CASE STUDY

COLMAC COIL
Manufacturing Inc.

SCALING SUSTAINABLY WITH CO_2 AIR COOLERS FOR A HIGH-BAY ASRS FREEZER EXPANSION.





Product:
Mixed frozen goods

Size:
188,000 sq. ft., 58,000 positions

System Type:
Freezer + dock, ASRS cold storage

Refrigeration System:
CO_2 direct expansion

Freezer / Dock Temp:
-10°F / 35°F

Equipment:
A+Series® A+L Air Coolers with long throw adapters — qty 8
A+Series® A+P Insulated Penthouse Air Coolers — qty 5

Results Delivered:

- Future-ready operation through CO_2 as a refrigerant with near-zero GWP and no phaseout risk for long-term compliance
- Full bay depth coverage from a single rack-top position, achieved through 367-foot air throw on the A+L Air Coolers
- Precise airflow control and energy efficiency delivered by EC fan motors across both A+L and A+P Air Coolers
- Uninterrupted ASRS operation supported by custom 2-pipe hot gas defrost through the coil and drain pan, and heated fan tube rings that prevent ice buildup during fan-off cycles
- Safe, long-term high-pressure operation through 1,740 PSIG-rated CO_2 equipment with UL 207 listing
- Direct rooftop installation enabled by the A+P Insulated Penthouse's pitched base, matched to the dock roof slope

Project Overview:

A 188,000 sq. ft. expansion at a Midwest multi-use cold storage facility called for a high-rise automated storage and retrieval system (ASRS) freezer operating at -10°F with more than 58,000 pallet positions. Colmac Coil supplied all air coolers/evaporators for the freezer and dock, each customized to the demands of its space.

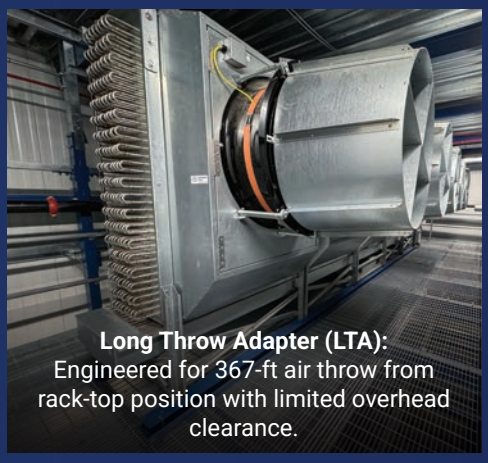
In the ASRS freezer, A+L Penthouse Air Coolers mount atop the rack structure with limited overhead clearance, using long-throw adapters to deliver conditioned air 367 feet across the bay. On the dock, A+P Insulated Penthouse Air Coolers feature a sloped base matched to the roof pitch, with factory ducting to simplify installation. All 13 air coolers use EC fan motors, including those inside the insulated dock penthouses.

The facility operates on a CO_2 direct expansion (DX) system, chosen for its low-temperature efficiency, low GWP, and immunity to future refrigerant phaseouts. All equipment is rated to 1,740 PSIG MAWP and carries UL 207 listing, meeting the pressure vessel and safety requirements of a continuously operating automated distribution facility.

High-Bay Cold Storage and CO_2 Industrial Refrigeration System Design Challenges

- Limited Overhead Clearance: Rack-top air coolers had to deliver air 367 feet across the full freezer bay depth without additional air coolers locations or ductwork.
- High-Pressure CO_2 Service: Freezer and dock evaporators had to be designed, fabricated, and UL 207 listed for CO_2 DX operation at 1,740 PSIG MAWP.
- 24/7 Automated Operation: Defrost cycles had to be fast and reliable enough to avoid interrupting the ASRS.
- Sloped Dock Roof: Insulated penthouses had to match the roof pitch and integrate cleanly without field modification.
- High Cost of Downtime: An automated facility of this scale needed industrial-grade equipment built for long service life and minimal maintenance.

COLD STORAGE ASRS FREEZER - A+SERIES® A+L AIR COOLERS WITH LONG THROW ADAPTERS



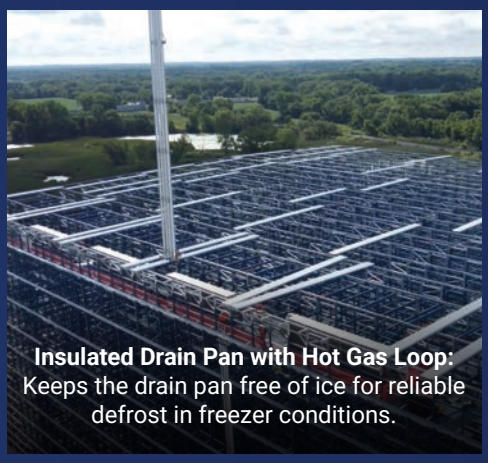
Long Throw Adapter (LTA):
Engineered for 367-ft air throw from rack-top position with limited overhead clearance.



