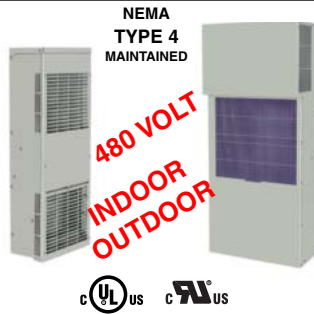


# KOOLTRONIC ENCLOSURE AIR CONDITIONER QUICK SHEET



### Guardian/ GuardianX Series

- NEMA 4 Rating Maintained ( 4X Rating available) (UL50)
- For applications requiring washdown
- Capacity range: 1,000 to 26,000 BTU/H
- Unit heights from 15 to 60 inches
- Epoxy-coated condenser coils
- Weather protection integral to the unit
- All models UL/CUL Listed



### Guardian/ GuardianX Series 480 Volt

- NEMA 4 Rating Maintained ( 4X Rating available) (UL50)
- For **480 Volt** applications requiring washdown
- Capacity range: 3,000 to 26,000 BTU/H
- Unit heights from 24 to 60 inches
- Epoxy-coated condenser coils
- Weather protection integral to the unit
- All models UL/CUL Listed



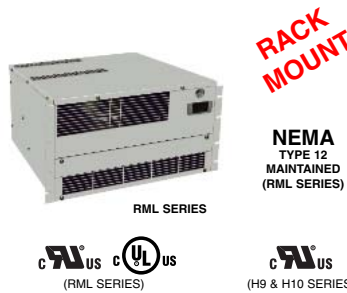
### SlimKool Series (Narrow Width)

- Specifically designed to fit on 12" deep enclosures
- For applications requiring washdown, outdoor or corrosive environments (NEMA 4 or 4X version)
- UL/CUL Listed
- NEMA 12, 3R & 4 Ratings Maintained (4X Rating available) (UL50)
- Capacity range: 4,000 to 11,000 BTU/H
- Programmable Thermostat
- Units available in 115, 230 & 480 Volt
- Unit heights from 28 to 43 inches



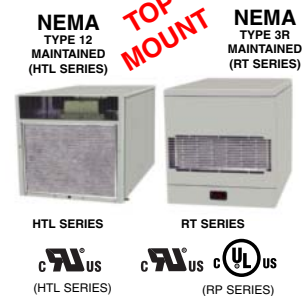
### Hazardous Location Series

- For use in NEC Class I, Division 1 and 2 applications
- UL Listed (UL484) and Recognized (NFPA 496)
- For use with pressurized or purged enclosures
- NEMA 12, 3R and 4/4X Ratings Maintained (UL50)
- Programmable Thermostat
- Available in a variety of sizes and BTU/H capacities (Contact Kooltronic for information)
- Programmable Temperature Alarm



### Horizontal Internal Rack Mount

- Three models available in two Series (RML and H9 & H10)
- **RML Series:** UL Listed, offers 5,000 BTU/H and up to five evaporator airflow patterns
- Unique RML condenser airflow design eliminates need for additional duct work
- **H9 & H10 Series:** UL Recognized, offers 3,500 BTU/H
- Units fit standard 19" data rack



### Horizontal External

- Excellent choice when side mounting is not an option
- Capacity range: 2,500 to 12,000 BTU/H
- All models UL/CUL Listed or Recognized
- Five sizes to choose from
- Advantage Top Mount features stylish design with rounded edges and no visible hardware



### Intrepid Series

- Designed for outdoor applications
- Protects against nearly all climate hazards
- High capacity: 30,000 BTU/H
- NEMA 1, 12 & 3R Ratings Maintained (UL50)
- Features significant noise reduction



### Micro-Mini (Traditional Series)

- Ideal for applications with space limitations
- Capacity 1,000 BTU/H
- UL/CUL Listed (UL50)
- Versatile mounting locations



### Water Cooled

- Suitable for extreme environments
- Protective waterflow controls
- UL/CSA Recognized components
- Slim 10", 12" & 15" wide mounting footprints

# KOOLTRONIC ENCLOSURE AIR CONDITIONER QUICK SHEET



**Kooltronic Air Conditioners are used in a wide range of applications:**

- **Telecommunications**
  - **Robotics**
  - **Medical**
  - **Hazardous Location**
  - **Industrial**
  - **Elevator**
  - **Kiosk**
  - **Food & Beverage**
  - **Transportation**
- **Steel & Paper Mills**
  - **Data (19" computer racks)**
  - **Oil & Gas**
  - **Security**
  - **Pharmaceutical**
  - **Wastewater & Water Treatment**
  - **Golf Course Irrigation**
  - **Alternative Power Generation**
  - **Factory Automation**

