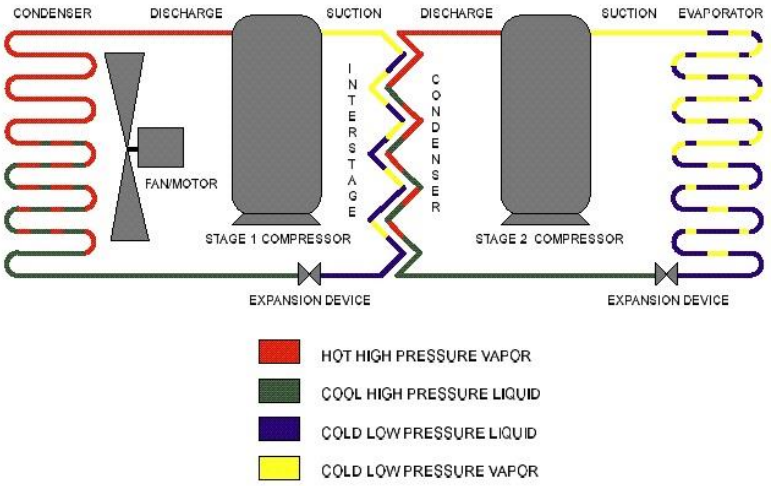
Gas Detection in Refrigeration Systems using Ammonia

Application Fields:

- Food and beverage production, processing and storage
- Refrigerated vehicles for transportation on road, train and ships, LNG/LPG vessels
- HVAC in public buildings
- Chemical industry
- Sports, ice arenas and rinks
- Schools, laboratories and hospitals

Many industries including petrochemical refining, cold storage and food processing rely on large-scale refrigeration systems for their day-to-day operations and ammonia is the most common choice of refrigerant. Household ammonia products most of us are familiar with are ammonium hydroxide (water based). However, since water freezes, refrigeration grade anhydrous (free of water and impurities) ammonia is required for refrigeration applications. Keeping the ammonia pure and free of water is extremely important for such systems.



Flow Schematic

What makes Ammonia so good for refrigeration?

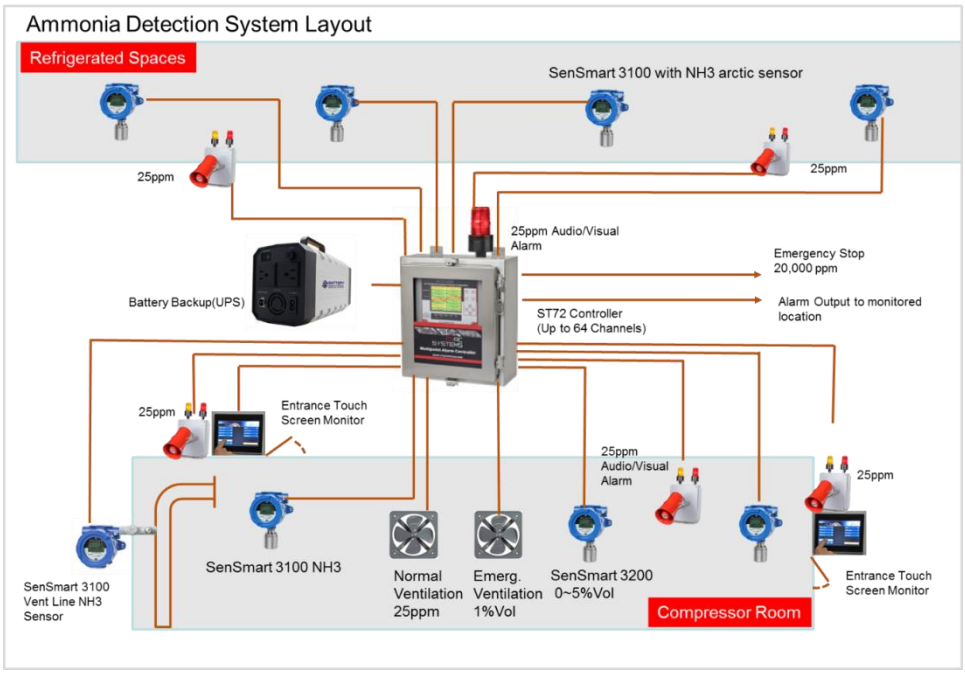
- According to the International Institute of Ammonia Refrigeration (IIAR), physical properties make ammonia 3-10% more efficient than competitive refrigerants.
- It breaks down quickly in air, unlike CFCs, and doesn't damage the ozone layer.
- Leaks and spills are identified far below hazardous levels because of its strong odor. People smell it at about 20 ppm while other refrigerants have no odor allowing leaks to go undetected.

So, what are the problems with using Ammonia in refrigeration?

- Vapor-compression refrigeration require high pressure to compress the gas into liquid, meaning large amounts of anhydrous ammonia, under high pressure, are always present.
- OSHA considers anhydrous ammonia to be "immediately dangerous to life and health" at a concentration of 300 parts per million (ppm), or 0.03%.
- Any ammonia-based refrigeration system presents risk of accidental exposure to high concentrations which could cause serious harm to human health and property.
- Ammonia is explosive but only in high concentrations (16-25%) and temperatures above 1200 degrees F. However, it is stored at high pressure and tanks can explode during a fire.

The Art of Gas Detection

How are ammonia leaks detected early to prevent accidents?



- Electrochemical sensor technology is used for 0-250PPM levels for early detection. Catalytic sensors are recommended for concentrations above 5000 PPM (.5%) to detect very large leaks or spills.
- Compressor Rooms are the most likely areas to leak ammonia and require at least two 0-250 PPM and one 0-5% fixed ammonia gas detectors connected to an alarm controller. One 0-250 PPM detector should be located under the normal ventilation fan. Others should be spaced in the breathing zone about 5 feet above the floor every 2000 sqft. The 0-5% detector should be located 5 feet above the floor and below the emergency ventilation fan. It should activate the EV fan (1% alarm trip) and also shut down compressors, pumps and disconnect power sources (2% alarm trip).
- Refrigerated Rooms should have 0-100PPM detectors and 25PPM alarm trips to ensure personnel protection and early leak detection. The alarm controller should trigger audio-visual indicators at monitored locations. Locate sensors in the breathing zone about 5 feet above the floor. Install enough detectors to be within 30 feet of potential leak sources.

RC Systems' Recommendation:

Wired Gas Detection System		
Gases	Detectors	Controllers
Ammonia (NH3) 0-5%	SenSmart 5200 Catalytic	ViewSmart 400 (Up to 4 points)
Ammonia (NH3) PPM	SenSmart 5100 EC	ViewSmart 1600 (Up to 16 Points)
Carbon Dioxide (CO2)	SenSmart 5400 IR	ViewSmart 6400 (Up to 64 Points)

Wireless Gas Detection System		
Gases	Detectors	Controllers
NH3, O2	SenSmart 7100 EC	WNR WaveNet Receiver
CO2	SenSmart 7400 IR	(Up to 32 Points)