CASE STUDY

COLMAC COIL
Manufacturing Inc.

WATER-EFFICIENT ADIABATIC HEAT REJECTION WITH LOW-CHARGE AMMONIA DX REFRIGERATION FOR DESERT COLD STORAGE

Facility: Bafar Cold Storage

Installer: RSCS

Location: El Paso, Texas

Type of Facility: Cold Storage

Size: 61,000 square feet

GRUPO BAFAR

RSCS REFRIGERATION

Type of Refrigeration System: Ammonia Direct Expansion (DX)

Frozen Product: Processed Meats

Air temperature for Freezer: -10.9°F

Adiabatic Condenser Surface Area: 116,722 FT²

Equipment:
- **A+Series® A+P Insulated Penthouse Air Coolers (qty. 5)**
- **Adiabatic Condenser**

Results Delivered:

- Water-efficient adiabatic heat rejection solution designed for desert climates.
- Energy-efficient DX performance with ADXi-enabled optimized superheat control.
- Reduced ammonia charge, increasing operational safety.
- Maximized freezer space and rooftop service access with evaporators located outside the storage area.
- Uniform airflow distribution through custom supply diffusers.

Project Overview:

Grupo Bafar, a leader in food manufacturing in Mexico, expanded its operations in the U.S. with a new cold storage facility in El Paso, Texas. RSCS partnered with Colmac Coil to engineer a refrigeration system that minimized water use, reduced ammonia charge, maximized interior freezer space, and maintained high efficiency in a desert climate.

The solution combined a water-efficient adiabatic condenser with a recirculated water design with A+Series® A+P Insulated Penthouse Air Coolers to enable a high-efficiency, low-charge ammonia DX system, while ADXi controls optimized performance and reliability. All refrigerant-bearing components were located outside human-occupied spaces and serviceable from the roof.

Challenges and Project Requirements

- Minimize water use for heat rejection, essential for operation in a water-scarce environment.
- Develop an ultra-low ammonia charge refrigeration solution to address community safety concerns and code requirements for a residentially proximate installation.
- Achieve higher operational efficiency by maximizing freezer footprint and pallet positions.
- Provide safe rooftop access for service and maintenance, while also keeping refrigerant components out of human-occupied spaces for increased safety and compliance.
- Utilize industrial-grade construction for long-term reliability.
- Integrate advanced ADXi controls for optimized performance, energy efficiency, and system monitoring.

Adiabatic Cooling Solution

Why Adiabatic Cooling

El Paso faces significant water scarcity, with drought risks making efficient water use a critical concern for industrial operations. Traditional cooling methods either consume excessive water, as with evaporative condensers, or require high energy use, as with dry condensers. Adiabatic condensing provides the ideal solution, operating as a dry condenser for most of the year with no water consumption.

Colmac Coil Exclusive Recirculated Adiabatic Water System

Colmac Coil's proprietary recirculated water design delivers greater cooling efficiency and significantly reduced water consumption compared to once-through adiabatic water systems, without the need for water circulation pumps.

Recirculated Water System Benefits

- Recirculated water system minimizes total water usage and maximizes cycles of concentration, operating with a high 75°F dry switch point to minimize the time water is required.
- No chemical water treatment required
- Eliminates need for water circulation pumps
- Standard 3-way makeup valve drains lines on shutdown
- Balancing valves and flow meters included for proper commissioning and flow control

Engineered for Longevity and Performance in Demanding Applications

- Adiabatic pre-cooling reduces entering air temperature during peak conditions, improving system efficiency and capacity.
- This robust 16-fan V-bank configuration enables a high cooling capacity with a surface area of 116,722 FT².
- Industrial-duty construction ensures reliability in continuous operation and equipment longevity.
- Operates in dry or adiabatic mode depending on the season, allowing for increased efficiency.

Integration & Controls

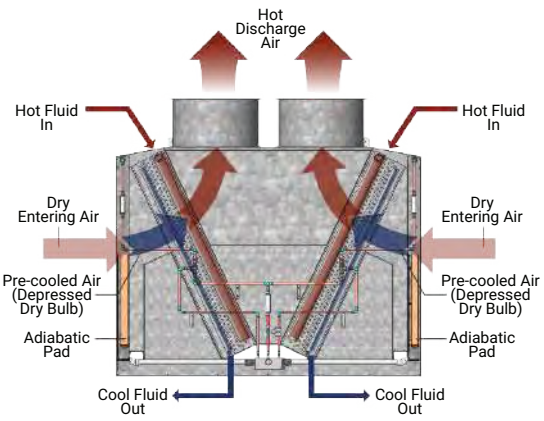
- Factory-mounted control panels and pre-wired fans simplify installation.
- Full integration with the refrigeration control system delivers remote oversight. Users can monitor, receive alerts, and make real-time adjustments from any device.
- Built-in adiabatic control strategies manage water distribution and pad protection efficiently.

