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# Thermal management system

## Thermal conditioning of electric and electronic switchboards



### What is thermal control?

#### Technological evolution

The miniaturization of components, the generalization of electronics and the appearance of new electronically-powered products have made temperature management a growing concern when designing electrical and/or electronic switchboards.

#### What are the advantages of efficient thermal management?

Thermal management of electrical switchboards is a major factor for industrial maintenance.

Many risks are incurred by not having a suitable thermal solution, which can affect the service life of the components and the performance of the facility to the extent of causing a halt in production.

The service life of the components also depends on the temperature and humidity conditions inside the enclosure. The ideal values range from +25 to +35 °C for the temperature and 40 to 60% for the relative humidity (RH).

#### Cooling, heating, controlling

Just as equipment installed in enclosures requires protection against solid bodies, liquids, and impacts, it also requires suitable thermal protection.

There are various solutions for thermal protection. They are chosen according to environmental conditions and the type of components in the electrical switchboard. In certain cases, it is sufficient to oversize the enclosure or to use fans or air-air exchangers. In other cases, where the ambient temperature is higher, it is necessary to install air-water exchangers or cooling units.

#### A solution for each need

We provide a complete Thermal offer to secure your installations.

- |                    |   |
|--------------------|---|
| <b>Cooling</b>     | 1. Forced ventilation systems<br>2. Air-air exchangers<br>3. Air-water exchangers<br>4. Cooling units |
| <b>Heating</b>     | 5. Resistance heaters   |
| <b>Controlling</b> | 6. Thermal control accessories  |
| <b>Calculating</b> | 7. New ProClima 5.0 software  |

## Risks

### Risks associated with the lack of thermal control



#### Random breakdowns and production halts result in heavy losses

Thermal control of enclosures extends the service life of the components and reduces their breakdown rate.

#### Reduction of the service life of the components

The service life of components is reduced if the temperature and humidity in enclosures are not controlled. Repeated sudden variations in temperature and humidity accelerate the aging process.

Example

##### Batteries – Accumulators

Manufacturers recommend installing batteries in environments where the controlled temperature is 15 °C...25 °C.

Cold slows down the battery charging and discharging cycles. Heat increases the evaporation of water in the electrolyte and speeds up the oxidation of the plates. Using batteries at temperatures above the recommended value therefore reduces their service life.



#### Sudden production halt

The formation of hot spots increases the breakdown rate and endangers the production process.

Example

##### Electronic equipment

Most electronic industrial control systems are equipped with axial fans for their own thermal control. A failure of the fan can lead to a production halt.

Reduced service life of the fan is one consequence of the enclosure heating up. 24 V DC axial fan.

Temperature range: -20...+70 °C.

Service life at 20 °C (L10 at 20 °C): 50000 h.

Service life at 60 °C (L10 at 20 °C): 20000 h.



The service life of the equipment can drop from 50000 h to only 20000 h.

#### The internal temperature increases with a high degree of IP

In aggressive atmospheres exposed to dust, humidity, chemical agents, or high temperatures, the equipment is installed in industrial enclosures (IP54) to protect it from the external environment. A high degree of IP protection can cause a reheating phenomenon which, if left unchecked, can stop the operation of the components.

Example

##### Variable speed drives

A variable speed drive controlling a 45 kW (60 hp) motor is programmed to work at temperatures ranging up to 50 °C or 60 °C.

The power dissipated by this variable speed drive inside the enclosure can reach 1360 W.

This contribution of heat inside the enclosure will cause the top temperature to rise to 60 °C and may cause a halt in production.



#### Our solution

Our new thermal offer includes a large range of solutions, suitable for most situations, from installing a ventilation system to exchangers or even a cooling unit. Do not hesitate to contact us to discover the best thermal solution for your installation.

# Choose the solution







## How to select the best temperature control auxiliary



System	Ventilation	Ventilating	
	Natural convection causes the temperature to drop inside the enclosure. Simple solutions for this case include installing grilles (without filter) or lifting the top.	Fans with filters are designed to evacuate a large amount of heat economically.	
When should it be used?	This solution can only be used when the power to be dissipated is low, in an environment with small amounts of dust.	When larger amounts of heat need to be evacuated in a polluted environment.	
Ta: Ambient temperature Td: Desired temperature	 <b>Ta &lt; Td</b>	 <b>Ta &lt; Td</b>	
The internal and external air circuits must be independent.	 <b>NO</b>	 <b>NO</b>	
Advantages	<ul style="list-style-type: none"> <li>• Economic solution.</li> <li>• No maintenance.</li> <li>• Quick and easy installation.</li> </ul>	<ul style="list-style-type: none"> <li>• Economic solution.</li> <li>• Easy maintenance.</li> <li>• Quick and easy installation.</li> <li>• Even temperature inside the enclosure.</li> <li>• High protection rating: IP54 or IP55.</li> </ul>	
Disadvantages	<ul style="list-style-type: none"> <li>• Small amount of heat evacuated.</li> <li>• Reduction of the IP protection rating.</li> <li>• Entry of dust particles.</li> </ul>	<ul style="list-style-type: none"> <li>• The temperature inside the enclosure is always higher than the external temperature.</li> <li>• The internal and external air circuits are in contact.</li> <li>• Maintenance required: filter replacement.</li> </ul>	
Solutions	 Ventilation devices	 Fans and outlet grilles	

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	Cooling	Heating
	<p>Air-conditioning devices provide efficient cooling of the enclosure, regardless of the outside air, and prevention of hot spots.</p>	<p>Resistance heaters prevent the formation of condensation and help ensure the ideal temperature for the correct operation of the electronic components.</p>
	<p>The cooling units can be used in the harshest environments, where the temperature can reach up to 55 °C. These devices control the temperature inside the enclosure and include an alarm function for signalling operational anomalies.</p>	<p>The resistance heaters are used to reheat the electrical switchboard when the ambient temperature is too low or to prevent the formation of condensation.</p>
	 <p>Ta &gt; Td</p>	 <p>Ta &lt; Td</p>
	 <p>YES</p>	
	<ul style="list-style-type: none"> <li>• Even temperature inside the enclosure.</li> <li>• High protection rating: IP54.</li> <li>• Use of an environmentally friendly gas.</li> </ul>	<ul style="list-style-type: none"> <li>• Small dimensions.</li> <li>• Equipped with a PTC-type heating system, which stabilizes the surface temperature of the aluminum profile.</li> <li>• Available in two versions: insulated with low surface temperature or in aluminum when the surface temperature is limited to 75 °C.</li> <li>• The fan-equipped resistance heaters help ensure an even temperature inside the enclosure.</li> </ul>
	<ul style="list-style-type: none"> <li>• Installation of a drain is recommended.</li> <li>• Maintenance required: filter replacement.</li> </ul>	
	 <p>Cooling units</p>	 <p>Resistance heaters</p>

# Choose the solution

## A thermal solution for every environment



### Ventilation systems with filters

Specially recommended for installations in which:

- The ambient temperature is lower than the desired temperature inside the enclosure.
- A high protection rating is required: IP54 or IP55.
- The surrounding environment is relatively clean, allowing air to enter the enclosure.

### Large range of solutions

- 42 possible combinations.
- Colors: RAL 7035 gray as standard, with the option of changing to RAL 7032 gray (with replacement grille **NSYCAG●●●LPC**).
- 38 to 850 m<sup>3</sup>/h.
- According to 5 input voltages:  
AC: 400/440 V, 230 V, 115 V (50/60 Hz),  
DC: 48 V and 24 V.
- Broad range of accessories (filters, IP55 & EMC covers, anti-vandalism kit).



### Cooling units

Cooling units control the temperature inside the enclosure to help ensure the correct operation of the components, regardless of the outside temperature, by separating the internal and external air circuits and reducing the humidity of the enclosure.

### Large range of solutions

- 32 models.
- Two versions: top-mounting model and side-mounting model.
- Cooling power from 240 to 4000 W.
- Two control versions: electronic and mechanical.
- According to the input voltage: 230 V (50/60 Hz);  
3 × 400/440 V (50/60 Hz); 115 V (50/60 Hz).
- Three installation types: surface, flush and partial flush (SLIM version).
- RAL 7035 gray and stainless steel.

# Choose the solution

## A thermal solution for every environment



### Resistance heaters

Two functions:

- To prevent the formation of condensation inside the enclosure.
- To reheat the electrical switchboard when the temperature is too low for the components to operate correctly.

### Large range of solutions

- 30 models.
- Insulated or aluminum versions.
- Versions with natural convection or fan.
- Cooling power from 10 to 550 W.
- According to the input voltage: 12 V to 450 V AC/DC.



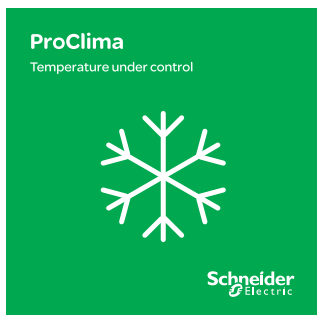
### Thermal control

Thermostats control the temperature inside the enclosure and send a signal when certain defined values are exceeded:

- Maximum value (cooling action).
- Minimum value (reheating action).

### Large range of solutions

- 15 models.
- Temperature control: adjustable thermostats; single or double.
- Relative humidity control: adjustable humidistat.
- Temperature and relative humidity control: adjustable hygrotherm.



### Calculation assistance: ProClima

We offer our customers a software application to help select thermal accessories. The software calculates a heat balance and defines the best ventilation or cooling solution for the inside of the enclosure.

# Ventilation systems

## Introduction



### Large range of fans

Flow rate efficiency, high protection rating, quick installation and easier maintenance to protect most applications.



### Optimized flow rate: average increase of 50%

#### Maximum use of surface

The outlet grille maximizes the air circulation.



#### Minimum loss of pressure

The corners of the walls, the variable tilt of the slats, the mounting distance of the motor and the dimensions of the device help ensure good air flow and a minimum loss of pressure.

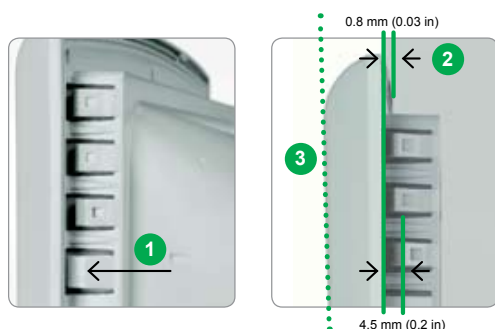
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# Ventilation systems

## Introduction



### High protection rating: IP54 as standard

#### 1 Mounting guide

An exclusive new mechanism is used to center the body of the fan on the wall of the enclosure. This system corrects machining faults. In addition, it facilitates the correct operation of the mounting clips.

#### 2 Multi-thickness mounting clips

This exclusive device helps ensure easy and reliable mounting of the ventilation system on walls with a thickness of 0.8 to 4.5 mm (0.03 to 0.2 in), with no hardware.

It helps ensure good compression of the seal around the outline of the cut-out. The seal between the grille and the wall is ensured for all the materials: steel, stainless steel, polyester, aluminum, etc.

#### 3 Inclined profile of the grille

- This innovative profile helps protect the filter against vertical spraying:
  - Each slat is protected by the slat above it.
  - The external dimensions remain small.



### Effective design for water evacuation

Water absorbed by the filter is effectively evacuated. Especially useful during high-pressure spraying.



### Hot-fitted sealing gasket

The polyurethane gasket, hot cast, helps ensure a long-lasting seal.



### Effective system for retaining the filter

The system for holding the synthetic filter in the cavity of the filter holder helps ensure a protection rating of IP54, in the most difficult conditions.

# Ventilation systems

## Introduction



### Innovative design

Innovative design with flowing lines.



### Easy installation

- Quick and easy mounting with the mounting device and the use of multi-thickness mounting clips.
- Mounting also possible with screws.
- Easy to invert.
- To operate as extractors, all the motors can be inverted by simply removing four screws.



### Easy maintenance

Quick and easy replacement of the filter installed in the fan, even during operation.



### Quality of the components

Motors are selected for improved flow rate and longer service life. Large range of input voltages available on all the motors delivered as standard, with alternating 50/60 Hz or direct current.

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### Certification

UL approval available.

# Ventilation systems

## Introduction



### ASA/PC plastic materials

ASA/PC material chosen to manufacture the ventilation system:

- Improved resistance to UV for longer service life.
- Excellent mechanical operation.
- Standard grille colors: RAL 7035 gray and RAL 7032 gray (replacement accessory).
- Other colors are available on request (contact us).
- ASA/PC plastic material, self-extinguishing according to standard UL94 V0.



### Large variety of filters

- Filters for oily environments (OEM).
  - Anti-insect filters.
  - Fine filters (improved protection against dust).
- See page 7/20.



### Sealing cover IP55

- Available in two versions:
    - Aluzinc: RAL 7035 gray paint.
    - Stainless steel.
- See page 7/21.



### EMC cover

Thanks to this accessory, the various ventilation systems offer greater resistance to magnetic fields (EMC), helping to prevent interference with the equipment installed inside the enclosure.

See page 7/22.



### Anti-vandalism kit

Accessory for outdoor applications, in contact with the public. The kit prevents unwanted opening of the grille.

See page 7/20.



**ENVIRONMENTALLY  
FRIENDLY**

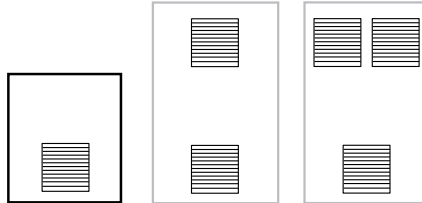
### Environmentally friendly

- Recyclable plastic materials and filters.
- Motors in compliance with the RoHS directive.
- Lower power consumption for improved air flow.

# Ventilation system

## Selection guide

### Ventilation systems with filters



	Fan flow rate: m³/h (ft³/h)			Voltage	Type of connection C = by cable F = by faston (1) B = by terminal block
	Free with filter	With 1 outlet grille	With 2 outlet grilles		
	50 Hz	50 Hz	50 Hz		
	38 (124.7)	25 (82.0)	33 (108.3)	230 V	C
	38 (124.7)	27 (88.6)	35 (114.8)	115 V	C
	58 (190.3)	39 (128.0)	47 (154.2)	24 V DC	C
	44 (144.4)	34 (111.5)	41 (134.5)	48 V DC	C
	85 (278.9)	63 (206.7)	71 (232.9)	230 V	F
	79 (259.2)	65 (213.3)	73 (239.5)	115 V	F
	80 (262.5)	57 (187.0)	77 (252.6)	24 V DC	F
	79 (259.2)	59 (193.6)	68 (223.1)	48 V DC	F
	165 (541.3)	153 (502.0)	161 (528.2)	230 V	F
	164 (538.1)	153 (502.0)	161 (528.2)	115 V	F
	188 (616.8)	171 (561.0)	179 (587.3)	24 V DC	F
	193 (633.2)	171 (561.0)	179 (587.3)	48 V DC	F
	302 (990.8)	260 (853.0)	268 (879.3)	230 V	F
	302 (990.8)	263 (862.9)	271 (889.1)	115 V	F
	262 (859.6)	221 (725.1)	229 (751.3)	24 V DC	F
	247 (810.4)	210 (689.0)	218 (715.2)	48 V DC	F
	562 (1843.8)	473 (1551.8)	481 (1578.1)	230 V	B
	582 (1909.4)	485 (1591.2)	494 (1620.7)	115 V	B
	838 (2749.3)	718 (2355.6)	728 (2388.5)	230 V	B
	983 (3225.1)	843 (2765.7)	854 (2801.8)	115 V	B
	931 (3054.5)	798 (2618.1)	809 (2654.2)	400/440 V	B

(1) Fan models with connection type (F) are delivered with a 2 m (6.6 ft) connection cord included.

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# Ventilation system

## Selection guide

	Dimensions: mm (in)		Catalog number					
	Total (external)	Cut-out	Fan with filter	Outlet grille	Color kit	IP55	IP55 stainless steel	EMC
			RAL 7035 gray		RAL 7032 gray			
	137 × 117 (5.4 × 4.6)	92 × 92 (3.6 × 3.6)	NSYCVF38M230PF	NSYCAG92LPF	NSYCAG92LPC	-	-	-
NSYCVF38M115PF								
NSYCVF38M24DPF								
NSYCVF38M48DPF								
	170 × 150 (6.7 × 5.9)	125 × 125 (4.9 × 4.9)	NSYCVF85M230PF	NSYCAG125LPF	NSYCAG125LPC	NSYCAP125LZF	NSYCAP125LXF	NSYCAP125LE
NSYCVF85M115PF								
NSYCVF85M24DPF								
NSYCVF85M48DPF								
	268 × 248 (10.6 × 9.8)	223 × 223 (8.8 × 8.8)	NSYCVF165M230PF	NSYCAG223LPF	NSYCAG223LPC	NSYCAP223LZF	NSYCAP223LXF	NSYCAP223LE
NSYCVF165M115PF								
NSYCVF165M24DPF								
NSYCVF165M48DPF								
NSYCVF300M230PF								
NSYCVF300M115PF								
NSYCVF300M24DPF								
NSYCVF300M48DPF								
	336 × 316 (13.2 × 12.4)	291 × 291 (11.5 × 11.5)	NSYCVF560M230PF	NSYCAG291LPF	NSYCAG291LPC	NSYCAP291LZF	NSYCAP291LXF	NSYCAP291LE
NSYCVF560M115PF								
NSYCVF850M230PF								
NSYCVF850M115PF								
NSYCVF850M400PF								



# Ventilation systems

## Forced ventilation 38 m<sup>3</sup>/h



### General characteristics

- The fans are comprised of an axial motor, a protective housing on the front and rear surfaces and a filter designed to block dust particles.
- This filter can be replaced during operation without risk of contact with the rotating element.
- The cut-out template supplied with the device avoids the need for marking and protects the surface of the enclosure during handling.
- RAL 7035 gray in the standard offer with an optional replacement grille in RAL 7032 gray.

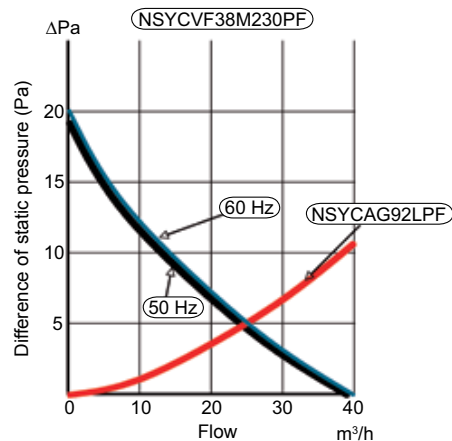
### Conditions of use

- The outside temperature (Te) must be 5 °C lower than the desired temperature (Ts) inside the enclosure.
- The filters that equip the fans must be cleaned and replaced regularly.
- The surrounding environment must be relatively clean and overfrequent filter replacement should be avoided.
- Bear in mind the pressure losses caused by the outlet element (grille with filter, ventilation louver or simple opening) when determining the fan flow rate.

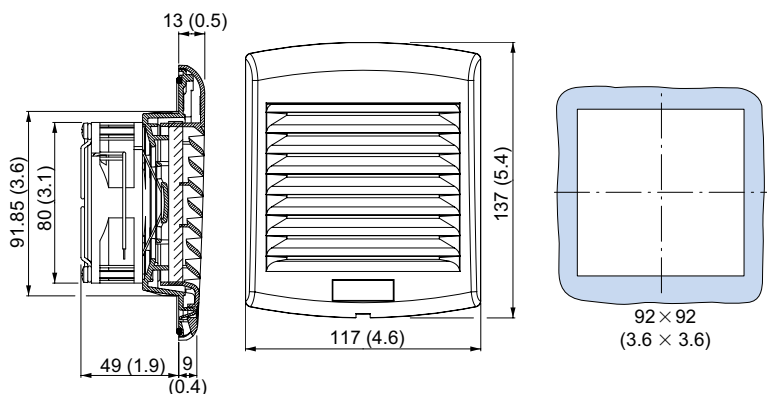
Specifications	Catalog number			
	Color: RAL 7035 gray	NSYCVF38M230PF	NSYCVF38M115PF	NSYCVF38M24DPF
Free flow rate with standard filter: m <sup>3</sup> /h (ft <sup>3</sup> /h)	38 (124.7) [50 Hz] 39 (128.0) [60 Hz]	38 (124.7) [50 Hz] 39 (128.0) [60 Hz]	58 (190.3)	44 (144.4)
Flow rate with 1 outlet grille: m <sup>3</sup> /h (ft <sup>3</sup> /h)	25 (82.0) [50 Hz] 26 (85.3) [60 Hz]	27 (88.6) [50 Hz] 28 (91.9) [60 Hz]	39 (128.0)	34 (111.5)
Nominal voltage	230 V (50/60 Hz)	115 V (50/60 Hz)	24 V DC	48 V DC
Voltage range	150–250 V	75–125 V	10–27.6 V	36–56 V
Absorbed power (50/60 Hz)	4.5/4.8 W	3.3/3.5 W	3.6 W	3.6 W
Max. intensity (50/60 Hz)	0.16/0.17 A	0.16/0.16 A	0.18 A	70 mA
Noise level	40/41 dB (A)			
Bearing	Balls			
IP	54			
External dimensions: mm (in)	137 × 117 × 49 (5.4 × 4.6 × 1.9)			
Cut-out: mm (in)	92 × 92 (3.6 × 3.6)			
Weight: kg (lbs)	0.220 (0.5)		0.230 (0.5)	
Material	Injected thermoplastic (ASA PC). Self-extinguishing according to UL94 V0.			
Operating temperature	-10...+70 °C			
Storage temperature	-40...+70 °C			
Max. static pressure (flow rate 0 m <sup>3</sup> /h)	29 Pa			

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### Flow curves



### Dimensions: mm (in)



# Ventilation systems

## Forced ventilation 85 m<sup>3</sup>/h



### General characteristics

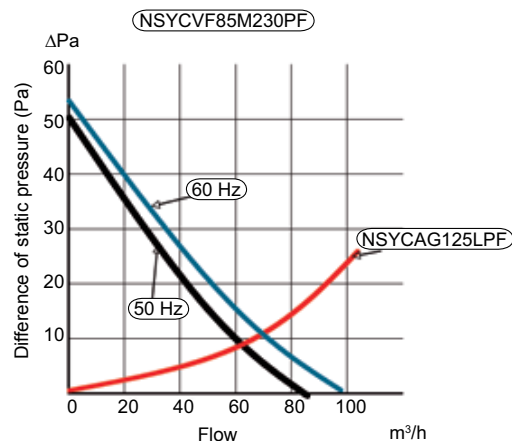
- The fans are comprised of an axial motor, a protective housing on the front and rear surfaces and a filter designed to block dust particles.
- This filter can be replaced during operation without risk of contact with the rotating element.
- Optionally, the device can be equipped with a filter that provides even more efficient protection for your sensitive facilities against dust particles.
- The cut-out template supplied with the device avoids the need for marking and protects the surface of the enclosure during handling.
- RAL 7035 gray in the standard offer with an optional replacement grille in RAL 7032 gray.

### Conditions of use

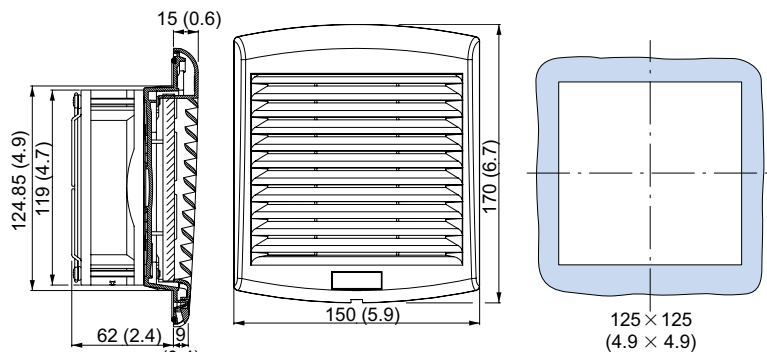
- The outside temperature (Te) must be 5 °C lower than the desired temperature (Ts) inside the enclosure.
- The filters that equip the fans must be cleaned and replaced regularly.
- The surrounding environment must be relatively clean and overfrequent filter replacement should be avoided.
- Bear in mind the pressure losses caused by the outlet element (grille with filter, ventilation louver or simple opening) when determining the fan flow rate.