For more information on our thermal management products, including **Heat Exchangers**, **Fans** and **Blowers**, please contact Kooltronic or visit:

## Kooltronic Air Conditioner Selection Guide

Series	Indoor	Outdoor	NEMA 12	NEMA 3R	NEMA 4	NEMA 4X	480 Volt	Panel Mounted	Rack Mounted	Top Mounted	BTU/H Capacity	UL Recognized	UL Listed
Guardian	✓	✓			✓			✓			1,000 - 26,000	✓	✓
GuardianX	✓	✓				✓		✓			1,000 - 26,000	✓	✓
Guardian 480 Volt	✓	✓			✓		✓	✓			3,000 - 26,000	✓	✓
GuardianX 480 Volt	✓	✓				✓	✓	✓			3,000 - 26,000	✓	✓
Hazardous Location	✓	✓	✓	✓	✓	✓	✓	✓			6,000 - 24,000	✓	✓
SlimKool	✓	✓	✓	✓	✓	✓	✓	✓			4,000 - 11,000	✓	✓
Micro-Mini (Traditional Series)	✓		✓					✓			1,000	✓	✓
Trimline	✓		✓					✓			2,000 - 16,000	✓	✓
Intrepid	✓	✓		✓				✓			30,000	✓	
Horizontal Internal (RML)	✓								✓		5,000	✓	✓
Horizontal Internal (H9 & H10)	✓								✓		3,500	✓	
Horizontal External	✓									✓	2,500 - 12,000	✓	
Advantage Horizontal External	✓	✓		✓						✓	6,000 - 12,000	✓	✓
Water Cooled	✓							✓			4,000 - 12,000		



# Special-Purpose Air Conditioners Cool Electrical Enclosures

Understanding how these “special” units work can help you decide if they are right for your equipment cooling needs.

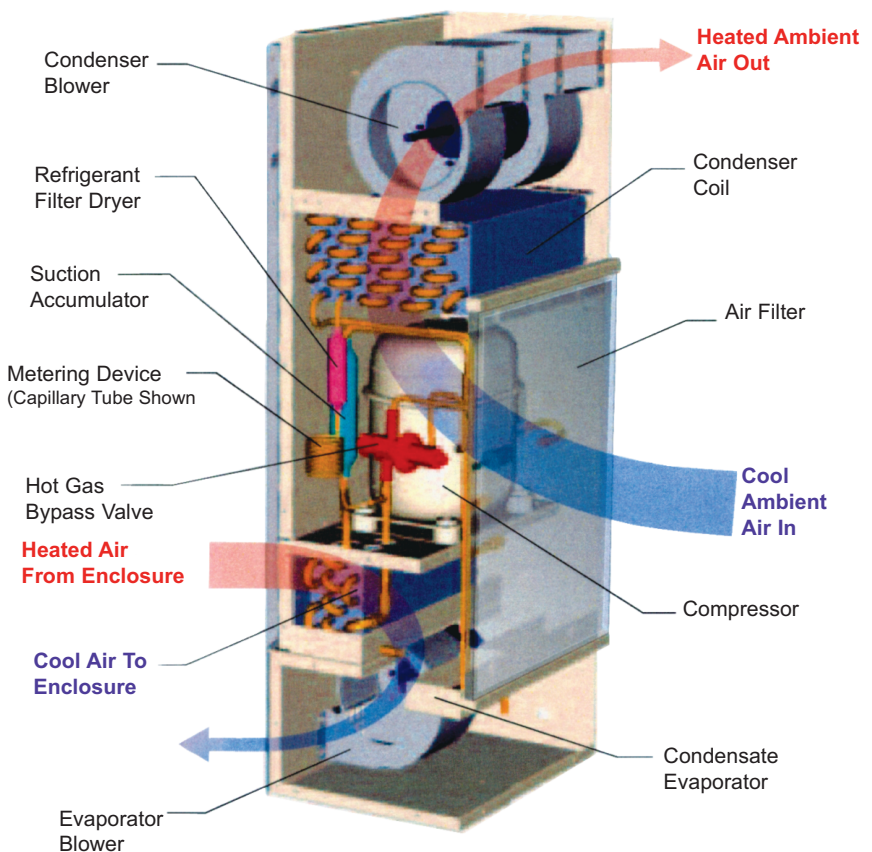
By **Bruce K. Kreeley, Kooltronic, Inc.**

**H**eat-producing power and control components are being packaged in less space, increasing the power densities in electronic and industrial equipment enclosures. Computers, programmable logic controllers, microprocessors, variable-speed drives, power conversion and storage devices have found their way into every industrial and commercial environment.

