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Enclosure Thermal Management

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Enclosure Thermal Management Overview

Industrial enclosures almost always require air conditioning to protect equipment and components from harsh and hot factory floor environments and heat generated from electrical components housed within the enclosure. In some instances, such as for outdoor installations, enclosures may require heating, or if they are located where temperature fluctuates, cooling and/or heating are often required to maintain optimal operating temperatures, keep condensation from forming, and prevent components from overheating or freezing.

AutomationDirect offers a wide selection of enclosure thermal management equipment to provide optimal conditions to protect enclosure components and ensure continuous and safe operation, while extending the life of equipment and components, which result in operation costs savings.

Our lineup of quality thermal management products include air conditioners, coolers, heat exchangers, cooling fans, filter fans, heaters, thermostats, hygrostats, and vents, from top manufacturers.

AutomationDirect provides many educational and informative resources to help you make the best decisions for solutions to your specific needs. Take advantage of all this FREE information we provide.

Learn Library

Check out our Library site with thermal management resources at:

https://go2adc.com/thermal

Video Library

Or, check our video library with air conditioner and other thermal management information at:

https://go2adc.com/VideosACs

For the latest prices, please check AutomationDirect.com.

Enclosure Thermal Management

Smart Sensors and Thermostats

Enclosure heaters controlled with thermostats, humidistats (hygrostats) and hygrotherms provide consistent temperature and humidity control. Many enclosure heaters include integrated thermostats or other controls, but some may require external controls.

Cooling devices such as filter fans and heat exchangers do not typically require a thermostat since they consume very little power, and therefore can be always on, but a control device will prolong filter life. Air conditioners commonly have an integral thermostat; while thermoelectric coolers may also have integral thermostats, but there are models available without thermostats that will require the use of an external version. Vortex coolers should always be controlled by a thermostat to minimize compressed air consumption. In some cases, a thermostat may be needed to prevent freezing of components inside the enclosure.

Heating and cooling devices are controlled to prevent overheating or overcooling, and to control the energy costs of thermal management.

The following devices are used to control heating and cooling devices:

STEGO Smart Sensors

Compact Smart Sensors are used to measure temperature and humidity within the enclosure and convert the measured data into a standardized analog 4 to 20 mA signal. This signal can then be used by a control unit (i.e., PLC control) to operate a heating or cooling device . The Smart Sensor is suitable for a wide variety of applications and can be used in harsh environmental conditions, such as wind power.

- Analog or IO Link Interface
- DIN rail and/or screw mounting
- High accuracy
- Quick connect M12 plug-in connector
- Wide temperature and humidity range
- UL Recognixed File E500143

STEGO Tamperproof Thermostats

Tamperproof thermostats are non-adjustable normally open or normally closed thermostats designed to “switch-off” or “switch-on” at a factory pre-set temperature setpoint.

- Normally open (N.O.) or normally closed (N.C.) versions and in vaious switch-off or switch-on fixed setpoints
- A single or dual thermostat
- DIN rail mounting
- Color coded - blue for N.C. and red for N.O.
- IP20 rating

STEGO Hazardous Area Thermostats

This small mechanical thermostat offers a high response accuracy, small switching difference, and a very long service life (switching cycles). This thermostat is used for the regulation of heaters deployed in hazardous areas. High current performance allows direct control of a heater.

- High switching capacity
- Compact design
- Preset temperatures
- Ready to use with strain relief
- Temperature class T6
- DIN rail mounting
- IP66 rating

STEGO Adjustable Single and Dual Setpoint Thermostats

Thermostats sense the temperature of the air inside the enclosure and compare it to a setpoint, which is either the minimum or maximum temperature that the enclosure should be maintained. These thermostats’ setpoint may be controlled by the user with an adjustable thermostat.

- Available with single or dual setpoint dials
- Normally Open (N.C.) and/or Normally Closed (N.C.) versions
- Compact DIN rail mounted designs
- Color coded dials - blue for N.C. and red for N.O.
- Thermostatic bi-metal or PTC sensor element

Enclosure Thermal Management

Hygrostats (Humidistats) and Hygrotherms

STEGO Hygrostats (Humidistats)

Electronic hygrostats (humidistats) sense the relative humidity in an enclosure and turn on a heater when humidity reaches the setpoint. Preventing humidity within the enclosure helps prevent condensation on the equipment and components inside the enclosure.

