in that piping section. In the case of a centrifugal system with no compressor isolation valves, the test shall be conducted at the low side design pressure. Conduct the test as follows:

Remove system relief valves as they will open under the required test pressure.

CAUTION: Any conventional refrigeration relief valve that has been lifted under pressure must be considered compromised and must be replaced.

Open all manually operated valves. Close all vents and drains. Make sure all flange closures are rated for the test pressure. If there is any question, contact the York Process Systems Service for clarification.

All relief devices (relief valves and rupture disks) should be removed initially and any openings or connections not used must be adequately sealed with caps, plugs or blind flanges.

Check that all control and pneumatically actuated valves are correctly installed in respect of the required direction of flow and are free to operate. Install calibrated test gauge(s) to permit verification of system test pressure.

The test medium should be dry nitrogen. Do not use mixtures of air and refrigerant due to possible explosion hazard. Do not hydrostatically test York refrigeration components using water without prior written approval from York.

For safety purposes all personnel, except those immediately concerned with execution of the test, should be excluded from an area of at least 50 feet (15 meters) around the package during the test. The test should preferably be carried out outside normal working hours. The test area should be roped off and warning notices stating "CAUTION - HIGH PRESSURE TESTING" displayed at all points of access.

Although factory leak tested prior to shipment, the package piping and components may have to be included within the scope of this pressure test if it cannot be isolated with a permanent valve or spectacle blind.

NOTE: YORK recommends that this test be conducted under the guidance of a YORK Service Representative. A record of the test and the results should be kept on file for future reference.

A test pressure in accordance with the applicable ANSI/ASME Piping Code (1.1 x maximum working pressure) shall be used. Test apparatus shall include a pressure limiting relief device, pressure control valve with gauge, or other device for preventing any pressure being imposed over that prescribed.

The design working pressure specified on all vessel data plates must be checked to ensure compliance of system test pressure. Check the ratings of ANSI flanges to make sure ratings agree with vessel markings. If there is any question, contact York Process Systems Service for clarification.

Where no markings are found the pressure test should not be attempted. A thorough examination of the system is recommended to ensure that the system is safe to pressurize.

Using a valve on the charge line, or an equivalent low point connection, pressurize the system slowly to a preliminary pressure, about 25 psi (1.7 Bar). A preliminary visual leak check shall be made using a soap solution.

Thereafter, the pressure shall be gradually increased in steps until the test pressure (1.1 x DWP) is reached, holding the pressure at each step long enough to equalize piping strains. The test pressure must be maintained for at least 10 minutes. The pressure shall then be reduced to the design pressure before examining for leakage. Follow the instructions provided in the governing piping code.

Any leakage detected at any stage of the pressure test shall be made good before the test is continued.

CAUTION: A leak will require the full release of pressure in the section of pipework to be repaired before it can be rectified. The full procedure must be repeated for the section repaired. If unable to isolate the section safely the entire system should be de-pressurized before repair work is commenced.

By adding glycerin to the soap solution, the bubble action is improved. For flange joints it may be advisable to tape the joints and put a small hole through the tape between the flanges to improve leak detection.

The test pressure (1.0 x DWP) must then be held for a minimum period of 4 hours with no change in pressure other than that which may result from changes in ambient temperature.

On completion, release the test gas slowly from the lowest point of the system. Install any system relief valves that were removed for this test. (Ensure that all relief valves are correctly set to lift at their specified pressures.)

System Leak Test

(For any refrigerant, including ammonia (NH₃/R717) or for any system in a hazardous area.)

NOTE: If the refrigeration system is completely manufactured and assembled at the factory, the leak test must be conducted anyway to insure a leak-tight system.

NOTE: If the above ASME Piping Code pressure test has been conducted, this leak test is not required.

The system should now be leak tested using oxygen free nitrogen. The pressure should slowly be increased until the pressure reaches 80% of the lowest relief valve setting.

Re-check all joints for tightness using a soap solution, particular attention should be paid to relief valves. Repair any leaks found and re-test until the system is leak tight.

CAUTION: A leak will require the full release of pressure in the section of pipework to be repaired before it can be rectified. The full procedure must be repeated for the section repaired. If unable to isolate the section safely the entire system should be de-pressurized before repair work is commenced.

On completion slowly release the test gas as before. If, however, vacuum dehydration is not to commence immediately, a holding charge of 15 psig (1 Bar G) should be left in the system to eliminate risk of moisture ingress.

A certificate of the satisfactory gas leak test shall be witnessed by the customer and the York Commissioning Engineer and issued by the engineer in charge of testing. Use the form in the front of this manual.

Insulation of the system may now be commenced, however, flanged joints must not be covered until vacuum dehydration has been completed.