The problem of dissipating the heat generated to prevent premature failure or process shutdown can be solved by several means. The surface area of the enclosure itself may serve as a passive means to dissipate this heat, provided the ambient conditions are below the desired enclosure interior temperature and the internal heat load does not cause an unacceptable rise in temperature. When this is not possible, an active approach is necessary. Open-loop powered ventilation or closed-loop cooling may be used.

Open-loop ventilation uses ambient air to remove the heat and may consist of small muffin-type fans that exhaust or supply an electrical enclosure, at times with filters to prevent airborne aerosols and dust from entering the enclosure. The fans have the advantage of utilizing

**Typical Special-Purpose Air Conditioner**



**Figure 1.** A typical special-purpose air conditioner is best suited for enclosure cooling applications subject to dust, dripping liquids, rain, wash-down and corrosive atmospheres.

## Air Conditioning

a minimum of enclosure space and will move a substantial volume of air where flow is unimpeded. Cost and complexity is minimized.

Where density of components impedes airflow, packaged blowers or motorized impellers may be arranged to operate against these higher static pressures. With a rack enclosure, supplemental fan trays may be used to spot cool or supplement other air-moving devices.

If maximum internal enclosure design temperatures cannot be maintained using open-loop ambient air cooling, closed-loop devices must be considered. Air-to-air, water-to-air or thermoelectric heat exchangers and air-conditioning units are able to cool a confined amount of air within an enclosure. Heat is transferred to the respective

enclosure design temperatures may exceed ambient temperatures yet be below the electronic components' design limits. Depending on the NEMA enclosure type, which designates the environmental hazard from which the contents are being protected, an air conditioner can be provided to operate in most locations. Locations subject to dust, dripping liquids, rain, wash down and corrosive atmospheres can utilize special-purpose air conditioners.

### A Closer Look

In a typical special-purpose air conditioner, heat is transferred from the enclosure components by circulating air around and through them. The air then

vapor form, into the condenser coil, where it is cooled by ambient air. As it cools, the refrigerant condenses into a liquid that is passed through a filter to remove impurities and excess moisture. The liquid refrigerant flow is metered by a thermostatic expansion valve or capillary tube to control its admission to the evaporator coil, which is a part of the closed loop inside the enclosure.

The refrigerant enters the evaporator as a liquid beginning to vaporize. As the blower or fan-driven heated air from the enclosure passes through the evaporator coil, the heat is transferred to the refrigerant, converting the refrigerant to vapor. High levels of humidity present in the air are removed by condensation; the water is drained to the outside and evaporated in some cases. The cool, dehumidified air is returned to the enclosure. After the heat is transferred to the refrigerant in the evaporator, the refrigerant passes into an accumulator, where any remaining liquid is separated. The gas then returns to the compressor to repeat the cycle in a continuous process.

Control of the system generally is kept simple. When power is applied to the air conditioner, the evaporator blower starts and runs continuously. If the temperature within the enclosure is high, the condenser blower and compressor turn on, operating until the thermostat setting is reached. The thermostat is used as a low-limit setting -- typically 75°F (24°C) -- serving as the point at which the compressor and condenser fans or blowers are turned off. Air within the enclosure continues to be circulated by the evaporator blower or fan, picking up heat from the components within the enclosure.

The thermostat has a differential setting that is typically 12 to 15°F (7 to 8°C) above the low-limit setting. When the air circulated within the enclosure rises by this amount, or at about 90°F (32°C), the compressor and condenser blower turn back on, reducing the enclosure internal air temperature once again. Therefore, at startup of an enclosure system, it would be normal



**Figure 2.** Enclosure cooling air conditioners typically carry agency markings such as UL, which designates the environmental hazard from which the contents are being protected. This marking should be matched to the enclosure to be cooled. Typical examples include NEMA 12 (left), NEMA 3R middle and NEMA 4X (right).

device's ambient side, where an air mover or water coil transfers the heat to the room or outdoors.