- Integrated LED indicates when the connected device is in operation
- DIN rail mounting
- SPDT/change-over contact
- Adjustable or tamperproof setpoint versions
- High switching capacity
- Compact design
- IP20 rating

STEGO Hygrotherms

Electronic hygrotherms sense the ambient temperature and relative air humidity to determine when to turn a connected device ON or OFF if either the temperature or humidity are out of the setpoint range. Hygrotherms are typically used to control PTC heaters, fan heaters, condensation heaters, or other climate control devices.

- Adjustable relative humidity and temperature setpoints
- DIN rail mounting
- High switching capacity
- Integrated LED in adjustment knobs indicate when the connected device is in operation
- Compact design
- IP20 rating

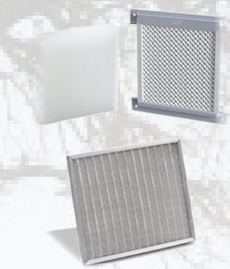
Breathers, Drains and Compensators

Breathers and compensators control pressure within the enclosure by equalizing the pressure differential between the enclosure and its environment to compensate for pressure fluctuations caused by internal/external temperature changes.

Drains provide a method of effectively removing unwanted moisture from within the enclosure while maintaining the enclosure rating. Dual-purpose breather/drain and compensator/drain models are available.

- Suitable for most types of metallic and non-metallic enclosures
- Available in various corrosion-resistant materials
- Selection of installation options to best fit your application needs

Filter Media



Thermal management systems for enclosures are vital to the health of the internal electrical devices. However, some of these cooling/heating systems can also pose a risk by bringing external contaminants into an enclosure along with the heating/cooling air. These filters block contaminants while allowing adequate clean air flow. Most of these filters are washable and reusable; however, when time to replace them, check our selection of filter media to find the best replacement for your device's filter.

- Filters available for louvers, vents, intake and exhaust grilles, air conditioners and filter fans
- All filters are removable and washable
- Filter media materials include synthetic fiber (coarse or medium), stainless steel, or aluminum mesh

For the latest prices, please check AutomationDirect.com.

Enclosure Thermal Management - Cooling

Enclosure Vents and Grilles

Vents allow air flow in and through the inside of the enclosure to provide basic ventilation or cooling and help reduce heat and moisture. Vents are typically used for applications where natural convection creates sufficient cooling for the enclosure content.

Grilles are used in conjunction with filter fans to create a flow of air from the outside of the enclosure to the interior and back out, displacing the hot air inside while preventing contamination.

- Various mounting styles to meet your application needs
- Roof mounted vents are available for applications with space restrictions
- Intake and exhaust grilles for specific filter fan models
- Filter Fan Plus grilles feature air flap technology and allow greater flow

Enclosure Filter Fans

STEGO Filter Fans

STEGO filter fans are perfect for basic enclosure cooling where ambient air is at a lower temperature than the enclosure interior.

The Filter Fan Plus series include the FPI system (airflow in) for an intake fan with filter and an exhaust grille with air flaps; the FPO system for airflow out consists of an exhaust fan with air flaps and an intake grille with filter. All Filter Fan Plus fans feature a true "no screw" mounting system that uses four 6-position ratchets to firmly mount the fan and the hinged covers on all fans facilitate quick and easy filter changes.

Filter Fans

- Indoor and outdoor versions available
- Easy filter change
- Weather/UV resistant UL 94V-0 (indoor)/ UL94H-B (outdoor)
- No-screw installation on indoor models
- Low noise
- 120 VAC and 24 VDC models
- Easy airflow direction switching on most models
- Includes pre-installed gasket
- UL recognized - file: E234324

Filter Fan Plus

- Impact-resistant polycarbonate fan housing
- Poured-in-place polyurethane gasket
- Low noise
- 115 and 230 VAC; 12, 24, and 48 VDC models
- UV light resistant according to UL 746C (f1)
- Flame retardant: UL94 V-0
- All models: IP54, VDE, EAC, CE, UL Type 12 when using supplied filter
- UL Recognized - file: E234324

Fandis Virdis Series Filter Fans

Virdis series filter fans are a practical solution to remove heat from an enclosure. These fans channel filtered ambient air into the enclosure while expelling warm internal air through an exhaust filter or roof unit to reduce temperatures and protect electronic components from overheating.

