PROCEDURE FOR MEASURING WATER IN AMMONIA REFRIGERATION SYSTEMS
BULLETIN ANW-SB17-01

Phillips REFRIGERATION
VALVES • VESSELS • SYSTEMS • CONTROLS

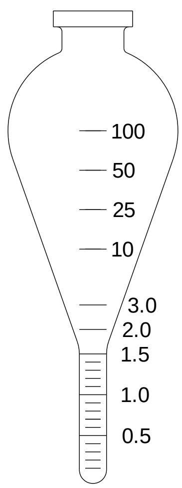
Refrigeration systems should only be serviced by a qualified technician. Always observe proper safety procedures when servicing a refrigeration system. For more information see the latest revision of Phillips Safety Bulletin SGRV.

The method outlined here is a simplification of that given in IIAR Bulletin No. 108 (Water Contamination in Ammonia Refrigeration systems). While less rigorous than the procedure recommended by the IIAR, this procedure is easy and the necessary sampling container is available directly from Phillips.

WARNING ANHYDROUS AMMONIA IS HAZARDOUS TO HUMAN HEALTH IF NOT HANDLED IN A SAFE MANNER. Persons who perform work on refrigeration systems should be thoroughly familiar with the system operating specifications as well as the safety procedures needed to avoid injury and deal with refrigerant spills. At a minimum, protective eyewear, and clothing should be used.

APPARATUS NEEDED

- Graduated sampling container (Part number ANH-MS, available from Phillips)



- A stand on which to place the sampling container while the ammonia evaporates (Part number ANH-AS, available from Phillips)
- Thin steel wire (approx 8”)
- Face shield
- Protective gloves

The following procedure allows ammonia to evaporate from an open container. Phillips has determined that the amount of moisture absorbed from the surroundings by the ammonia by using this process is small, compared to the water needed to significantly degrade system performance.

For a more precise measurement of water, as well as methods used in constructing the charts in this bulletin, refer to IIAR Bulletin No. 108.

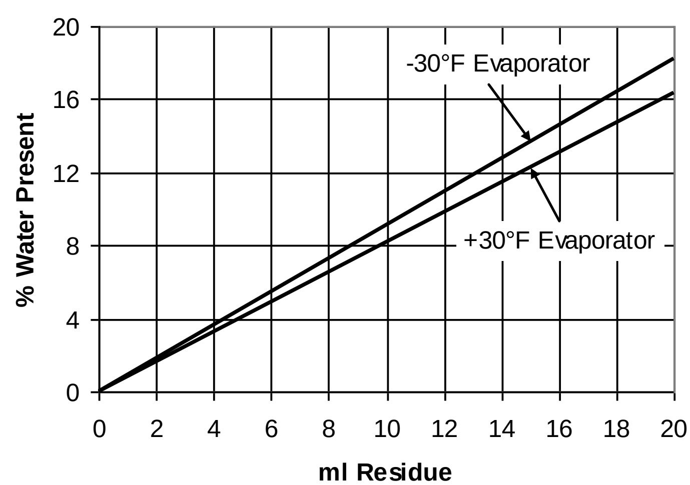
PROCEDURE

1. Wear protective clothing, including face and hand protection.
2. SLOWLY draw a 100 ml ammonia sample from al location on the cold side of the system such as the pump discharge[1] into the sampling container.
3. Place the container on a stand or rack in a safe, ventilated area and allow the ammonia to boil away completely. (1-2 hours) Note that heat from a hand touching or holding the container could cause the ammonia to boil-over. If the liquid is boiling violently, a thin steel wire should be put into the sampling container.
4. After boiling has ceased, note the volume of residual liquid at the bottom of the sampling container. This residue is water (about 70% by weight), ammonia, oil, and other impurities.
5. Compare the quantity of remaining liquid to the chart below. The charts on the reverse of this bulletin show impact of this water on system performance.

For example: If 14 ml of liquid remained after boiling the ammonia drawn from a 0°F system, this indicates the ammonia contains about 12% water. As shown on the chart on the reverse of this page, the system is losing nearly 10% of its compressor capacity.

