

PLANNING | DESIGN | PRE-CONSTRUCTION | CONSTRUCTION | REFRIGERATION | MECHANICAL & UTILITY | BUILDING ENVELOPE | TOTAL OPERATIONS & MAINTENANCE

WHITE PAPER:

PACKAGED REFRIGERATION SYSTEMS (PRS)

7 key advantages over traditional field-built systems

NH360
PACKAGED REFRIGERATION SYSTEMS

 **stellar**
TAKING SOLUTIONS FURTHER®

stellar.net | 904-260-2900



INTRODUCTION

A traditional (or “field-built”) refrigeration system consists of a machine room and several components such as compressors, heat exchangers, vessels, control panels, piping, valves and instruments.

Today, contractors building traditional refrigeration systems face many challenges, including rising construction costs, high per diem, skilled trade shortages and delays resulting from inclement weather. Product manufacturers are racing to get their products on the shelf faster and faster while contractors are trying to improve efficiency and reduce installation cost, all while working to accommodate accelerated schedules.

One way to accomplish the goals of both the manufacturer and the contractor is by using a **Packaged Refrigeration System (PRS)**. A packaged refrigeration system consists of the same components found in a traditional field-built system, however the components are mounted on a steel base and assembled off site in a controlled environment.

In this white paper we will discuss the benefits of choosing a Packaged Refrigeration System over a traditional field-built refrigeration system. As you will see below, the shift of labor from the job site to a controlled manufacturing facility positively affects all aspects of a project.

THE *Advantages* OF A PACKAGED REFRIGERATION SYSTEM

① IMPROVED SAFETY

Safety is perhaps the most important benefit of prefabrication or off-site manufacturing. The shift of labor from the job site to a controlled manufacturing facility improves safety for those doing the prefabrication work (when compared to doing the same task at the job site) and for those doing other necessary work at the job site. Here are some safety benefits of prefabrication:

- ▶ Fewer contractors, less debris and fewer deliveries reduce job site congestion.
- ▶ Safety measures are easier to monitor in a factory setting.
- ▶ Dangers associated with harsh weather and elements are eliminated.
- ▶ Less overall man hours result in a lower potential for safety issues.
- ▶ More efficient use of tools and cranes.

② MINIMAL PLANT INTERRUPTION

Job site congestion is greatly reduced at both existing plants (i.e., upgrade projects) and at greenfield plants because the refrigeration system is assembled off site. At existing sites, the reduced congestion minimizes disruption to plant production, delivery and shipment of products.

③ LOWER COST

Several aspects of the Packaged Refrigeration System contribute to lower capital cost:

- ▶ The reduced overall schedule results in fewer installation man hours.
- ▶ Increased labor efficiency results in fewer total man hours.
- ▶ A machine room is smaller, or potentially not required.



4 REDUCED OVERALL SCHEDULE

Constructing the refrigeration system in a controlled environment (i.e., a manufacturing facility) can save months when compared to a traditional system:

- ▶ Labor efficiency is greater, resulting in fewer installation man hours.
 - ▶ Work is not subject to weather delays, work stoppage, waiting for cranes, etc.
 - ▶ Off-site construction of the system can proceed while permits are in process. This is a significant time saver since permits often take months to obtain and on-site construction work cannot begin without them.
 - ▶ Completion of the machine room is not a prerequisite to construction of the refrigeration system. Since the system is built off site, construction of the refrigeration system can be concurrent or even ahead of the machine room construction. The contractor can install the refrigeration system the same day the machine room is completed, shaving several months off the installation schedule when compared to a traditional system.
 - ▶ Packaged systems can be built with integrated enclosures, eliminating the traditional machine and resulting in a significant savings.
-

5 IMPROVED QUALITY

The shift of labor from the job site to a controlled manufacturing facility improves quality in a number of ways:

- ▶ The controlled environment of a manufacturing facility and use of automated tools provides reliable working conditions that contribute to a high-quality product.
 - ▶ The controlled environment lends itself to more thorough testing techniques and traceability of components.
 - ▶ Material and equipment are removed from the elements during assembly, providing a better product at delivery.
-

6 ADDRESSES SKILLED LABOR SHORTAGES

A lack of skilled tradesmen has become one of the construction industry's largest challenges. As noted in [The Wall Street Journal](#) article, "A shortage of skilled workers is stirring a variety of responses in the construction industry, from higher wages to an increasing reliance of prefabrication work." By shifting the labor from the job site to a controlled manufacturing facility, skilled labor is concentrated to one area with the following benefits:

- ▶ Increased labor efficiency requires fewer people to do the same job.
- ▶ Prefabrication results in increased efficiency through repetition.
- ▶ Many industrial job sites are in remote areas where skilled labor is scarce. Prefabrication eliminates the cost of per diem and allows the work to be done in an area where skilled labor is available and where staff is familiar with the work.



