



BY JOHNSON CONTROLS

Service Information

File In/With:	N/A	SI0203	
		New	309
Equipment Affected:	Large Tonnage Chillers (excluding absorption)		
Leak Checking Heat Exchanger Bundles			

General

The following is the recommended procedure for leak checking chilled and condenser water bundles on large tonnage chillers (excluding absorption) in the field.

This procedure is specific to leak checking the entire bundle using pure refrigerant (i.e. machine already charged with refrigerant) or a mixture of R-134a (trace) and nitrogen.

This procedure does not address leak testing of individual tubes.

Tools and Materials Required

Basic mechanics hand tools

Garden Hose (length dependent on distance between water box and nearest drain)

Calibrated R-134A Electronic Leak Detector (capable of detecting 0.1 oz./yr. R-134a)

Tank(s) dry nitrogen

R-134a tank(s)

Nitrogen Regulator

Pressure Gauge – 0-30 PSIG range (300 PSIG working pressure)

Misc. Pipe Fittings and Ball Valves

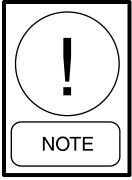
Refrigeration Manifold Set

Leak Test Procedures

The following leak test procedures are included in this bulletin:

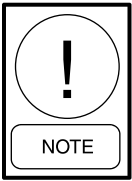
1. Chiller charged with pure refrigerant (chiller connected to electrical and mechanical systems)
2. Chiller charged with pure refrigerant (chiller NOT connected to electrical and mechanical systems)
3. Chiller NOT charged with refrigerant (chiller connected to electrical and mechanical systems)
4. Chiller NOT charged with refrigerant (chiller NOT connected to electrical and mechanical systems)

Chiller charged with pure refrigerant (chiller connected to electrical and mechanical systems)



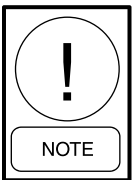
This test is applicable to those machines that are charged and have already been connected to the system.

1. Lock-out and tag the electrical supply to unit.
2. Shut off chilled and condenser water pumps to the unit.
3. Isolate the water side of the chiller from the plant system by closing off the appropriate evaporator and condenser isolation valves. Lock-out and tag valves.
4. Attach hose to the water box drain valve (either end).
5. Run hose to nearest floor drain.
6. Open drain valve slowly to drain water and relieve water side pressure. Care should be taken so that the hose does not whip around during this process.
7. Open vent valve to allow for quicker draining of bundle.
8. Install ball valves on all drain and vent connections.
9. Install a pressure gauge capable of indicating 2 psi or finer increments off of one of the vent connections.
10. Close all ball valves and monitor (10 minutes) for increase in pressure.



Any increase in pressure is indicative of a leak (assumes isolation valves are holding and bundle is not filling up with system water).

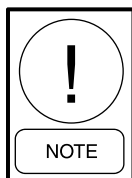
11. If no increase in pressure is observed, proceed to Step 12. If an increase in pressure is observed, a large leak is present. The water boxes must be removed and a leak test performed to find the location of the leak(s). Repair all leaks identified using field best practices, reinstall water boxes and proceed to Step 12.
12. Install nitrogen regulator on nitrogen tank.
13. Connect common hose from manifold to nitrogen regulator.
14. Connect High Side Hose to drain connection.
15. Bleed nitrogen slowly through the tube bundles for 5 minutes to assure that no residual refrigerant is present.



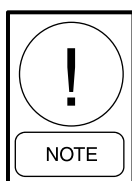
If chiller has a multiple pass bundle, be sure to bleed nitrogen in a manner that will assure that it flows though all passes.

16. Close nitrogen tank and allow pressure in bundle to reduce to atmosphere, checking drains on both ends with refrigerant detector (set to 0.1 oz./yr. 134a).
17. If refrigerant is detected, continue nitrogen purge for 5 more minutes and check the drain flow again. If refrigerant remains in the stream, remove the waterboxes and leak test the tubes and tube roll joints. Repair all leaks identified using field best practices, reinstall water boxes.

18. Close all drain and vent connections.
19. Start timer.
20. After one hour has elapsed, open drain valves and insert leak detector probe into connection.
21. If a leak is detected, repeat steps 15 thru 22. If a leak is detected after a second test, remove water boxes and leak test the tubes. Repair all leaks identified using field best practices, reinstall water boxes.
22. Continue process of leak testing/repairing leaks until no refrigerant is detected after the one hour interval.

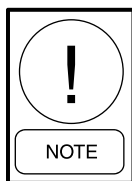


If you have to remove the water boxes during any of the above steps, it is recommended that a piece of 4 mil plastic be taped over all the tubes (on both ends) with at least a 2-3 inch overlap. The leak detector probe can then be poked through the plastic at the bottom to determine if a leak is present. This will eliminate the need to remove and reinstall the water boxes multiple times. The water boxes can then be reinstalled after the leak test is completed and no further leaks are identified.



It is preferred to leave the ball valves installed for future serviceability. Ball valves may be removed from the drain and vent connections and returned to original state if requested.

