



# PACKAGED REFRIGERATION EQUIPMENT BUYER'S GUIDE



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**WHAT TO LOOK FOR WHEN SELECTING  
LOW-CHARGE PACKAGED REFRIGERATION EQUIPMENT**

*for your facility*

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### **Packaged Refrigeration Equipment Buyer's Guide**

What to look for when selecting low-charge packaged refrigeration equipment for your facility

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Stellar  
2900 Hartley Road  
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## WHY SHOULD YOU CONSIDER LOW-CHARGE *packaged refrigeration equipment?*



### REFRIGERATION FOR THE FUTURE

Ammonia has been the dominant, go-to refrigerant for industrial refrigeration for nearly 100 years. Ammonia is not only environmentally friendly, with zero global warming potential (GWP) and zero ozone depletion potential (ODP), but it's also energy efficient, inexpensive and readily available.

However, while ammonia may be “greener” than soon-to-be-phased-out hydrofluorocarbons (HFCs), such as R22 or R134A, it is still toxic and flammable in certain concentrations. This, of course, has led to the development of very specific design and operational regulations so facilities can tap into ammonia's benefits while operating safely.

But now, the refrigeration industry is aiming higher. There has been a push to take advantage of the benefits of ammonia while reducing the risks—and it has resulted in an innovative solution: **low-charge packaged refrigeration equipment** that uses ammonia or CO<sub>2</sub> and a **secondary refrigerant** (such as glycol). This allows facilities to reap the benefits of ammonia's excellent thermodynamic properties while minimizing the charge and risk.

This new type of system is “**packaged**” or “**modular**,” with refrigeration equipment built off site, mounted on a structural steel base, and delivered to your plant as a self-contained, “plug-and-play” system. Because it uses secondary refrigerants, which isolates ammonia to the machine room and only uses about one pound of ammonia per ton of refrigeration, the charge is minimized.



## 5 BENEFITS OF LOW-CHARGE PACKAGED REFRIGERATION EQUIPMENT UTILIZING A SECONDARY REFRIGERANT

- 1: ENHANCED SAFETY** — Secondary refrigerant systems **reduce the total quantity of primary refrigerant**. Ammonia is isolated to the machine room, **reducing the risk** to plant personnel in the event of a leak. This means that **no ammonia is in the process space** and ammonia detection is **not required in multiple rooms**. Facilities with more than 10,000 pounds of ammonia must comply with [Occupational Safety and Health Administration \(OSHA\) rule 29 CFR](#), but secondary refrigeration systems use less than that amount.
- 2: SPACE SAVINGS** — Each packaged unit is comprised of refrigeration equipment **mounted on a structural steel base, complete with interconnecting piping, valves and instruments**. Because refrigeration components are incorporated and compacted into one, single unit, these natural chillers assume a **smaller space** within the facility and **do not require a large machine room**.
- 3: LOWER TOTAL COST OF OWNERSHIP** — Ammonia is **less expensive** than hydrofluorocarbons (HFCs) and other refrigerants. For example, it takes **six volumes of R134A** to produce the same cooling effect as **one volume of ammonia**. Because of the lower energy cost, low-charge packaged refrigeration equipment is **cost competitive** over its lifetime.



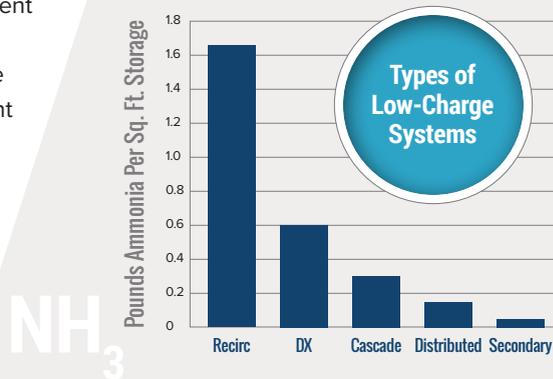
- 4: INSTALLATION BENEFITS** — Modular refrigeration equipment is built in a controlled facility, which makes the process **more efficient and less dangerous** for those constructing it. Packaged refrigeration systems are cheaper and safer to build and install thanks to less onsite construction.
- 5: USE OF ENVIRONMENTALLY FRIENDLY REFRIGERANTS** — Ammonia does not harm the environment and has **zero ozone depletion potential (ODP)** and **zero global warming potential (GWP)**. In July 2015, via the Significant New Alternatives Program (SNAP), the Environmental Protection Agency (EPA) announced the **delisting of the use of R134A, R404A, R507A and other high-GWP HFCs** as of 2017 or later. Under SNAP, each application with a delisted HFC is approved for the use of a natural refrigerant like ammonia. Exactly what lies ahead in terms of legislation and oversight has yet to be determined; however, strict regulations on the use and phaseout of high-GWP refrigerants is certain.

## WHICH PACKAGED REFRIGERATION SYSTEM IS

*is best for your facility?*

When considering modular packaged refrigeration equipment for your facility, it's key to understand **how many tons of refrigeration you need and at what temperature**. (If you're unsure, reach out to your packaged refrigeration equipment provider for clarification).