Specifications	Catalog number			
	Color: RAL 7035 gray	NSYCVF85M230PF	NSYCVF85M115PF	NSYCVF85M24DPF
Free flow rate with standard filter: m <sup>3</sup> /h (ft <sup>3</sup> /h)	85 (278.9) [50 Hz] 98 (321.5) [60 Hz]	79 (259.2) [50 Hz] 92 (301.8) [60 Hz]	80 (262.5)	
Flow rate with 1 outlet grille: m <sup>3</sup> /h (ft <sup>3</sup> /h)	63 (206.7) [50 Hz] 72 (236.2) [60 Hz]	65 (213.3) [50 Hz] 74 (242.8) [60 Hz]	60 (196.9)	
Nominal voltage	230 V (50/60 Hz)	115 V (50/60 Hz)	24 V DC	48 V DC
Voltage range	175–253 V	75–126 V	10–27.6 V	25–55.2 V
Absorbed power	17/15 W	16/15 W	7.6 W	8 W
Max. intensity (50/60 Hz)	0.121/0.097 A	0.207/0.179 A	0.30 A	0.173 A
Noise level	46/49 dB (A)			
Bearing	Balls			
IP	54			
External dimensions: mm (in)	170 × 150 × 62 (6.7 × 5.9 × 2.4)			
Cut-out: mm (in)	125 × 125 (4.9 × 4.9)			
Weight: kg (lbs)	0.78 (1.7)		0.48 (1.1)	
Material	Injected thermoplastic (ASA PC). Self-extinguishing according to UL94 V0.			
Operating temperature	-20...+60 °C		-10...+70 °C	
Storage temperature	-40...+70 °C			
Max. static pressure (flow rate m <sup>3</sup> /h)	50 Pa			

### Flow curves



### Dimensions: mm (in)





# Ventilation systems

## Forced ventilation 165 m<sup>3</sup>/h



### General characteristics

- The fans are comprised of an axial motor, a protective housing on the front and rear surfaces and a filter designed to block dust particles.
- This filter can be replaced during operation without risk of contact with the rotating element.
- Optionally, the device can be equipped with a filter that provides even more efficient protection for your sensitive facilities against dust particles.
- The cut-out template supplied with the device avoids the need for marking and protects the surface of the enclosure during the handling.
- RAL 7035 gray in the standard offer with an optional replacement grille in RAL 7032 gray.

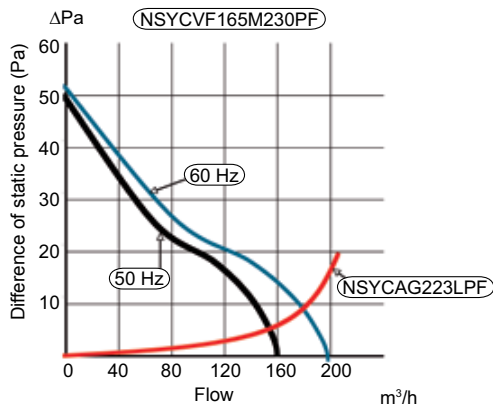
### Conditions of use

- The outside temperature (Te) must be 5 °C lower than the desired temperature (Ts) inside the enclosure.
- The filters that equip the fans must be cleaned and replaced regularly.
- The surrounding environment must be relatively clean and overfrequent filter replacement should be avoided.
- Bear in mind the pressure losses caused by the outlet element (grille with filter, ventilation louver or simple opening) when determining the fan flow rate.

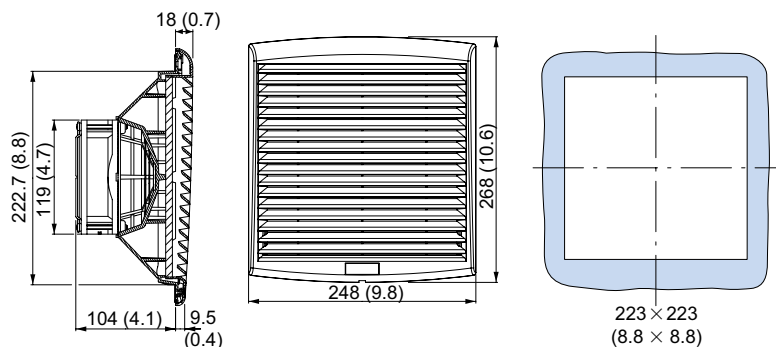
Specifications	Catalog number			
Color: RAL 7035 gray	NSYCVF165M230PF	NSYCVF165M115PF	NSYCVF165M24DPF	NSYCVF165M48DPF
Free flow rate with filter: m <sup>3</sup> /h (ft <sup>3</sup> /h)	165 (541.3) [50 Hz]	193 (633.2) [60 Hz]	190 (623.4)	
Flow rate with 1 outlet grille: m <sup>3</sup> /h (ft <sup>3</sup> /h)	153 (502.0) [50 Hz]	171 (561.0) [60 Hz]	171 (561.0)	
Flow rate with 2 outlet grilles: m <sup>3</sup> /h (ft <sup>3</sup> /h)	161 (528.2) [50 Hz]	175 (574.1) [60 Hz]	179 (587.3)	
Nominal voltage	230 V (50/60 Hz)	115 V (50/60 Hz)	24 V DC	48 V DC
Voltage range	175–253 V	75–126 V	10–27.6 V	25–55.2 V
Absorbed power	16.3/14.3 W	15.5/14.4 W	8 W	8.7 W
Max. intensity (50/60 Hz)	0.12/0.94 A	0.20/0.18 A	0.3 A	0.18 A
Noise level	50/51 dB (A)			
Bearing	Balls			
IP	54			
External dimensions: mm (in)	268 × 248 × 104 (10.6 × 9.8 × 4.1)			
Cut-out: mm (in)	223 × 223 (8.8 × 8.8)			
Weight: kg (lbs)	1.14 (2.5)		0.81 (1.8)	
Material	Injected thermoplastic (ASA PC). Self-extinguishing according to UL94 V0.			
Operating temperature	-20...+60 °C		-10...+70 °C	
Storage temperature	-40...+70 °C			
Max. static pressure	50 Pa			

7

### Flow curves



### Dimensions: mm (in)





# Ventilation systems

## Forced ventilation 300 m<sup>3</sup>/h



### General characteristics

- The fans are comprised of an axial motor, a protective housing on the front and rear surfaces and a filter designed to block dust particles.
- This filter can be replaced during operation without risk of contact with the rotating element.
- Optionally, the device can be equipped with a filter that provides even more efficient protection for your sensitive facilities against dust particles.
- The cut-out template supplied with the device avoids the need for marking and protects the surface of the enclosure during handling.
- RAL 7035 gray in the standard offer with an optional replacement grille in RAL 7032 gray.

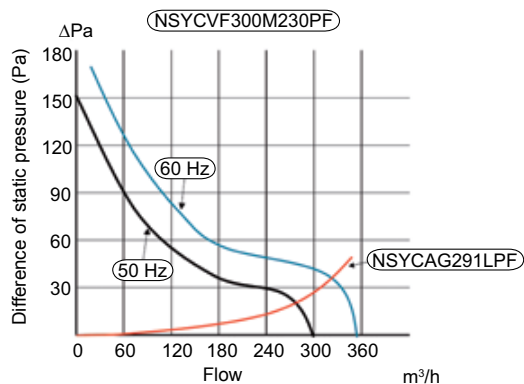
### Conditions of use

- The outside temperature (Te) must be 5 °C lower than the desired temperature (Ts) inside the enclosure.
- The filters that equip the fans must be cleaned and replaced regularly.
- The surrounding environment must be relatively clean and overfrequent filter replacement should be avoided.
- Bear in mind the pressure losses caused by the outlet element (grille with filter, ventilation louver or simple opening) when determining the fan flow rate.

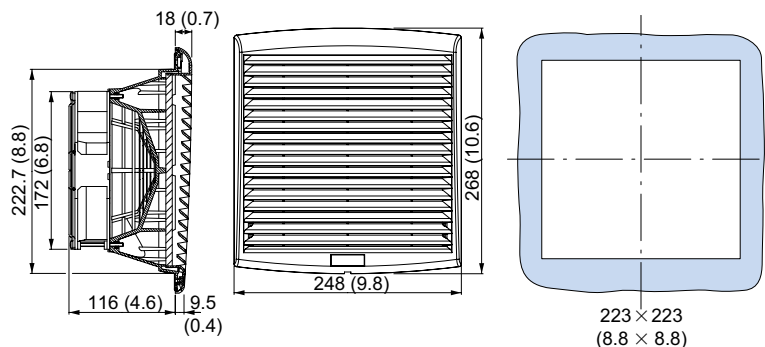
Specifications	Catalog number			
	NSYCVF300M230PF	NSYCVF300M115PF	NSYCVF300M24DPF	NSYCVF300M48DPF
Color: RAL 7035 gray				
Free flow rate with filter: m <sup>3</sup> /h (ft <sup>3</sup> /h)	300 (984.3) [50 Hz]	350 (1148.3) [60 Hz]	262 (859.6)	
Flow rate with 1 outlet grille: m <sup>3</sup> /h (ft <sup>3</sup> /h)	260 (853.0) [50 Hz]	307 (1007.2) [60 Hz]	221 (725.1)	
Nominal voltage	230 V (50/60 Hz)	115 V (50/60 Hz)	24 V DC	48 V DC
Voltage range	145–253 V	75–126 V	12–30 V	25–60 V
Absorbed power	36/37 W	36/36 W	13 W	11 W
Max. intensity (50/60 Hz)	0.17/0.16 A	0.35/0.32 A	0.53 A	0.24 A
Noise level	55/56 dB (A)			
Bearing	Balls			
IP	54			
External dimensions: mm (in)	268 × 248 × 116 (10.6 × 9.8 × 4.6)		268 × 248 × 103.4 (10.6 × 9.8 × 4.1)	
Cut-out: mm (in)	223 × 223 (8.8 × 8.8)			
Weight: kg (lbs)	1.3 (2.9)		1.1 (2.4)	
Material	Injected thermoplastic (ASA PC). Self-extinguishing according to UL94 V0.			
Operating temperature	-10...+70 °C		-10...+70 °C	
Storage temperature	-40...+70 °C			
Max. static pressure	158 Pa			



### Flow curves



### Dimensions: mm (in)



# Ventilation systems

## Forced ventilation 560-850 m<sup>3</sup>/h



### General characteristics

- The fans are comprised of an axial motor, a protective housing on the front and rear surfaces and a filter designed to block dust particles.
- This filter can be replaced during operation without risk of contact with the rotating element.
- Optionally, the device can be equipped with a filter that provides even more efficient protection for your sensitive facilities against dust particles.
- The cut-out template supplied with the device avoids the need for marking and protects the surface of the enclosure during handling.
- RAL 7035 gray in the standard offer with an optional replacement grille in RAL 7032 gray.

### Conditions of use

- The outside temperature (Te) must be 5 °C lower than the desired temperature (Ts) inside the enclosure.
- The filters that equip the fans must be cleaned and replaced regularly.
- The surrounding environment must be relatively clean and overfrequent filter replacement should be avoided.
- Bear in mind the pressure losses caused by the outlet element (grille with filter, ventilation louver or simple opening) when determining the fan flow rate.

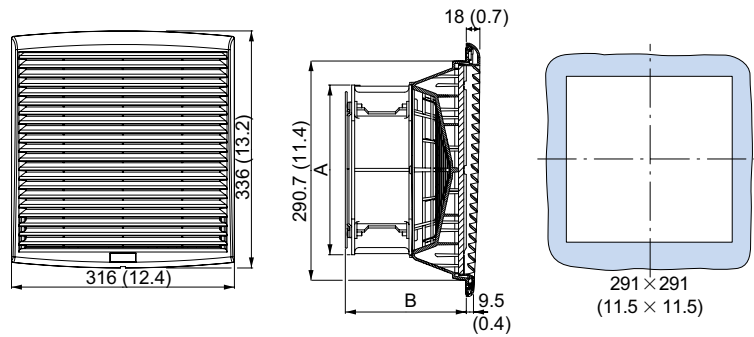
Specifications	Catalog number				
Color: RAL 7035 gray	NSYCVF560M230PF	NSYCVF560M115PF	NSYCVF850M230PF	NSYCVF850M115PF	NSYCVF850M400PF
Free flow rate with filter: m <sup>3</sup> /h (ft <sup>3</sup> /h)	562 (1843.8) [50 Hz] 586 (1922.6) [60 Hz]		838 (2749.3) [50 Hz] 803 (2634.5) [60 Hz]	983 (3225.1) [50 Hz] 944 (3097.1) [60 Hz]	931 (3054.5) [50 Hz] 803 (2634.5) [60 Hz]
Flow rate with 1 outlet grille: m <sup>3</sup> /h (ft <sup>3</sup> /h)	473 (1551.8) [50 Hz] 477 (1565.0) [60 Hz]		718 (2355.6) [50 Hz] 568 (1863.5) [60 Hz]	843 (2765.7) [50 Hz] 642 (2106.3) [60 Hz]	798 (2618.1) [50 Hz] 568 (1863.5) [60 Hz]
Nominal voltage	230 V (50/60 Hz)	115 V (50/60 Hz)	230 V (50/60 Hz)	115 V (50/60 Hz)	400 V (50/60 Hz)
Voltage range	207–244 V	103–122 V	207–244 V	103–122 V	396–466 V
Absorbed power	68/85 W	65/83 W	150/195 W	145/182 W	126/126 W
Max. intensity (50/60 Hz)	0.52/0.370 A	0.60/0.72 A	0.65/0.85 A	1.279/1.6 A	0.226/0.232 A
Noise level	59/59 dB (A)		76/75 dB (A)	78/77 dB (A)	77/75 dB (A)
Bearing	Balls				
IP	54				
External dimensions: mm (in)	336 × 316 × 161 (13.2 × 12.4 × 6.3)		336 × 316 × 162 (13.2 × 12.4 × 6.4)		
Cut-out: mm (in)	291 × 291 (11.5 × 11.5)				
Weight: kg (lbs)	3.2 (7.1)		4.1 (9.0)		
Material	Injected thermoplastic (ASA PC). Self-extinguishing according to UL94 V0.				
Operating temperature	-15...+60 °C				
Storage temperature	-40...+70 °C				
Max. static pressure	140 Pa		170 Pa		

# Ventilation systems

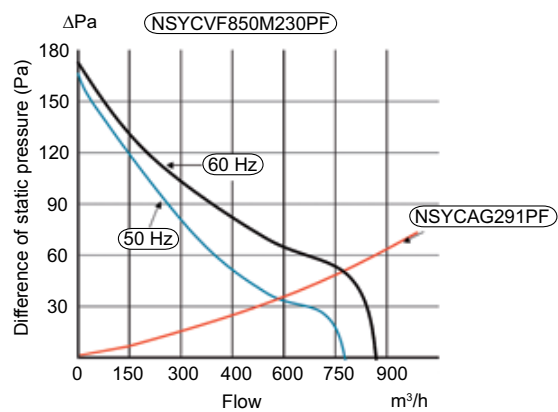
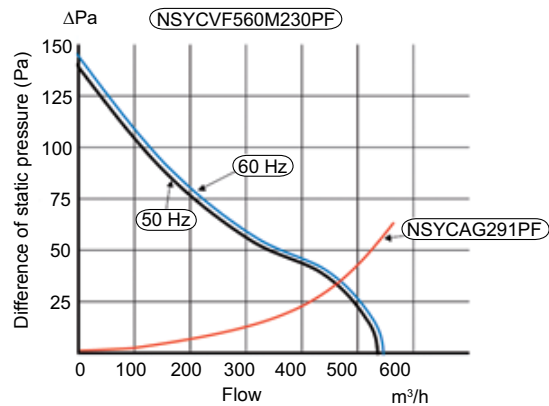
## Forced ventilation 560-850 m<sup>3</sup>/h

### Dimensions: mm (in)

A	B	Catalog number
225 (8.9)	160.5 (6.3)	<b>NSYCVF560M230PF</b> <b>NSYCVF560M115PF</b>
280 (11.0)	162 (6.4)	<b>NSYCVF850M230PF</b> <b>NSYCVF850M115PF</b>



### Flow curves



# Ventilation systems

## Accessories



RAL 7035

### Outlet grilles

- Delivered with G2 M1 synthetic standard filter.
- Material: Injected thermoplastic (ASA PC), self-extinguishing according to UL94 V0.

Dimensions: mm (in)		IP	Catalog number RAL 7035 gray
Total (external)	Cut-out		
137 (5.4) × 117 (4.6) × 13 (0.5)	92 (3.6) × 92 (3.6)	54	<b>NSYCAF92LPC</b>
170 (6.7) × 150 (5.9) × 15 (0.6)	125 (4.9) × 125 (4.9)	54	<b>NSYCAF125LPC</b>
268 (10.6) × 248 (9.8) × 18 (0.7)	223 (8.8) × 223 (8.8)	54	<b>NSYCAF223LPC</b>
336 (13.2) × 316 (12.4) × 18 (0.7)	291 (11.5) × 291 (11.5)	54	<b>NSYCAF291LPC</b>



RAL 7032

### Replacement grilles in RAL 7032 gray

- External part of the grille (for fan or outlet grille) for changing the color to RAL 7032 gray.

Dimensions: mm (in) Total (external)	IP	Catalog number RAL 7032 gray
137 (5.4) × 117 (4.6) × 13 (0.5)	54	<b>NSYCAF92LPC</b>
170 (6.7) × 150 (5.9) × 15 (0.6)	54	<b>NSYCAF125LPC</b>
268 (10.6) × 248 (9.8) × 18 (0.7)	54	<b>NSYCAF223LPC</b>
336 (13.2) × 316 (12.4) × 18 (0.7)	54	<b>NSYCAF291LPC</b>



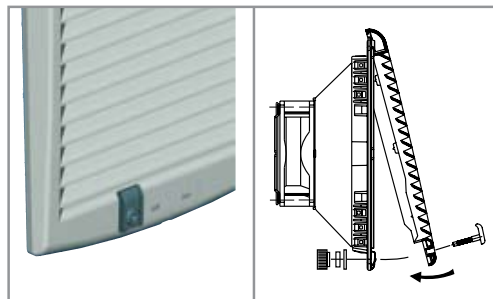
### Filters

Description	For fans and grilles		Qty.	Catalog number
	Ext. dimensions: mm (in)	Cut-out: mm (in)		
G2 M1 synthetic standard filters	137 (5.4) × 117 (4.6)	92 (3.6) × 92 (3.6)	5	<b>NSYCAF92</b>
	170 (6.7) × 150 (5.9)	125 (4.9) × 125 (4.9)	5	<b>NSYCAF125</b>
	268 (10.6) × 248 (9.8)	223 (8.8) × 223 (8.8)	5	<b>NSYCAF223</b>
	336 (13.2) × 316 (12.4)	291 (11.5) × 291 (11.5)	5	<b>NSYCAF291</b>
Filters for greasy environments G2 M1	170 (6.7) × 150 (5.9)	125 (4.9) × 125 (4.9)	5	<b>NSYCAF125O</b>
	268 (10.6) × 248 (9.8)	223 (8.8) × 223 (8.8)	5	<b>NSYCAF223O</b>
	336 (13.2) × 316 (12.4)	291 (11.5) × 291 (11.5)	5	<b>NSYCAF291O</b>
G3 M1 synthetic fine filters	170 (6.7) × 150 (5.9)	125 (4.9) × 125 (4.9)	5	<b>NSYCAF125T</b>
	268 (10.6) × 248 (9.8)	223 (8.8) × 223 (8.8)	5	<b>NSYCAF223T</b>
	336 (13.2) × 316 (12.4)	291 (11.5) × 291 (11.5)	5	<b>NSYCAF291T</b>
Stainless-steel anti-insect filters	137 (5.4) × 117 (4.6)	92 (3.6) × 92 (3.6)	1	<b>NSYCAF92M</b>
	170 (6.7) × 150 (5.9)	125 (4.9) × 125 (4.9)	1	<b>NSYCAF125M</b>
	268 (10.6) × 248 (9.8)	223 (8.8) × 223 (8.8)	1	<b>NSYCAF223M</b>
	336 (13.2) × 316 (12.4)	291 (11.5) × 291 (11.5)	1	<b>NSYCAF291M</b>

### Anti-vandalism kit

- Prevents the grille from being opened from the outside.
- The unlocking thumbwheel is accessed from the inside of the wall-mounting enclosure.
- RAL 7011 gray color (same material as the grille: ASA PC).

Quantity	Catalog number
2	<b>NSYCAAPV</b>



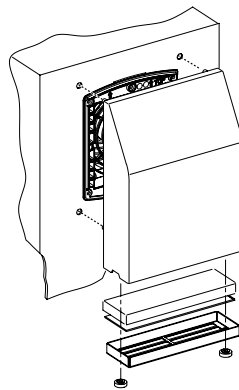


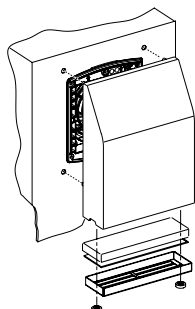
### Sealing cover IP55

- This solution protects the fan or grille from direct sprays.
- 2 materials available:
  - Aluzinc in RAL 7035 gray color for outdoor applications.
  - Stainless steel 304L for food and beverage applications.
- Protection rating: IP55.
- Resistance to mechanical impacts: IK10.
- Double insulation maintained if installed in an insulated enclosure.
- UL certification.
- The cover is placed over the fan or the grille. A filter at the bottom of the cover helps prevent the entry of particles.
- Easy access to the filter with the removal of two screws.
- When mounting, remove the external part of the fan or the grille as well as the filter.
- The cover is the preferred solution to help ensure:
  - An efficient air flow for cooling.
  - IP55 rating.
- For a complete system, order 1 fan + 1 grille + 2 covers.

Flow rate: m³/h (ft³/h)* with cover		Dimensions: mm (in)		Cover reference		Spare filter for cover	Fan reference	Grille reference
Free	With 1 outlet grille	External	Cut-out	Aluzinc RAL 7035 gray	Stainless steel 304L	Quantity 5	RAL 7035 gray	RAL 7035 gray
74 (242.8)	53 (173.9)	240 × 180 × 60	125 × 125	NSYCAP125LZF	NSYCAP125LXF	NSYCAF125L55	NSYCVF85M230PF	NSYCAP125L55
110 (360.9)	82 (269.0)	350 × 305 × 80	223 × 223	NSYCAP223LZF	NSYCAP223LXF	NSYCAF223L55	NSYCVF165M230PF	NSYCAP223L55
165 (541.3)	123 (403.5)	350 × 305 × 80	223 × 223	NSYCAP223LZF	NSYCAP223LXF	NSYCAF223L55	NSYCVF300M230PF	NSYCAP223L55
316 (1036.7)	265 (869.4)	430 × 373 × 105	291 × 291	NSYCAP291LZF	NSYCAP291LXF	NSYCAF291L55	NSYCVF560M230PF	NSYCAP291L55
502 (1647.0)	430 (1410.8)	430 × 373 × 105	291 × 291	NSYCAP291LZF	NSYCAP291LXF	NSYCAF291L55	NSYCVF850M230PF	NSYCAP291L55

\*The impact on the flow rates of the fans supplied with the other voltages is similar to those provided by the 230 V fans.





### EMC cover IP55

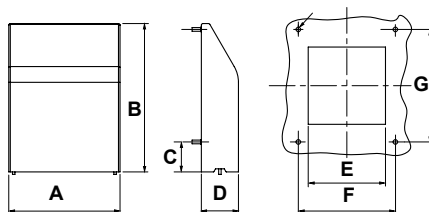
- This solution helps protect against electromagnetic interference and helps ensure IP55 protection.
- The EMC cover is installed on the fans or standard IP54 outlet grilles.
- The cover, made from Aluzinc sheet steel, completely covers the fan or outlet grille.
- Conductivity is obtained by:
  - A conductive coating (2 Ω).
  - A conductive copper braid.
- Protection degree: IP55.
- Resistance to mechanical impacts: IK10.
- RAL 7035 gray.
- Absorption curve according to standard IEEE 299 1997 (UNE 50147-1).