Chiller charged with pure refrigerant (chiller NOT connected to electrical and mechanical systems)

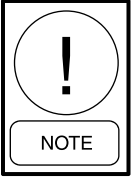


This procedure is applicable to a machine that has already been charged with refrigerant (e.g. Form 1 shipment) and has not as yet been installed (i.e. unit in as received condition).



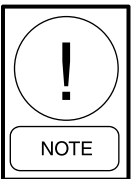
This procedure assumes that no piping or wiring has been connected to the chiller, and as such, no lock out and tag out procedures will apply.

1. Verify that water box nozzle enclosures (i.e. plastic flange or victaulic caps) are installed.
2. Verify that the chiller's pressure is at saturation corresponding the ambient temperature as measured adjacent to the chiller.
3. Remove plug from water box drain connections (both sides) and insert refrigerant leak detector probe up into connection. If no refrigerant is detected, the bundle can be assumed to be leak free. No further testing is required. If refrigerant is detected, or if nozzle enclosures were removed for some reason, proceed to step 4.
4. Install ball valves on all water box drain and vent connections.
5. Install plastic water box nozzle enclosures if not installed.
6. Install nitrogen regulator on nitrogen tank.
7. Connect common hose from manifold to nitrogen regulator.
8. Connect high side hose to drain connection.
9. Bleed nitrogen slowly through the tube bundles for 5 minutes to assure that no residual refrigerant is present.

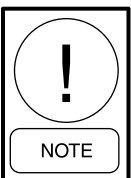


If chiller has a multiple pass bundle, be sure to bleed nitrogen in a manner that will assure that it flows through all passes.

10. Close nitrogen tank and allow pressure in bundle to reduce to atmosphere, checking drains on both ends with refrigerant detector (set to 0.1 oz./yr. R-134a).
11. If refrigerant is detected, continue nitrogen purge for 5 more minutes and check the drain flow again. If refrigerant remains in the stream, remove the waterboxes and leak test the tubes and tube roll joints. Repair all leaks identified using field best practices, reinstall water boxes.
12. Close all drain and vent valves/connections.
13. Start timer.
14. After one hour has elapsed, open drain valves and insert leak detector probe into connection.
15. If a leak is detected, repeat steps 9 thru 14. If a leak is detected after a second test, remove water boxes and leak test the tubes. Repair all leaks identified using field best practices, reinstall water boxes.
16. Continue process until no refrigerant is detected after the one hour interval.

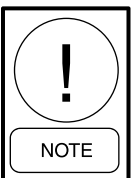


If you have to remove the water boxes during any of the above steps, it is recommended that a piece of 4 mil plastic be taped over all the tubes (on both ends) with at least a 2-3 inch overlap. The leak detector probe can then be poked through the plastic at the bottom to determine if a leak is present. This will eliminate the need to remove and reinstall the water boxes multiple times. The water boxes can then be reinstalled after the leak test is completed and no further leaks are identified.



It is preferred to leave the ball valves installed for future serviceability. Ball valves may be removed from the drain and vent connections and returned to original state if requested.

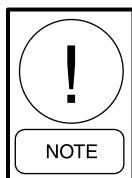
Chiller NOT charged with refrigerant (chiller connected to electrical and mechanical systems)



This procedure is applicable to those machines that have already been connected to system but are not yet charged with refrigerant. This test will be performed using a 90 % nitrogen / 10% R134a gas mixture.

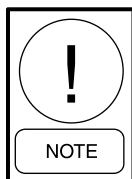
1. Lock-out and tag the electrical supply to unit.
2. Shut off chilled and condenser water pumps to the unit.
3. Isolate the water side of the chiller from the plant system by closing off the appropriate evaporator and condenser isolation valves. Lock-out and tag valves.
4. Attach hose to the water box drain valve (either end).
5. Run hose to nearest floor drain.
6. Open drain valve slowly to drain water and relieve water side pressure. Care should be taken so that the hose does not whip around during this process.

7. Open vent valve to allow for quicker draining of bundle.
8. Install ball valves on all drain and vent connections.
9. Install a pressure gauge capable of indicating 2 psi or finer increments off of one of the vent connections.
10. Evacuate shell side of chiller to at least 600 microns.
11. Connect a refrigeration manifold set to the unit's charging valve.
12. Charge R-134a gas into chiller at charging valve until internal pressure (as read on the high side manifold pressure gage) increases to 5PSIG.
13. Continue to increase pressure using dry nitrogen until the internal pressure reaches 160 PSIG.
14. Close all ball valves and monitor (10 minutes) for increase in pressure.



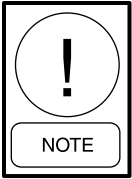
Any increase in pressure is indicative of a leak (assumes isolation valves are holding and bundle is not filling up with system water).

15. If no increase in pressure is observed, proceed to Step 16. If an increase in pressure is observed, a large leak is present. The water boxes must be removed and a leak test performed to find the location of the leak(s). Repair all leaks identified using field best practices, reinstall water boxes and proceed to Step 16.
16. Install nitrogen regulator on nitrogen tank.
17. Connect common hose from manifold to nitrogen regulator.
18. Connect High Side Hose to drain connection.
19. Bleed nitrogen slowly through the tube bundles for 5 minutes to assure that no residual refrigerant is present.