ADIABATIC CONDENSER

16 Fan V-Bank Design:
Provides high-capacity, efficient cooling

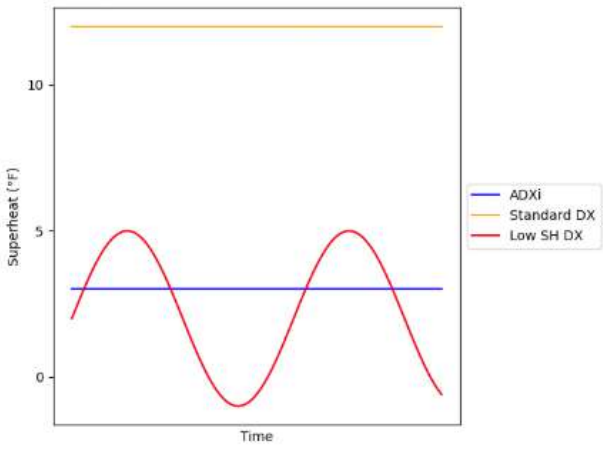
Water Recirculation System:
Optimizes water usage while maintaining peak cooling performance.

Controls Integration & Adiabatic Pads:
Fully integrates with refrigeration system for efficient operation and water management.



Adiabatic Operation

Superheat Stability in DX Evaporators: Traditional vs. Independent Circuit Metering



A+P Insulated Penthouse Air Coolers with ADXi

To minimize ammonia charge, the facility utilized an ammonia DX system with A+P Insulated Penthouse evaporators featuring enhanced coil tubing. ADXi technology was incorporated to improve evaporator efficiency and enable stable operation at reduced superheat levels.

ADXi Technology

ADXi is an independent circuit metering technology designed to address performance losses caused by uneven airflow across evaporator coils. Unlike conventional DX systems that meter refrigerant at the coil level, ADXi meters refrigerant across smaller circuit groups, allowing each section of the coil to receive refrigerant based on local operating conditions.

This balanced distribution prevents localized circuit starvation or flooding and ensures more uniform coil utilization. By stabilizing refrigerant flow internally, ADXi allows the evaporator to operate at a lower, more consistent superheat without increasing the risk of liquid carryover, improving heat transfer efficiency and reducing overall energy consumption.

A+P Penthouse Benefits for Bafar Cold Storage:

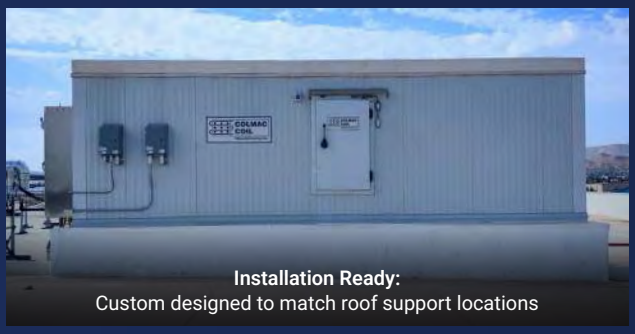
- Rooftop installation preserves freezer space and improves service access, with accessible panels and rooftop service points that simplify routine maintenance and inspections.
- Refrigerant components positioned outside human-occupied spaces for safer operation.
- Minimal ammonia charge achieved through integration with an ammonia DX refrigeration system and proprietary enhanced coil tubing.
- Optimized airflow through custom diffusers, reducing hot/cold spots throughout the freezer.
- Fully compatible with refrigeration system controls, allowing remote controls for real-time monitoring and adjustments.
- Efficient hot gas defrost minimizes defrost duration and supports consistent airflow and evaporator performance.

A+SERIES® A+P INSULATED PENTHOUSE AIR COOLERS – FREEZER AND DOCK EVAPORATORS

Integrated Controls:
Provides more effective defrost and consistent airflow.

Dock & Freezer Air Distribution Diffusers:
Enables optimized airflow across the facility

Industrial Grade Construction:
G235 Galvanized Steel and Primed A+P Base



Installation Ready:
Custom designed to match roof support locations

Operational Impact

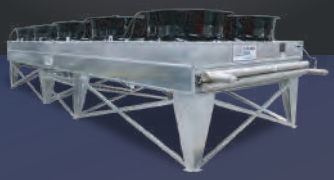
By integrating a water-efficient adiabatic condensing system with low-charge A+P Penthouse Evaporators equipped with ADXi technology, Grupo Bafar achieved a high-efficiency ammonia refrigeration design suited for water-limited environments. The system reduces resource consumption, improves operational safety, maximizes freezer capacity, and supports long-term reliability in a demanding cold storage application.

QUALITY PRODUCTS FROM COLMAC COIL

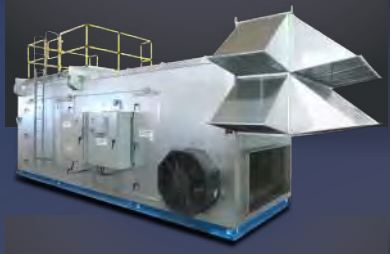
COLMAC COIL
Manufacturing Inc.

A+Series®
Air Coolers

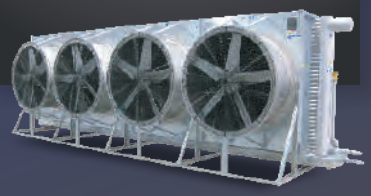
Fluid Coolers
and Condensers



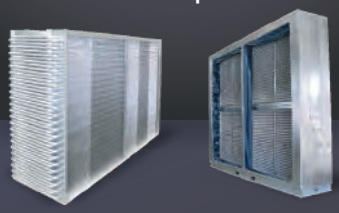
HygenAir™ Hygienic
Air Handlers



Custom Evaporators
and Blast Freezers



Heat Pipes



Heating and
Cooling Coils

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ASME Sec. VIII, Canadian Registration Number, UL508

ENG00020952