Flow rate: m <sup>3</sup> /h (ft <sup>3</sup> /h)*		Dimensions: mm (in)		Cover catalog number	Spare filter for cover	Fan catalog number	Grille catalog number
Free	With 1 outlet grille	External	Cut-out	Aluzinc RAL 7035 gray	Quantity 5	RAL 7035 gray	RAL 7035 gray
74 (242.8)	53 (173.9)	240 × 180 × 60 (9.4 × 7.1 × 2.4)	125 × 125 (4.9 × 4.9)	NSYCAP125LE	NSYCAF125L55	NSYCVF85M230PF	NSYCAG125L55
110 (360.9)	82 (269.0)	350 × 305 × 80 (13.8 × 12.0 × 3.1)	223 × 223 (8.8 × 8.8)	NSYCAP223LE	NSYCAF223L55	NSYCVF165M230PF	NSYCAG223L55
165 (541.3)	123 (403.5)	350 × 305 × 80 (13.8 × 12.0 × 3.1)	223 × 223 (8.8 × 8.8)	NSYCAP223LE	NSYCAF223L55	NSYCVF300M230PF	NSYCAG223L55
316 (1036.7)	265 (869.4)	430 × 373 × 105 (16.9 × 14.7 × 4.1)	291 × 291 (11.5 × 11.5)	NSYCAP291LE	NSYCAF291L55	NSYCVF560M230PF	NSYCAG291L55
502 (1647.0)	430 (1410.8)	430 × 373 × 105 (16.9 × 14.7 × 4.1)	291 × 291 (11.5 × 11.5)	NSYCAP291LE	NSYCAF291L55	NSYCVF850M230PF	NSYCAG291L55

\*The impact on the flow rates of the fans with different voltages is similar to the impact of the 230 V fans.

### Dimensions of EMC covers

Dimensions: mm (in)										
A	B	C	D	E	F	G	No. of mounting points	Cover catalog number		
								IP54	EMC	
180 (7.1)	240 (9.4)	49 (1.9)	60 (2.4)	125 (4.9)	157 (6.2)	182 (7.2)	4	NSYCAP125LZF	NSYCAP125LXF	NSYCAP125LE
305 (12.0)	350 (13.8)	61 (2.4)	80 (3.1)	223 (8.8)	283 (11.1)	280 (11.0)	8	NSYCAP223LZF	NSYCAP223LXF	NSYCAP223LE
373 (14.7)	430 (16.9)	73 (2.9)	105 (4.1)	291 (11.5)	351 (13.8)	348 (13.7)	8	NSYCAP291LZF	NSYCAP291LXF	NSYCAP291LE



# Ventilation systems

## Fans and accessories



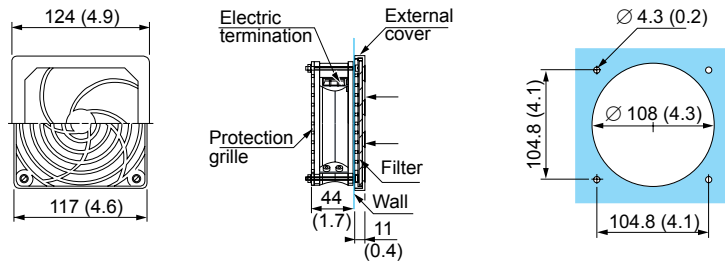
### IP20 fans

- Free flow without filter or grille: 170 m<sup>3</sup>/h (557.7 ft<sup>3</sup>/h).
- Two models according to the input voltage: 230 and 115 V, 50-60 Hz.
- Accessories: IP20 outlet grille (ABS, black) and filter (black polyurethane foam).

Voltage (V)	Flow rate: m <sup>3</sup> /h (ft <sup>3</sup> /h)	Catalog number
115	65 (213.3)	<b>NSYCVF65M115PF</b>
230	65 (213.3)	<b>NSYCVF65M230PF</b>

### Accessories

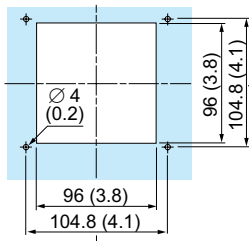
Dimensions: mm (in)	Description	Catalog number
124 × 124 × 11 (4.9 × 4.9 × 0.4)	Outlet grille	<b>NSYCAG108LP</b>
-	Filter	<b>NSYCAF108</b>



### IP33 ventilation kit

- The ventilation kit is comprised of:
  - One 120 × 120 × 38 mm (4.7 × 4.7 × 1.5 in) fan, 230 V-50/60 Hz, free flow rate 170 m<sup>3</sup>/h (557.7 ft<sup>3</sup>/h), IP33/IK10.
  - Two 120 × 120 mm (4.7 × 4.7 in) metal louvers, RAL 7035 gray.
  - Two 115 × 98 mm (4.5 × 3.9 in) anti-insect grilles, stainless-steel 304L wire.
  - Ø 0.32 mm (0.01 in) braided, 1.07 mm (0.04 in) meshes.
  - A power cord.
  - The hardware required for installation.
- Overall flow rate: 54 m<sup>3</sup>/h (177.2 ft<sup>3</sup>/h).
- Resistance to mechanical impacts: IK10.

Voltage (V)	Flow rate: m <sup>3</sup> /h (ft <sup>3</sup> /h)	Catalog number
230	54 (177.2)	<b>NSYCVF54M230MM2</b>



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### IP54 top fan with hood

- Fan with hood, for floor-standing enclosures.
- Device delivered with hardware and connection terminal block.
- Electric power: 85 W.
- A flow rate of 350 m<sup>3</sup>/h (1148.3 ft<sup>3</sup>/h) is obtained with an outlet grille cat. no. **NSYCAG291LPF**, cut-out 291 × 291 mm (11.5 × 11.5 in).
- Noise level: 64 dB (A).
- Installation and removal from the outside.

Flow rate*: m <sup>3</sup> /h (ft <sup>3</sup> /h)	Voltage (V)	Weight: kg (lbs)	Catalog number
570 (1870.1)	115	5.8 (12.8)	<b>NSYCVF570M115MF</b>
575 (1886.5)	230	5.8 (12.8)	<b>NSYCVF575M230MF</b>

\* Flow rate measured without counter-pressure.



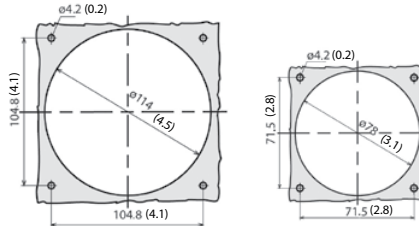
# Ventilation systems

## Fans and accessories



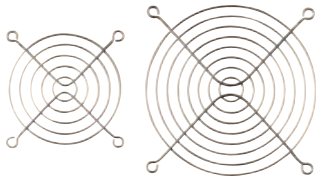
### Fan motor

- Turbine-type fan motor for ventilation/extraction.



### Outlet grilles

- Outlet filter kit for enclosure ventilation. For fans **NSYCVF156M●●●** and **NSYCVF35M●●●**.



### Rear protective grille

- Protective grille for enclosure fan motor. For fans **NSYCVF156M●●●** and **NSYCVF35M●●●**.



### Fan connection cable

- For coupling to the connection terminal of the fan motors.

Catalog number  
**NSYCVAC100**

Fan motor catalog number	Flow rate: m <sup>3</sup> /h (ft <sup>3</sup> /h)	Voltage (V)	Absorbed power (W)	Noise level (dB)	External dimensions: mm (in)	Outlet grille catalog number	Protective grille catalog number
<b>NSYCVF156M230</b>	156 (511.8)	230/50-60	17/15	42	120 × 120 × 38 (4.7 × 4.7 × 1.5)	<b>NSYCAG114LPF</b>	<b>NSYCVA114M</b>
<b>NSYCVF156M115</b>	156 (511.8)	120/50-60	17/15	42	120 × 120 × 38 (4.7 × 4.7 × 1.5)	<b>NSYCAG114LPF</b>	<b>NSYCVA114M</b>
<b>NSYCVF35M230</b>	35 (114.8)	230/50-60	16/14	32	80 × 80 × 25 (3.1 × 3.1 × 1.0)	<b>NSYCAG78LPF</b>	<b>NSYCVA78M</b>
<b>NSYCVF35M115</b>	35 (114.8)	120/50-60	16/14	32	80 × 80 × 25 (3.1 × 3.1 × 1.0)	<b>NSYCAG78LPF</b>	<b>NSYCVA78M</b>

# Ventilation systems

## Circulation accessories



### Circulation fan

- User protection according to DIN 31001.
- Power: 17 W.
- Dimensions:
  - Fan: 119 × 119 × 38 mm (4.7 × 4.7 × 1.5 in).
  - Collar length: 140 mm (5.5 in); mounting center-to-center distance: 130 mm (5.1 in).
- Installation on ball-bearing.

Flow rate (1): m <sup>3</sup> /h (ft <sup>3</sup> /h)	Voltage (V)	Weight: kg (lbs)	dB (A)	Catalog number
170 (557.7)	230	0.82 (1.8)	41	<b>NSYCVF170M115</b>
170 (557.7)	115	0.82 (1.8)	41	<b>NSYCVF170M230</b>

(1) Free flow.

# Ventilation systems

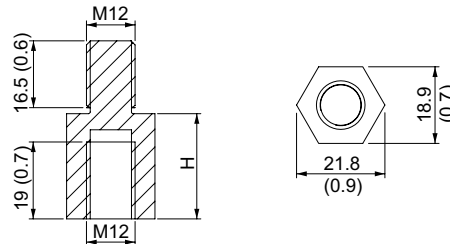
## Natural ventilation accessories



### Roof elevators

- The elevators allow the roof to be raised, providing natural ventilation.
- They are screwed onto the structure, at the roof mounting point.
- Material: zinc-coated steel.
- Supply: 4 elevators.

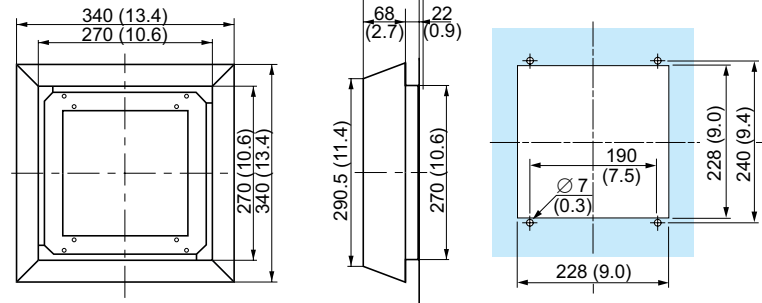
Top elevation: mm (in) (H)	Catalog number
26 (1.0)	<b>NSYRE26</b>
60 (2.4)	<b>NSYRE60</b>



### Hood for natural ventilation, IP54

- Natural ventilation device for coupling to the top of metal floor-standing enclosures.
- Can be combined with the ventilation louvers (page 7/29).
- Mounting to the top by means of caged nuts and special screws.
- Material: steel.
- Finish: painted with epoxy-polyester resin, textured RAL 7035 gray.
- Protection rating: IP54.
- Weight: 4.6 kg (10.1 lbs).
- Supply: one hood for natural ventilation and mounting hardware.

Catalog number
<b>NSYCAC228RMF</b>



### Spare filter

Catalog number
<b>NSYCAF228R</b>

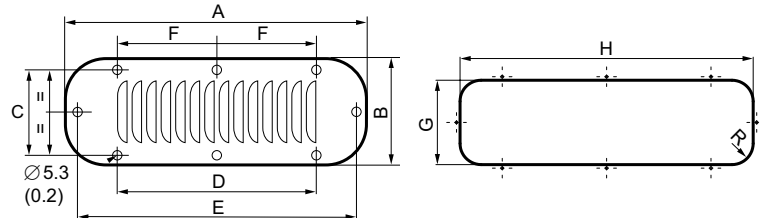
# Ventilation systems

## Natural ventilation accessories



### Metal louver plate, rectangular

- Louvers designed to be installed on the sides of the enclosure.
- Mounting by screws.
- Material: steel.
- Finish: painted with epoxy-polyester resin, textured RAL 7035 gray.
- Supply: one metal louver and mounting hardware.
- Protection rating: IP20.

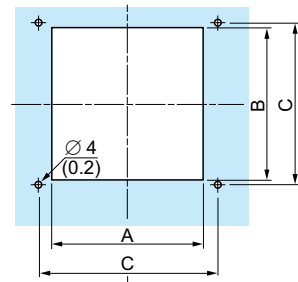


Dimensions: mm (in)									Catalog number
A	B	C	D	E	F	G	H	R	
144 (5.7)	62 (2.4)	36 (1.4)	110 (4.3)	-	-	110 (4.3)	46 (1.8)	10 (0.4)	NSYCAG110X46M
208 (8.2)	90 (3.5)	72 (2.8)	94 (3.7)	190 (7.5)	-	180 (7.1)	62 (2.4)	18 (0.7)	NSYCAG180X62M
244 (9.6)	90 (3.5)	72 (2.8)	130 (5.1)	226 (8.9)	-	216 (8.5)	62 (2.4)	18 (0.7)	NSYCAG216X62M
345 (13.6)	118 (4.6)	100 (3.9)	231 (9.1)	327 (12.9)	115.5 (4.5)	317 (12.5)	90.5 (3.6)	30 (1.2)	NSYCAG317X91M
345 (13.6)	148 (5.8)	130 (5.1)	231 (9.1)	327 (12.9)	115.5 (4.5)	317 (12.5)	120 (4.7)	30 (1.2)	NSYCAG317X120M
445 (17.5)	148 (5.8)	130 (5.1)	267 (10.5)	427 (16.8)	148.5 (5.8)	417 (16.4)	120 (4.7)	30 (1.2)	NSYCAG417X120M



### Metal louver plate, square

- Supply: one metal louver.
- Protection rating: IP23.



Dimensions: mm (in)	A	B	C	Slot width	No. of slots	Catalog number
120 × 120 (4.7 × 4.7)	95 (3.7)	104 (4.1)	104.8 (4.1)	90 (3.5)	5	NSYCAG104X95LM
160 × 160 (6.3 × 6.3)	110 (4.3)	130 (5.1)	140 (5.5)	100 (3.9)	5	NSYCAG130X110LM
220 × 220 (8.7 × 8.7)	190 (7.5)	170 (6.7)	200 (7.9)	180 (7.1)	5	NSYCAG170X190LM

### Anti-insect filters for metal louver plate, square

- The filters are installed between the enclosure and the metal louver.
- Material: Stainless steel 304L Ø 0.32 mm (0.01 in) wire mesh, of 1.07 mm (0.04 in), thickness 0.6 mm (0.02 in).
- Increases protection rating to IP33.
- Weight: 0.8 kg/m<sup>2</sup> (19.0 lbs/ft<sup>2</sup>).
- Supply: one anti-insect filter.

Louver plate cat. no.	External dimensions: mm (in)	Filter cat. no.
NSYCAG104X95LM	98 × 115 (3.9 × 4.5)	NSYCAF104X95X
NSYCAG130X110LM	133 × 158 (5.2 × 6.2)	NSYCAF130X110X
NSYCAG170X190LM	197 × 215 (7.8 × 8.5)	NSYCAF170X190X

# Ventilation systems

## Natural ventilation accessories



### Plastic ventilation louvers

- Four models available according to IP rating, in vertical position.
- Supply: 2 plastic ventilation louvers.

Cut-out Ø: mm (in)	IP	Catalog number
45.5 (1.8)	22	NSYCAG45LP
35 (1.4)	30/44 (1)	NSYCAG35LP
38 (1.5)	45	NSYCAG38LP
33 (1.3)	44	NSYCAG33LP
19 (0.7)	45	NSYCAG19LP

(1) When installed in the Thalassa enclosure.



NSYCAG12LPH•

### Sealed anti-condensation valve

- Controls the pressure to avoid condensation following an internal temperature increase.
- Maintains IP68.
- Material: PA6-V2, acrylic co-polymer membrane, water and oil repellent.
- Operating temperature: -40... +105 °C.

Cut-out Ø: mm (in)	Permeability (1): liters/h (gal/h)	Pressure difference (2)	Quantity	Catalog number
M12 (0.5)	16 (4.2)	$\Delta P < 1$ bar	10	NSYCAG12LPH1
M12 (0.5)	120 (31.7)	$\Delta P < 0.1$ bar	10	NSYCAG12LPH2

(1) Air flow under  $\Delta P = 0.07$  bar.

(2) Condition for IP68.



### Applications

- Protection of equipment for lighting, industrial control, rolling systems, pumps, etc.

# Cooling unit

## SLIM electronic control

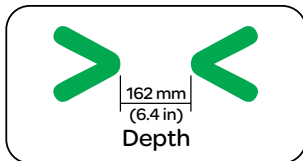
### SLIM for perfect integration



- 1 cooling unit:
- 4 power levels
  - 3 voltage levels

- 1 cover:
- Flush
  - Partial-flush
  - Surface

66 models, from 1100 to 2700 W, 115 to 460 V, flush mounting, partial-flush mounting or surface mounting, with or without electronic display, IP55, UL compliant.



### Minimum depth

All the models of the SLIM range have a depth of 162 mm (6.4 in) to maximize the volume inside the enclosure.

### Modular system

- There are 66 possible combinations with only 17 catalog numbers.
- Three different installation types are possible with the same air-conditioning unit (surface, partial flush and flush).

### Power ranges

1100 W, 1500 W, 2200 W and 2700 W.

### Versions

- RAL 7035 gray and stainless steel.
- Option to provide other colors on request.

### Internal IP55

The SLIM range is supplied as standard with an expanded polyurethane gasket to help ensure optimum sealing with IP55 protection throughout the enclosure.

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## Cooling unit SLIM electronic control



### UL/UR certification

UL certification awarded for the entire SLIM range.



### The best is inside

The best material has been selected to offer maximum reliability and durability. The compressors and fans, as well as the rest of the components, are top quality.

### Electronic regulation as standard

- Programmed to control the enclosure temperature of 35 °C. This temperature should be enough to protect the electrical and electronic equipment installed in the enclosure.
- Supplied with an electronic thermostat to provide greater reliability and precision for the cooling unit.
- Optional electronic display for reading and controlling the temperature setting, cat. no. NSYCUAY.

55 °C

### High resistance to outside ambient temperatures of up to 55 °C

The high-quality compressors used allow work to be performed in areas with extreme temperatures of up to 55 °C.



ENVIRONMENTALLY  
FRIENDLY

### Cooling fluid used: R134a (HFC)

This is a gas that respects the ozone layer.

### Easy opening and closing of the covers

The cover of the cooling unit is released by simply unscrewing two screws. This saves time and facilitates maintenance tasks.



### Easy maintenance

- Internal details such as the space between the aluminum plates enable easier access during cleaning.
- The inside can be accessed by removing only two screws.

# Cooling unit

## SLIM electronic control

### Characteristics



NSYCUB1100W230S

#### SLIM

- Power ranges from 1100 W to 2700 W.
- 3 installation options: surface, partial flush and flush.
- Versions in RAL 7035 gray and stainless steel.
- Electronic thermostat with control option (precision of  $\pm 1$  °C). Option of installing a display as an accessory.
- Minimal depth of 162 mm (6.4 in) in every model.
- Internal IP55 (enclosure side) maintains the protection degree of the enclosure up to IP55.
- The unit is controlled by 3 commands:
  - Thermostat value.
  - Signal of an anomaly (sudden disconnection, incorrect phase installation, filter blocked with dirt, high compressor temperature, high enclosure temperature).
  - Door open switch signal.
- A minimum height of 1800 mm (70.9 in) and door width of 800 mm (31.5 in) or side panel width of 600 mm (23.6 in) is required to install a SLIM cooling unit in a Spacial enclosure.

#### General characteristics

- Desired internal temperature adjustable from +20 to +50 °C.
- Maximum ambient temperature: +55 °C.
- All the units have as standard a pressure gauge with automatic reset. If the high pressure exceeds the safe value (in the high-pressure circuit) the pressure gauge acts by cutting off the power supply to the compressor and the external fan.
- External and internal air circuits separated with IP55. The fan of the internal circuit operates permanently, to help prevent hot spots in the installation.
- Equipped with an alarm relay activated by the pressostat in the high-pressure circuit.
- Respect for the environment using environmentally friendly gas R134a (HFC).

Modular version:  
1 cooling unit + 1 cover

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Specifications	NSYCUB1100W230S
Dimensions: mm (in)	
Height	1580 (62.2)
Width (according to installation type)	surface: 460 (18.1); partial flush or flush: 495 (19.5)
Depth	162 (6.4)
Control type	electronic with control without display (display optional)
Unit control	thermostat+alarm+door closed
Temperature setting range	+20...+50 °C
Maximum outside temperature	+55 °C
Type of zero-potential alarm	Inverter contact
Cooling gas type	R134a
IP (IEC 60529)	
On the internal circuit	55
On the external circuit	34
External circuit filter	No (for use in aggressive environments, contact us)
Mounting position (order the correct cover)	surface, partial flush or flush
Available cover versions	RAL 7035 gray and stainless steel (please contact us for RAL 7032 gray)
Certifications/markings	UL in process and CE



Modular version: Always order one SLIM cooling unit plus one cover unit.



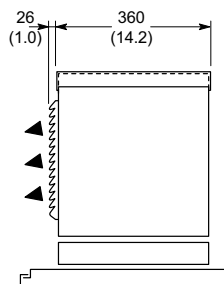
## Cooling unit Accessories



### Intermediate frame

- Frame allowing the top-mounting unit, cat. no. **NSYCU760W230VR**, to be mounted on enclosures with a width of 600 mm (23.6 in) and a depth of 400 mm (15.7 in).

Description	Catalog number
Intermediate frame	<b>NSYCUAI</b>



### Spare filter

- Filter with a density of 32 kg/m<sup>2</sup> (759.4 lbs/ft<sup>2</sup>) and a thickness of 13 mm (0.5 in), for all the side-mounting and top-mounting units.
- Order in multiples of 24 filters.

Description	Catalog number
Spare filter	<b>NSYCEAF</b>

### Electronic display

Enables control of the thermostat and displays the temperature inside the enclosure. The display is supplied with a connection cable and a metal plate for inserting the display in the cover of the cooling unit. No prior programming is required.

Description	Catalog number
Display	<b>NSYCUAY</b>

# Cooling unit

## SLIM electronic control

### Characteristics

Catalog number	NSYCUB1100W230S	NSYCUB1100W400S	NSYCUB1100W115S
	1100 W	1100 W	1100 W
Voltage	230 V 50/60 Hz	3 × 400 V 50 Hz/3 × 460V 60 Hz	115 V 50/60 Hz
Power according to EN14511			
L35-L35	1100/1200 W (3754/4095 Btu/h)	1100/1200 W (3754/4095 Btu/h)	1100/1200 W (3754/4095 Btu/h)
L35-L50	850/900 W (2900/3071 Btu/h)	850/900 W (2900/3071 Btu/h)	850/900 W (2900/3071 Btu/h)
Intensity			
Starting current	11/13.5 A	8.5/10.5 A	22/27A
Rated current	2.9/3.5 A	2.2/2.3 A	5.8/7 A
Power consumption			
L35-L35	600/710 W	0.87/0.92 KW	0.6/0.71 KW
L50-L35	710/850 W	0.99/1.1 KW	0.71/0.85 KW
Energy efficiency ratio (EER)			
L35-L35	1.8/1.7	1.3/1.3	1.8/1.7
Noise level	67 dB (A)	67 dB (A)	67 dB (A)
Air flow: m <sup>3</sup> /h (ft <sup>3</sup> /h)			
of the internal circuit	570 (1870.1) / 620 (2034.1)	570 (1870.1) / 620 (2034.1)	570 (1870.1) / 620 (2034.1)
of the external circuit	860 (2821.5) / 900 (2952.8)	860 (2821.5) / 900 (2952.8)	860 (2821.5) / 900 (2952.8)
Weight of unit: kg (lbs)	46 (101.4)	42 (92.6)	46 (101.4)
Thermal protection recommended (fuse melt curve)	T4A	T6A	T8A

Catalog number	NSYCUB1500W230S	NSYCUB1500W400S	NSYCUB1500W115S
	1500 W	1500 W	1500 W
Voltage	230 V 50/60 Hz	3 × 400 V 50Hz/3 × 460V 60Hz	115 V 50/60 Hz
Power according to EN14511			
L35-L35	1600/1700 W (5459/5800 Btu/h)	1500/1600 W (5118/5459 Btu/h)	1600/1700 W (5459/5800 Btu/h)
L35-L50	1300/1400 W (4436/4777 Btu/h)	1200/1300 W (4094/4435 Btu/h)	1300/1400 W (4436/4777 Btu/h)
Intensity			
Starting current	16.7/19.2 A	7.2/9.0 A	33.4/38.4 A
Rated current	4.4/5.1 A	2.4/3.0 A	8.8/10.2 A
Power consumption			
L35-L35	830/950 W	1300/1500 W	0.83/0.95 KW
L50-L35	950/1100 W	1500/1800 W	0.95/1.1 KW
Energy efficiency ratio (EER)			
L35-L35	1.9/1.8	1.2/1.1	1.9/1.8
Noise level	69 dB (A)	67 dB (A)	69 dB (A)
Air flow: m <sup>3</sup> /h (ft <sup>3</sup> /h)			
of the internal circuit	860 (2821.5) / 900 (2952.8)	860 (2821.5) / 900 (2952.8)	885 (2903.5) / 990 (3248.0)
of the external circuit	885 (2903.5) / 990 (3248.0)	885 (2903.5) / 990 (3248.0)	886 (2906.8) / 990 (3248.0)
Weight of unit: kg (lbs)	49 (108.0)	50 (110.2)	49 (108.0)
Thermal protection recommended (fuse melt curve)	T6A	T4A	T4A

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## SLIM covers

	Surface-mounting	Partial flush-mounting	Flush-mounting
RAL 7035 gray	<b>NSYCUCL</b>	<b>NSYCUCH</b>	<b>NSYCUCF</b>
Stainless-steel	<b>NSYCUCLX</b>	<b>NSYCUCHX</b>	<b>NSYCUCFX</b>



Modular version: Always order one SLIM cooling unit plus one cover unit.