7 MULTIPLE MACHINE ROOM / ENCLOSURE OPTIONS

Packaged Refrigeration Systems can be installed in a variety of locations with three key machine room enclosure options available, each with their own advantages:

- 1: A **TRADITIONAL MACHINE ROOM** offers access for maintenance, operation and can be designed for future equipment installation. Access for equipment removal is often through a large roll-up door that allows fork truck access to the equipment; however, it is much more expensive and adds to the overall duration of construction when compared to the other two options. Machine room construction must begin several months before the PRS units are delivered and the units cannot be installed until the machine room is complete.
- 2: A site-built **PRE-ENGINEERED METAL BUILDING (PEMB)** is often the most cost-effective solution for large or multiple units and offers access for maintenance and operation like that of the traditional machine room at a much lower price and shorter duration of construction. Access for equipment removal and future equipment installation is through removal panels. Construction must take place about three weeks prior to arrival of the PRS units. One wall is typically left off the building until the skids arrive at the job site.
- 3: A **SKID-MOUNTED INTEGRATED ENCLOSURE** is the most compact and often most cost-effective solution for small- to mid-size units. Access for maintenance, operation and equipment removal is through removable panels. The skid and enclosure are delivered to the jobsite as a single unit for installation on the ground or roof.

PRS UNIT ENCLOSURE OPTIONS

	Traditional Machine Room	Site-Built PEMB	Skid-Mounted Integrated Enclosure
INSTALLATION FEATURES			
Must be installed at ground level	X	X	
Can be installed outdoors on ground or roof			X
Smallest overall footprint			X
Size on single PRS limited by enclosure shipping constraints			X
SCHEDULE ADVANTAGES			
PRS fabrication is concurrent with enclosure erection	X	X	X
PRS cannot be installed until machine room is completed	X	X	
Enclosure is built off site and shipped with PRS			X
On-site erection of enclosure is required	X	X	
MAINTENANCE & PERSONNEL ACCESS			
Personnel has full access within enclosure	X	X	
Personnel access only through panels on outside of enclosure			X
Easy access to multiple units	X	X	
Equipment removal via removable access panels		X	X
Equipment removal through roll-up door	X		
Fork truck access within enclosure	X		



KEY FEATURES AND BENEFITS

Packaged Refrigeration Systems offer many installation benefits and key features:

	Traditional Field-built System	PRS
INSTALLATION BENEFITS		
Refrigeration system assembly can begin before all permits have been approved		X
Refrigeration system assembly is concurrent with machine room erection		X
Can be installed at ground level	X	X
Can be installed on roof		X
Reduced footprint		X
KEY FEATURES		
Size of system is not limited by shipping constraints	X	
Eliminates the need for a steel base	X	
Reduced footprint		X
Factory-installed insulation		X
Factory-installed electrical controls wiring		X
Factory-installed electrical power wiring		X
Factory-installed valve tags and pipe labels		X
Factory pressure test and evacuation		X



EXAMPLES OF PACKAGED REFRIGERATION SYSTEMS IN USE

FOOD FACILITY

For one client, the use of a Packaged Refrigeration System with a PEMB enclosure was instrumental in completing the entire project 20 weeks from receipt of the purchase order. Each unit was built, inspected and tested in the controlled environment of a manufacturing facility prior to shipment to the job site. The PRS units were built concurrent to the process building.

Equipment included in this system:

Description	Qty	Type	Load/GPM	Temp	Length	Width	Height	Weight (Lbs)
PRS 1	1	NH ₃	335TR	-50F	40'-0"	15'-0"	14'-0"	100,000
PRS 2	1	NH ₃	1220TR	18F	32'-0"	15'-0"	13'-0"	63,000
PRS 2	1	Glycol Pump Package	925GPM	N/A	11'-0"	10'-3"	11'-6"	20,000
Enclosure	1	PEMB	N/A	N/A	68'-0"	44'-0"	20'-0"	N/A

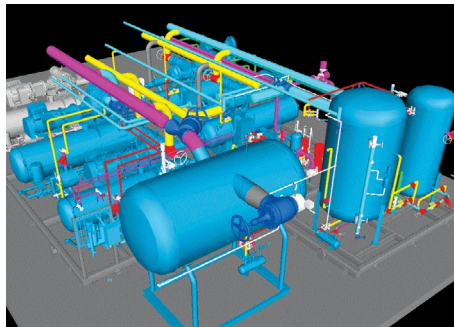
The following photos illustrate the timeline of PRS manufacturing and PEMB installation:

Weeks 1-4:

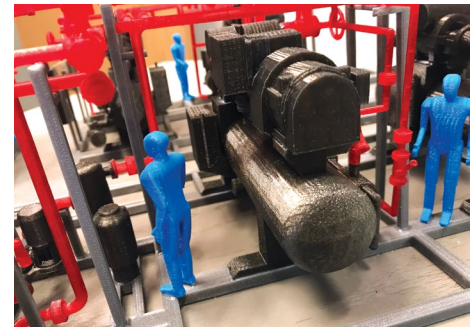
Equipment is ordered; a 3D design model, 3D printed model, fabrication drawings and submittals are created.



NO WORK DONE ONSITE



3D DESIGN MODEL



3D PRINTED MODEL

Weeks 4-8:

Base frames complete; piping is prefabricated; valves and equipment begin arriving at manufacturing facility.