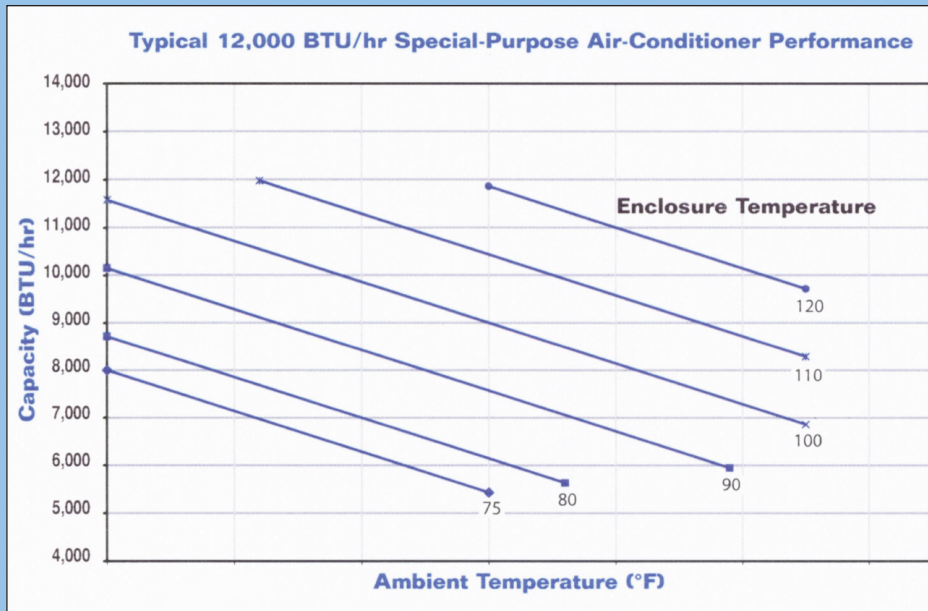
Air conditioners and water-to-air heat exchangers provide the greatest capacity to transfer heat in closed-loop conditions. They have the unique ability to maintain a lower-than-ambient temperature and reduce the humidity within the controlled space. It is important to note that

is cooled, dehumidified and returned to the enclosure without the admission of air from the outdoors. The heat is removed from this air within the air conditioner and discharged by means of a vapor compression refrigeration cycle. This takes place in a hermetically sealed system, utilizing either an air- or water-cooled condenser coil (figure 1).

The compressor forces refrigerant, in

## Tips for Selecting Special-Purpose Air Conditioners

Follow these tips to ensure reliable operation.



- ✓ Be sure not to oversize the unit.
- ✓ Be certain that both the evaporator and condenser airflow paths cannot short circuit or airflow are impeded.
- ✓ Be cautious of adding protective covers to the outside of the unit, which may reduce airflow and unit thermal performance.
- ✓ Seal the electrical enclosure to prevent humidity and outside air from entering.

Closed-loop enclosure cooling is the goal. Consult performance data or contact the manufacturer for temperature conditions other than the rating points shown in most catalogs.

for the internal temperature to rise to this temperature before the refrigerated cooling would begin. As the air cools, a temperature balance within the enclosure is reached. Ideally, the compressor and condenser fan run most of the time until the heat load changes.

Enclosure cooling is not comfort cooling as found in homes and buildings. Heat-producing power and control components typically are limited to maximum enclosure air temperatures of 100 to 110°F (38 to 43°C). The actual component surface temperatures are higher. Maintaining enclosure temperatures too low often becomes problematic. Condensation may form on live electrical surfaces if their temperature falls below the dew point of the air. Subsequent corrosion or electrical safety become serious issues.

Various control features are available to operate in cooler ambient conditions found outdoors or in poorly heated settings. Compressor short cycling controls may be added to prevent damage caused by frequent starting when heat loads fluctuate.

Enclosure cooling air conditioners typically carry agency markings such as UL, which designates the environmental hazard from which the contents are being protected. This marking should be matched to the enclosure to be cooled. Typical examples include NEMA 12 for indoor use, protection from dust and dripping liquids; NEMA 3R for outdoor

**Enclosure cooling is not comfort cooling as found in homes and buildings. Locations subject to dust, dripping liquids, rain, wash-down and corrosive atmospheres can utilize special-purpose air conditioners.**

use and rain-proof applications; and NEMA 4X for outdoor or indoor use to provide protection from wash-down and corrosive environments (figure 2).