Raised Fan Position:
Optimizes discharge trajectory for maximum coverage across the ASRS bay.



Stainless Steel Venturi Distributor and Protective Guard:
Uniform CO_2 refrigerant distribution across the coil face, with components protected from damage during transport and installation.



Insulated Drain Pan with Hot Gas Loop:
Keeps the drain pan free of ice for reliable defrost in freezer conditions.



EC Fan Motors and Controls:
5 fans per air cooler with onboard speed control and UL 508A listed control panel.



Shrink Wrap Packaging:
Factory-packaged for jobsite protection during transport and staging.

Purpose-Built CO_2 Air Cooler Solutions

Long Air Throw Performance

- Factory long throw adapters (LTAs) deliver 367-ft air throw from the rack top despite limited overhead clearance.
- Raised fan positions direct airflow over the racks across the full bay depth.
- Eight air coolers mounted at the rack ends, purpose-built for the footprint constraints of a high-bay ASRS freezer

EC Fan Motors Across All Air Coolers

- Fan speed adjusts to cooling demand, reducing energy use during low-load periods without sacrificing performance.
- Sealed motor enclosures and built-in overload protection support long-term reliability in cold storage.
- EC motors are integrated directly into the insulated dock penthouses, a capability not every manufacturer offers.

Durability Under Pressure

- CO_2 evaporator design rated to 1,740 PSIG MAWP; UL 207 listed with design and fabrication per ASME B31.5.
- 304 stainless steel tubes for corrosion resistance and long service life, with a stainless-steel venturi distributor ensuring uniform refrigerant distribution and reduced frost buildup across the coil face.
- Danfoss CCMT-16 electronic expansion valve for precise refrigerant control in CO_2 DX service.

Defrost Reliability

- Custom 2-pipe hot gas defrost runs through both the coil and the insulated drain pan for fast, complete defrost cycles without standing water.
- Heated fan tube rings energize when the fans are off and space temperature is at or below 32°F, preventing ice at the fan discharge that could restrict airflow or damage components.

Structural Integration

- The A+P penthouse base slopes along the unit's length to match the dock roof pitch for direct installation.
- Factory-provided ducting simplifies installation and ensures proper airflow distribution into the dock.
- All refrigeration equipment, electrical components, and high-pressure CO_2 piping contained within the A+P penthouse enclosure, keeping the occupied dock space below completely clear.
- A+L Air Coolers supplied with removable lifting brackets for safe crane placement and positioning at the top of the ASRS rack structure during installation.

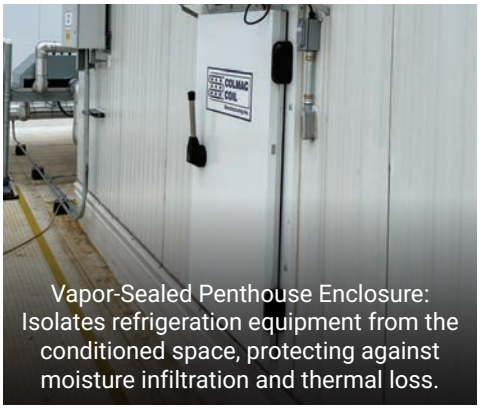
Industrial-Grade Materials

- 304 stainless steel tubes, aluminum fins, and G235 galvanized steel coil housings provide long-term corrosion resistance.
- UL 508A listed control panels are factory-installed by Colmac Coil.
- 304 stainless steel refrigerant connection stubs for corrosion-resistant piping connections rated for high-pressure CO_2 service.

COLD STORAGE DOCK – A+SERIES® A+P INSULATED AIR COOLERS


Rooftop Penthouse Design: Keeps all refrigeration equipment outside the conditioned space for easier service access and maintenance.





Vapor-Sealed Penthouse Enclosure: Isolates refrigeration equipment from the conditioned space, protecting against moisture infiltration and thermal loss.


EC Fan Motors in Insulated Penthouse: Precise airflow with built-in speed control inside a fully insulated enclosure.


Pitched Base Frame: Factory-fabricated to match the dock roof slope for direct rooftop installation.