# Cooling unit

## SLIM electronic control

### Characteristics

Catalog number	NSYCUB2200W230S	NSYCUB2200W400S	NSYCUB2200W115S
	2200 W	2200 W	2200 W
Voltage	230 V 50/60 Hz	3 × 400 V 50 Hz/3 × 460 V 60 Hz	115 V 50/60 Hz
Power according to EN14511			
L35-L35	2200/2400 W (7507/8189 Btu/h)	2200/2400 W (7507/8189 Btu/h)	2200/2400 W (7507/8189 Btu/h)
L35-L50	1800/2000 W (6142/6824 Btu/h)	1800/2000 W (6142/6824 Btu/h)	1800/2000 W (6142/6824 Btu/h)
Intensity			
Starting current	22.2/26.2 A	7.9/9.5 A	44.4/52.4 A
Rated current	5.8/6.9 A	2.6/3.2 A	11.6/13.8 A
Power consumption			
L35-L35	1100/1300 W	1500/1800 W	1.1/1.3 KW
L50-L35	1300/1500 W	1800/2100 W	1.3/1.5 KW
Energy efficiency ratio (EER)			
L35-L35	2/1.8	1.5/1.3	2/1.8
Noise level	67 dB (A)	69 dB (A)	67 dB (A)
Air flow: m <sup>3</sup> /h (ft <sup>3</sup> /h)			
of the internal circuit	860 (2821.5) / 900 (2952.8)	885 (2903.5) / 990 (3248.0)	885 (2903.5) / 990 (3248.0)
of the external circuit	885 (2903.5) / 990 (3248.0)	885 (2903.5) / 990 (3248.0)	886 (2906.8) / 990 (3248.0)
Weight of unit: kg (lbs)	50 (110.2)	54 (119.0)	50 (110.2)
Thermal protection recommended (fuse melt curve)	T8A	T4A	T16A

Catalog number	NSYCUB2700W230S	NSYCUB2700W400S
	2700 W	2700 W
Voltage	230 V 50/60 Hz	3 × 400 V 50 Hz/3 × 460 V 60 Hz
Power according to EN14511		
L35-L35	2700/2900 W (9218/9901 Btu/h)	2700/2900 W (9218/9901 Btu/h)
L35-L50	2200/2400 W (7511/8194 Btu/h)	2200/2400 W (7511/8194 Btu/h)
Intensity		
Starting current	24.8/28.2 A	9/10.6 A
Rated current	6.4/6.7 A	3/3.5 A
Power consumption		
L35-L35	1200/1400 W	1700/2000 W
L50-L35	1400/1700 W	2000/2300 W
Energy efficiency ratio (EER)		
L35-L35	2.3/2.1	1.6/1.5
Noise level	69 dB (A)	69 dB (A)
Air flow: m <sup>3</sup> /h (ft <sup>3</sup> /h)		
of the internal circuit	1050 (3444.9) / 1160 (3805.8)	1050 (3444.9) / 1160 (3805.8)
of the external circuit	1200 (3937.0) / 1340 (4396.3)	1200 (3937.0) / 1340 (4396.3)
Weight of unit: kg (lbs)	57 (125.7)	60 (132.3)
Thermal protection recommended (fuse melt curve)	T8A	T4A

SLIM covers			
	Surface-mounting	Partial flush-mounting	Flush-mounting
RAL 7035 gray	<b>NSYCUCL</b>	<b>NSYCUCH</b>	<b>NSYCUCF</b>
Stainless-steel	<b>NSYCUCLX</b>	<b>NSYCUCHX</b>	<b>NSYCUCFX</b>

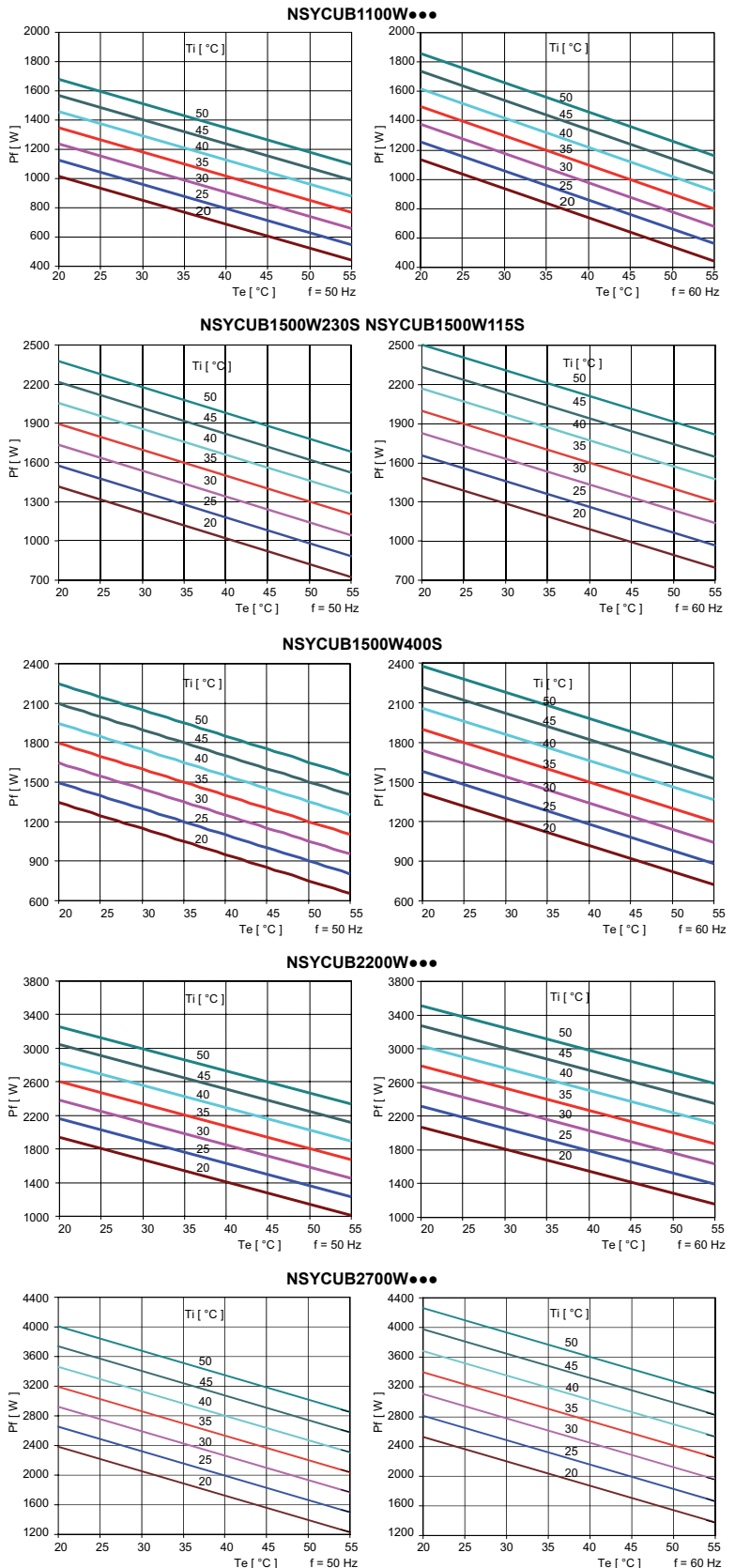


Modular version: Always order one SLIM cooling unit plus one cover unit.

# Cooling unit

## SLIM electronic control

### Curves

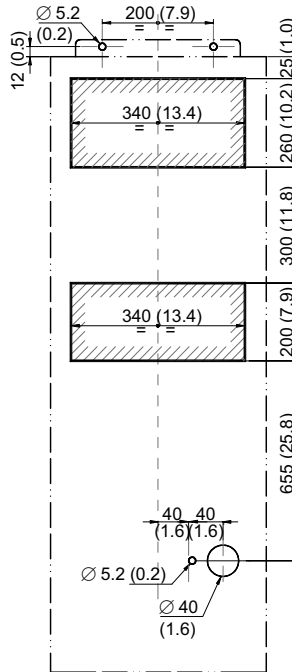


# Cooling unit

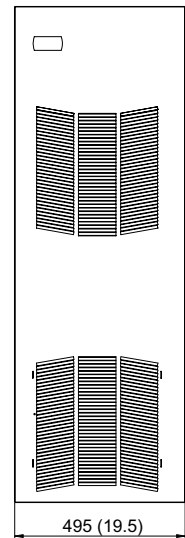
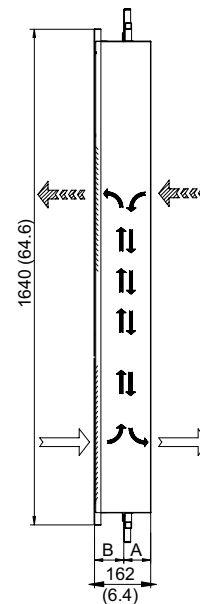
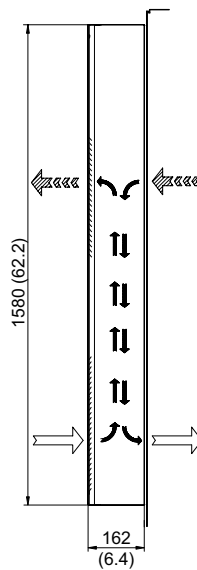
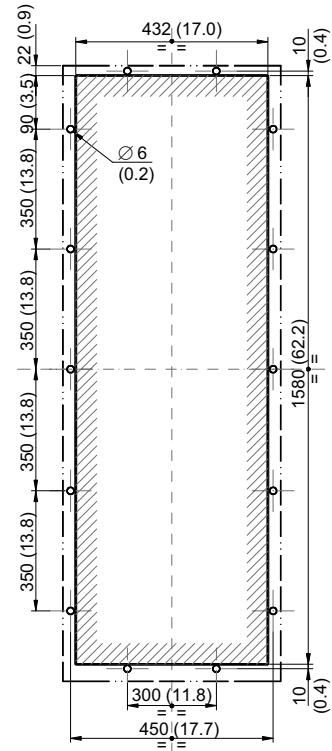
## SLIM electronic control

### Mounting templates

Template for surface mounting



Template for flush-mounting and partial flush-mounting



Version	Flush-mounting	Partial flush-mounting and surface-mounting
A = inside the enclosure	141 mm (5.6 in)	81 mm (32. in)
B = outside the enclosure	21 mm (0.8 in)	81 mm (32. in)

# Insulated resistance heaters

## Introduction

The resistance heaters prevent the formation of condensation and help ensure the ideal temperature for the correct operation of the electronic components in the enclosure.



### Large range of power levels

- 2 versions: by natural convection and with fan.
- AC or DC power supply.
- 7 power levels, from 10 W to 550 W.



### Innovative design

Covered with plastic to prevent direct contact with the aluminum radiator.



# Insulated resistance heaters

## Introduction



### Easy installation and connection

- Reduced dimensions.
- Quick electric connection by terminal board.
- No maintenance required.
- Direct clipping onto a 35-mm (1.4 in) DIN rail.

### Safety

- The protection prevents direct contact with the aluminum radiator.
- Electric protection device with terminal block cover.
- Equipped with a PTC-type heater (positive temperature coefficient).
- Surface temperature lower than 70 °C.

### High thermal efficiency

- The configuration of the aluminum profile produces a chimney effect for high natural convection.
- Low power consumption thanks to a self-regulating PTC-type heater.



### Models with fan

- The heaters are equipped with a fan to help ensure air circulation and a uniform temperature inside the enclosure.
- High-flow, silent fan.



### Certifications

- CE marking.
- Range compliant with UL and VDE.

# Resistance heaters

## Applications



### Conditions of use

- The resistance heaters are controlled by a thermostat or a humidistat.
- The enclosure must be sealed to prevent the entry of air from the outside.



### Dew point temperature

The dew point temperature is the minimum temperature that can be reached before condensation begins to form.

Example:

Ambient temperature = 25 °C.

Relative humidity = 50%.

A temperature of more than 14 °C must be maintained inside the enclosure.

Relative humidity (%)	Ambient temperature (°C)							
	20	25	30	35	40	45	50	55
40	6	11	15	19	24	28	33	37
50	9	14	19	23	28	32	37	41
60	12	17	21	26	31	36	40	45
70	14	19	24	29	34	38	43	48
80	16	21	26	31	36	41	46	51
90	18	23	28	33	38	43	48	53
100	20	25	30	35	40	45	50	55

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### Installation tips

- Install several heaters according to the desired power level at the bottom of the enclosure.
- Maintain a clearance of at least 10 cm (3.9 in) around the device.
- Do not install bulky devices above the heater, since this could reduce the effect of natural convection.
- Do not install heat-sensitive components directly above a heater.
- If several heaters are used, they must be installed in parallel. Serial installation is not an option.
- The heater must be installed vertically to ensure optimum convection.



## Resistance heaters

### Selection guide



### Insulated resistance heaters

Power (W)	Voltage (V)	Connection type Terminal block	Catalog number
10	110–250 AC	•	NSYCR10WU2C
21	110–250 AC	•	NSYCR20WU2C
55	110–250 AC	•	NSYCR50WU2C
100	110–250 AC	•	NSYCR100WU2C
147	110–250 AC	•	NSYCR150WU2C

# Resistance heaters

## Selection guide



### Insulated resistance heater with fan

Power (W)	Voltage (V)	Connection type Terminal block	Catalog number
177	230 AC	•	NSYCR170W230VVC



NSYCR350W230VTVC

### Thermofans

Power (W)	Voltage (V)	Connection type Terminal block	Catalog number
350	230 AC	•	NSYCR350W230VTVC
400/550	120 AC	•	NSYCRP1W120VTVC
400/550	230 AC	•	NSYCRP1W230VTVC



NSYCRS200W230V

### Resistance heaters with fan

Power (W)	Voltage (V)	Connection type Terminal block	Catalog number
250	115 AC	•	NSYCR250W115V
400	115 AC	•	NSYCR400W115V
200	115 AC	•	NSYCRS200W115V

### Mounting accessories



NSYCRAFD



NSYCRAF

Description	Catalog number
Set of 5 studs	NSYCRAF
Set of 5 studs and DIN rail	NSYCRAFD

# Insulated resistance heaters



## Insulated resistance heater 10 W and 20 W

### General characteristics

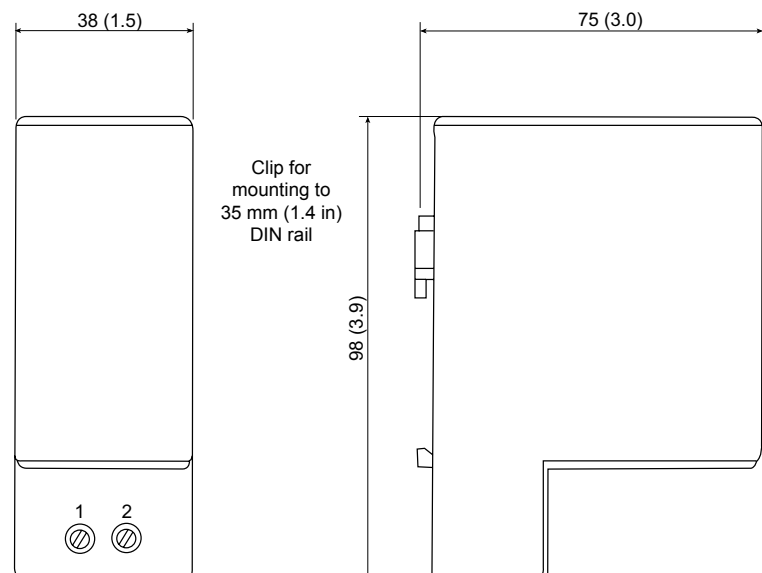
- Compact resistance heater to help prevent the formation of condensation or frost.
- Designed to ensure good natural convection and high thermal efficiency.
- Compact design with reduced dimensions.
- Extruded aluminum body.
- Covered with a UL94 V0 plastic cover, light gray, to avoid direct contact with the heating elements.
- Surface temperature limited to 70 °C.
- Equipped with a power cable.
- Double insulated.
- Range with PTC technology.
- Quick mounting by clip on a 35-mm DIN rail.
- UL and VDE certifications. CE marking.

### Conditions of use

- The heaters must be installed with a thermal controller (see the selection tables on pages 7/48 and 7/49) to control the temperature or the humidity inside the enclosure.
- The enclosure must be sealed to prevent the entry of air from the outside.
- An electrical protection device must be installed on the supply side of the unit.

Specifications	Catalog number	
	NSYCR10WU2C	NSYCR20WU2C
Power at 0 °C	10 W	20 W
Voltage	110–250 V AC	110–250 V AC
Technology	PTC	
Surface temperature	<70 °C, except for the top protection grille	
Electric connection	2 poles, 2.5 mm <sup>2</sup> (0.1 in <sup>2</sup> )	
Mounting	By clip on a 35-mm (1.4 in) DIN rail.	
Cover	UL94 V0 plastic	
Operating position	Vertical	
Operating temperature	-40...+70 °C	-10...+158 °F
IP protection rating	IP20 class II (double insulated)	
Certifications	VDE and UL	

### Dimensions: mm (in)



# Insulated resistance heaters



## Insulated resistance heater 55 W - 100 W - 147 W

### General characteristics

- Compact resistance heater to help prevent the formation of condensation or frost.
- Designed to ensure good natural convection and high thermal efficiency.
- Compact design with reduced dimensions.
- Extruded aluminum body.
- Covered with a UL94 V0 plastic cover, light gray, to avoid direct contact with the heating elements.
- Surface temperature limited to < 70 °C.
- Equipped with quick-connection terminals: 2.5 mm<sup>2</sup> (0.1 in<sup>2</sup>).
- Double insulated.
- Range with PTC technology.
- Quick mounting by clip on a 35-mm (1.4 in) DIN rail.
- UL and VDE certifications. CE marking.

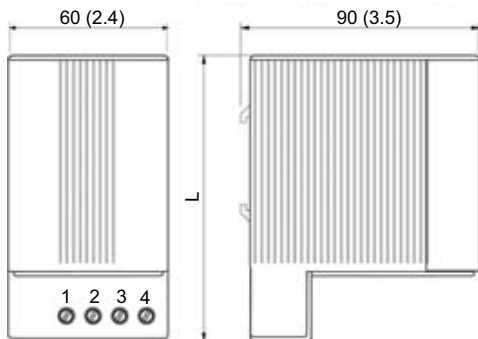
### Conditions of use

- The heaters must be installed with a thermal controller (see the selection tables on pages 7/48 and 7/49) to control the temperature or the humidity inside the enclosure.
- The enclosure must be sealed to prevent the entry of air from the outside.
- An electrical protection device must be installed on the supply side of the unit.

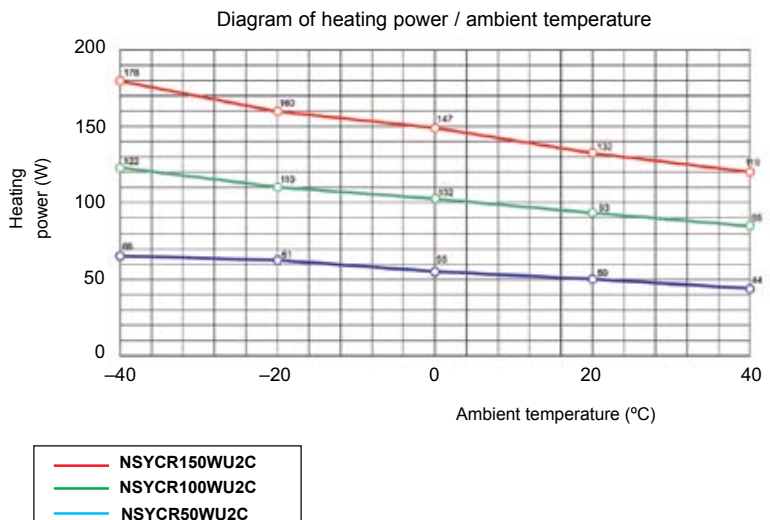
Specifications	Catalog number		
	NSYCR50WU2C	NSYCR100WU2C	NSYCR150WU2C
Power at 0 °C	55 W	100 W	147 W
Voltage	110–250 V AC	110–250 V AC	110–250 V AC
Technology	PTC		
Surface temperature	<70 °C, except for the top protection grille		
Electric connection	4 poles, 2.5 mm <sup>2</sup> (0.1 in <sup>2</sup> )		
Mounting	By clip on 35-mm DIN rail		
Cover	UL94 V0 plastic		
Operating position	Vertical		
Operating temperature	-40...+70 °C -10...+158 °F		
IP protection rating	IP20 class II (double insulated)		
Certifications	VDE and UL		
Height (H)	110 mm (4.3 in)	150 mm (5.9 in)	

7

### Dimensions: mm (in)



### Performance diagram



# Insulated ventilated resistance heaters



## Insulated, ventilated resistance heater 177 W

### General characteristics

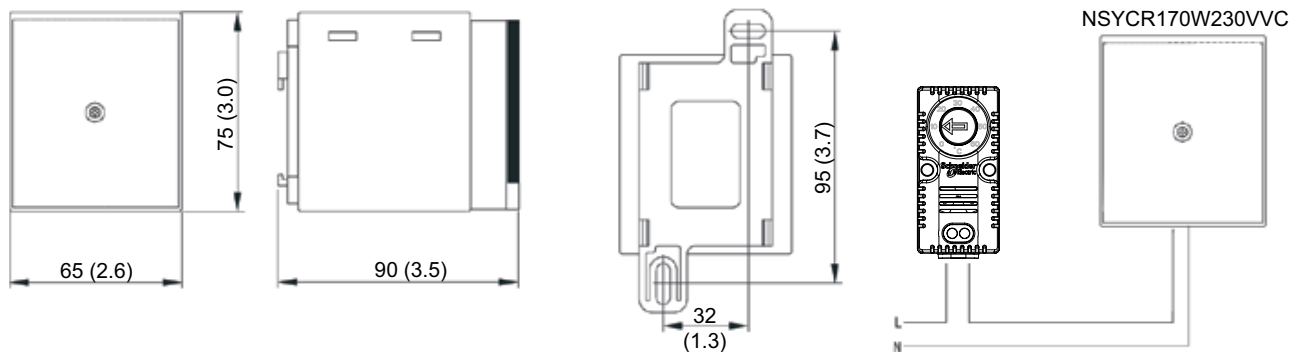
- Compact resistance heater to help prevent the formation of condensation or frost.
- Equipped with an axial fan for uniform heating inside the enclosure.
- Compact design with reduced dimensions.
- Extruded aluminum body.
- Covered with a UL94 V0 plastic cover, light gray, to avoid direct contact with the heating elements (PTC).
- Surface temperature limited to 50 °C.
- Equipped with quick-connection terminals: 2.5 mm<sup>2</sup> (0.1 in<sup>2</sup>).
- Double insulated.
- Range with PTC technology.
- Quick mounting by clip on a 35-mm (1.4 in) DIN rail.
- UL and VDE certifications. CE marking.