- Cover slides open for easy filter change without tools
- No-screw installation
- Low noise
- 120 VAC, 230 VAC, and 24 VDC models
- Permanent Polyurethane sealing gasket
- G3 (coarse) and G4 (coarse) replacement filter mats available
- Available in NEMA 3R or 12 models
- Roof mount units can be used when side mounting is not available
- Available in ANSI 61 gray, RAL 7035 light gray, or black

Fan Hoods

Stego and Seifert fan hoods increase the protection class and serve as a protective cover for enclosure filter fans, intake grilles and exhaust grilles. Hoods can be used for protection against water projected by a hose and extreme climatic influences when the enclosure is located outdoors.

- Increases protection to UL Type 4 or 4X depending on model
- Easy hood removal for cleaning and filter change
- Weather resistant
- Solid impact-resistant carbon steel or stainless steel construction
- Models available with food-safe silicone seal
- Optional security feature available
- IP56 rating

Enclosure Thermal Management - Cooling

StegoJet Directional Fans

StegoJet directional cooling fans provide spot cooling for "hot spots" and high heat load components inside an enclosure. This compact and powerful fan provides maximum rotation range with an air output in almost any direction.

- Dual clip system allows four different DIN rail mount orientations, while a hinge allows the housing to tilt to up to 40° angle
- Air duct at the air outlet can be directed at a 45° angle to the housing and can be rotated 360° to force the air in any direction
- Prevents heat pockets
- Quick connection
- Panel or DIN rail mounting
- 100-240 VAC, 50/60 Hz voltage ratings

Hammond Rack Panel Fans

Hammond high CFM fan kits for data communication racks extend the life of rack-mounted equipment by increasing airflow within the rack or cabinet. Fan kits include one or two fans, fan grills for added safety, and all essential parts.

- One or two ball bearing type fan kits
- Kits include one cord assembly
- Mounting hardware included
- UL 507 rated nd CSA certified

Seifert SoliTherm® Thermoelectric Coolers

Seifert SoliTherm thermoelectric coolers use the Peltier Effect for IP66/NEMA 4X closed-loop cooling. The only moving parts for these coolers are axial fans so there is virtually no maintenance.

Their compact design also allows for easy installation in nearly every position (except roof mounting) because there is no compressor or moving parts aside from the fans. These units are available as recessed with internal heat sink and fan inside the enclosure and ambient components on the outside. Frames are also available for easy external mounting.

- Use with NEMA 4, 4X and 12 enclosures
- Stainless steel housing
- 24 VDC and 120 VAC power options
- No maintenance required
- Recessed mounting. Frames for external mounting available separately
- 100, 170, 340, 510, and 680 BTU/H capacities

Stratus® Vortex Coolers

Stratus vortex coolers create a vortex that reaches speeds of up to 1,000,000 rpm as it is forced down the inner walls of the vortex tube. The air is separated into hot and cold air streams and at the end of the hot tube, a small portion of this air exits through a needle valve as hot air exhaust. The super-cooled air flows through the center of the generator and exits through the cold air exhaust port into the enclosure for cooling.

- Use where conventional enclosure cooling by air conditioners or heat exchangers is not possible
- Small physical size
- No fans
- Creates cool air without refrigerants (no CFCs, HCFCs)
- Exceptionally reliable - no moving parts and virtually no maintenance
- Suitable for harsh environments

For the latest prices, please check AutomationDirect.com.

Enclosure Thermal Management - Cooling

Enclosure Air Conditioners

Our offering of enclosure air conditioners, thermoelectric coolers, vortex coolers, and fans, include a wide range of top-quality cooling units designed to maintain the temperature inside an electrical enclosure at or below a safe level to protect enclosed equipment.

There are several questions to answer when selecting the type of device that best suits an enclosure's cooling requirements.

1. *Does the maximum ambient air temperature exceeds the maximum allowable enclosure temperature?* If it does, devices that exchange air between the interior and exterior of the enclosure (fans and vents) or use the outside air to cool the inside air (heat exchangers) will be ineffective, and will in fact raise the inside temperature of the enclosure instead of lowering it. In this situation, an air conditioner, thermoelectric cooler or vortex cooler is required.