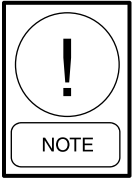


If chiller has a multiple pass bundle, be sure to bleed nitrogen in a manner that will assure that it flows though all passes.

20. Close nitrogen tank and allow pressure in bundle to reduce to atmosphere, checking drains on both ends with refrigerant detector (set at 0.1 oz./yr. R-134a).
21. If refrigerant is detected, continue nitrogen purge for 5 more minutes and check the drain flow again. If refrigerant remains in the stream, remove the waterboxes and leak test the tubes and tube roll joints. Repair all leaks identified using field best practices, reinstall water boxes.
22. Close all drain and vent connections.
23. Start timer.
23. After one hour has elapsed, open drain valves and insert leak detector probe into connection.
24. If a leak is detected, repeat steps 19 thru 23. If a leak is detected after a second test, remove water boxes and leak test the tubes. Repair all leaks identified using field best practices, reinstall water boxes.
25. Continue process of leak testing/repairing leaks until no refrigerant is detected after the one hour interval.

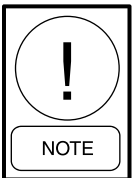


If you have to remove the water boxes during any of the above steps, it is recommended that a piece of 4 mil plastic be taped over all the tubes (on both ends) with at least a 2-3 inch overlap. The leak detector probe can then be poked through the plastic at the bottom to determine if a leak is present. This will eliminate the need to remove and reinstall the water boxes multiple times. The water boxes can then be reinstalled after the leak test is completed and no further leaks are identified.



It is preferred to leave the ball valves installed for future serviceability. Ball valves may be removed from the drain and vent connections and returned to original state if requested.

Chiller NOT charged with refrigerant (chiller NOT connected to electrical and mechanical systems)

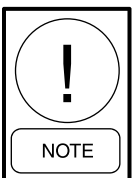


This procedure is applicable to those machines that are not charged with refrigerant and are not connected to the system (e.g. Form 7 shipment). This test will be performed using a 90 % nitrogen / 10% R134a gas mixture.



Please note that this same procedure can be used to check individual bundles as well.

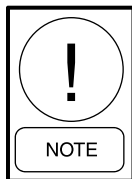
1. Connect a refrigeration manifold set to the unit's charging valve.
2. Vent nitrogen holding charge if one is present until the shell reaches atmospheric pressure.
3. Evacuate shell side of chiller to at least 600 microns.
4. Charge R-134a gas into chiller at charging valve until internal pressure (as read on the high side manifold pressure gage) increases to 5PSIG.
5. Continue to increase pressure using dry nitrogen until the internal pressure reaches 160 PSIG.
6. Install plastic water box nozzle enclosures if not already installed.
7. Install ball valves on all drain and vent connections.
8. Install a pressure gauge capable of indicating 2 psi or finer increments off of one of the vent connections.
9. Close all ball valves and monitor (10 minutes) for increase in pressure.



Any increase in pressure is indicative of a leak.

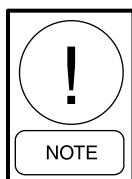
10. If no increase in pressure is observed, proceed to Step 16. If an increase in pressure is observed, a large leak is present. The water boxes must be removed and a leak test performed to find the location of the leak(s). Repair all leaks identified using field best practices, reinstall water boxes and proceed to Step 16.
11. Install nitrogen regulator on nitrogen tank.

12. Connect common hose from manifold to nitrogen regulator.
13. Connect High Side Hose to drain connection.
14. Bleed nitrogen slowly through the tube bundles for 5 minutes to assure that no residual refrigerant is present.

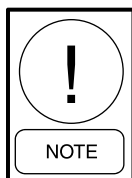


If chiller has a multiple pass bundle, be sure to bleed nitrogen in a manner that will assure that it flows through all passes.

15. Close nitrogen tank and allow pressure in bundle to reduce to atmosphere, checking drains on both ends with refrigerant detector (set at 0.1 oz./yr. R-134a).
16. If refrigerant is detected, continue nitrogen purge for 5 more minutes and check the drain flow again. If refrigerant remains in the stream, remove the waterboxes and leak test the tubes and tube roll joints. Repair all leaks identified using field best practices, reinstall water boxes.
17. Close all drain and vent connections.
18. Start timer.
19. After one hour has elapsed, open drain valves and insert leak detector probe into connection.
20. If a leak is detected, repeat steps 14 thru 21. If a leak is detected after a second test, remove water boxes and leak test the tubes. Repair all leaks identified using field best practices, reinstall water boxes.
21. Continue process of leak testing/repairing leaks until no refrigerant is detected after the one hour interval.



If you have to remove the water boxes during any of the above steps, it is recommended that a piece of 4 mil plastic be taped over all the tubes (on both ends) with at least a 2-3 inch overlap. The leak detector probe can then be poked through the plastic at the bottom to determine if a leak is present. This will eliminate the need to remove and reinstall the water boxes multiple times. The water boxes can then be reinstalled after the leak test is completed and no further leaks are identified.



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