### Conditions of use

- The heaters must be installed with a thermal controller (see selection table on pages 7/48 and 7/49) to control the temperature or the humidity inside the enclosure.
- The enclosure must be sealed to prevent the entry of air from the outside.
- An electrical protection device must be installed on the supply side of the unit.

Specifications	Catalog number
	NSYCR170W230VVC
Power at 0 °C	177 W
Voltage	230 V AC; 50-60 Hz
Technology	PTC
Surface temperature	Max. 50 °C in the enclosure, 100 °C on the top protection grille (for an ambient temperature of 20 °C / 68 °F)
Service life	40,000 h at 40 °C
Air flow	13.8 m <sup>3</sup> /h (45.3 ft <sup>3</sup> /h)
Electric connection	2 poles 2.5 mm <sup>2</sup> (0.1 in <sup>2</sup> )
Mounting	By clip on 35-mm (1.4 in) DIN rail
Cover	UL94 V0 plastic
Operating position	Vertical
Operating temperature	-40...+70 °C -10...+158 °F
IP protection rating	IP20 class II (double insulated)
Certifications	VDE and UL

### Dimensions: mm (in)



# Thermal control

## Overview



### Adjustable thermostats

- Blue button with normally open (NO) contact to control the starting of a fan when the temperature exceeds the displayed maximum value.
- Red button with normally closed (NC) contact to control the stopping of a resistance heater when the temperature exceeds the displayed value.
- Large range of temperature control.
- Small dimensions.
- Easily accessible terminals.
- High connection power.
- 4 types of hardware.

### Double-adjustable thermostat

- Double temperature control with a resistance heater and a fan with separate operation.
- Red button with normally closed (NC) contact for controlling the resistance heaters.
- Blue button with normally open (NO) contact for controlling the fans.
- A double thermostat with separate adjustments and operations within the same device.
- Easily accessible terminals.
- Various installation methods.

### The new quick-mounting systems:

- On a 35-mm (1.4 in) DIN rail.

- On a Spacial upright.

- On a cross-rail.

- On a mounting plate.

# Thermal control

## Overview



### Thermostat with NO/NC contact

- NO/NC inverter for controlling the resistance heaters or the fans.
- Switching by means of two NO/NC contacts.
- Easily accessible terminals.
- High connection power.
- 4 types of quick-mounting systems.
- Versions in °C and °F.



### Electronic thermostat with LCD screen

- Three thermostats for different input voltages (9–30 V, 110–127 V, 220–240 V).
- Operating temperature: 0 °C...+50 °C.
- Simple programming.
- Option of installing an external sensor, cat. no. **NSYCCAST**, for remotely reading the temperature (operating temperature: –30 °C...+80 °C).
- Ventilation and heating function (2 separate relays).
- High switching power.
- Hysteresis: 2 K (+/–0.1 K).
- 7 different operating modes.
- Additional operating mode with 1 external sensor. Reads and compares the internal and external temperatures in order to control the ventilation, the heating or the alarm.
- Temperature adjustment range: +5 °C...+50 °C.



### Electronic hygrotherms

- Electronic hygrotherms for different input voltages (9–30 V, 110–127 V, 220–240 V).
- Operating temperature: 0 °C...+ 50 °C.
- Option of installing an external sensor, cat. no. **NSYCCAST**, for remotely reading the temperature (operating temperature: –30 °C...+80 °C).
- Simple programming.
- 3 different operating modes.
- High switching power.
- T hysteresis: 2 K (+/–0.1 K).
- RH hysteresis: 3%.
- Temperature adjustment range: +5 °C...+50 °C.
- Humidity adjustment range: 20%...80%.



### Electronic humidistat

- Electronic humidistat for different input voltages (110–240 V).
- Operating temperature: 0 °C...+50 °C.
- Simple programming.
- 2 different operating modes.
- High switching power.
- RH hysteresis: 3%.
- Humidity adjustment range: 20%...80% RH.

# Thermal control

## Selection guide mechanical version

### Control a resistance heater or an alarm



NC thermostat

Setting range	Display	Contact	Application	Control element	Interrupting capacity (resistive load)	Catalog number
0...+60 °C	°C	O	Heat	Bimetal	30 W DC 120 V AC; 15 A 250 V AC; 10 A	NSYCCOTHC
+32...+140 °F	°F					NSYCCOTHCF

### Control a fan or an alarm



NO thermostat

Setting range	Display	Contact	Application	Control element	Interrupting capacity (resistive load)	Catalog number
0...+60 °C	°C	NO	Ventilate	Bimetal	30 W DC 120 V AC; 15 A 250 V AC; 10 A	NSYCCOTH0
+32...+140 °F	°F					NSYCCOTH0F

### Control a resistance heater and a fan



Double thermostat

Setting range	Display	Contact	Application	Control element	Interrupting capacity (resistive load)	Catalog number
0...+60 °C	°C	NC +	Heat or ventilate	Bimetal	30 W DC 120 V AC; 15 A 250 V AC; 10 A	NSYCCOTH0D
+32...+140 °F	°F					NO

### Control a resistance heater or a fan



Thermostat with inverse contact

Setting range	Display	Contact	Application	Control element	Interrupting capacity (resistive load)	Catalog number
0...+60 °C	°C	Inverse	Heat or ventilate	Bimetal	Closing: 30 W DC 250 V AC; 5 A Opening: 30 W DC 250 V AC; 10 A	NSYCCOTH0I
+32...+140 °F	°F					NSYCCOTH0IF



# Thermal control

## Selection guide electronic version

### Control a resistance heater or a fan



Electronic thermostat

Setting range	Display	Power input	Application	Control element	No. of relays	Interrupting capacity (resistive load)	Catalog number
+5 °C...+50 °C	°C or °F	9–30 V AC/DC	Heat or ventilate	Electronic	2	8 (5) A 230 V AC 5 A 30 V DC	NSYCCOTH30VID
		110–127 V AC					NSYCCOTH120VID
		220–240 V AC					NSYCCOTH230VID

7 different operating modes.  
Option of installing one or two external sensors.

### Control temperature and relative humidity



Electronic hygrotherm

Setting range	Display	Power input	Application	Control element	No. of relays	Interrupting capacity (resistive load)	Catalog number
+5 °C...+50 °C	°C or °F	9–30 V AC/DC	Heat or ventilate	Electronic	2	8 (5) A 230 V AC 5 A 30 V DC	NSYCCOHT30VID
		110–127 V AC					NSYCCOHT120VID
		220–240 V AC					NSYCCOHT230VID

3 different operating modes.  
Option of installing an external sensor.

### Control relative humidity



Electronic humidistat

Setting range	Display	Power input	Application	Control element	No. of relays	Interrupting capacity (resistive load)	Catalog number
20%...80%	% RH	110–240 V AC	Heat or ventilate	Electronic	2	8 (5) A 230 V AC 5 A 30 V DC	NSYCCOHT230VID

2 different operating modes.

### PTC external temperature sensor (double insulation)

- Length: 3 m (9.8 ft).
- Several types of hardware (on DIN rail, on Spacial SF profile, on VDI cross-rail, on mounting plate).
- Sensor operation or reading range: -30 °C...+80 °C.
- Protection rating: IP67.



Temperature sensor

Catalog number

NSYCCAST

#### Thermostat installation tips:

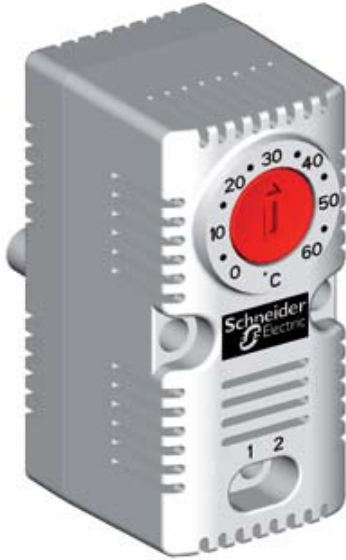
Install the thermostat at the top of the enclosure (the hottest place).  
See the various operating modes of each thermostat to choose the one that best meets your needs.

#### Humidistat installation tips:

Install the humidistat at the bottom of the enclosure.  
60% RH is the optimum value in the enclosure.

# Thermal control

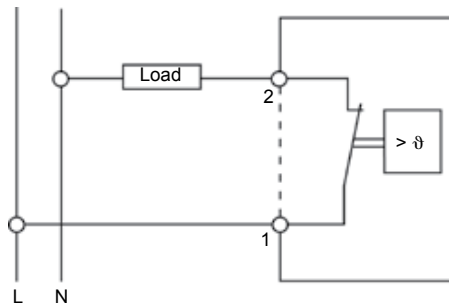
## Thermostat with NC contact



- Thermostat with NC contact to control the stopping of a resistance heater when the temperature exceeds the displayed value.
- This lengthens the service life of the resistance heaters since they are used less frequently.
- Protection rating: IP20.
- PC plastic material, self-extinguishing according to standard UL94 V0.
- Temperature adjustment range: 0...+60 °C.
- Connection: four 2.5-mm<sup>2</sup> (0.1 in<sup>2</sup>) terminals.
- Multiple mounting systems.
- UL certification.

Display	Max. command intensity	Catalog number
°C	10 A 250 V	<b>NSYCCOTHC</b>
°F	10 A 250 V	<b>NSYCCOTHCF</b>

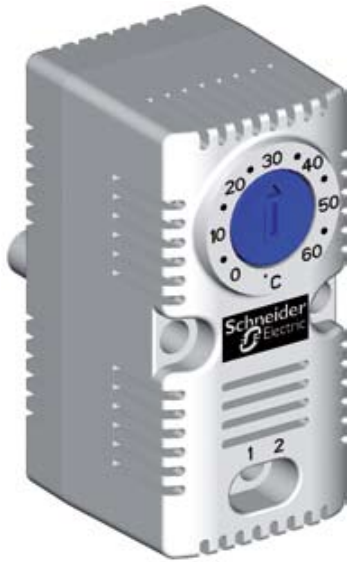
Technical characteristics	
<b>Sensor element</b>	Bimetal
<b>Contact</b>	NC, forced rupture
<b>Contact resistance</b>	< 10 m Ω
<b>Service life</b>	> 100000 cycles
<b>Switching capacity</b>	250 V AC; 10 A (resistive load) 120 V AC; 15 A (resistive load) 250 V AC/120 V AC 2 A (inductive load cos φ = 0.6) 30 W DC
<b>Connection</b>	Four 2.5-mm <sup>2</sup> (0.1 in <sup>2</sup> ) terminals
<b>Mounting</b>	By clip on 35-mm (1.4 in) DIN rail
<b>Enclosure</b>	UL94 V0 plastic, light gray
<b>Dimensions</b>	60 × 33 × 43 mm (2.4 × 1.3 × 1.7 in)
<b>Weight</b>	40 g (1.4 oz)
<b>Mounting position</b>	Any
<b>Operating temperature</b>	-20...+80 °C (-4...+176 °F)
<b>Protection rating</b>	IP20
<b>Hysteresis</b>	7 °K
<b>Temperature setting range</b>	0...+60 °C



Load = resistance

# Thermal control

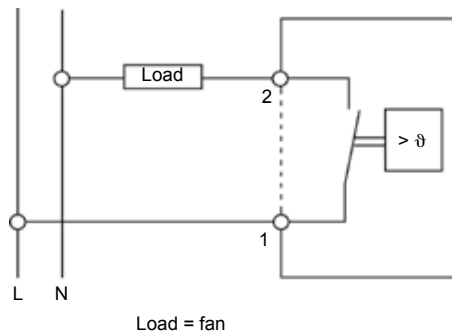
## Thermostat with NO contact



- Thermostat with NO contact to control the starting of a fan when the temperature exceeds the displayed maximum value.
- It can control the temperature inside the enclosure by only starting the fan when necessary, thus increasing the service life of the fan and reducing the clogging of the filter.
- Protection rating: IP20.
- PC plastic material, self-extinguishing according to standard UL94 V0.
- Temperature setting range: 0...+60 °C.
- Connection: four 2.5-mm<sup>2</sup> (0.1 in<sup>2</sup>) terminals.
- Multiple mounting systems.
- UL certification.

Display	Max. command intensity	Catalog number
°C	10 A 250 V	<b>NSYCCOTHO</b>
°F	10 A 250 V	<b>NSYCCOTHOF</b>

Technical characteristics	
<b>Sensor element</b>	Bimetal
<b>Contact</b>	NO, forced rupture
<b>Contact resistance</b>	< 10 m Ω
<b>Service life</b>	> 100000 cycles
<b>Switching capacity</b>	250 V AC; 10 A (resistive load)
	120 V AC; 15 A (resistive load)
	250 V AC/120 V AC 2 A (inductive load cos φ = 0.6)
	30 W DC
<b>Connection</b>	Four 2.5 mm <sup>2</sup> (0.1 in <sup>2</sup> ) terminals
<b>Mounting</b>	By clip on 35-mm (1.4 in) DIN rail
<b>Enclosure</b>	UL94 V0 plastic, light gray
<b>Dimensions</b>	60 × 33 × 43 mm (2.4 × 1.3 × 1.7 in)
<b>Weight</b>	40 g (1.4 oz)
<b>Mounting position</b>	Any
<b>Operating temperature</b>	-20...+80 °C (-4...+176 °F)
<b>Protection rating</b>	IP20
<b>Hysteresis</b>	7 °K
<b>Temperature adjustment</b>	0...+60 °C



# Thermal control

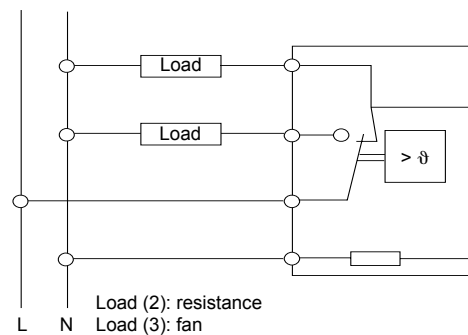
## Thermostat with NO/NC contact



- Thermostat (contact adapted to control fans, resistance heaters, ventilation drawers, heat exchangers, etc).
- Signals and controls the temperature inside the enclosure.
- Mounting on a DIN rail.
- Protection rating: IP20.
- PC plastic material, self-extinguishing according to standard UL94 V0.
- Temperature setting range: 0...+60 °C.
- Connection: four 2.5-mm<sup>2</sup> terminals.

Display	Max. command intensity	Catalog number
°C	(NO) 5 A (NC) 10 A	<b>NSYCCOTHI</b>
°F		<b>NSYCCOTHIF</b>

Technical characteristics	
Sensor element	Bimetal
Contact	Inverse, forced rupture
Contact resistance	< 10 m Ω
Service life	> 100000 cycles
Switching capacity	250 V AC; 10 A (resistive load)
Maximum interrupting capacity with direct current	250 V AC 4 A (inductive load cos φ = 0.6) 30 W DC
Connection	Four 2.5-mm <sup>2</sup> (0.1 in <sup>2</sup> ) terminals
Mounting	By clip on 35-mm (1.4 in) DIN rail
Enclosure	UL94 V0 plastic, light gray
Dimensions	67 × 50 × 44 mm (2.6 × 2.0 × 1.7 in)
Weight	100 g (3.5 oz)
Mounting position	Any
Operating temperature	-20...+80 °C (-4...+176 °F)
Protection rating	IP20
Hysteresis	7 °K
Temperature setting range	+5...+60 °C



# Thermal control

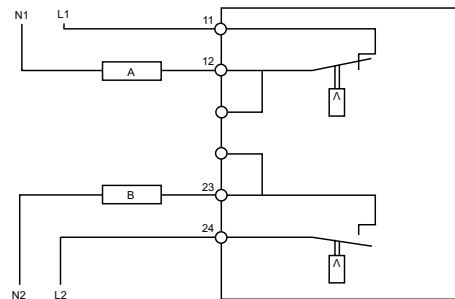
## Double thermostat



- Double thermostat: two thermostats in a single device with separate adjustment and operation.
  - Red button with normally closed (NC) contact for controlling the resistance heaters.
  - Blue button with normally open (NO) contact for controlling the fans, signalling systems or alarms.
- This thermostat can control the activation of a fan and a heater controlling the temperature independently.
- PC plastic material, self-extinguishing according to standard UL94 V0.
- Multiple mounting systems.
- UL certification.

Display	Max. command intensity	Catalog number
°C	(NO) 5 A (NC) 10 A	<b>NSYCCO THD</b>
°F		<b>NSYCCO THDF</b>

Technical characteristics	
<b>Sensor element</b>	Bimetal
<b>Contact</b>	NO / NC, forced rupture
<b>Contact resistance</b>	< 10 m Ω
<b>Service life</b>	> 100000 cycles
<b>Switching capacity</b>	250 V AC; 10 A (resistive load) 120 V AC; 15 A (resistive load) 250 V AC/120 V AC 2 A (inductive load cos φ = 0.6) 30 W DC
<b>Connection</b>	Four 2.5-mm <sup>2</sup> (0.1 mm <sup>2</sup> ) terminals
<b>Mounting</b>	By clip on 35-mm (1.4 in) DIN rail
<b>Enclosure</b>	UL94 V0 plastic, light gray
<b>Dimensions</b>	60 × 33 × 43 mm (2.4 × 1.3 × 1.7 in)
<b>Weight</b>	40 g (1.4 oz)
<b>Mounting position</b>	Any
<b>Operating temperature</b>	-20...+80 °C (-4...+176 °F)
<b>Protection rating</b>	IP20
<b>Hysteresis</b>	7 °K
<b>Temperature setting range</b>	0...+60 °C



# Thermal control

## Electronic thermostat with LCD screen



- Electronic temperature controller.
- Input voltages: 9–30 V, 110–127 V and 220–240 V.
- Thermostats with 2 independent switching relays (ventilation / heating function).
- Thermostat precision:  $\pm 1.5$  °C.
- Option of installing external PTC sensors, cat. no. **NSYCCAST**, for remote reading (L = 3 m).
- PC plastic material, self-extinguishing according to standard UL94 V0.
- Option of displaying the temperature in degrees Celsius (°C) or Fahrenheit (°F).

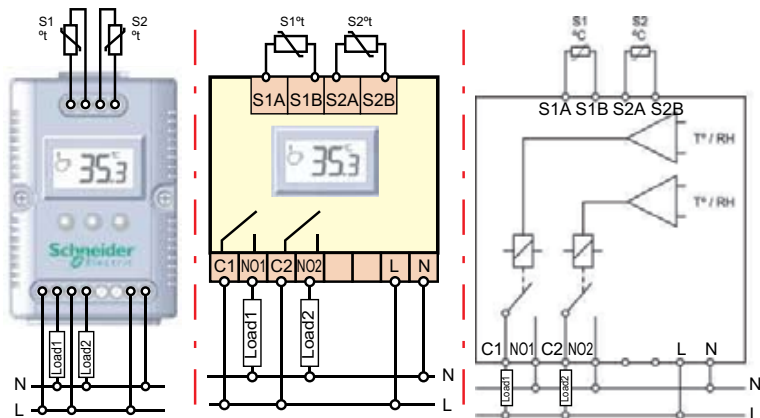
Display	Voltage	Type of current	Max. command intensity	Catalog number
°C or °F	9–30 V	AC DC	8 (5) A 230 V AC / 5 A 30 V DC	<b>NSYCCOTH30VID</b>
	110–127 V	AC		<b>NSYCCOTH120VID</b>
	220–240 V			<b>NSYCCOTH230VID</b>

Technical characteristics	
<b>Operating temperature</b>	0 °C...+50 °C
<b>Temperature setting range</b>	+5 °C...+50 °C
<b>Hysteresis</b>	Programmed 2 °K
<b>Internal sensor element</b>	Internal temperature sensor
<b>Connection</b>	2 × 2.5 mm <sup>2</sup> (0.1 in <sup>2</sup> ) [input voltage] + 2 relays [2 × 2.5 mm <sup>2</sup> (0.1 in <sup>2</sup> ) + 2 × 2.5 mm <sup>2</sup> (0.1 in <sup>2</sup> )]
<b>Contact</b>	Free with zero potential
<b>Mounting</b>	3 different methods: by DIN rail, Spacial SF profile, or on mounting plate
<b>Enclosure</b>	UL94-V0 plastic, light gray
<b>Certification</b>	UL / UR

### 7 different operating modes in the same thermostat

1	Ventilation (the addition of an external sensor inhibits the inner sensor and the reading is that of the external sensor) (activate 1st relay)
2	Heating (activate 2nd relay)
3	Ventilation / Heating (2 relays)
4	Double ventilation (2 relays)
5	Double heating (2 relays)
6	Comparison function (1 or 2 external sensors required). Compares the readings from the external sensor and the internal sensor in order to start up a fan or a heating element
7	Readings of max./min. temperature.

The thermostat automatically detects any connected sensors.



Load (1) = fan/resistance  
Load (2) = fan/resistance/alarm

# Thermal control

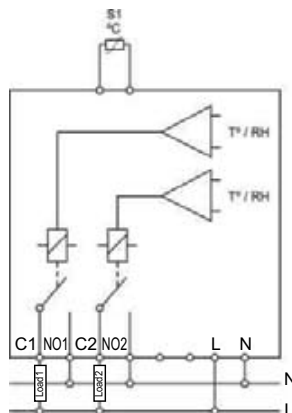
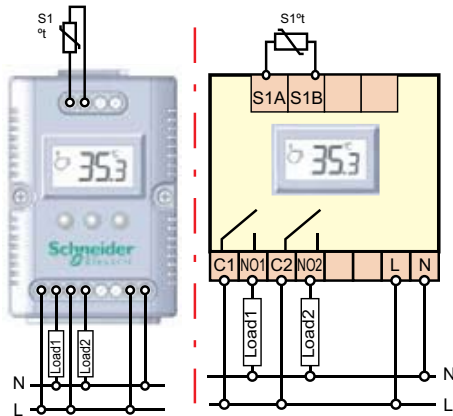
## Electronic hygrotherm with LCD screen



- Electronic temperature and humidity controller.
- Input voltages: 9–30 V, 110–127 V and 220–240 V.
- Hygrotherm with 2 independent switching relays (ventilation / heating function).
- Thermostat precision:  $\pm 1.5$  °C.
- Humidistat precision:  $\pm 5\%$  RH, relative humidity.
- Option of installing external PTC sensors, cat. no. **NSYCCAST**, for remote reading (L = 3 m).
- PC plastic material, self-extinguishing according to standard UL94 V0.
- Option of displaying the temperature in degrees Celsius (°C) or Fahrenheit (°F).

Display	Voltage	Type of current	Max. command intensity	Catalog number
°C or °F % RH	9–30 V	AC DC	8 (5) A 230 V AC / 5 A 30 V DC	NSYCCOHYT30VID
	110–127 V			NSYCCOHYT120VID
	220–240 V	AC		NSYCCOHYT230VID

Technical characteristics	
Operating temperature	0 °C...+50 °C
Temperature setting range	+5 °C...+50 °C
Humidity setting range	20%...80%
RH hysteresis	3%
Connection	2 × 2.5 mm <sup>2</sup> (0.1 in <sup>2</sup> ) [input voltage] + 2 relays [2 × 2.5 mm <sup>2</sup> (0.1 in <sup>2</sup> ) + 2 × 2.5 mm <sup>2</sup> (0.1 in <sup>2</sup> )]
Contact	Free with zero potential
Mounting	3 different methods: by DIN rail, Spacial SF profile, or on mounting plate
Enclosure	UL94-V0 plastic, light gray
Certification	UL/UR



Load (1) = fan/resistance  
Load (2) = fan/resistance/alarm

### Operating modes

Mode 1	Relay 1	Relay 2
Controlled device	Fan	Resistance heater
Measured variables	Temperature	Temp. (T) and humidity (RH)
Control type	Avoid high temperatures	Avoid low temperatures

Mode 2	Relay 1	Relay 2
Controlled device	Resistance heater	Alarm by switching
Measured variables	Control of the dew point	Temperature and humidity
Control type	Avoid high humidity	High humidity or temperature alert

Mode 3	Relay 1	Relay 2
Controlled device	Fan	Resistance heater
Measured variables	External temperature - Internal temperature*	Temperature (T) and humidity (RH)
Control type	Heating by ventilation	Avoid low temperatures

\*Comparison mode in Relay 1: an external sensor is required for the comparison function (external temperature - internal temperature).