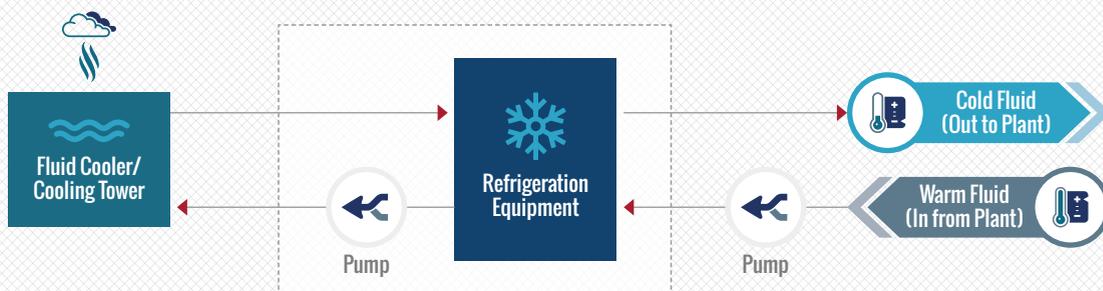
Then, examine the **five different types of low-charge packaged refrigeration equipment** so you can work with your packaged refrigeration equipment manufacturer to understand which may be best for you.



*natural alternative*

### HOW DOES LOW-CHARGE PACKAGED REFRIGERATION EQUIPMENT WORK?

Heat to Atmosphere



#### SIMPLE BLOCK FLOW:

By using a small quantity of ammonia to make chilled water/brine, systems with a secondary refrigerant offer an alternative to traditional ammonia systems, or a natural alternative to centrifugal chillers/freon systems.

## 5 TYPES OF LOW-CHARGE PACKAGED CHILLERS

- 1: RECIRCULATION SYSTEM** — A recirculated system utilizes a **centralized refrigeration machine room** where pumps recirculate expanded, cooled liquid from a vessel. Typically, excess liquid refrigerant is provided to the evaporators (cooling coils) to **increase heat transfer** in the evaporators. If there is excess liquid fed to the evaporators (known as overfeed) it is carried back to the vessel in the suction line (known as wet suction).
- 2: DIRECT EXPANSION (DX) SYSTEM** — A DX system uses the pressure differential provided by the refrigerant compressors to **move room-temperature, high-pressure liquid from the centralized refrigeration machine room to the evaporators**. The refrigerant is expanded, and therefore cooled, **directly at the unit**. Typically, the liquid is fed to the evaporator at a rate that allows the refrigerant to evaporate so there is **typically no liquid found in the suction line** (known as dry suction).
- 3: CASCADE SYSTEM** — A **cascade system** uses a combination of **two centralized refrigeration systems** (secondary refrigerant) **to work in unison to provide cooling to evaporators**. The high-temperature refrigeration system (usually ammonia) **pulls heat away from the lower-temperature refrigeration system**. The lower-temperature refrigeration system (usually CO<sub>2</sub>) typically uses recirculated liquid to provide cooling to the evaporators.
- 4: DISTRIBUTED SYSTEM** — A **distributed refrigeration system** uses **localized refrigeration systems** located near the evaporator to keep the refrigerant charge lower. Each evaporator **has its own compressors and condensers**.
- 5: SECONDARY SYSTEM** — A secondary refrigerant system uses a **centralized refrigeration system** to chill large amounts of a secondary coolant (also known as secondary brine, or glycol). The secondary coolant is then pumped out to each air handling unit. **Primary refrigerant does not leave the machine room**, so the refrigerant charge is minimized and the risk of exposure to plant personnel is greatly reduced.



## HOW TO FACILITATE AN EFFICIENT PACKAGED REFRIGERATION EQUIPMENT *installation process*



### KEY INSTALLATION QUESTIONS TO ANSWER FOR YOUR PACKAGED REFRIGERATION EQUIPMENT



1

#### WHERE WILL YOUR PACKAGED EQUIPMENT UNIT BE LOCATED?

Features will vary depending on the location of your system. For example, if installed outside, your modular equipment must be designed within an enclosure to protect the system.



2

#### IS YOUR FACILITY CAPABLE OF ACCOMMODATING A PACKAGED REFRIGERATION EQUIPMENT INSTALLATION?

Packaged equipment is a plug-and-play system, fully designed and built before arriving at your facility. Thus, your facility's doors and walkways must be large enough to accommodate the installation of such equipment. If not, you will need to make the appropriate modifications to your facility.