Sizing calculations for an air conditioner

can be accomplished using software available on manufacturers' web sites or supplied on disk. The internal heat load is determined based on measurement or estimation. Enclosure surface area, desired maximum internal enclosure temperature, degree of thermal insulation, if any, ambient temperature and, for outdoor use, solar load are used to determine the total heat load in BTUs per hour. It is important to note that the solar load and the degree of insulation can become significant.

A properly sized, well-designed system, free of refrigerant leaks and with a stable power supply will cool critical systems -- trouble-free -- for many years.

**Bruce K. Kreeley is Director of Engineering at Kooltronic Inc.,**

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Intrepid	✓	✓		✓				✓			30,000	✓	
Horizontal Internal (RML)	✓								✓		5,000	✓	✓
Horizontal Internal (H9 & H10)	✓								✓		3,500	✓	
Horizontal External	✓									✓	2,500 - 12,000	✓	
Advantage Horizontal External	✓	✓		✓						✓	3,000 - 12,000	✓	✓
Water Cooled	✓							✓			4,000 - 12,000		



# Enclosure Cooling Equipment Prepared for the Worst

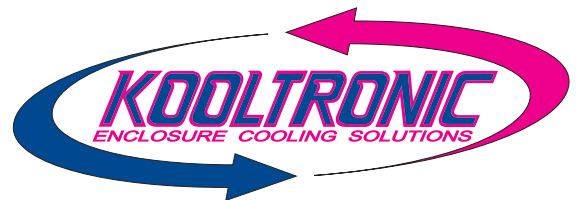


Scan with your smart phone  
to visit [kooltronic.com](http://kooltronic.com)



# 4/4X

*Integrity Series*  
NEMA 4/4X Air Conditioners and  
Heat Exchangers



# The Integrity Series



*Gasketed flanges on all four mounting edges for a positive leakproof seal.*

## A Harsh Environment is No Longer a Separate Set of Problems

Cooling sensitive components housed in NEMA 4/4X enclosures has always been a difficult issue. Until now, makeshift solutions such as oversized enclosures or field-constructed rain shields were the only options. But these efforts do not meet NEMA 4/4X standards and offer inadequate protection against environmental contamination, heat or water penetration.

These approaches can also increase installation costs, reduce component reliability and require frequent production stoppages for maintenance. Ultimately, there is the threat of production shutdown due to system failure.

## Kooltronic Introduces The Integrity Series of NEMA 4/4X Air Conditioners and Heat Exchangers: The Total Solution

Now Kooltronic, Inc. has introduced a line of air conditioners and heat exchangers designed and rated to reliably maintain the integrity and true configuration of NEMA 4/4X enclosures\* for heat-sensitive electrical and electronic equipment.

For the first time, effective enclosure cooling for NEMA 4/4X applications can be accomplished with a UL/CUL tested and approved Air Conditioner or Heat Exchanger. These units are so unique that Kooltronic has been awarded a patent by the US Government.

## About The Company

Kooltronic, Inc. was founded in 1956 to fill the growing need in the electronics industry for the cooling of heat-sensitive components. Due to innovative engineering and extensive product lines, Kooltronic is recognized as the major national manufacturer of enclosure cooling products.

### Air Conditioners



\* NEMA 4/4X interface between enclosure and air conditioner or heat exchanger maintained. Cooling equipment is rated 3R.



# Outdoors or on the plant floor

## Unparalleled Protection for The Most Challenging Environments

Kooltronic NEMA 4/4X stainless steel Air Conditioners and Heat Exchangers have been carefully designed and tested by both Kooltronic and Underwriters Laboratories to function in wash-down and outdoor applications where closed-loop cooling is required on NEMA 4/4X enclosures.

Their sealed high-compression interface, special sheet-metal design and stainless-steel construction provide indoor and outdoor protection against water hose-down and splashes, airborne dust and caustic or corrosive environments.

