



Indian Refrigeration And Cold Chain Industry



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The refrigeration industry predominantly uses ammonia as a refrigerant. Ammonia systems are normally field-erected, since packaged refrigeration systems are manufactured by very few companies and are much more expensive than field-erected systems. The percentage of factory made packages is less than 1 to 2%.

The refrigeration industry comprises mainly of cold storages, and ice plants of various types like block ice, IBT, flake ice and tube ice machines. Industrial refrigeration systems are also field-erected.

In field-erected systems, compressors, motors and air coolers are purchased from manufacturers and rest of the items like condensers and receivers are fabricated at some workshop or at the site. These components are located at the site and connected with piping and controls to fabricate a closed system before the refrigerant is charged.

Currently, there are no mandatory standards for design, erection and commissioning of such systems. More than 70% field-erected systems are designed and installed by personnel who are not qualified engineers – mostly technicians who have seen a few projects executed by some established companies and have some erection experience. This results in the use of incorrect or scrap materials for fabrication of heat exchangers, pressure vessels, piping and fitting materials as well as incorrect erection practices, especially for interconnecting these components with piping.

Due to such incorrect practices, ammonia refrigerant has unnecessarily earned bad publicity as it leaks out and, being toxic, causes discomfort or harm in occupied areas.

Some of the current industry trends are:

- i. Association of Ammonia Refrigeration (AAR) is a registered organization with over 51 leading corporate members. The objective of AAR is to improve the current state of practices followed as mentioned above so that unnecessary criticism of ammonia refrigeration systems is neutralised

and installations become safe. The Association has now prepared Standard AAR-1 for safe design of closed circuit ammonia refrigeration systems. The Standard includes design requirements for equipment, and specifies the correct materials to be used and correct piping practices. It also covers operation and maintenance aspects. The Standard is specifically prepared to suit Indian climatic conditions and is much more exhaustive compared to similar international standards. A presentation has been made to BIS, and the Standard is under active consideration of the government for adoption as there is no similar standard available in India or elsewhere.

- ii. AAR has conducted more than 200 training programs and is continuing doing so for engineers and technicians with a view to improve the overall standards of ammonia systems.
- iii. Make in India: The current government's 'Make in India' campaign is persuading many international as well as Indian companies to establish manufacturing and R&D facilities in India. Refrigeration equipment manufacturers, who abandoned manufacturing of many products due to the globalisation policy of the earlier government, are now thinking of resuming production of these items, like centrifugal compressors, screw compressors and package chillers. More and more multinationals are establishing their manufacturing and R&D facilities in India due to the availability of skilled labour as well as qualified engineers. There are mainly two issues currently facing the refrigeration and air conditioning industry:
 - a. Global warming due to the use of man-made synthetic refrigerants.
 - b. Energy efficiency improvement required, since more than 40% energy is consumed by this industry.

When the AC&R industry was born at the beginning of the 20th century, all the refrigerants used were natural refrigerants like ammonia, carbon dioxide and sulphur dioxide. Man-made refrigerants were introduced in early 1920s and they quickly captured many applications. These refrigerants were considered as man-made but god-sent chemicals till it was realized after nearly 50 years that they are causing ozone depletion, and were phased out as per the Montreal Protocol. Another batch of man-made refrigerants to replace these

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chlorine-based chemicals was introduced and although they have no ozone depletion potential, they have high global warming potential.

Engineers all over the world, especially in Europe, China, Australia and some developing countries, therefore came together to phase out these refrigerants in a timely manner. This resulted in the Kigali Amendment to the Montreal Protocol in 2016 to phase out the currently used chemical refrigerants R404A, R410A, R134a, etc.

The industry has also realized that the future lies in natural refrigerants such as ammonia, hydrocarbons, air and water; the industry is coming back to what it started with. Natural refrigerants, although they have some limitations, have been available in nature since the beginning of life on earth and contain no unknown surprises if we use them in the AC&R industry.

The leading contender is ammonia due to its advantage of excellent energy efficiency and near zero global warming potential, which no other known refrigerant possesses. Engineers working in the area of R&D have therefore developed or are developing ammonia hermetic scroll compressors and semi-hermetic screw and reciprocating compressors for use in small capacity air conditioning and refrigeration systems.

Low charge ammonia systems and roof mounted air and water-cooled packages using ammonia as the refrigerant are available. Direct expansion systems using miscible oils

are also available. Mixtures of ammonia with other natural hydrocarbons like dimethyl ether to reduce toxicity are being tried. Large airports and office buildings in Europe have started using ammonia as the refrigerant. (Please see my article in the June 2017 issue of the *Journal*.)

Hydrocarbons like propane are being used in room air conditioners and isobutane in domestic refrigerators in China and India as well as in developed countries. Supermarkets are increasingly using ammonia-carbon dioxide cascade systems. Passenger cars are using carbon oxide as the refrigerant, and trains are experimenting with air.

ASHRAE News, in its edition on January 11, 2018 has reported:

Researchers Develop Water-Based, Energy-Saving Air Conditioner

Singapore—Researchers at the National University of Singapore (NUS) have developed a water-based air conditioning system designed to cool air to as low as 18°C (64°F) without compressors and chemical refrigerants. According to NUS, the system consumes about 40% less electricity than conventional compressor-based air conditioners. The system also generates drinking water – an estimated 12 L to 15 L (3 gallons to 4 gallons) per day – while it cools ambient air.

Looking at all these developments, I am more than convinced that the future of this industry would be totally based on the use of natural refrigerants with ammonia playing a leading role in all AC&R applications.



Pankaj Mehta
Managing Director
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The cold chain in India is still relatively small, but there has been a marked improvement in the understanding of the various components of the cold chain in the past few years.

Some recent changes made by the government could have a positive impact on the growth of the cold chain. The implementation of the Goods and Services Tax (GST) has already seen transit time for reefer trucks improve on long haul routes. The GST structure would also enable the hub-and-spoke distribution model with simplified logistics across state borders.

The government has granted infrastructure status to the logistics sector, which will help to reduce the cost of logistics. Increased awareness of food safety and the introduction of

new regulations are paving the way for the proliferation of the cold chain.

Growth in dairy and produce transportation via reefer trucks has resulted in an increased requirement for affordable and simple refrigerated transport solutions, for which Carrier Transicold India has recently developed and introduced the Citifresh™ range of direct drive truck units with robust design and stainless steel evaporator, suited for demanding applications. We have also introduced advanced telematics solutions for diesel truck and trailer units for remote monitoring and control of refrigeration units, and tracking of consignments with a strict watch over temperature integrity.

Carrier Transicold provides customers around the world with advanced, energy efficient and environmentally sound transport refrigeration solutions, including equipment for vans, trucks and trailers for transportation of fresh and frozen food, pharmaceuticals and other perishables both for long range transport and for urban distribution.

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