



# DANOTHERM™



## The High Power Resistor Collection

- Resistors for filter and brake applications

- Natural air / forced air cooled and liquid cooled
- Suited for harsh environmental conditions
- Stainless steel tube elements
- High IP ratings



Welcome to the world of power resistors





WHDN



TRV



G12RT



WHBS



WHHB



WHB



HVB

| Type  | Power         | Working Voltage     | Protection degree | Cooling    | Page |
|-------|---------------|---------------------|-------------------|------------|------|
| WHDN  | 40 - 1,450 kW | 1kVAC / 1.4 kVDC    | IP65/IP66         | Liquid     | 5    |
| WHHB  | 5 - 25 kW     | 4.7 kVAC / 6.6 kVDC | IP00/IP65         | Liquid     | 11   |
| WHBS  | 6 - 100 kW    | 1kVAC / 1.4 kVDC    | IP00/IP66         | Liquid     | 12   |
| WHB   | 6 - 23 kW     | 1kVAC / 1.4 kVDC    | IP00/IP65         | Liquid     | 16   |
| HVB   | 0.6 - 1.2 kW  | 4.5 kVAC / 6.4 kVDC | IP65              | Air        | 17   |
| TRV   | 50 - 275 kW   | 1kVAC / 1.4 kVDC    | IP65/IP66         | Forced air | 18   |
| GxxRT | 3 - 32 kW     | 1kVAC / 1.4 kVDC    | IP65/IP66         | Air        | 22   |

## Preface

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Resistenze Elettriche Busto Arsizio (REBA) was founded in 1970 in Busto Arsizio, which is located nearby Milan, Italy. REBA is a division of Backer Fer s.r.l which is owned by NIBE Industrier AB, a stock exchange listed company from Sweden. REBA, is part of NIBE Element, Danotherm Resistor division.

The production of resistors, made with steel tube elements, filled with magnesium oxide, is a well established production process and the basis for many of Danotherm's resistors with natural, forced-air and water-cooling. Next to this technique REBA also engineer and produce resistors in other techniques.

The engineering team consists of highly qualified and experienced engineers, who lay the basis for all resistors. Most resistors are customized to the specific customer's need and environmental conditions. The engineering team uses 3D CAD software and the production is carried out by a highly specialized workforce.

Each customized resistor starts with the customer's specifications and the electrical load conditions. With resistor thermal models and simulation software, the resistor is dimensioned to the appropriate size. In this way the resistor is not over or under-dimensioned, giving the customer confidence in the resistors capability, saving costs and reducing engineering time.

In recent years, particularly in marine applications, Certificates of Conformity or Authenticity are often required by the end-user. Danotherm is accustomed to such demands and is able to provide documents on the origin of materials and the conformity of processes e.g. for steel and welding processes. FAT (Factory Acceptance Test) with the customer and or a Accrediting Company like Lloyds, DSV or RINA is very well possible. The production facility is optimized for small and medium scale production runs.

At Danotherm, Resistor division, we are dedicated to design and produce advanced and optimized resistors and welcome new design challenges that drive our customers' success.





# DANOTHERM™

WHDN fully welded steel tank resistors are offered with tank diameters ranging from 100mm to 300mm.

The resistor unit consists of steel resistor elements with a diameter of 16mm which are welded in a flange that is fitted to the tank. Different alloys can be used for both resistor elements and tank and connection box. The resistor unit is fitted on a flange and is closed with a gasket. With this construction it is possible to open the resistor and clean the inside of the tank.

The electrical configuration can be single, star/delta or multiple segments. Inside the connection box are the main terminals and the secondary circuits such as box heater, thermal protection circuits and air bubble detection circuit.

The resistor can be equipped with a drain, closing or pressure valves. Standard mounting position is horizontal but vertical types are available (with limited heights).