Factory-Provided Ducting: Simplifies installation and directs airflow into the dock space.

Air Throw Coverage, Uptime, and Sustainable Cooling Delivered

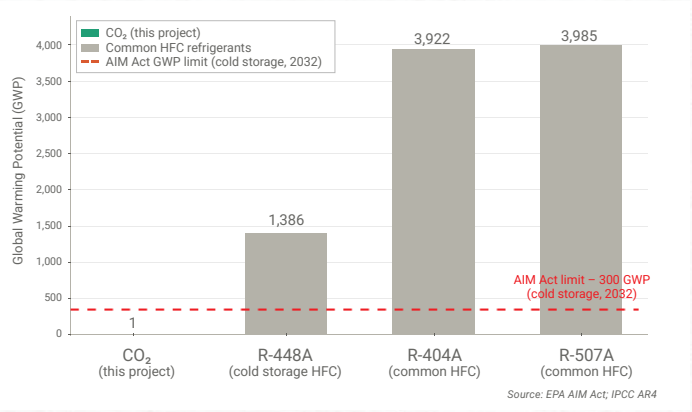
Air Throw Coverage: Long throw adapters on rack-top A+L Air Coolers deliver 367-ft air throw across the ASRS freezer bay.

Continuous Operation: Custom 2-pipe hot gas defrost through the coil and drain pan, combined with heated fan tube rings, keeps defrost cycles fast and the facility running without interruption.

Energy Efficiency: EC fan motors on all 13 air coolers, including the insulated dock penthouses, provide precise airflow control and reduced energy consumption across varying load conditions.

Maximum Rack Density: A+L Air Coolers at the rack ends blow over the top of the ASRS racks, keeping aisles and pallet positions clear. On the dock, A+P Penthouses keep all refrigeration equipment and high-pressure CO_2 piping out of the occupied space.

Future-Ready Refrigeration: CO_2 has a GWP of 1, faces no regulatory phaseout, and performs efficiently at low freezer temperatures, protecting the facility from future refrigerant transition costs.



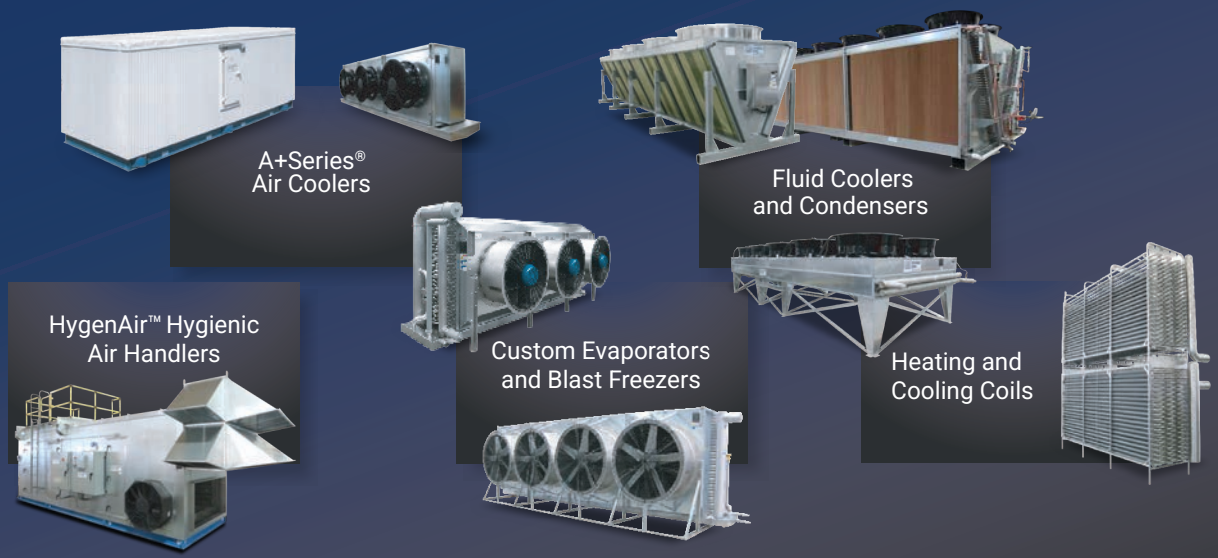
Source: EPA AIM Act; IPCC AR4

YOUR FACILITY HAS UNIQUE DEMANDS. WE ENGINEER TO THEM.

Contact the Colmac Coil team to explore what a purpose-built solution looks like for your facility.

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