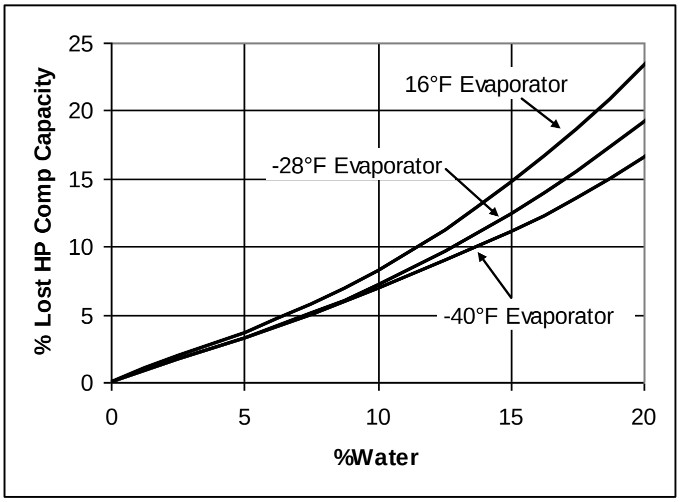
A yellowish or hazy liquid (before or after boiling) indicates the presence of impurities other than water. The Phillips Anhydrator can help remove these impurities as well.

Note that the results of this test can vary depending on the ammonia level in the low-temperature vessel when the sample is taken. More ammonia in the vessel will tend to dilute the water, resulting in smaller measured water content. Less ammonia in the accumulator will result in larger measured water content.



[1] Typical places where water will collect include the pump accumulator, flooded-shell chillers, shell-and-tube economizers, and anywhere in the system that ammonia is boiled.

LOST COMPRESSOR CAPACITY DUE TO WATER

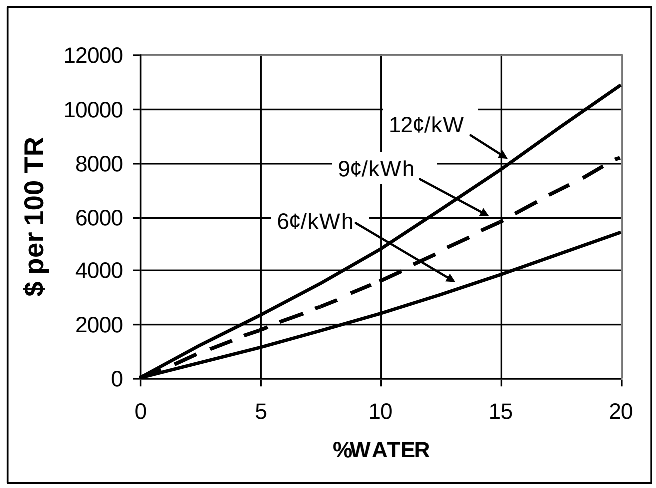


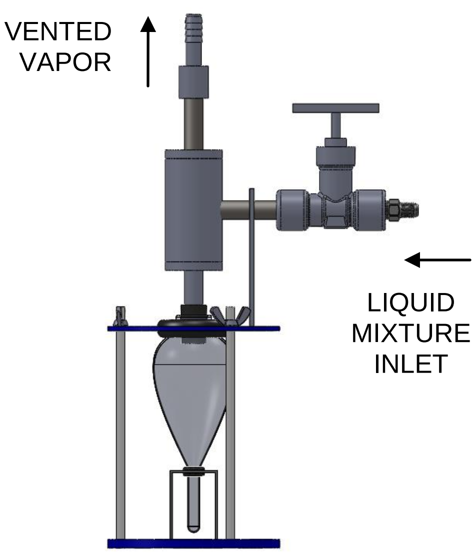
For each percent of water in the ammonia, you are losing about 1% in compressor capacity.

Chart based on increased suction temperature due to water and 2.4% lost compressor capacity per °F. (Ref: IIAR Bulletin No. 108)

ENERGY COST DUE TO WATER

With water in the system, the evaporator pressure must be lowered to maintain the desired temperature. For example a 0°F coil with 5% water in the ammonia must operate at 14.3 psig instead of 15.7 psig. So your compressor must work harder, and uses more energy. The graph (at right) shows the extra energy cost to an ideal system operating with a 0°F evaporator and 95°F condenser. For a 100 TR system operating 24/7 with 5% water in the ammonia, the extra electric power is around $2000 per year (depending on local rates).





PHILLIPS ANH-AS SAMPLING STAND KIT

The Phillips ANH-AS sampling stand kit provides a means to safely sample the water contamination level in ammonia refrigeration systems. The kit comes standard in a hard plastic case and includes a robust and stable stand, to secure the sampling container in place, and the sampling container ANH-MS. A stainless steel weldment including a needle valve for precise control of liquid flow, a liquid vapor separation chamber, and a connection for a vapor hose to safely remove ammonia vapor is also included. The ANH-AS kit meets IIAR Bulletin No. 108 standards.

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