Example of Mode 3: Decides whether the external temperature is favorable and controls the ventilation (Relay 1) or heating (Relay 2).

Advantage of Mode 3: Energy efficiency. Option of efficiently heating the enclosure by ventilation (using hot external air) before bringing the resistance heater into operation. The thermostat automatically detects any connected sensors.



# Thermal control

## Electronic humidistat with LCD screen



- Electronic humidity controller.
- Input voltages: 110–240 V.
- Precision: +/- 5% RH, relative humidity.
- Humidistat with 2 independent switching relays (ventilation / heating function).
- PC plastic material, self-extinguishing according to standard UL94 V0.
- 2 operating modes for RH%: relative humidity control and dew point control.

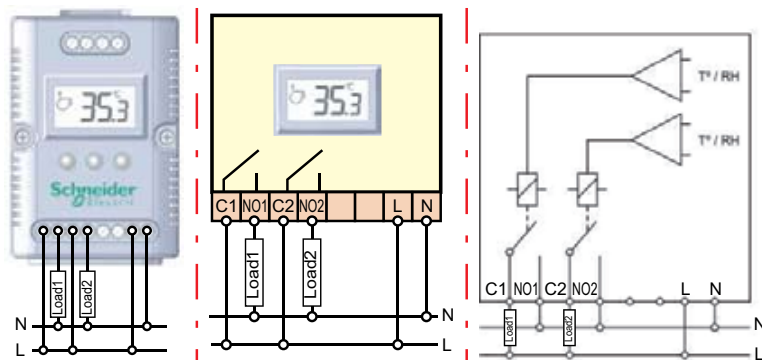
Display	Voltage	Type of current	Max. command intensity	Catalog number
% RH	110–240 V	AC	8 (5) A 230 V AC / 5 A 30 V DC	NSYCCOHY230VID

Technical characteristics	
Humidity setting range	20%...80%
RH hysteresis	3%
Internal sensor element	Internal humidity sensor
Connection	2 × 2.5 mm <sup>2</sup> (0.1 in <sup>2</sup> ) [input voltage] + 1 relay [2 × 2.5 mm <sup>2</sup> (0.1 in <sup>2</sup> )]
Contact	Free with zero potential
Mounting	3 different methods: by DIN rail, Spacial SF profile, or on mounting plate
Enclosure	UL94-V0 plastic, light gray
Certification	UL/UR

### Operating modes

Mode 1	Relay 1	Relay 2
Controlled device	Resistance	-
Measured variables	Humidity	-
Control type	Dehumidify RH (%)	-

Mode 2	Relay 1	Relay 2
Controlled device	Resistance	Alarm by switching or resistance
Measured variables	Humidity	Humidity
Control type	Dehumidify RH (%)	High humidity warning



Load (1) = fan/resistance  
Load (2) = fan/resistance/alarm



# Thermal balance

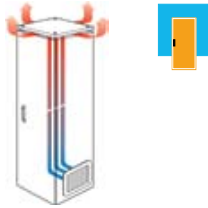
## Thermal management system

The miniaturization of components, the generalization of electronics and the appearance of new electronically-powered products have made temperature management a growing concern when designing electrical and/or electronic switchboards.

Reliability and the search for lower breakdown rates are two determining factors in process industries, where the cost per hour is extremely high. The smallest failure can instantly result in considerable losses. The service life of the components depends, among other factors, on the temperature and humidity conditions inside the enclosure.

The ideal values are +25...+35 °C for the temperature and 60% for the relative humidity (RH).

There are various solutions to these problems. They are chosen according to environmental conditions, the type of components in the electrical switchboard, and their cost. In certain cases, all it takes is to oversize the enclosures or use fans. In other cases, when the temperature is higher, it is necessary to install air-water exchangers or air coolers operating according to the principle of refrigeration (cooling units). We offer you a range of solutions that adapt to every possible scenario: from the enclosure itself to ventilation systems, resistance heaters or exchangers, and even cooling units.



### Natural dissipation through the enclosure walls

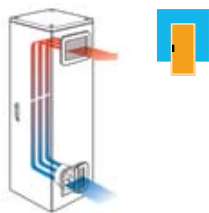
The use of a larger enclosure can, in certain cases, solve your heating problem.

### Natural ventilation

The addition of fresh air from the outside through ventilation louvers improves the dissipation of heat by natural convection. However, this solution can only be used to dissipate small power levels and in environments with a small amount of dust.

# Thermal balance

## Thermal management system



### Ventilation

#### Circulation

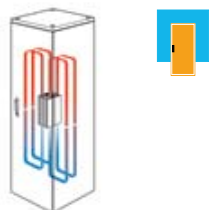
Air circulation inside the enclosure with the help of a fan helps ensure an even temperature, avoiding hot spots that can damage certain components.

#### Forced ventilation

Fans are designed to evacuate a considerable amount of heat coming from the components of the electrical switchboards. The service life of the switchboard is considerably extended, helping to ensure the long life and correct operation of the installation.

Fans can only be used if the ambient temperature is at least 5 °C lower than the desired temperature inside the enclosure.

They offer an efficient solution to the problem of temperature increases in the electrical switchboards; one that is inexpensive and easy to implement and maintain. Thanks to their standard IP54 degree of protection (IP55 with accessories) the fans are suitable for use in industrial and tertiary sectors.



### Heating

#### Resistance heaters

Resistance heaters can be used for two reasons:

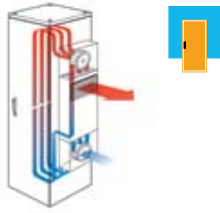
- To reheat the electrical switchboard when the ambient temperature is too low for the correct operation of the components.
- To prevent the formation of condensation.

The second phenomenon can cause short-circuits, premature oxidation of the contacts, corrosion of metal parts and the enclosure, and a considerable reduction in the service life of the electrical and electronic components.

Condensation occurs when the temperature suddenly drops below the dew point temperature. To avoid this, it is necessary to maintain the temperature inside the enclosure at a few degrees above the ambient temperature of the environment. Thanks to their design, the heaters encourage natural convection and help ensure quick and even heating within the enclosure.

# Thermal balance

## Thermal management system

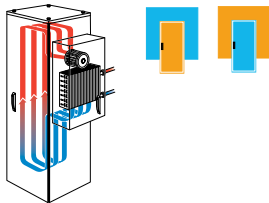


### Cooling

#### Air-air exchangers

Air-air exchangers are devices that combine efficiency and simplicity. The hot air flows out of the enclosure and cold air from the surrounding environment, created by two fans, circulates on either side of hermetic separation walls, which prevent penetration of dust or moisture into the enclosure. The hot air from the switchboard reheats these walls, which in turn are cooled by the fresh air from the outside. The transfer always takes place from the hotter side to the cooler side. This is why these devices can only be used if the ambient temperature is at least 5 °C lower than the desired temperature inside the enclosure.

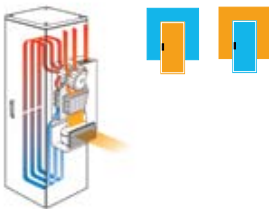
An aluminum exchange cassette forms the core of the system. This element can be removed and easily cleaned. In addition, the permanent operation of the internal fan helps prevent hot spots in the electrical switchboard. The temperature regulation system integrated in the unit turns the external circuit fan on and off.



#### Air-water exchangers

Air-water exchangers operate on the same principle as air-air exchangers. Fresh air from the outside is replaced with cold water supplied by a network installed on the industrial site. This change of fluid makes it possible to evacuate much larger amounts of heat and, possibly, to reduce the temperature in the enclosure below the temperature of the ambient air.

Temperature control in the enclosure is carried out by modulating the water flow. The water circuit is protected by a shut-off device to help protect your electrical installation.



#### Cooling units

Cooling units can be used in the harshest environments, where the temperature can reach 55 °C. These devices are especially recommended when the desired temperature inside the enclosure must be lower than the ambient temperature, or when a large amount of heat must be evacuated. As in the case of the exchangers, they do not affect the IP of the switchboard.

The filter, placed at the inlet of the external air circuit, allows the cooling unit to operate even when the ambient air is charged with dust or oil particles. Easily replaceable and quite inexpensive, the filter helps ensure the efficiency of the cooling unit throughout its service life. The cooling units control the temperature inside the enclosure and include an alarm function for signalling operational anomalies.



The ambient temperature is lower than the desired temperature inside the enclosure.



The ambient temperature is higher than the desired temperature inside the enclosure.

The ProClima calculation software, available on our website, is an indispensable tool for the selection of a thermal auxiliary.

### Method of determining the thermal solution

The heat balance, obtained by comparing the power released by the devices with the power exchanged spontaneously through the wall of the enclosure, allows us to calculate the internal temperature in the enclosure, with no thermal accessories, and thus to determine whether it is necessary to install any, bearing in mind the desired internal and external temperatures. Below is a simple method for determining the thermal solution.

#### 1 Characteristics of the enclosure

H = Height	W = Width	D = Depth	
<b>Position of the enclosure</b>	<b>Location according to IEC 890 ratio</b>	<b>Formula for calculating S (m<sup>2</sup>)</b>	
	Accessible from every side	$S = 1.8 \times H \times (W + D) + 1.4 \times W \times D$	<b>Example</b> Spacial cat. no. <b>NSYSF20840</b> H = 2000 mm (78.7 in) W = 800 mm (31.5 in) D = 400 mm (15.7 in) Installation method: Modular enclosure placed against a wall.  <b>S = 4.13 m<sup>2</sup></b>
	Placed against a wall	$S = 1.4 \times W \times (H + D) + 1.8 \times D \times H$	
	On the end when joined	$S = 1.4 \times D \times (H + W) + 1.8 \times W \times H$	
	On the end when joined, placed against a wall	$S = 1.4 \times H \times (W + D) + 1.4 \times W \times D$	
	In the middle when joined	$S = 1.8 \times W \times H + 1.4 \times W \times D + D \times H$	
	In the middle when joined, placed against a wall	$S = 1.4 \times W \times (H + D) + D \times H$	
	In the middle when joined, placed against a wall with the top covered	$S = 1.4 \times W \times H + 0.7 \times W \times D + D \times H$	
		<b>S = m<sup>2</sup></b>	

#### 2 Thermal power dissipated by the operational components

Calculated as the sum of the power dissipated by each of the installed components. If these are not known, use the ProClima software and refer to page 7/65, which shows the average values.	<b>Pd = W</b>	Assume that the switchgear dissipates 800 W	<b>Pd = 800 W</b>
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#### 3 Characteristics of the environment air

Maximum ambient temperature Minimum ambient temperature Average relative humidity Dew point temperature. Calculation of resistance heater power.	<b>Te<sub>max</sub> = °C</b> <b>Te<sub>min</sub> = °C</b> <b>RH = %</b> <b>Tr = °C</b>	The temperature conditions are as follows:	<b>Te<sub>max</sub> = 35 °C</b> <b>Te<sub>min</sub> = 15 °C</b> <b>RH = 70%</b> <b>Tr = 29 °C</b>
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#### 4 Average desired internal temperatures

They are defined by the nature of the components and the characteristics of the environment air. Maximum internal temperature Minimum internal temperature (maximum value between the dew point temperature and the minimum operating temperature of the devices)	<b>Ts<sub>max</sub> = °C</b> <b>Ts<sub>min</sub> = °C</b>	<b>Ts<sub>max</sub> = 40 °C</b> <b>Ts<sub>min</sub> = 29 °C</b>
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#### 5 Final temperature inside the enclosure with no thermal system

Max. internal temperature: $Ti_{max} = \frac{Pd}{K \times S} + Te_{max}$ Min. internal temperature: $Ti_{min} = \frac{Pd}{K \times S} + Te_{min}$  K = 5.5 W/m <sup>2</sup> /°C for an enclosure made of painted sheet steel K = 3.5 W/m <sup>2</sup> /°C for a polyester enclosure K = 3.7 W/m <sup>2</sup> /°C for a stainless-steel enclosure K = 12 W/m <sup>2</sup> /°C for an aluminum enclosure	<b>Ti<sub>max</sub> = °C</b> <b>Ti<sub>min</sub> = °C</b>	<b>Ti<sub>max</sub> = 70 °C</b> <b>Ti<sub>min</sub> = 50 °C</b>
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# Thermal balance

## Thermal management system

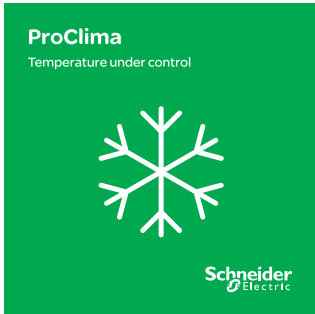
### 6 Determining the type of thermal device and its power: Psyst

If $T_{s\ min} < T_{i\ min}$	If $T_{s\ min} > T_{i\ min}$	If $T_{s\ max} < T_{i\ max}$	If $T_{s\ max} > T_{i\ max}$
No need for a thermal system; a circulation fan may be used to even out the temperature.	Need for a thermal system: resistance heater 1. Permanent operation of the switchboard <b><math>Psyst = K \times S (T_{s\ min} - T_{e\ min}) - Pd</math></b> 2. Discontinuous operation <b><math>Psyst = K \times S (T_{s\ min} - T_{e\ min})</math></b>	Need for a thermal system: ventilation, fan, exchanger, cooling unit. <b><math>Psyst = Pd - K \times S (T_{s\ max} - T_{e\ max})</math></b> <b><math>Psyst = 800 - 5.5 \times 4.13 \times (40 - 35)</math></b> <b>~ 690 W</b>	No need for a thermal system; a circulation fan may be used to even out the temperature.

	Temperature conditions	Solution	Advantages	Constraints
CIRCULATING	Avoid hot spots.	Install circulation fans in the enclosure.	Highly economical solution requiring no maintenance, easy to install; Installation IP maintained.	The amount of heat evacuated is relatively low.
		Oversize the enclosure or the wall-mounting enclosure.	Economical solution requiring no maintenance, easy to install; Installation IP maintained.	The amount of heat evacuated is relatively low, larger dimensions.
COOLING	Final temperature $T_{s\ max}$ desired in the enclosure is at least 5 °C higher than the ambient temperature	Install ventilation louvers.	Highly economical solution requiring no maintenance, easy to install.	The amount of heat evacuated is low, it depends on the layout of the components, reduced IP (entry of dust).
	$T_{e\ max}$ . <b><math>T_{s\ max} \geq T_{e\ max} + 5\ ^\circ C</math></b>	Install fans for introducing fresh air. <b><math>D = \frac{Psyst}{(T_{s\ max} - T_{e\ max})} \times 3.1\ m^3/h</math></b>	Economical solution, easy to install; large amount of heat evacuated; possible temperature control.	Regular filter maintenance. IP slightly reduced.
		Use an air-air exchanger. <b><math>q = \frac{Psyst}{(T_{s\ max} - T_{e\ max})} - wk</math></b>	Easy to install; IP maintained during installation; temperature control as standard; easy maintenance.	Regular filter maintenance.
	Final temperature $T_{s\ max}$ desired in the enclosure is lower than the ambient temperature $T_{e\ max} + 5\ ^\circ C$ .	Use a cooling unit.	Easy to install; allows the evacuation of large amounts of heat, even when the ambient temperature is high, IP maintained during installation, temperature control.	Regular filter maintenance, cannot be used beyond an ambient temperature of 55 °C.
	<b><math>T_{s\ max} \geq T_{e\ max} + 5\ ^\circ C</math></b>	Use an air-water exchanger.	Easy to install; allows the evacuation of large amounts of heat, even when the ambient temperature is high, IP maintained during installation, temperature control, no filter to maintain.	Needs a water circuit; consumption if supplied by the water mains.
HEATING	Outside temperature is lower than the lowest acceptable ambient temperature for the switchgear.	Heat using a resistance heater.	Economical, reliable.	Energy consumption; space taken up in the enclosure.
	Risk of condensation.	Heat using a resistance heater in order to maintain the temperature beyond the dew point temperature.	Economical, reliable; the humidity in the switchgear can be regulated.	Energy consumption; space taken up in the enclosure.



# Software ProClima



## New ProClima software

- Software package for calculating and selecting the thermal accessories required for enclosures containing electrical and electronic equipment.
- Performs the calculations described on pages 7/60 and 7/61, as well as the corrected surfaces, according to the dimensions of the enclosure and its position in relation to the walls.
- Available for download from our website.

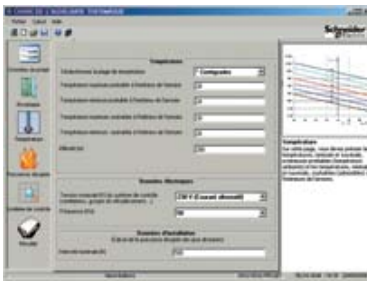
## Data entry

Follow these steps for the calculation:

**1**  
Enter the project and customer data (optional).



**2**  
Enter the internal and external temperature data for the enclosure (required).



**3**  
Enter the electrical data for the installation (voltage, rating, etc.) (required).



**4**  
Determine the power dissipated by the electrical equipment inside the enclosure (required).  
If this value is not known, the software can calculate it:

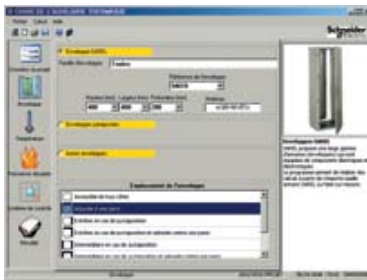
- Based on the electrical or electronic switchgear that make up the switchboard (type and number),
- Based on a temperature reading.



7

### Results

The software offers to print the project summary containing the calculation values, the results obtained and the thermal accessories recommended for maintaining the internal temperature of the enclosure in the specified conditions. In addition, the summary specifies the power, characteristics and catalog number of the device, as well as any related accessories.



5

Select the enclosure and the installation method (required).



6

Select the thermal management system (fans, exchangers, etc.) (required).



7

View and print the project summary.



# Example of calculation and selection

<b>Data</b>									
<ul style="list-style-type: none"> <li>• <b>Enclosure data</b>                      Height: 2000 mm (78.7 in)                      Width: 800 mm (31.5 in)                      Depth: 500 mm (19.7 in)</li> </ul>									
<ul style="list-style-type: none"> <li>• <b>Location:</b> Placed on the wall</li> </ul>									
<ul style="list-style-type: none"> <li>• <b>Material:</b> Painted sheet-steel enclosure</li> </ul>									
<ul style="list-style-type: none"> <li>• <b>Thermal power dissipated by the operational components</b>                      Pd: 950 W</li> </ul>									
<ul style="list-style-type: none"> <li>• <b>Information on temperature and the environment:</b></li> </ul> <table border="0"> <tr> <td>Maximum desired temperature inside the enclosure</td> <td><math>T_{e_{max}}</math> : 25 °C</td> </tr> <tr> <td>Minimum desired temperature inside the enclosure</td> <td><math>T_{e_{min}}</math> : 25 °C</td> </tr> <tr> <td>Maximum temperature dissipated in the enclosure</td> <td><math>T_{e_{max}}</math> : 35 °C</td> </tr> <tr> <td>Minimum temperature dissipated in the enclosure</td> <td><math>T_{e_{min}}</math> : 25 °C</td> </tr> </table>		Maximum desired temperature inside the enclosure	$T_{e_{max}}$ : 25 °C	Minimum desired temperature inside the enclosure	$T_{e_{min}}$ : 25 °C	Maximum temperature dissipated in the enclosure	$T_{e_{max}}$ : 35 °C	Minimum temperature dissipated in the enclosure	$T_{e_{min}}$ : 25 °C
Maximum desired temperature inside the enclosure	$T_{e_{max}}$ : 25 °C								
Minimum desired temperature inside the enclosure	$T_{e_{min}}$ : 25 °C								
Maximum temperature dissipated in the enclosure	$T_{e_{max}}$ : 35 °C								
Minimum temperature dissipated in the enclosure	$T_{e_{min}}$ : 25 °C								
<b>Environment:</b> Low pollution and low dust level									

**Selection and calculation:**

The desired maximum temperature inside ( $T_{s_{max}}$ ) the enclosure is 10 °C higher than the maximum value expected for the outside ( $T_{i_{max}}$ ). It is possible to cool the enclosure using the filtered ventilation systems.

**Calculation of the required fan:**

Usage formulas: $Ps_{is} = Pd - k \times S \times (T_{s_{max}} - T_{e_{max}})$ $Flow = f \times Ps_{is} / (T_{d_{max}} - T_{e_{max}})$
<b>Pd: Thermal power dissipated by the operational components</b> $S = 1.4 \times W \times (H + D) + 1.8 \times D \times H = 4.6 \text{ m}^2$ . According to standard IEC 890. <b>K = Constant defined by the material used to manufacture the enclosure</b>
K = 5.5 W/m <sup>2</sup> × °C for a solid sheet-steel enclosure K = 3.5 W/m <sup>2</sup> × °C for a polyester enclosure K = 3.7 W/m <sup>2</sup> × °C for a stainless-steel enclosure

In order to make the calculation, it is necessary to know the height above sea level of the installation location:

Height above sea level: 800 m (2624.7 ft)

**f = Coefficient relating to the height above sea level (value)**

0 to 100 m (0 to 328.1 ft), f = 3.1	500 to 750 m (1640.4 to 2460.6 ft), f = 3.4
100 to 250 m (328.1 to 820.2 ft), f = 3.2	750 to 1000 m (2460.6 to 3280.8 ft), f = 3.5
250 to 500 m (820.2 to 1640.4 ft), f = 3.3	.....

