

Cool Concepts

For Industrial Refrigeration Systems

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What is Industrial Refrigeration?

The title for this issue might seem like a rhetorical question. Is industrial refrigeration only concerned with ammonia refrigeration systems?

With the exception of a few systems, you might be inclined to say the majority are using ammonia as the refrigerant. What about other systems that do not use ammonia?

Some facilities may be using R-22 in a liquid overfeed system. Are these industrial refrigeration systems? A liquid overfeed system for ammonia or R-22 are similar, except for the difference in oil recovery issues.

The use of carbon dioxide (CO₂) as a refrigerant is returning to more prevalent use after a long absence. In the last few years an increased interest in the use of CO₂ for low temperature systems has been seen.

In some applications we see CO₂ used in a close loop system where the refrigerant is being circulated by compressors in direct expansion (DX) systems.

In other applications you may see liquid CO₂ being circulated by pumps. This may be for

either phase change (boiling) in a liquid overfeed system or as a sensible heat transfer fluid.

Look at some of the freezing tunnels using cryogenic fluids such as nitrogen or CO₂. These systems are an example of expendable refrigerants.

The refrigerant undergoes an expansion process (similar to any conventional refrigeration system) to produce a cooling effect in the tunnel. After the refrigerant has absorbed as much heat as possible, it is vented to the atmosphere.

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Some other interesting applications of refrigeration systems use hydrocarbons as the refrigerant.

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Propane is a very good refrigerant that is in common use in large industrial/process applications. Ethane has also been used for very low temperatures (-100°F or lower) in cascade refrigeration systems.

In the examples above we see one common principle. We are using different fluids as refrigerants for various purposes.

In some applications, the refrigerant undergo an expansion process from a higher pressure to a lower pressure. During this expansion process, the refrigerant goes through a phase change (latent heat by boiling). Useful cooling is accomplished by the cold liquid and vapor absorbing heat.

In other applications, the refrigerant is pumped through the system and remains in a liquid state, only absorbing sensible heat.

The choice of refrigerant used in a refrigeration system is based on many factors, some of which are:

1. Low specific mass flow
2. High latent heat (for phase change applications)
3. High specific heat and low viscosity (for sensible heat transfer applications)
4. Operating pressures above atmospheric pressure (to reduce operation in a vacuum)
5. Familiarity and experience with actual refrigerant for safety reasons
6. Low refrigerant cost and environmental impact

The refrigeration system can be used for food freezing, maintaining warehouse temperatures, soil freezing for excavation pur-

An industrial refrigeration system can use any one of, or combination of, the following processes:

- Latent heat process known as phase change (boiling)
- Sensible heat transfer
- Expendable refrigerant used once and vented to atmosphere

poses, generating ice, or environmental testing purposes.

Any combination of processes can be accomplished with the basic principles of industrial refrigeration.

Now back to the original question, what is industrial refrigeration?

One definition may look something like this; industrial refrigeration is a process where a custom engineered system is designed to use various components that work with a fluid to produce the desired cooling in an economical and safe manner.

The one thing to remember about refrigerants is that the "basics" apply to them all. Subcooling, superheat, expansion processes, and compression. These principles do not change with various refrigerants.

The variety of system applications and equipment selected to produce the refrigerating effect is only limited by your imagination.

Cold Systems, LLC provides technical assistance to owners and other users of refrigeration systems. Using our services will provide you with long-term value and benefits of:

- Energy reduction with increased efficiency & equipment capability, and
- Reduction of challenging issues & improved operational flexibility

We offer a broad range of services designed to promote safety, reliability, and cost effectiveness for refrigeration systems. You can rely on our 35 years of experience to help solve your problems and increase the cost-effectiveness of your refrigeration system .