NO WORK DONE ONSITE



PACKAGE BASE FRAME



EQUIPMENT BEGINS TO ARRIVE AT FABRICATION SHOP



Weeks 8-12:

Equipment is installed on steel base; piping installation begins; material for the PEMB is ordered.



NO WORK DONE ONSITE



PACKAGE FABRICATION IS UNDERWAY



Weeks 12-15:

Piping installation is completed; electrical controls wiring is installed; final QA/QC checks and testing are completed; final paint is applied to the PRS units; units are loaded and ready to ship from the manufacturing facility. PEMB erection begins and is completed at the job site.



SITE WORK BEGINS



ERECTION OF PEMB BEGINS AT WEEK 15



PACKAGED UNITS READY TO SHIP



PACKAGED UNITS ARE LOADED FOR DELIVERY

Week 16:

PRS units are loaded at the manufacturing facility, delivered to the job site and installed inside the PEMB. Last wall of PEMB is installed while construction is still underway at the job site.



PEMB IS READY FOR PACKAGE INSTALL



PACKAGED UNITS ARE INSTALLED



Weeks 20: Start-up



DISTRIBUTION FACILITY

Poor site conditions, no parking, and no lay down area would have created an unsafe and inefficient working environment for this project. In addition, permitting issues resulted in months-long delays for the refrigeration contractor.

Use of a Packaged Refrigeration Systems for this project provided the following benefits:

- 1:** Created a safer work environment for the refrigeration contractor.
- 2:** Reduced job site congestion.
- 3:** Reduced the overall schedule by allowing the refrigeration system to be assembled prior to permit approval.
- 4:** Reduced overall installation time of the refrigeration system.

Equipment included in this system:

Description	Qty	Type	Load/GPM	Temp	Length	Width	Height	Weight (Lbs)
PRS 1	1	NH ₃	502TR 212TR	-23F 20F	45'-0"	15'-6"	14'-0"	85,000
PRS 2	1	CO ₂	100TR	-60F	22'-6"	15'-6"	12'-0"	35,000

The PRS units were loaded at the manufacturing facility and transported to the job site located approximately six miles away. The units were unloaded and installed that same day. Unloading was not able to take place until after 9:00 p.m. due to crane restrictions imposed by the job site's proximity to an airport.

The following timeline illustrates the process to load, deliver, off-load and install the PRS units:

8:00 AM – 10:00 AM:

Crane is set up at manufacturing facility.





10:00 AM – 12:00 PM:

PRS units are loaded at the manufacturing facility.



12:00 PM – 6:00 PM:

PRS units are staged nearby until the end of the day when all other trades are off site.

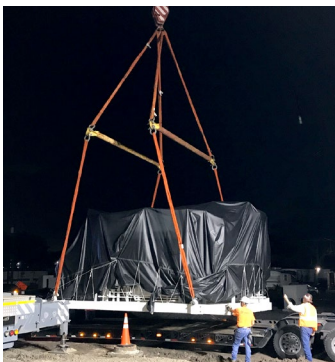
6:00 PM – 9:00 PM:

PRS units are staged at the job site. Job site crane is set up.



9:00 PM – 11:30 PM:

PRS units are unloaded and placed in the machine room.



CONCLUSION

Packaged Refrigeration Systems offer many benefits and features as illustrated above. As ozone-depleting refrigerants continue to be phased out, facility owners are increasingly turning to low-charge PRS units. These systems are a proven and extremely viable option that will only continue to grow in popularity, because they are a safe, high quality and cost-effective solution.

NH360 PACKAGED REFRIGERATION SYSTEMS, powered by Stellar, is the all-in-one provider for packaged refrigeration trusted by leading brands across the country.

Rather than outsource to subcontractors, NH360 handles every stage of the process, including:

- ▶ Design
- ▶ Assembly
- ▶ Installation
- ▶ Maintenance

NH360 has service technicians located throughout the country, so ongoing maintenance for the lifecycle of your system is convenient no matter where your facility is located.

Trusting a single provider for all your packaged refrigeration needs not only makes your life easier, it ensures continuity and a higher quality product. Our designers know who will be servicing the equipment and the service technicians are already familiar with the equipment.

There's no finger-pointing between subcontractors when you work with NH360. We operate as one team and take full responsibility for every step of the process with the goal of putting your needs first.



Do you have questions about packaged refrigeration equipment?
SCHEDULE A COMPLIMENTARY, NO-OBLIGATION CONSULTATION
 to discuss your specific needs and to discover the best option for your facility.

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, including planning, design, pre-construction, construction, refrigeration, mechanical and utility, building envelope, and total operations and maintenance services. More than 750 Stellar employees worldwide create award-winning food processing plants, refrigerated warehouses, distribution centers, commercial buildings and military facilities. In addition to its Jacksonville, Florida, headquarters, Stellar operates nearly 50 support locations and offices throughout the United States, China and in the Middle East and North Africa (MENA) region. The company also serves Central and South America, Europe and India. For more information, visit www.stellar.net.

© 2018 Published by Stellar

2900 Hartley Road | Jacksonville, FL 32257

Phone: **904-260-2900** | Toll-free: **800-488-2900**

info@stellar.net | stellar.net