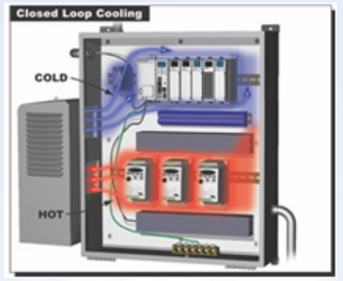
2. *To what degree does the interior of the enclosure need to be isolated from the ambient environment?* If no outside air can be allowed to enter the enclosure, a closed-loop cooling device, such as an air conditioner, heat exchanger, thermoelectric cooler, or vortex cooler, is required.

   Closed-loop cooling is commonly used for:

   - Areas where ambient temperature is as high or higher than the desired internal temperature
   - When internal components generate excessive heat
   - Harsh environments
   - Areas where washdown is required
   - Areas with heavy dust and debris
   - Areas where chemicals are airborne
   - To maintain temperature inside an enclosure at or below safe levels without introducing outside air

3. *How much cooling capacity is required?* Each type of device has a range of cooling capacities. In many cases, the required cooling capacity alone can dictate the type of device needed.

4. *Does the overall enclosure cooling system needs to be supplemented to improve the circulation of air within the enclosure or increase the convection rate at "hot spots" within the enclosure?* If so, a rack panel fan or a directional cooling fan should be considered.



Saginaw Enviro-Therm® Series Air Conditioners

Saginaw Enviro-Therm series air conditioners are rugged, energy efficient, and reliable closed-loop cooling systems that provide superior cooling capacity and are constructed with heavy gauge carbon steel, 304 or 316 stainless steel.

Saginaw NextGen series is the super energy-efficient version of Saginaw's Enviro-Therm series. These air conditioners provide reliable closed-loop cooling in a heavy gauge carbon steel housing.

- Multiple frame sizes with various BTU/H choices
- Use with NEMA/UL Type 3R, 4, & 12 enclosures (also 4X for standard Enviro-Therm series)
- 120, 230, 460 VAC models
- Corrosion resistant components
- High performance ball bearing fans
- Filter-less coils with fin spacing and hydrophobic nanocoating to reduce clogging
- Digital programmable controller
- Washable, reusable 8-layer aluminum mesh filters included
- Compressor heater (standard Enviro-Therm units)
- Enclosure heater for low ambient temperatures (standard Enviro-Therm units)
- High temp alarm
- Hermetically sealed rotary compressor (NextGen series)
- Built-in RS-485 serial modbus control and monitoring (NextGen series)
- Active condensate system (NextGen series)
- Environmentally friendly and chlorine-free R-134a refrigerant
- UL File: E498756e (Standard) & E49875 (NextGen series)

Saginaw Enviro-Therm Series

Saginaw NextGen Enviro-Therm Series

Enclosure Thermal Management - Cooling

Enclosure Air Conditioners (continued)

Seifert SlimLine® Series Air Conditioners

Seifert SlimLine series air conditioners are lower cost, energy efficient, and designed for indoor applications. These air conditioners use a reliable closed-loop cooling system that protects from dust, oil, and water and provides superior cooling capacity.

- Multiple frame sizes with cooling capacities up to 4,090 BTU/H
- For use with NEMA 12 enclosures
- 460 VAC units have an SCCR of 5kA
- Corrosion resistant condensor coils
- High-performance ball bearing fans
- Heavy gauge carbon steel
- Washable/reusable aluminum mesh filters
- Environmentally friendly refigerant
- High temperature alarm
- Filterless coils with fin spacing and hydrophobic nanocoating to help reduce clogging
- Compressor heater
- Enclosure heater for low ambient temperatures
- Door-activated switch wiring provisions
- cULus File: E498756; cULus Recognized File SA32278
- IP54

Seifert SlimLine Series

Seifert SlimLine Vario® Series Air Conditioners

Seifert SlimLine Vario series air conditioners feature an adjustable compressor and a programmable controller that work together to supply the required cooling at a much higher capacity.

In addition to the standard Slim Line features shown above, the Vario series offers:

- 8,700 BTU/H
- Digital programmable controller
- Active condensate system
- Hermetically sealed rotary compressor
- Built-in RS-485 serial modbus control and monitoring
- Mounting flange hangers for easy installation

Seifert SlimLine Vario Series

STRATUS® TA Series Air Conditioners

STRATUS TA series air conditioners are designed to fit 7-, 8-, 10- and 12-inch-deep enclosures. TA series air conditioners offer smooth/flat sides and provide reliable cooling with high efficiency.