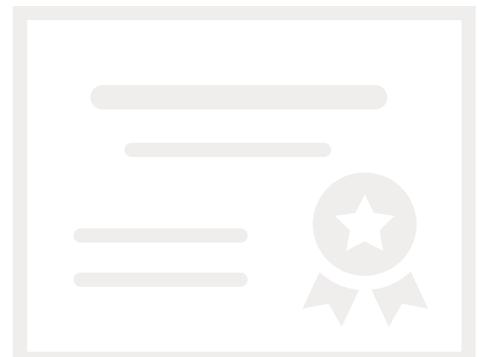
*plug-and-play*

## WHAT TO LOOK FOR IN A MODULAR REFRIGERATION EQUIPMENT PROVIDER

As packaged refrigeration equipment becomes increasingly popular, more and more providers continue to emerge in the marketplace. But, like your unit, not every provider is built the same. Do your due diligence and look for the following qualities to ensure you're finding the best modular refrigeration equipment provider for your needs:



- 1: PACKAGED REFRIGERATION EQUIPMENT EXPERTISE —** Examine your provider's experience in designing and installing ammonia and carbon dioxide systems. Who are their previous clients? Does their portfolio range in systems with varying tons of refrigeration?
- 2: MULTIPLE FABRICATION LOCATIONS —** Where are your provider's fabrication shops located? Where will your system be built? While fabrication can technically occur anywhere in the country, engaging a provider with a fabrication shop close to your facility will facilitate cheaper shipping costs.
- 3: TOTAL REFRIGERATION INDUSTRY SOLUTIONS —** Is the provider well-rounded in the refrigeration industry? Hiring a provider who has a range of refrigeration capabilities ensures they understand your refrigeration needs, top to bottom. In addition to refrigeration contracting services, research their other in-house services. Do they offer installation, in-house parts, nationwide service, automation and process safety management (PSM)? Ensure you're working with a *refrigeration expert*, not just a *refrigeration equipment provider*.
- 4: NATIONWIDE INSTALLATION AND SERVICE CREWS —** Does the provider have parts and service available near your plant? Understand not only your access to parts inventory and refrigeration service professionals, but how quickly these elements can be shipped or dispatched to meet your needs.
- 5: CUSTOMIZABLE SOLUTIONS —** Does the provider offer project-specific designs to meet your unique needs? Examine the variability with your packaged refrigeration equipment design. What are the customization options available to you? Do they offer enclosures to ensure your system is safe in its location? Do they offer pre-wiring and pre-insulation?
- 6: STANDARD SOLUTIONS —** Custom solutions are not always the answer. In fact, a wide range of standard solutions can greatly reduce cost and lead time. So while it may be important to determine if the provider offers a range of custom solutions, it's also important to determine if the provider can help you decide if a standard product may be the best solution for your needs.



## STELLAR – THE *undisputed leader* IN REFRIGERATION

With 30+ years of experience, Stellar is the undisputed leader in industrial refrigeration for food processing plants and cold storage facilities. We offer the industry's most comprehensive range of self-performed services, from initial system design and contracting to refrigeration parts, service, maintenance and everything in between. Our team of more than **120 full-time refrigeration engineers, designers, field service specialists, and experts** in automation and controls all work together to deliver the best outcomes for our clients. With **more than 1,000 food and distribution systems installed to date**, we have experience in all major refrigerants, including CO<sub>2</sub> and ammonia.

**120**  **FULL-TIME REFRIGERATION ENGINEERS, DESIGNERS, SPECIALISTS & EXPERTS**



**PACKAGED REFRIGERATION EQUIPMENT SOLUTIONS THAT DELIVER QUALITY, ENERGY EFFICIENCY AND LOWER INSTALLATION COSTS**

Stellar offers standard off-the-shelf packaged refrigeration equipment in addition to custom-designed equipment to match our clients' unique needs and applications. We serve markets including food and beverage, distribution, HVAC and pharmaceutical. Our natural refrigeration systems are factory built and quality controlled, allowing for high-quality builds, enhanced safety and a compact and efficient design.

Our modular refrigeration equipment experts prioritize quality, focusing on every detail throughout the design and fabrication process. Due to our nationwide parts inventory and service network, Stellar provides clients unmatched access to high inventory levels and 24/7 service response, keeping systems maintained to the highest standards.

Our designs use natural refrigerants, greatly reducing refrigerating operating costs. With operating ranges spanning from -50°F to +50°F, Stellar's packaged refrigeration equipment designs provide better peak and part load efficiencies than traditional systems, with significantly lower refrigerant charges. Our low-charge systems produce one ton of refrigeration while using less than one pound of ammonia.

All of our packaged equipment designs are available pre-insulated and pre-wired with factory-built enclosures for immediate startup, resulting in less onsite construction and shorter lead times.

*custom-designed*

## ABOUT STELLAR

Stellar is a fully integrated design, engineering, construction and mechanical services firm that provides the industry's most comprehensive range of self-performed services. More than 600 Stellar employees worldwide create food processing plants, refrigerated warehouses, distribution centers, commercial buildings and military facilities. In addition to its Jacksonville, Florida, headquarters, Stellar operates tactical support locations and offices throughout the United States and across the world.



STILL HAVE QUESTIONS ABOUT LOW-CHARGE PACKAGED REFRIGERATION EQUIPMENT?  
**SCHEDULE A COMPLIMENTARY, NO-OBLIGATION CONSULTATION.**

2900 Hartley Road  
Jacksonville, FL 32257

Phone: **904-260-2900**  
Toll-free: **800-488-2900**  
Packaged Solutions: [bfrance@stellar.net](mailto:bfrance@stellar.net)

[info@stellar.net](mailto:info@stellar.net) | [stellar.net](http://stellar.net)