**Our example:**

$Ps_{is} = 950 - 5.5 \times 4.6 \times (35 - 25) = 497 \text{ W}$   
 $Flow \text{ rate} = 3.5 \times 497 / (35 - 25) = 244 \text{ m}^3/\text{h}$   
 Selection from the fan quick-selection table  
**1 fan with standard filter cat. no. NSYCVF300M230PF + 1 grille with standard filter cat. no. NSYCAG223LPF + 1 thermostat cat. no. NSYCCOTH0 enable a flow rate of 302 m<sup>3</sup>/h**  
 The minimum outside temperature is lower than the desired minimum temperature inside the enclosure.  
 It is necessary to install resistance heaters:

**Calculation of the useful resistance heater**

Usage formula $W = k \times S \times (T_{s_{min}} - T_{e_{min}})$
--

**Our example:**

$W = 5.5 \times 4.6 (15 - 10) = 127 \text{ W}$

Selection from the selection guide of the resistance heaters.  
**1 resistance heater cat. no. NSYCR150WU2C + 1 thermostat cat. no. NSYCCOTH3C**





# Help table to calculate corrected surfaces

## Spatial wall-mounting enclosures

Installation mode									
H: mm (in)	W: mm (in)	D: mm (in)	1	2	3	4	5	6	7
			m <sup>2</sup> (ft <sup>2</sup> )	m <sup>2</sup> (ft <sup>2</sup> )	m <sup>2</sup> (ft <sup>2</sup> )	m <sup>2</sup> (ft <sup>2</sup> )	m <sup>2</sup> (ft <sup>2</sup> )	m <sup>2</sup> (ft <sup>2</sup> )	m <sup>2</sup> (ft <sup>2</sup> )
300 (11.8)	200 (7.9)	150 (5.9)	0.23 (0.8)	0.21 (0.7)	0.21 (0.7)	0.19 (0.6)	0.20 (0.7)	0.17 (0.6)	0.15 (0.5)
300 (11.8)	250 (9.8)	150 (5.9)	0.28 (0.9)	0.24 (0.8)	0.25 (0.8)	0.22 (0.7)	0.23 (0.8)	0.20 (0.7)	0.18 (0.6)
300 (11.8)	300 (11.8)	150 (5.9)	0.31 (1.0)	0.27 (0.9)	0.29 (1.0)	0.25 (0.8)	0.27 (0.9)	0.23 (0.8)	0.20 (0.7)
300 (11.8)	300 (11.8)	200 (7.9)	0.35 (1.1)	0.32 (1.0)	0.33 (1.1)	0.29 (1.0)	0.31 (1.0)	0.27 (0.9)	0.23 (0.8)
300 (11.8)	400 (15.7)	150 (5.9)	0.38 (1.2)	0.33 (1.1)	0.36 (1.2)	0.32 (1.0)	0.35 (1.1)	0.30 (1.0)	0.26 (0.9)
300 (11.8)	400 (15.7)	200 (7.9)	0.41 (1.3)	0.39 (1.3)	0.41 (1.3)	0.36 (1.2)	0.39 (1.3)	0.34 (1.1)	0.28 (0.9)
400 (15.7)	300 (11.8)	150 (5.9)	0.39 (1.3)	0.34 (1.1)	0.36 (1.2)	0.32 (1.0)	0.34 (1.1)	0.29 (1.0)	0.26 (0.9)
400 (15.7)	300 (11.8)	200 (7.9)	0.44 (1.4)	0.40 (1.3)	0.41 (1.3)	0.36 (1.2)	0.38 (1.2)	0.33 (1.1)	0.29 (1.0)
400 (15.7)	400 (15.7)	200 (7.9)	0.54 (1.8)	0.48 (1.6)	0.51 (1.7)	0.45 (1.5)	0.48 (1.6)	0.42 (1.4)	0.36 (1.2)
400 (15.7)	600 (23.6)	200 (7.9)	0.74 (2.4)	0.65 (2.1)	0.71 (2.3)	0.62 (2.0)	0.68 (2.2)	0.58 (1.9)	0.50 (1.6)
400 (15.7)	600 (23.6)	250 (9.8)	0.82 (2.7)	0.73 (2.4)	0.78 (2.6)	0.69 (2.3)	0.74 (2.4)	0.65 (2.1)	0.54 (1.8)
500 (19.7)	300 (11.8)	200 (7.9)	0.53 (1.7)	0.47 (1.5)	0.49 (1.6)	0.43 (1.4)	0.45 (1.5)	0.39 (1.3)	0.35 (1.1)
500 (19.7)	400 (15.7)	200 (7.9)	0.65 (2.1)	0.57 (1.9)	0.61 (2.0)	0.53 (1.7)	0.57 (1.9)	0.49 (1.6)	0.44 (1.4)
500 (19.7)	400 (15.7)	250 (9.8)	0.73 (2.4)	0.65 (2.1)	0.68 (2.2)	0.60 (2.0)	0.63 (2.1)	0.55 (1.8)	0.48 (1.6)
500 (19.7)	500 (19.7)	200 (7.9)	0.77 (2.5)	0.67 (2.2)	0.73 (2.4)	0.63 (2.1)	0.69 (2.3)	0.59 (1.9)	0.52 (1.7)
500 (19.7)	500 (19.7)	250 (9.8)	0.85 (2.8)	0.75 (2.5)	0.80 (2.6)	0.70 (2.3)	0.75 (2.5)	0.65 (2.1)	0.56 (1.8)
600 (23.6)	400 (15.7)	200 (7.9)	0.76 (2.5)	0.66 (2.2)	0.71 (2.3)	0.62 (2.0)	0.66 (2.2)	0.57 (1.9)	0.51 (1.7)
600 (23.6)	400 (15.7)	250 (9.8)	0.84 (2.8)	0.75 (2.5)	0.78 (2.6)	0.69 (2.3)	0.72 (2.4)	0.63 (2.1)	0.56 (1.8)
600 (23.6)	500 (19.7)	250 (9.8)	1.02 (3.3)	0.87 (2.9)	0.93 (3.1)	0.81 (2.7)	0.87 (2.9)	0.75 (2.5)	0.66 (2.2)
600 (23.6)	600 (23.6)	200 (7.9)	1.03 (3.4)	0.89 (2.9)	0.98 (3.2)	0.84 (2.8)	0.94 (3.1)	0.79 (2.6)	0.71 (2.3)
600 (23.6)	600 (23.6)	250 (9.8)	1.13 (3.7)	0.98 (3.2)	1.07 (3.5)	0.92 (3.0)	1.01 (3.3)	0.86 (2.8)	0.76 (2.5)
600 (23.6)	600 (23.6)	300 (11.8)	1.22 (4.0)	1.08 (3.5)	1.15 (3.8)	1.01 (3.3)	1.08 (3.5)	0.94 (3.1)	0.81 (2.7)
600 (23.6)	600 (23.6)	400 (15.7)	1.42 (4.7)	1.27 (4.2)	1.32 (4.3)	1.18 (3.9)	1.22 (4.0)	1.08 (3.5)	0.91 (3.0)
600 (23.6)	800 (31.5)	300 (11.8)	1.52 (5.0)	1.33 (4.4)	1.45 (4.8)	1.26 (4.1)	1.38 (4.5)	1.19 (3.9)	1.02 (3.3)
700 (27.6)	500 (19.7)	250 (9.8)	1.12 (3.7)	0.98 (3.2)	1.05 (3.4)	0.91 (3.0)	0.98 (3.2)	0.84 (2.8)	0.75 (2.5)
800 (31.5)	600 (23.6)	200 (7.9)	1.32 (4.3)	1.13 (3.7)	1.26 (4.1)	1.06 (3.5)	1.19 (3.9)	1.00 (3.3)	0.92 (3.0)
800 (31.5)	600 (23.6)	250 (9.8)	1.43 (4.7)	1.24 (4.1)	1.35 (4.4)	1.16 (3.8)	1.27 (4.2)	1.08 (3.5)	0.98 (3.2)
800 (31.5)	600 (23.6)	300 (11.8)	1.55 (5.1)	1.36 (4.5)	1.45 (4.8)	1.26 (4.1)	1.36 (4.5)	1.16 (3.8)	1.04 (3.4)
800 (31.5)	600 (23.6)	400 (15.7)	1.78 (5.8)	1.58 (5.2)	1.65 (5.4)	1.46 (4.8)	1.52 (5.0)	1.33 (4.4)	1.16 (3.8)
800 (31.5)	800 (31.5)	250 (9.8)	1.79 (5.9)	1.54 (5.1)	1.71 (5.6)	1.46 (4.8)	1.63 (5.3)	1.38 (4.5)	1.24 (4.1)
800 (31.5)	800 (31.5)	300 (11.8)	1.92 (6.3)	1.66 (5.4)	1.82 (6.0)	1.57 (5.2)	1.73 (5.7)	1.47 (4.8)	1.30 (4.3)
800 (31.5)	1000 (39.4)	300 (11.8)	2.29 (7.5)	1.97 (6.5)	2.20 (7.2)	1.88 (6.2)	2.10 (6.9)	1.78 (5.8)	1.57 (5.2)
800 (31.5)	1200 (47.2)	300 (11.8)	2.50 (8.2)	2.28 (7.5)	2.57 (8.4)	2.18 (7.2)	2.47 (8.1)	2.09 (6.9)	1.84 (6.0)
1000 (39.4)	600 (23.6)	250 (9.8)	1.74 (5.7)	1.50 (4.9)	1.64 (5.4)	1.40 (4.6)	1.54 (5.1)	1.30 (4.3)	1.19 (3.9)
1000 (39.4)	600 (23.6)	300 (11.8)	2.04 (6.7)	1.63 (5.3)	1.75 (5.7)	1.51 (5.0)	1.63 (5.3)	1.39 (4.6)	1.27 (4.2)
1000 (39.4)	600 (23.6)	400 (15.7)	2.14 (7.0)	1.90 (6.2)	1.98 (6.5)	1.74 (5.7)	1.82 (6.0)	1.58 (5.2)	1.41 (4.6)
1000 (39.4)	800 (31.5)	250 (9.8)	2.17 (7.1)	1.85 (6.1)	2.07 (6.8)	1.75 (5.7)	1.97 (6.5)	1.65 (5.4)	1.51 (5.0)
1000 (39.4)	800 (31.5)	300 (11.8)	2.32 (7.6)	2.00 (6.6)	2.20 (7.2)	1.88 (6.2)	2.08 (6.8)	1.76 (5.8)	1.59 (5.2)
1000 (39.4)	800 (31.5)	400 (15.7)	2.61 (8.6)	2.29 (7.5)	2.45 (8.0)	2.13 (7.0)	2.29 (7.5)	1.97 (6.5)	1.74 (5.7)
1000 (39.4)	1000 (39.4)	300 (11.8)	2.76 (9.1)	2.36 (7.7)	2.64 (8.7)	2.24 (7.3)	2.52 (8.3)	2.12 (7.0)	1.91 (6.3)
1000 (39.4)	1200 (47.2)	300 (11.8)	3.20 (10.5)	2.72 (8.9)	3.08 (10.1)	2.60 (8.5)	2.96 (9.7)	2.48 (8.1)	2.23 (7.3)
1000 (39.4)	1200 (47.2)	400 (15.7)	3.44 (11.3)	3.07 (10.1)	3.39 (11.1)	2.91 (9.5)	3.23 (10.6)	2.75 (9.0)	2.42 (7.9)
1200 (47.2)	600 (23.6)	300 (11.8)	2.45 (8.0)	1.91 (6.3)	2.05 (6.7)	1.76 (5.8)	1.91 (6.3)	1.62 (5.3)	1.49 (4.9)
1200 (47.2)	600 (23.6)	400 (15.7)	2.83 (9.3)	2.21 (7.3)	2.30 (7.5)	2.02 (6.6)	2.11 (6.9)	1.82 (6.0)	1.66 (5.4)
1200 (47.2)	800 (31.5)	300 (11.8)	2.71 (8.9)	2.33 (7.6)	2.57 (8.4)	2.18 (7.2)	2.42 (7.9)	2.04 (6.7)	1.87 (6.1)
1200 (47.2)	800 (31.5)	400 (15.7)	3.04 (10.0)	2.66 (8.7)	2.85 (9.4)	2.46 (8.1)	2.66 (8.7)	2.27 (7.4)	2.05 (6.7)
1200 (47.2)	1000 (39.4)	300 (11.8)	3.23 (10.6)	2.75 (9.0)	3.08 (10.1)	2.60 (8.5)	2.94 (9.6)	2.46 (8.1)	2.25 (7.4)
1200 (47.2)	1000 (39.4)	400 (15.7)	3.70 (12.1)	3.10 (10.2)	3.39 (11.1)	2.91 (9.5)	3.20 (10.5)	2.72 (8.9)	2.44 (8.0)
1200 (47.2)	1200 (47.2)	300 (11.8)	3.74 (12.3)	3.17 (10.4)	3.60 (11.8)	3.02 (9.9)	3.46 (11.4)	2.88 (9.4)	2.63 (8.6)
1400 (55.1)	1000 (39.4)	300 (11.8)	3.86 (12.7)	3.14 (10.3)	3.53 (11.6)	2.97 (9.7)	3.36 (11.0)	2.80 (9.2)	2.59 (8.5)








- Installation mode**
- 1 Accessible from every side
  - 2 Placed against a wall
  - 3 On the end when joined
  - 4 On the end when joined, placed against a wall
  - 5 In the middle when joined
  - 6 In the middle when joined, placed against a wall
  - 7 In the middle when joined, placed against a wall, closed covered top










Use ProClima to save time and find the best solution!

# Help table to calculate corrected surfaces

## Thalassa wall-mounting enclosures

H: mm (in)	W: mm (in)	D: mm (in)	Installation mode						
			1  m <sup>2</sup> (ft <sup>2</sup> )	2  m <sup>2</sup> (ft <sup>2</sup> )	3  m <sup>2</sup> (ft <sup>2</sup> )	4  m <sup>2</sup> (ft <sup>2</sup> )	5  m <sup>2</sup> (ft <sup>2</sup> )	6  m <sup>2</sup> (ft <sup>2</sup> )	7  m <sup>2</sup> (ft <sup>2</sup> )
310 (12.2)	215 (8.5)	160 (6.3)	0.26 (0.9)	0.23 (0.8)	0.24 (0.8)	0.21 (0.7)	0.22 (0.7)	0.19 (0.6)	0.17 (0.6)
307 (12.1)	255 (10.0)	164 (6.5)	0.29 (1.0)	0.26 (0.9)	0.27 (0.9)	0.24 (0.8)	0.25 (0.8)	0.22 (0.7)	0.19 (0.6)
430 (16.9)	330 (13.0)	200 (7.9)	0.50 (1.6)	0.45 (1.5)	0.47 (1.5)	0.41 (1.3)	0.43 (1.4)	0.38 (1.2)	0.33 (1.1)
530 (20.9)	430 (16.9)	200 (7.9)	0.72 (2.4)	0.63 (2.1)	0.68 (2.2)	0.59 (1.9)	0.64 (2.1)	0.55 (1.8)	0.49 (1.6)
645 (25.4)	435 (17.1)	250 (9.8)	0.95 (3.1)	0.84 (2.8)	0.88 (2.9)	0.77 (2.5)	0.82 (2.7)	0.71 (2.3)	0.63 (2.1)
745 (29.3)	535 (21.1)	300 (11.8)	1.34 (4.4)	1.19 (3.9)	1.26 (4.1)	1.10 (3.6)	1.17 (3.8)	1.01 (3.3)	0.89 (2.9)
845 (33.3)	635 (25.0)	300 (11.8)	1.69 (5.5)	1.47 (4.8)	1.59 (5.2)	1.37 (4.5)	1.49 (4.9)	1.27 (4.2)	1.14 (3.7)
1055 (41.5)	850 (33.5)	350 (13.8)	2.70 (8.9)	2.34 (7.7)	2.55 (8.4)	2.19 (7.2)	2.40 (7.9)	2.04 (6.7)	1.83 (6.0)

## Thalassa floor-standing enclosures

H: mm (in)	W: mm (in)	D: mm (in)	Installation mode						
			1  m <sup>2</sup> (ft <sup>2</sup> )	2  m <sup>2</sup> (ft <sup>2</sup> )	3  m <sup>2</sup> (ft <sup>2</sup> )	4  m <sup>2</sup> (ft <sup>2</sup> )	5  m <sup>2</sup> (ft <sup>2</sup> )	6  m <sup>2</sup> (ft <sup>2</sup> )	7  m <sup>2</sup> (ft <sup>2</sup> )
500 (19.7)	500 (19.7)	320 (12.6)	0.96 (3.1)	0.86 (2.8)	0.90 (3.0)	0.80 (2.6)	0.83 (2.7)	0.73 (2.4)	0.62 (2.0)
500 (19.7)	750 (29.5)	320 (12.6)	1.30 (4.3)	1.15 (3.8)	1.24 (4.1)	1.09 (3.6)	1.17 (3.8)	1.02 (3.3)	0.85 (2.8)
500 (19.7)	1000 (39.4)	320 (12.6)	1.64 (5.4)	1.44 (4.7)	1.57 (5.2)	1.37 (4.5)	1.51 (5.0)	1.31 (4.3)	1.08 (3.5)
500 (19.7)	1250 (49.2)	320 (12.6)	1.97 (6.5)	1.72 (5.6)	1.91 (6.3)	1.66 (5.4)	1.85 (6.1)	1.60 (5.2)	1.32 (4.3)
750 (29.5)	500 (19.7)	320 (12.6)	1.33 (4.4)	1.18 (3.9)	1.24 (4.1)	1.09 (3.6)	1.14 (3.7)	0.99 (3.2)	0.88 (2.9)
750 (29.5)	750 (29.5)	320 (12.6)	1.78 (5.8)	1.56 (5.1)	1.68 (5.5)	1.46 (4.8)	1.59 (5.2)	1.36 (4.5)	1.20 (3.9)
750 (29.5)	1000 (39.4)	320 (12.6)	2.23 (7.3)	1.93 (6.3)	2.13 (7.0)	1.83 (6.0)	2.04 (6.7)	1.74 (5.7)	1.51 (5.0)
750 (29.5)	1250 (49.2)	320 (12.6)	2.68 (8.8)	2.30 (7.5)	2.58 (8.5)	2.21 (7.3)	2.49 (8.2)	2.11 (6.9)	1.83 (6.0)
1000 (39.4)	500 (19.7)	320 (12.6)	1.70 (5.6)	1.50 (4.9)	1.57 (5.2)	1.37 (4.5)	1.44 (4.7)	1.24 (4.1)	1.13 (3.7)
1000 (39.4)	750 (29.5)	320 (12.6)	2.26 (7.4)	1.96 (6.4)	2.13 (7.0)	1.83 (6.0)	2.01 (6.6)	1.71 (5.6)	1.54 (5.1)
1000 (39.4)	1000 (39.4)	320 (12.6)	2.82 (9.3)	2.42 (7.9)	2.70 (8.9)	2.30 (7.5)	2.57 (8.4)	2.17 (7.1)	1.94 (6.4)
1000 (39.4)	1250 (49.2)	320 (12.6)	3.39 (11.1)	2.89 (9.5)	3.26 (10.7)	2.76 (9.1)	3.13 (10.3)	2.63 (8.6)	2.35 (7.7)
1250 (49.2)	500 (19.7)	320 (12.6)	2.07 (6.8)	1.82 (6.0)	1.91 (6.3)	1.66 (5.4)	1.75 (5.7)	1.50 (4.9)	1.39 (4.6)
1250 (49.2)	750 (29.5)	320 (12.6)	2.74 (9.0)	2.37 (7.8)	2.58 (8.5)	2.21 (7.3)	2.42 (7.9)	2.05 (6.7)	1.88 (6.2)
1250 (49.2)	1000 (39.4)	320 (12.6)	3.42 (11.2)	2.92 (9.6)	3.26 (10.7)	2.76 (9.1)	3.10 (10.2)	2.60 (8.5)	2.37 (7.8)
1250 (49.2)	1250 (49.2)	320 (12.6)	4.09 (13.4)	3.47 (11.4)	3.93 (12.9)	3.31 (10.9)	3.77 (12.4)	3.15 (10.3)	2.87 (9.4)
1500 (59.1)	500 (19.7)	320 (12.6)	2.44 (8.0)	2.14 (7.0)	2.25 (7.4)	1.95 (6.4)	2.05 (6.7)	1.75 (5.7)	1.64 (5.4)
1500 (59.1)	750 (29.5)	320 (12.6)	3.23 (10.6)	2.78 (9.1)	3.03 (9.9)	2.58 (8.5)	2.84 (9.3)	2.39 (7.8)	2.22 (7.3)
1500 (59.1)	1000 (39.4)	320 (12.6)	4.01 (13.2)	3.41 (11.2)	3.82 (12.5)	3.22 (10.6)	3.63 (11.9)	3.03 (9.9)	2.80 (9.2)
1500 (59.1)	1250 (49.2)	320 (12.6)	4.80 (15.7)	4.05 (13.3)	4.61 (15.1)	3.86 (12.7)	4.42 (14.5)	3.67 (12.0)	3.39 (11.1)
500 (19.7)	500 (19.7)	420 (16.5)	1.12 (3.7)	1.02 (3.3)	1.04 (3.4)	0.94 (3.1)	0.95 (3.1)	0.85 (2.8)	0.71 (2.3)
500 (19.7)	750 (29.5)	420 (16.5)	1.49 (4.9)	1.34 (4.4)	1.41 (4.6)	1.26 (4.1)	1.33 (4.4)	1.18 (3.9)	0.96 (3.1)
500 (19.7)	1000 (39.4)	420 (16.5)	1.87 (6.1)	1.67 (5.5)	1.78 (5.8)	1.58 (5.2)	1.70 (5.6)	1.50 (4.9)	1.20 (3.9)
500 (19.7)	1250 (49.2)	420 (16.5)	2.24 (7.3)	1.99 (6.5)	2.15 (7.1)	1.90 (6.2)	2.07 (6.8)	1.82 (6.0)	1.45 (4.8)
750 (29.5)	500 (19.7)	420 (16.5)	1.54 (5.1)	1.39 (4.6)	1.41 (4.6)	1.26 (4.1)	1.28 (4.2)	1.13 (3.7)	0.99 (3.2)
750 (29.5)	750 (29.5)	420 (16.5)	2.02 (6.6)	1.80 (5.9)	1.89 (6.2)	1.67 (5.5)	1.77 (5.8)	1.54 (5.1)	1.32 (4.3)
750 (29.5)	1000 (39.4)	420 (16.5)	2.51 (8.2)	2.21 (7.3)	2.38 (7.8)	2.08 (6.8)	2.25 (7.4)	1.95 (6.4)	1.66 (5.4)
750 (29.5)	1250 (49.2)	420 (16.5)	2.99 (9.8)	2.61 (8.6)	2.86 (9.4)	2.49 (8.2)	2.74 (9.0)	2.36 (7.7)	2.00 (6.6)
1000 (39.4)	500 (19.7)	420 (16.5)	1.95 (6.4)	1.75 (5.7)	1.78 (5.8)	1.58 (5.2)	1.61 (5.3)	1.41 (4.6)	1.27 (4.2)
1000 (39.4)	750 (29.5)	420 (16.5)	2.55 (8.4)	2.25 (7.4)	2.38 (7.8)	2.08 (6.8)	2.21 (7.3)	1.91 (6.3)	1.69 (5.5)
1000 (39.4)	1000 (39.4)	420 (16.5)	3.14 (10.3)	2.74 (9.0)	2.98 (9.8)	2.58 (8.5)	2.81 (9.2)	2.41 (7.9)	2.11 (6.9)
1000 (39.4)	1250 (49.2)	420 (16.5)	3.74 (12.3)	3.24 (10.6)	3.57 (11.7)	3.07 (10.1)	3.41 (11.2)	2.91 (9.5)	2.54 (8.3)
1250 (49.2)	500 (19.7)	420 (16.5)	2.36 (7.7)	2.11 (6.9)	2.15 (7.1)	1.90 (6.2)	1.94 (6.4)	1.69 (5.5)	1.55 (5.1)
1250 (49.2)	750 (29.5)	420 (16.5)	3.07 (10.1)	2.70 (8.9)	2.86 (9.4)	2.49 (8.2)	2.65 (8.7)	2.28 (7.5)	2.06 (6.8)
1250 (49.2)	1000 (39.4)	420 (16.5)	3.78 (12.4)	3.28 (10.8)	3.57 (11.7)	3.07 (10.1)	3.36 (11.0)	2.86 (9.4)	2.57 (8.4)
1250 (49.2)	1250 (49.2)	420 (16.5)	4.49 (14.7)	3.87 (12.7)	4.28 (14.0)	3.66 (12.0)	4.07 (13.4)	3.45 (11.3)	3.08 (10.1)
1500 (59.1)	500 (19.7)	420 (16.5)	2.78 (9.1)	2.48 (8.1)	2.53 (8.3)	2.23 (7.3)	2.27 (7.4)	1.97 (6.5)	1.83 (6.0)
1500 (59.1)	750 (29.5)	420 (16.5)	3.60 (11.8)	3.15 (10.3)	3.35 (11.0)	2.90 (9.5)	3.10 (10.2)	2.65 (8.7)	2.43 (8.0)
1500 (59.1)	1000 (39.4)	420 (16.5)	4.42 (14.5)	3.82 (12.5)	4.17 (13.7)	3.57 (11.7)	3.92 (12.9)	3.32 (10.9)	3.02 (9.9)
1500 (59.1)	1250 (49.2)	420 (16.5)	5.24 (17.2)	4.49 (14.7)	4.99 (16.4)	4.24 (13.9)	4.74 (15.6)	3.99 (13.1)	3.62 (11.9)