- Multiple frame sizes with cooling capacities up to 7,580 BTU/H
- For use with NEMA/UL Type 4, 4X and 12 enclosures
- 115, 230, 460 VAC and 48 VDC models
- Corrosion resistant condensor coils
- Free-standing rigid chasis for easy installation and maintenance
- Anti-short-cycle compressor protection
- Digital programmable controller with visual alarms
- High energy-efficient compressors
- Active condensate system
- Thermal expansion valve
- UL File: SA33404; UL 50, Types 4, 4X, and 12
- Made in the USA

STRATUS TA Series

Stratus® Air to Air Heat Exchangers

Stratus air to air heat exchangers use a closed-loop cooling system that employs the heat pipe principle, which have a liquid refrigerant inside the sealed tubes, and exchanges heat from inside the enclosure to the outside.

The design provides a top-to-bottom air flow pattern with maximum separation of the inlet and outlet. This design pulls the hottest air from the top of the enclosure and returns the cooled air from the bottom of the heat pipe to the enclosure. The air flow on the ambient side is bottom in, top out, so that the hotter discharge air moves up and away rather than being recirculated. The aluminum end plates and baffles improve conduction and reduce corrosion for longer life.

- Low operating cost and low maintenance
- Easy to mount on only one side of your enclosure
- Energy efficient; uses no more power than a filtered fan system
- Filter-free; no diminished cooling capacity
- Use with NEMA Type 4 and 4X enclosures
- 120 VAC or 24 VDC powered models
- Motors have a sealed overload protector
- Finned evaporator and condenser sections provide a closed loop
- UL/cUL listed: UL File: SA34086
- Made in USA

STRATUS Air to Air Heat Exchangers

For the latest prices, please check AutomationDirect.com.

Enclosure Thermal Management - Heating

Enclosure Heaters

Enclosure heating may save equipment and components within the enclosure from improper operation or failure. Enclosure heating is important because as temperature drops within the enclosure, the capacity for air to hoild water vapor is reduced. Therefore, the relative humidity of the air increases (even if the amount of water vapor remains constant), which causes condensation on and around components and equipment, eventually causing corrosion and component malfunction.

Our selection of heaters used along with our thermostats, hygrotherms and hygrostats are designed to prevent condensation by maintaining the appropriate temperature and relative humidity within the enclosure.

Positive Temperature Coefficient heaters are energy-efficient, safe, and reliable heaters that use a constant voltage to heat the heating element, which will produce a higher amount of heat when the surrounding temperature is low and a lower amount of heat when the surrounding temperature is high. Thus, the amount of heat exerted depends on the current surrounding temperature.

Stego® Small Positive Temperature Coefficient (PTC) Heaters

- **Small PTC Heaters:** Heaters designed to prevent failure of electronic components caused by condensation, corrosion and low temperatures in small enclosures. Available in various voltages and Watt ratings.
- **Touch-Safe PTC Heaters:** These enclosure heaters are designed to use natural convection, which results in a circulating current of warm air. The heater's design minimizes surface temperatures on the accessible side surfaces of the housing.

Stego® Compact 10W to 200W Hazardous Location Heaters

These compact loop heaters are designed for hazardous areas with temperature class T3 (392°F/200°C max.) to prevent formation of condensation, temperature fluctuations, and for protection against frost in control and switch cabinets, as well as in measuring equipment.

Stego® Flat Heaters

Enclosure flat heaters provide evenly distributed temperature and feature an ultra-thin design that makes them suitable for high-density applications in which standard enclosure heaters are often too large. Depending on the application, the flat heater can be used as a convection heater or as a contact heater.

Stego® Fan Heaters

- **PTC Fan Heaters:** These semiconductor heaters prevent the formation of condensation and ensure an even temperature in enclosures. The integrated thermostat is used to set the desired temperature while the high-performance axial fan provides forced air circulation. PTC Fan heaters are also available in touch-safe, compact, and integral thermostat versions.
- **Fan Heaters:** High-performance fan heaters help to prevent the formation of condensation and provide an evenly distributed interior air temperature in enclosures with electric/electronic components. Fan heaters are available with various mounting options in space-saving and compact versions with various Watt ratings.

Hammond Fan Heaters with Thermostats

Hammond fan heaters are designed to prevent condensation or to maintain minimum temperature inside enclosures. These fan heaters have an aluminum alloy outer casing and include a built-in thermostat with fan Auto/On switch control and a pilot light for Heat On indication.