### Heat Exchangers



47"  
54W/°F Air In  
108W/°F Air Out



38"  
44W/°F Air In  
88W/°F Air Out



32"  
21W/°F Air In  
42W/°F Air Out

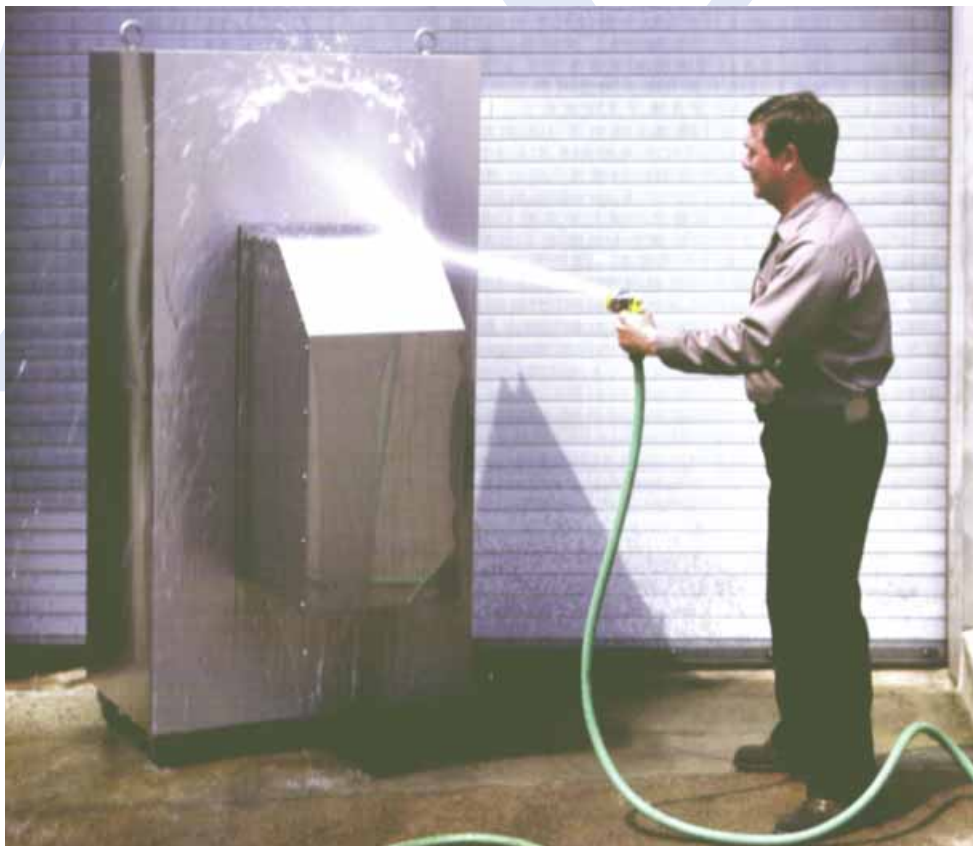
## Limitless Applications

Kooltronic NEMA 4/4X Air Conditioners and Heat Exchangers can be utilized in a wide range of OEM and end-user applications.

Because of the high degree of protection they offer, Kooltronic NEMA 4/4X Air Conditioners and Heat Exchangers are suitable for applications in processing and preparation plants for food, beverages, pharmaceuticals, chemicals and plastics, industrial process controls, communications equipment, anywhere water hose-downs and harsh cleaning agents are used, as well as in wastewater treatment or petrochemical applications.



*The Integrity Series is the only line of air conditioners and heat exchangers that are rated to meet NEMA 4/4X and awarded both UL and CUL Recognized status.*



*Designed specifically for the challenging indoor/outdoor environments where protection against dirt, liquids, splashing, dust, rain, snow and sleet are necessary.*

## Why Kooltronic NEMA 4/4X Cooling Equipment Performs Best:

- The ONLY units which have been tested and approved by Underwriters Laboratories to provide you with the total solution.
- Fully tested and recognized by UL/CUL to maintain the enclosure's NEMA 4/4X ratings.
- M/TAB Quick-Mounting System assures easy, accurate installation and allows for interchangeable mounting of Air Conditioners and Heat Exchangers of the same Series size.
- 32", 38", 47" and 59" heights allow optimal match to enclosure height and cooling requirements.
- Durable stainless steel construction maintains its attractive appearance in the harshest environments
- High Performance Blowers assure maximum airflow and efficient heat transfer in densely packed cabinets.
- Heat Exchanger elements are removable for easy cleaning.
- Air Conditioning units offer 1,000 to 10,000 BTU/H and feature the environmentally preferred CFC-free R134a refrigerant.
- Heat Exchangers are available with efficiencies to 65W/°F Air In, 130W/°F Air Out.

Wherever you need to cool sensitive electronic or electrical components and still protect them from airborne contaminants, water and corrosive chemicals and the enclosure is exposed to wash-down or installed outdoors, Kooltronic's Integrity Series NEMA 4/4X Air Conditioners and Heat Exchangers offer the ultimate assurance of performance and protection.



*Unique Mounting Template and Assembly Bracket (M/TAB) for quick, easy installation.*