For Non-Hazardous Areas and Any Refrigerant Except Ammonia

The system should now be leak tested using an oxygen free nitrogen/refrigerant gas mixture (**ammonia must not be used**). The system should first be charged with a quantity of refrigerant

then the pressure should be slowly increased to 80% of the lowest relief valve setting using oxygen free nitrogen.

Re-check all joints for tightness using electronic leak detector. Particular attention should be paid to relief valves. Repair any leaks found and re-test until the system is leak tight.

CAUTION: A leak will require the full release of pressure in the section of pipework to be repaired before it can be rectified. The full procedure must be repeated for the section repaired. If unable to isolate the section safely the entire system should be de-pressurized before repair work is commenced.

On completion slowly release the test gas as before. If, however, vacuum dehydration is not to commence immediately, a holding charge of 15 psig (1 Bar G) should be left in the system to eliminate risk of moisture ingress.

A certificate of the satisfactory gas leak test shall be witnessed by the customer and the York Commissioning Engineer and issued by the engineer in charge of testing. Use the form in the front of this manual.

Insulation of the system may now be commenced, however, flanged joints must not be covered until vacuum dehydration has been completed (ref. to Para. 4.2).

Leak Test of Water Piping (where applicable)

The same procedure shall be followed for all York supplied water piping as is used for refrigerant piping, with the exception that nitrogen only is to be used, and therefore, leaks can only be identified using a soap solution.

Leak Test for Control-Air Piping (where applicable)

The control air piping shall be leak tested by introducing nitrogen, initially at a pressure corresponding to the lowest pressure regulator setting shown on the pneumatic diagram. The regulators should progressively be set one at a time, starting with the lowest set regulator and finishing with the highest set regulator, the nitrogen pressure then being increased in steps accordingly. Leak test all joints with a soap solution, mark all leaks and then repair as necessary. Re-check until the system is considered leak tight. When complete release the nitrogen slowly.

VACUUM DEHYDRATION OF REFRIGERANT SYSTEM

VACUUM DEHYDRATION OF REFRIGERANT SYSTEM (non Ammonia systems)

In order to eliminate operational problems resulting from trapped moisture it is necessary to evacuate the system prior to charging it with refrigerant and oil. For the system to be considered dry, the equipment must be able to sustain a 2000 micron (2.0 mm Hg Abs) pressure. In order to achieve this, a double or even triple evacuation procedure may have to be carried out. This is described below.

The equipment typically recommended is:

QTY	DESCRIPTION
1	Two stage vacuum pumps capable of creating a vacuum of 1mm Hg Abs. (1.3 m Bar A).
1 set	Charging/evacuation lines complete with necessary valves.

The procedure to be used is as follows:

1. First ensure that all parts of the system are at atmospheric pressure and that all free water has been drained as far as is practicable. Open all valves, including gauge and oil-line valves, except those to atmosphere or to any instruments liable to be damaged by a vacuum - in the event of any doubt obtain confirmation from York International as to suitability. Warm up all parts to be evacuated (where possible) typically 70-85°F (20 to 30 deg C). Note: this requirement is advisable when the ambient temperature is 60°F (16°C) or less.
2. Connect the vacuum pump(s) to the system charging valves and install a vacuum gauge in the system at a point as far away from the vacuum pump as possible.
3. The vacuum pump(s) oil should be checked frequently for signs of water contamination (milky appearance). If this situation occurs, the pump(s) must be run for 30 minutes isolated from the system with the gas ballast open and the system charging valve closed. Alternatively, the oil charge may be replaced.
4. This process will also show if the pump(s) are faulty as 1 mm Hg Abs. (1.3 m Bar A) would not be achieved. Even a small amount of moisture contamination in vacuum pump oil will raise the pump blank off pressure and prevent achieving the required vacuum level.
5. After proving that the vacuum pump(s) are working correctly, open the system charging valves.

The system pressure will fall initially and then stabilize when the moisture evaporates and will then continue to fall. The length of time required to dehydrate the system depends upon the size and efficiency of the vacuum pump(s), the ambient temperature and the quantity of moisture in the system.

DO NOT stop the pump(s) without first closing the system charging valves otherwise the pump oil may be drawn into - and contaminate - the system. Always check for this possibility if an interruption to the power supply is experienced, or suspected. In the event of oil loss, it will be necessary to strip and internally clean affected parts.

During evacuation, check the vacuum pump oil regularly and service as required. The oil may need to be replaced and/or topped off.

During the primary evacuation it might not be possible to pump down the system to 3 mm Hg Abs (4 m Bar A) due to leaks. These leaks must be rectified before continuing evacuation.

NOTE: The compressor shaft seal may have become misaligned during shipment and installation. Rotate the shaft by hand to align and lubricate the seal prior to evacuation.

A leak is unlikely to occur if the system was carefully leak tested but likely areas are:

- (1) Compressor Shaft Seals
- (2) Valve Packing
- (3) Vacuum Pump Connections
- (4) Defective Stop Valves (not tightly shut off)

After rectifying any leaks, continue to pump the system down to 2000 microns (2.0 mm Hg Abs). Once this pressure has been achieved, isolate the vacuum pump(s).

