Enclosure Cooling – Selecting an Air-to-Air Heat Exchanger

Air-to-Air Heat Exchanger Selection

To select the proper size heat exchanger, the worst-case conditions should be considered. For a heat exchanger to work, the ambient air temperature must be lower than the desired internal enclosure air temperature.

There are three main factors in choosing a heat exchanger for an uninsulated metal NEMA rated enclosure located indoors:

- Internal heat load
- Delta T
- Heat load transfer

Internal Heat Load

Internal heat load is the heat generated by the components inside the enclosure. This can be determined by a few different methods. The preferred method is to add the maximum heat output specifications that the manufacturers list for all the equipment installed in the cabinet. This is typically given in Watts.

Delta T (ΔT)

Delta T = maximum allowable internal enclosure temperature °F – maximum outside ambient temperature °F.

Heat Load Transfer

Heat load transfer is the heat lost (negative heat load transfer) or gained (positive heat load transfer) through the enclosure walls with the surrounding ambient air. This can be calculated by the following formulas:

Surface Area (sq. ft.) = 2 [(H x W) + (H x D) + (W x D)] / (144 sq. inches/sq. ft.)

Note: Only include exposed surfaces of enclosue in calculations. Exclude surfaces such as a surface mounted to a wall.

Heat Load Transfer (W/°F) = 0.22 W/°F sq. ft. x surface area

Note: Use 0.22 Watts/°F sq. ft. for painted steel and non-metallic enclosures. Use.10 Watts/°F sq. ft. for stainless steel and bare aluminum enclosures.

Cooling Capacity

Once you have determined your Internal Heat Load, the Heat Load Transfer and the Delta T, you can choose the proper size unit by calculating the needed cooling capacity.

Cooling Capacity (W/°F) = Internal Heat Load / ΔT - Heat Load Transfer

Air-to-Air Heat Exchanger Selection Example

A NEMA 12 Wiegmann N12302412 enclosure (30in [762mm] high x 24in [610mm] wide x 12in [305mm] deep) contains a GS3-4010 AC drive 10 HP 460 volt) that has a maximum allowable operating temperature of 104°F and is located in a warehouse that has a maximum outside ambient air temperature of 90°F.

Power to be dissipated is stated in the specifications of the GS3-4010 and is found to be 345 watts.

Internal heat load:

Internal Heat Load = 345 Watts

Delta T:

ΔT (°F) 104°F – 90°F = 14°F

Heat load transfer:

Surface Area (ft.2) = 2 [(30 x 24) + (30 x 12) + (24 x 12)] / 144 sq. inches = 19 ft.2
Heat Load Transfer = 0.22 x 19 ft2 = 4.2 Watts/°F

Cooling capacity:

Cooling Capacity = 345 Watts/14°F - 4.2 Watts/°F = 20.4 Watts/°F

In this example, you are able to determine that a heat exchanger, with a capacity of at least 20.4 Watts/°F is needed, such as a Stratus TE30-030-17-04 or a Saginaw Enviro-Therm SCE-HE24W120V.

*This selection procedure applies to metal and non-metal, uninsulated, sealed enclosures in indoor locations. This selection procedure gives the minimum required size; be careful not to undersize when purchasing.

Enviro-Therm® Series Air To Air Heat Exchangers

SAGINAW CONTROL & ENGINEERING
Your Enclosure Source ®

Application

Enviro-Therm® Heat Exchangers are designed for high-efficiency and high-performance air-to-air heat transfer. Designed with an internal closed loop system to provide protection from dust, oil and water. For indoor and outdoor application. Rugged, energy efficient, and reliable cooling system.

SCE-HE04W120V

Construction

- Internal components are corrosion resistant
- HE08, HE18 and HE24 counter-flow core
- HE04 modified heat pipe core
- Filterless design, low maintenance counter-flow heat exchangers are finless, reducing the chances of clogging, and easy to clean
- Threaded mounting studs provided for simple installation
- Digital touchpad programmable controller
- Controller Preset 95°F to cool - Adjustable 68°F to 122°F.
- Temperature differential hysteresis 5.4°F
- High temp alarm preset 131°F
- High performance ball bearing fans
- Door activated switch wiring provisions provided for easy installation
- Cage clamp terminal connector

Finish

RAL 7035 river texture powder coat over aluzinc coated steel

Listings

- NEMA Type 3R & 12
- cULus Recognized Type 3R & 12 [File E498756]
- IEC 60529
- IP 54

c UL us CE

Enviro-Therm® Series Air To Air Heat Exchanger General Specifications				
Part Number	***SCE-HE04W120V***	***SCE-HE08W120V***	***SCE-HE18W120V***	***SCE-HE24W120V***
Price	$1,208.00	$1,584.00	$1,799.00	$2,065.00
Drawing Links	PDF	PDF	PDF	PDF
Cooling Capacity	4 Watts/°F	8 Watts/°F	18 Watts/°F	24 Watts/°F
Operating Temperature Range	23°F - 131°F			
Dimensions (H x W x D)	20.00 x 7.50 x 5.95	29.50 x 10.00 x 5.95	29.66 x 10.24 x 5.95	47.16 x 10.24 x 5.95
Weight	16.5 lbs	25.0 lbs	26.5 lbs	36.8 lbs
Rated Operating Voltage / Frequency	120 V - 50/60 Hz			
Running Current	1.10 A		1.40 A	1.80 A
Starting Current	1.30 A		1.60 A	2.20 A
Power Consumption	65 W	120 W	150 W	195 W
Fuse Rating	1.6A (T) - Time Delayed [Slow Acting]		3A (T) - Time Delayed [Slow Acting]	
Circuit Breaker - MCB Type D or K	1.6A Slow Acting		3A Slow Acting	
Connection	Cage Clamp Terminal Connector			
Max Current at Door Switch	5 A DC			

Dimensions given in Inches