



Ammonia Refrigeration Liquid Level Indicators



Tips to Maintain Liquid Indicator Mechanical Integrity

Ammonia refrigeration liquid level indicators require routine inspection and maintenance that follow the equipment manufacturer's recommendations. Loss of mechanical integrity can result in a significant financial loss to your business. This guide provides information on how to mitigate risk and maintain a safe and reliable refrigeration system.



Why are liquid indicators used in ammonia refrigeration systems?

Indicator assemblies are a means to visually determine the liquid level of anhydrous ammonia within receivers, intercoolers, suction accumulators, oil separators, surge drums and oil pots. They use a circular clear or frosted glass lens within a threaded housing that allows observation of the liquid level. These assemblies are available from several manufacturers, such as SEE-LEVEL™ (Hansen) and Level Eye® (H. A. Phillips), and are sold under their trademarked names.

Anhydrous ammonia release claim example

Following is an example of an anhydrous ammonia release due to loss of mechanical integrity of a liquid level indicator assembly.

A cold storage facility lost electrical power as a result of severe weather. Internal pressure in the ammonia accumulator increased from 5 psi to 30 psi. At 30 psi, one of the liquid level indicator assemblies separated from the column. An estimated 6,000 pounds of anhydrous ammonia was released in less than three minutes. Subsequent investigation determined the mechanical integrity of the liquid indicator assemblies was not being maintained per the manufacturer's requirements. The \$4 million financial impact of this release was due to ammonia contamination of food product in storage.

Key takeaway: This type of event can occur if the liquid indicators are not inspected and maintained following the requirements of the equipment manufacturer.



Generic liquid level indicator column consisting of six indicator assemblies.

Loss of mechanical integrity of a liquid indicator assembly can result in the following issues:

- Uncontrolled release of anhydrous ammonia
- Health concerns for employees and individuals in the vicinity
- Contamination to products in process or storage
- Potential fines and penalties levied by federal and state agencies
- Damage to the company's reputation and good standing in the community

What causes loss of mechanical integrity of liquid indicator assemblies?

- Cross-threading upon installation
- Threads becoming worn from overtightening
- Improper torqueing
- Assembly loosening from system operation, vibration and pressure
- Hardening of O-rings
- Inappropriately using sharp tools to remove ice from the assembly

In order to prevent loss of mechanical integrity, performing specific inspection and maintenance tasks can reduce the chances of an uncontrolled ammonia release. Consider the following when developing a written procedure:

- The liquid indicators must be designed to meet or exceed the maximum allowable working pressure of the vessel or column to which they are attached.
- The liquid indicators must be made of a material to withstand the maximum temperatures and pressures of the ammonia system. The materials must not chemically react with the materials of the system.
- The manufacturer of the liquid indicator must verify if sulfur sticks can be utilized to check for ammonia leaks. The combination of the sulfur stick, water and heat can develop sulfuric acid, causing a deterioration of the components of the liquid indicator.

- The manufacturer's maintenance schedule must be followed, as they may be more specific or specialized than this document.
- Periodic visual checks of the assembly's glass, liquid indicator threads (if visible), attachment welds, etc. must be performed. The visual check should look for discoloration, cracks, leaking O-rings, etc. Use only replacement parts approved by the manufacturer.
- Liquid indicators must not be re-installed if there is any damage to the threads, housings, gaskets or glass.
- The liquid indicators must be torqued to the manufacturer's specifications. If a statement is added to the Mechanical Integrity section of a Process Safety Management (PSM) program, the following wording is suggested: "Torque values to be utilized during initial installation and maintenance/repair work per the manufacturer's guidelines."
- All inspections, maintenance and service tasks must be recorded for tracking and trending purposes.
- It is recommended that the installation and maintenance should only be completed by technicians possessing sufficient experience to safely work on ammonia refrigeration systems.

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