It may, however, not be possible to achieve 3 mm Hg Abs (4 m Bar A) without double/triple evacuation due to the quantity of the water within the system. Double/triple evacuation overcomes the inherent danger of freezing free water within the system.

While evacuating, if the pressure remains constant for a long time, this will suggest a large quantity of water. If this situation occurs, the vacuum pumps should be isolated and the pressure in the system allowed to rise to just above atmospheric by the introduction of oxygen free nitrogen.

The system should then be re-evacuated to 2000 microns (2.0 mm Hg Abs). If, however, the pressure remains constant for any length of time at the saturation point of water (for the local ambient temperature) a triple evacuation will be required, i.e. introduce Oxygen Free Nitrogen and then re-evacuate.

This procedure should be repeated as necessary to reduce the pressure to 2000 microns (2.0 mm Hg Abs). Not being able to achieve 3 mm Hg Abs (4 m Bar A) after triple evacuation indicates the presence of significant quantities of free water which should be removed before further attempts are made to evacuate the system.

The system must now be checked to see if it is dry and fully tight. This is done by isolating the vacuum pump(s) from the system and leaving for a period not normally less than 4 hours.

The vacuum should be held for this period with a maximum pressure rise of to 2000 microns (2.0 mm Hg Abs).

A dehydration of the system should be avoided if the ambient temperature is below 41°F (5 deg C). If this situation does occur, the system should be sectioned off and the compartments warmed and evacuated individually using the same method as described before.

A vacuum test shall be witnessed by the customer and a certificate issued by the York Commissioning Engineer. The certificate form in the front of this manual should be used.

The system can now be considered dry and ready for refrigerant charging, and all remaining insulation can be applied. If refrigerant charging is not to commence

immediately, then the vacuum should be broken and the system pressure raised to about 15 psig (1 Bar G) with oxygen free nitrogen.

EVACUATION OF REFRIGERANT SYSTEM (Ammonia systems)

In order to eliminate operational problems it is necessary to evacuate the system prior to charging it with refrigerant and oil.

The equipment typically recommended is:

QTY	DESCRIPTION
1	Single stage vacuum pumps capable of creating a vacuum of 1mm Hg Abs. (1.3 m Bar A).
1 set	Charging/evacuation lines complete with necessary valves.

The procedure to be used is as follows:

1. First ensure that all parts of the system are at atmospheric pressure and that all free water has been drained as far as is practicable. Open all valves, including gauge and oil-line valves, except those to atmosphere or to any instruments liable to be damaged by a vacuum - in the event of any doubt obtain confirmation from York International as to suitability. Warm up all parts to be evacuated (where possible) typically 70-85°F (20 to 30 deg C).
2. Connect the vacuum pump(s) to the system charging valve.
3. The vacuum pump(s) oil should be checked frequently for signs of water contamination (milky appearance). If this situation occurs, the oil charge must be replaced.
4. After proving that the vacuum pump(s) are working correctly, open the system charging valves.

DO NOT stop the pump(s) without firstly closing the system charging valves otherwise the pump oil may be drawn into - and contaminate - the system. Always check for this possibility if an interruption to the power supply is experienced, or suspected. In the event of oil loss, it will be necessary to strip and internally clean affected parts.

During evacuation, check the oil regularly and service as required. The oil may be replaced and/or topped up.

During the primary evacuation it might not be possible to pump down the system due to leaks. These leaks must be rectified before continuing evacuation.

NOTE: The compressor shaft seal may have become misaligned during shipment and installation. Rotate the shaft by hand to align and lubricate the seal prior to evacuation.

A leak is unlikely to occur if the system was carefully leak tested but likely areas are:-

- (1) Compressor Shaft Seals
- (2) Valve Packing
- (3) Vacuum Pump Connections
- (4) Defective Stop Valves (not tightly shut off)

After rectifying any leaks, continue to pump the system down to below 2000 microns (2 mm Hg Abs). Once this pressure has been achieved, isolate the vacuum pump(s) and leave

the system for 4 hours. The vacuum should be held after this period with a maximum pressure rise of 2000 microns (2 mm Hg Abs).

Evacuation of the system should be avoided if the ambient temperature is below 41°F (5 deg C). If this situation does occur, the system should be sectioned off and the compartments warmed and evacuated individually using the same method as described before.

A vacuum test shall be witnessed by the customer and a certificate issued by the York Commissioning Engineer. The certificate form in the front of this manual should be used.

The system can now be considered ready for refrigerant charging, and all remaining insulation can be applied. If refrigerant charging is not to commence immediately, then the vacuum should be broken and the system pressure raised to about 15 psig (1 Bar G) with oxygen free nitrogen.