# Help table to calculate corrected surfaces

## Spacial floor-standing enclosures

H: mm (in)	W: mm (in)	D: mm (in)	Installation mode						
			1	2	3	4	5	6	7
1200 (47.2)	800 (31.5)	300 (11.8)	2.71 (8.9)	2.33 (7.6)	2.57 (8.4)	2.18 (7.2)	2.42 (7.9)	2.04 (6.7)	1.87 (6.1)
1200 (47.2)	1000 (39.4)	300 (11.8)	3.23 (10.6)	2.75 (9.0)	3.08 (10.1)	2.60 (8.5)	2.94 (9.6)	2.46 (8.1)	2.25 (7.4)
1200 (47.2)	1200 (47.2)	400 (15.7)	4.13 (13.5)	3.55 (11.6)	3.94 (12.9)	3.36 (11.0)	3.74 (12.3)	3.17 (10.4)	2.83 (9.3)
1400 (55.1)	600 (23.6)	300 (11.8)	2.52 (8.3)	2.18 (7.2)	2.35 (7.7)	2.02 (6.6)	2.18 (7.2)	1.85 (6.1)	1.72 (5.6)
1400 (55.1)	600 (23.6)	400 (15.7)	2.86 (9.4)	2.52 (8.3)	2.63 (8.6)	2.30 (7.5)	2.41 (7.9)	2.07 (6.8)	1.90 (6.2)
1400 (55.1)	800 (31.5)	300 (11.8)	3.11 (10.2)	2.66 (8.7)	2.94 (9.6)	2.49 (8.2)	2.77 (9.1)	2.32 (7.6)	2.16 (7.1)
1400 (55.1)	800 (31.5)	400 (15.7)	3.47 (11.4)	3.02 (9.9)	3.25 (10.7)	2.80 (9.2)	3.02 (9.9)	2.58 (8.5)	2.35 (7.7)
1400 (55.1)	1000 (39.4)	400 (15.7)	4.09 (13.4)	3.53 (11.6)	3.86 (12.7)	3.30 (10.8)	3.64 (11.9)	3.08 (10.1)	2.80 (9.2)
1400 (55.1)	1200 (47.2)	400 (15.7)	4.70 (15.4)	4.03 (13.2)	4.48 (14.7)	3.81 (12.5)	4.26 (14.0)	3.58 (11.7)	3.25 (10.7)
1600 (63.0)	600 (23.6)	300 (11.8)	2.84 (9.3)	2.46 (8.1)	2.65 (8.7)	2.27 (7.4)	2.46 (8.1)	2.08 (6.8)	1.95 (6.4)
1600 (63.0)	600 (23.6)	400 (15.7)	3.22 (10.6)	2.83 (9.3)	2.96 (9.7)	2.58 (8.5)	2.70 (8.9)	2.32 (7.6)	2.15 (7.1)
1600 (63.0)	800 (31.5)	300 (11.8)	3.50 (11.5)	2.99 (9.8)	3.31 (10.9)	2.80 (9.2)	3.12 (10.2)	2.61 (8.6)	2.44 (8.0)
1600 (63.0)	800 (31.5)	400 (15.7)	3.90 (12.8)	3.39 (11.1)	3.65 (12.0)	3.14 (10.3)	3.39 (11.1)	2.88 (9.4)	2.66 (8.7)
1600 (63.0)	1000 (39.4)	300 (11.8)	4.16 (13.6)	3.52 (11.5)	3.97 (13.0)	3.33 (10.9)	3.78 (12.4)	3.14 (10.3)	2.93 (9.6)
1600 (63.0)	1000 (39.4)	400 (15.7)	4.59 (15.1)	3.95 (13.0)	4.34 (14.2)	3.70 (12.1)	4.08 (13.4)	3.44 (11.3)	3.16 (10.4)
1600 (63.0)	1200 (47.2)	300 (11.8)	4.82 (15.8)	4.06 (13.3)	4.63 (15.2)	3.86 (12.7)	4.44 (14.6)	3.67 (12.0)	3.42 (11.2)
1600 (63.0)	1200 (47.2)	400 (15.7)	5.28 (17.3)	4.51 (14.8)	5.02 (16.5)	4.26 (14.0)	4.77 (15.6)	4.00 (13.1)	3.66 (12.0)
1800 (70.9)	600 (23.6)	300 (11.8)	3.17 (10.4)	2.74 (9.0)	2.95 (9.7)	2.52 (8.3)	2.74 (9.0)	2.30 (7.5)	2.18 (7.2)
1800 (70.9)	600 (23.6)	400 (15.7)	3.58 (11.7)	3.14 (10.3)	3.29 (10.8)	2.86 (9.4)	3.00 (9.8)	2.57 (8.4)	2.40 (7.9)
1800 (70.9)	600 (23.6)	500 (19.7)	3.98 (13.1)	3.55 (11.6)	3.62 (11.9)	3.19 (10.5)	3.26 (10.7)	2.83 (9.3)	2.62 (8.6)
1800 (70.9)	800 (31.5)	300 (11.8)	3.90 (12.8)	3.32 (10.9)	3.68 (12.1)	3.11 (10.2)	3.47 (11.4)	2.89 (9.5)	2.72 (8.9)
1800 (70.9)	800 (31.5)	400 (15.7)	4.34 (14.2)	3.76 (12.3)	4.05 (13.3)	3.47 (11.4)	3.76 (12.3)	3.18 (10.4)	2.96 (9.7)
1800 (70.9)	800 (31.5)	500 (19.7)	4.77 (15.6)	4.20 (13.8)	4.41 (14.5)	3.84 (12.6)	4.05 (13.3)	3.48 (11.4)	3.20 (10.5)
1800 (70.9)	800 (31.5)	600 (23.6)	5.21 (17.1)	4.63 (15.2)	4.78 (15.7)	4.20 (13.8)	4.34 (14.2)	3.77 (12.4)	3.43 (11.3)
1800 (70.9)	1000 (39.4)	400 (15.7)	5.10 (16.7)	4.38 (14.4)	4.81 (15.8)	4.09 (13.4)	4.52 (14.8)	3.80 (12.5)	3.52 (11.5)
1800 (70.9)	1000 (39.4)	500 (19.7)	5.56 (18.2)	4.84 (15.9)	5.20 (17.1)	4.48 (14.7)	4.84 (15.9)	4.12 (13.5)	3.77 (12.4)
1800 (70.9)	1200 (47.2)	400 (15.7)	5.86 (19.2)	4.99 (16.4)	5.57 (18.3)	4.70 (15.4)	5.28 (17.3)	4.42 (14.5)	4.08 (13.4)
1800 (70.9)	1200 (47.2)	500 (19.7)	6.35 (20.8)	5.48 (18.0)	5.99 (19.7)	5.12 (16.8)	5.63 (18.5)	4.76 (15.6)	4.34 (14.2)
1800 (70.9)	1600 (63.0)	400 (15.7)	7.38 (24.2)	6.22 (20.4)	7.09 (23.3)	5.94 (19.5)	6.80 (22.3)	5.65 (18.5)	5.20 (17.1)
1800 (70.9)	1600 (63.0)	500 (19.7)	7.92 (26.0)	6.77 (22.2)	7.56 (24.8)	6.41 (21.0)	7.20 (23.6)	6.05 (19.8)	5.49 (18.0)
2000 (78.7)	600 (23.6)	300 (11.8)	3.49 (11.5)	3.01 (9.9)	3.25 (10.7)	2.77 (9.1)	3.01 (9.9)	2.53 (8.3)	2.41 (7.9)
2000 (78.7)	600 (23.6)	400 (15.7)	3.94 (12.9)	3.46 (11.4)	3.62 (11.9)	3.14 (10.3)	3.30 (10.8)	2.82 (9.3)	2.65 (8.7)
2000 (78.7)	600 (23.6)	500 (19.7)	4.38 (14.4)	3.90 (12.8)	3.98 (13.1)	3.50 (11.5)	3.58 (11.7)	3.10 (10.2)	2.89 (9.5)
2000 (78.7)	800 (31.5)	300 (11.8)	4.30 (14.1)	3.66 (12.0)	4.06 (13.3)	3.42 (11.2)	3.82 (12.5)	3.18 (10.4)	3.01 (9.9)
2000 (78.7)	800 (31.5)	400 (15.7)	4.77 (15.6)	4.13 (13.5)	4.45 (14.6)	3.81 (12.5)	4.13 (13.5)	3.49 (11.5)	3.26 (10.7)
2000 (78.7)	800 (31.5)	500 (19.7)	5.24 (17.2)	4.60 (15.1)	4.84 (15.9)	4.20 (13.8)	4.44 (14.6)	3.80 (12.5)	3.52 (11.5)
2000 (78.7)	800 (31.5)	600 (23.6)	5.71 (18.7)	5.07 (16.6)	5.23 (17.2)	4.59 (15.1)	4.75 (15.6)	4.11 (13.5)	3.78 (12.4)
2000 (78.7)	1000 (39.4)	400 (15.7)	5.60 (18.4)	4.80 (15.7)	5.28 (17.3)	4.48 (14.7)	4.96 (16.3)	4.16 (13.6)	3.88 (12.7)
2000 (78.7)	1000 (39.4)	500 (19.7)	6.10 (20.0)	5.30 (17.4)	5.70 (18.7)	4.90 (16.1)	5.30 (17.4)	4.50 (14.8)	4.15 (13.6)
2000 (78.7)	1200 (47.2)	400 (15.7)	6.43 (21.1)	5.47 (17.9)	6.11 (20.0)	5.15 (16.9)	5.79 (19.0)	4.83 (15.8)	4.50 (14.8)
2000 (78.7)	1200 (47.2)	500 (19.7)	6.96 (22.8)	6.00 (19.7)	6.56 (21.5)	5.60 (18.4)	6.16 (20.2)	5.20 (17.1)	4.78 (15.7)
2000 (78.7)	1200 (47.2)	600 (23.6)	7.49 (24.6)	6.53 (21.4)	7.01 (23.0)	6.05 (19.8)	6.53 (21.4)	5.57 (18.3)	5.06 (16.6)
2000 (78.7)	1600 (63.0)	400 (15.7)	8.10 (26.6)	6.82 (22.4)	7.78 (25.5)	6.50 (21.3)	7.46 (24.5)	6.18 (20.3)	5.73 (18.8)
2000 (78.7)	1600 (63.0)	500 (19.7)	8.68 (28.5)	7.40 (24.3)	8.28 (27.2)	7.00 (23.0)	7.88 (25.9)	6.60 (21.7)	6.04 (19.8)
2000 (78.7)	1600 (63.0)	600 (23.6)	9.26 (30.4)	7.98 (26.2)	8.78 (28.8)	7.50 (24.6)	8.30 (27.2)	7.02 (23.0)	6.35 (20.8)

- Installation mode**
- 1 Accessible from every side
  - 2 Placed against a wall
  - 3 On the end when joined
  - 4 On the end when joined, placed against a wall
  - 5 In the middle when joined
  - 6 In the middle when joined, placed against a wall
  - 7 In the middle when joined, placed against a wall, closed covered top

The surfaces are given in m<sup>2</sup>.










Use ProClima to save time and find the best solution!



# Help table to calculate corrected surfaces

## Spacial modular enclosures

H: mm (in)	W: mm (in)	D: mm (in)	Installation mode						
			1  m <sup>2</sup> (ft <sup>2</sup> )	2  m <sup>2</sup> (ft <sup>2</sup> )	3  m <sup>2</sup> (ft <sup>2</sup> )	4  m <sup>2</sup> (ft <sup>2</sup> )	5  m <sup>2</sup> (ft <sup>2</sup> )	6  m <sup>2</sup> (ft <sup>2</sup> )	7  m <sup>2</sup> (ft <sup>2</sup> )
1200 (47.2)	600 (23.6)	400 (15.7)	2.50 (8.2)	2.21 (7.3)	2.30 (7.5)	2.02 (6.6)	2.11 (6.9)	1.82 (6.0)	1.66 (5.4)
1200 (47.2)	600 (23.6)	600 (23.6)	3.10 (10.2)	2.81 (9.2)	2.81 (9.2)	2.52 (8.3)	2.52 (8.3)	2.23 (7.3)	1.98 (6.5)
1200 (47.2)	800 (31.5)	400 (15.7)	3.04 (10.0)	2.66 (8.7)	2.85 (9.4)	2.46 (8.1)	2.66 (8.7)	2.27 (7.4)	2.05 (6.7)
1200 (47.2)	800 (31.5)	600 (23.6)	3.70 (12.1)	3.31 (10.9)	3.41 (11.2)	3.02 (9.9)	3.12 (10.2)	2.74 (9.0)	2.40 (7.9)
1400 (55.1)	600 (23.6)	400 (15.7)	2.86 (9.4)	2.52 (8.3)	2.63 (8.6)	2.30 (7.5)	2.41 (7.9)	2.07 (6.8)	1.90 (6.2)
1400 (55.1)	800 (31.5)	400 (15.7)	3.47 (11.4)	3.02 (9.9)	3.25 (10.7)	2.80 (9.2)	3.02 (9.9)	2.58 (8.5)	2.35 (7.7)
1600 (63.0)	600 (23.6)	600 (23.6)	3.96 (13.0)	3.58 (11.7)	3.58 (11.7)	3.19 (10.5)	3.19 (10.5)	2.81 (9.2)	2.56 (8.4)
1600 (63.0)	600 (23.6)	800 (31.5)	4.70 (15.4)	4.32 (14.2)	4.19 (13.7)	3.81 (12.5)	3.68 (12.1)	3.30 (10.8)	2.96 (9.7)
1600 (63.0)	800 (31.5)	600 (23.6)	4.70 (15.4)	4.19 (13.7)	4.32 (14.2)	3.81 (12.5)	3.94 (12.9)	3.42 (11.2)	3.09 (10.1)
1600 (63.0)	800 (31.5)	800 (31.5)	5.50 (18.0)	4.99 (16.4)	4.99 (16.4)	4.48 (14.7)	4.48 (14.7)	3.97 (13.0)	3.52 (11.5)
1800 (70.9)	400 (15.7)	400 (15.7)	2.82 (9.3)	2.53 (8.3)	2.53 (8.3)	2.24 (7.3)	2.24 (7.3)	1.95 (6.4)	1.84 (6.0)
1800 (70.9)	400 (15.7)	500 (19.7)	3.20 (10.5)	2.91 (9.5)	2.84 (9.3)	2.55 (8.4)	2.48 (8.1)	2.19 (7.2)	2.05 (6.7)
1800 (70.9)	400 (15.7)	600 (23.6)	3.58 (11.7)	3.29 (10.8)	3.14 (10.3)	2.86 (9.4)	2.71 (8.9)	2.42 (7.9)	2.26 (7.4)
1800 (70.9)	600 (23.6)	400 (15.7)	3.58 (11.7)	3.14 (10.3)	3.29 (10.8)	2.86 (9.4)	3.00 (9.8)	2.57 (8.4)	2.40 (7.9)
1800 (70.9)	600 (23.6)	500 (19.7)	3.98 (13.1)	3.55 (11.6)	3.62 (11.9)	3.19 (10.5)	3.26 (10.7)	2.83 (9.3)	2.62 (8.6)
1800 (70.9)	600 (23.6)	600 (23.6)	4.39 (14.4)	3.96 (13.0)	3.96 (13.0)	3.53 (11.6)	3.53 (11.6)	3.10 (10.2)	2.84 (9.3)
1800 (70.9)	600 (23.6)	800 (31.5)	5.21 (17.1)	4.78 (15.7)	4.63 (15.2)	4.20 (13.8)	4.06 (13.3)	3.62 (11.9)	3.29 (10.8)
1800 (70.9)	800 (31.5)	400 (15.7)	4.34 (14.2)	3.76 (12.3)	4.05 (13.3)	3.47 (11.4)	3.76 (12.3)	3.18 (10.4)	2.96 (9.7)
1800 (70.9)	800 (31.5)	500 (19.7)	4.77 (15.6)	4.20 (13.8)	4.41 (14.5)	3.84 (12.6)	4.05 (13.3)	3.48 (11.4)	3.20 (10.5)
1800 (70.9)	800 (31.5)	600 (23.6)	5.21 (17.1)	4.63 (15.2)	4.78 (15.7)	4.20 (13.8)	4.34 (14.2)	3.77 (12.4)	3.43 (11.3)
1800 (70.9)	1000 (39.4)	400 (15.7)	5.10 (16.7)	4.38 (14.4)	4.81 (15.8)	4.09 (13.4)	4.52 (14.8)	3.80 (12.5)	3.52 (11.5)
1800 (70.9)	1000 (39.4)	500 (19.7)	5.56 (18.2)	4.84 (15.9)	5.20 (17.1)	4.48 (14.7)	4.84 (15.9)	4.12 (13.5)	3.77 (12.4)
1800 (70.9)	1000 (39.4)	600 (23.6)	6.02 (19.8)	5.30 (17.4)	5.59 (18.3)	4.87 (16.0)	5.16 (16.9)	4.44 (14.6)	4.02 (13.2)
1800 (70.9)	1200 (47.2)	400 (15.7)	5.86 (19.2)	4.99 (16.4)	5.57 (18.3)	4.70 (15.4)	5.28 (17.3)	4.42 (14.5)	4.08 (13.4)
1800 (70.9)	1200 (47.2)	500 (19.7)	6.35 (20.8)	5.48 (18.0)	5.99 (19.7)	5.12 (16.8)	5.63 (18.5)	4.76 (15.6)	4.34 (14.2)
1800 (70.9)	1200 (47.2)	600 (23.6)	6.84 (22.4)	5.98 (19.6)	6.41 (21.0)	5.54 (18.2)	5.98 (19.6)	5.11 (16.8)	4.61 (15.1)
2000 (78.7)	300 (11.8)	500 (19.7)	3.09 (10.1)	2.85 (9.4)	2.69 (8.8)	2.45 (8.0)	2.29 (7.5)	2.05 (6.7)	1.95 (6.4)
2000 (78.7)	300 (11.8)	600 (23.6)	3.49 (11.5)	3.25 (10.7)	3.01 (9.9)	2.77 (9.1)	2.53 (8.3)	2.29 (7.5)	2.17 (7.1)
2000 (78.7)	400 (15.7)	400 (15.7)	3.10 (10.2)	2.78 (9.1)	2.78 (9.1)	2.46 (8.1)	2.46 (8.1)	2.14 (7.0)	2.03 (6.6)
2000 (78.7)	400 (15.7)	500 (19.7)	3.52 (11.5)	3.20 (10.5)	3.12 (10.2)	2.80 (9.2)	2.72 (8.9)	2.40 (7.9)	2.26 (7.4)
2000 (78.7)	400 (15.7)	600 (23.6)	3.94 (12.9)	3.62 (11.9)	3.46 (11.4)	3.14 (10.3)	2.98 (9.8)	2.66 (8.7)	2.49 (8.2)
2000 (78.7)	400 (15.7)	800 (31.5)	4.77 (15.6)	4.45 (14.6)	4.13 (13.5)	3.81 (12.5)	3.49 (11.5)	3.17 (10.4)	2.94 (9.6)
2000 (78.7)	600 (23.6)	400 (15.7)	3.94 (12.9)	3.46 (11.4)	3.62 (11.9)	3.14 (10.3)	3.30 (10.8)	2.82 (9.3)	2.65 (8.7)
2000 (78.7)	600 (23.6)	500 (19.7)	4.38 (14.4)	3.90 (12.8)	3.98 (13.1)	3.50 (11.5)	3.58 (11.7)	3.10 (10.2)	2.89 (9.5)
2000 (78.7)	600 (23.6)	600 (23.6)	4.82 (15.8)	4.34 (14.2)	4.34 (14.2)	3.86 (12.7)	3.86 (12.7)	3.38 (11.1)	3.13 (10.3)
2000 (78.7)	600 (23.6)	800 (31.5)	5.71 (18.7)	5.23 (17.2)	5.07 (16.6)	4.59 (15.1)	4.43 (14.5)	3.95 (13.0)	3.62 (11.9)
2000 (78.7)	800 (31.5)	400 (15.7)	4.77 (15.6)	4.13 (13.5)	4.45 (14.6)	3.81 (12.5)	4.13 (13.5)	3.49 (11.5)	3.26 (10.7)
2000 (78.7)	800 (31.5)	500 (19.7)	5.24 (17.2)	4.60 (15.1)	4.84 (15.9)	4.20 (13.8)	4.44 (14.6)	3.80 (12.5)	3.52 (11.5)
2000 (78.7)	800 (31.5)	600 (23.6)	5.71 (18.7)	5.07 (16.6)	5.23 (17.2)	4.59 (15.1)	4.75 (15.6)	4.11 (13.5)	3.78 (12.4)
2000 (78.7)	800 (31.5)	800 (31.5)	6.66 (21.9)	6.02 (19.8)	6.02 (19.8)	5.38 (17.7)	5.38 (17.7)	4.74 (15.6)	4.29 (14.1)
2000 (78.7)	1000 (39.4)	400 (15.7)	5.60 (18.4)	4.80 (15.7)	5.28 (17.3)	4.48 (14.7)	4.96 (16.3)	4.16 (13.6)	3.88 (12.7)
2000 (78.7)	1000 (39.4)	500 (19.7)	6.10 (20.0)	5.30 (17.4)	5.70 (18.7)	4.90 (16.1)	5.30 (17.4)	4.50 (14.8)	4.15 (13.6)
2000 (78.7)	1000 (39.4)	600 (23.6)	6.60 (21.7)	5.80 (19.0)	6.12 (20.1)	5.32 (17.5)	5.64 (18.5)	4.84 (15.9)	4.42 (14.5)
2000 (78.7)	1000 (39.4)	800 (31.5)	7.60 (24.9)	6.80 (22.3)	6.96 (22.8)	6.16 (20.2)	6.32 (20.7)	5.52 (18.1)	4.96 (16.3)
2000 (78.7)	1200 (47.2)	400 (15.7)	6.43 (21.1)	5.47 (17.9)	6.11 (20.0)	5.15 (16.9)	5.79 (19.0)	4.83 (15.8)	4.50 (14.8)
2000 (78.7)	1200 (47.2)	500 (19.7)	6.96 (22.8)	6.00 (19.7)	6.56 (21.5)	5.60 (18.4)	6.16 (20.2)	5.20 (17.1)	4.78 (15.7)
2000 (78.7)	1200 (47.2)	600 (23.6)	7.49 (24.6)	6.53 (21.4)	7.01 (23.0)	6.05 (19.8)	6.53 (21.4)	5.57 (18.3)	5.06 (16.6)
2000 (78.7)	1200 (47.2)	800 (31.5)	8.54 (28.0)	7.58 (24.9)	7.90 (25.9)	6.94 (22.8)	7.26 (23.8)	6.30 (20.7)	5.63 (18.5)
2000 (78.7)	1600 (63.0)	400 (15.7)	8.10 (26.6)	6.82 (22.4)	7.78 (25.5)	6.50 (21.3)	7.46 (24.5)	6.18 (20.3)	5.73 (18.8)
2000 (78.7)	1600 (63.0)	500 (19.7)	8.68 (28.5)	7.40 (24.3)	8.28 (27.2)	7.00 (23.0)	7.88 (25.9)	6.60 (21.7)	6.04 (19.8)
2000 (78.7)	1600 (63.0)	600 (23.6)	9.26 (30.4)	7.98 (26.2)	8.78 (28.8)	7.50 (24.6)	8.30 (27.2)	7.02 (23.0)	6.35 (20.8)
2200 (86.6)	400 (15.7)	600 (23.6)	4.30 (14.1)	3.94 (12.9)	3.77 (12.4)	3.42 (11.2)	3.24 (10.6)	2.89 (9.5)	2.72 (8.9)
2200 (86.6)	600 (23.6)	600 (23.6)	5.26 (17.3)	4.73 (15.5)	4.73 (15.5)	4.20 (13.8)	4.20 (13.8)	3.67 (12.0)	3.42 (11.2)
2200 (86.6)	600 (23.6)	800 (31.5)	6.22 (20.4)	5.69 (18.7)	5.51 (18.1)	4.98 (16.3)	4.81 (15.8)	4.28 (14.0)	3.94 (12.9)
2200 (86.6)	800 (31.5)	600 (23.6)	6.22 (20.4)	5.51 (18.1)	5.69 (18.7)	4.98 (16.3)	5.16 (16.9)	4.46 (14.6)	4.12 (13.5)
2200 (86.6)	800 (31.5)	800 (31.5)	7.23 (23.7)	6.53 (21.4)	6.53 (21.4)	5.82 (19.1)	5.82 (19.1)	5.12 (16.8)	4.67 (15.3)
2200 (86.6)	1000 (39.4)	600 (23.6)	7.18 (23.6)	6.30 (20.7)	6.65 (21.8)	5.77 (18.9)	6.12 (20.1)	5.24 (17.2)	4.82 (15.8)
2200 (86.6)	1200 (47.2)	600 (23.6)	8.14 (26.7)	7.08 (23.2)	7.61 (25.0)	6.55 (21.5)	7.08 (23.2)	6.02 (19.8)	5.52 (18.1)
2200 (86.6)	1200 (47.2)	800 (31.5)	9.26 (30.4)	8.21 (26.9)	8.56 (28.1)	7.50 (24.6)	7.86 (25.8)	6.80 (22.3)	6.13 (20.1)