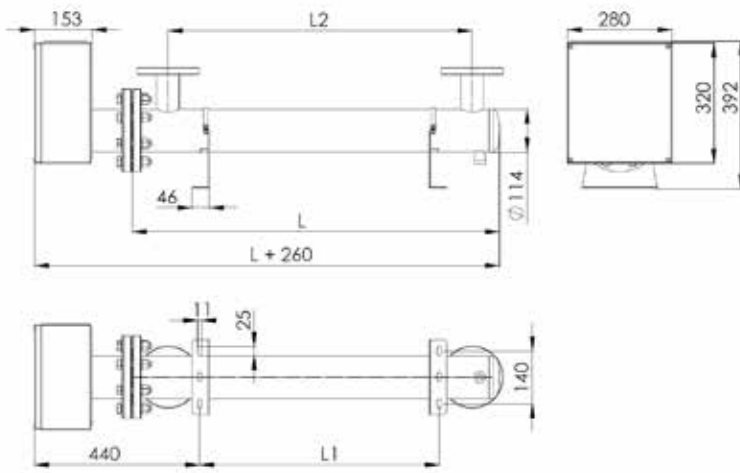


## WHDN

## General specifications WHDN

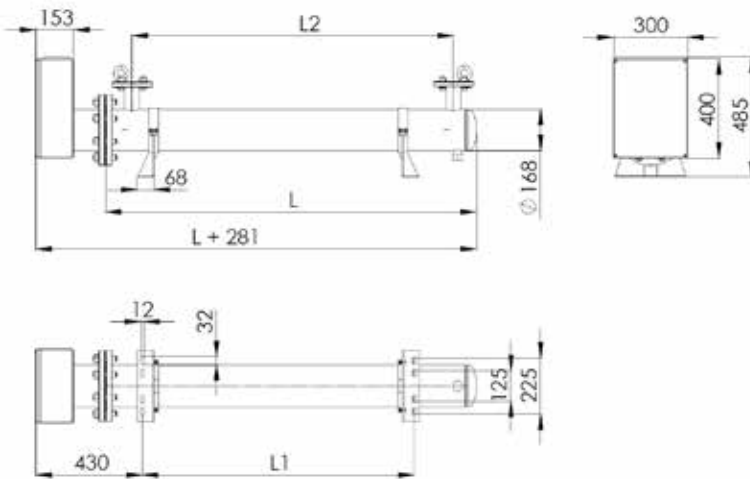
|  |                   |   |
|--|-------------------|---|
| Nominal power                                  |                   | 40 kW - 1450 kW                                 |
| Working voltage                                |                   | 1000 VAC / 1400 VDC                             |
| Dielectric strength @ 50Hz, 1 min.             |                   | 3,500 VAC                                       |
| Insulation resistance @ 5000 VDC               | dried condition   | >> 10 MΩ  |
| Overload @ 1s pulse / hour                     |                   | 8 x Pn (depends on R value)                     |
| Overload @ 5s pulse / hour                     |                   | 4 x Pn (depends on R value)                     |
| Resistance tolerance                           | standard          | ± 10%   |
|  | <i>optional</i>   | ± 5% / ± 3%                                     |
| Temperature coefficient                        | 20 °C - 400 °C    | 85 ppm/K  |
| Time constant for heating up                   |                   | 30 s  |
| Protection degree                              |                   | IP65 / IP66                                     |
| Cooling fluid                                  |                   | fresh water / water-glycol                      |
| Maximum temperature liquid inlet               | without de-rating | * 60 °C   |
| ΔT inlet/outlet (recommended)                  |                   | 10 K - 20 K                                     |
| Pressure drop @ Pn and Δ20K                    |                   | 0.3 bar   |
| Materials                                      |                   |   |
| - tank   | standard          | AISI 304  |
|  | <i>optional</i>   | <i>AISI 316</i>                                 |
| - connection box                               | standard          | AISI 304  |
|  | <i>optional</i>   | <i>AISI 316</i>                                 |
| - resistor elements                            | standard          | AISI 304  |
|  | <i>optional</i>   | <i>AISI 316 &amp; 321, incoloy800 &amp; 825</i> |
| - cable gland                                  | <i>optional</i>   | <i>nickel plated brass / AISI 304</i>           |
|  | standard          | undrilled plate                                 |
| Mounting, maintenance and storage instructions |                   | available document                              |
| Water temp. protection                         |                   | Thermostat                                      |
| - range (advised 10K + T water out)            |                   | 0 °C - 150 °C                                   |
| - contact                                      |                   | Change-over contact                             |
| - max. current                                 |                   | 16 A  |
| Air bubble protection                          |                   | Thermostat                                      |
| - range (advised 180°C)                        |                   | 50 °C - 300 °C                                  |
| - contact                                      |                   | Change-over contact                             |
| - max. current                                 |                   | 16 A  |
| Moisture protection                            | standard          | 20 W - 30 W heating cable 230 V                 |
| - voltage                                      | <i>optional</i>   | <i>115 V</i>                                    |
| Factory acceptance tests                       |                   | - Aspect / dimensional Inspection               |
|  |                   | - Resistance value                              |
|  |                   | - Insulation resistance                         |
|  |                   | - Dielectric strength                           |
|  |                   | - Pressure test                                 |
|  | <i>optional</i>   | <i>Certified Body witness test</i>              |
| PT100 + transducer                             | <i>optional</i>   |   |
| Pressure sensor 4-20mA                         | <i>optional</i>   |   |

## Dimensions WHDN 100



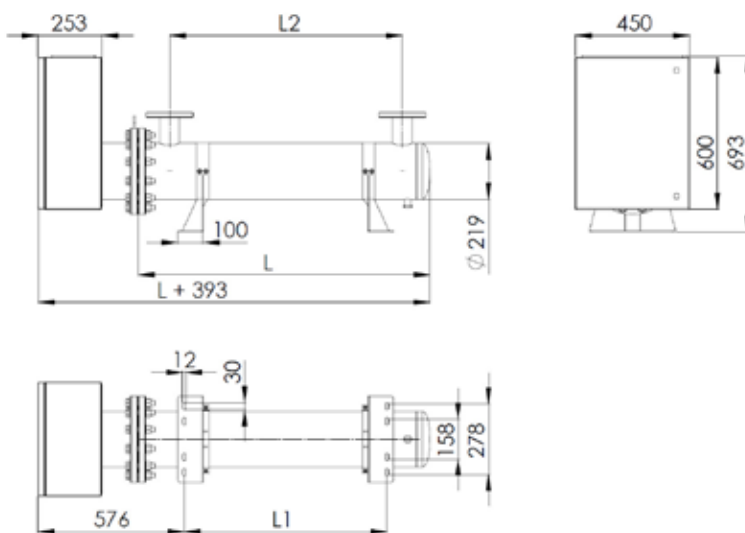
| Type          | Power [kW] | L [mm] | Weight* [kg] |
|---------------|------------|--------|--------------|
| WHDN 100-1000 | 40         | 1000   | 40           |
| WHDN 100-1200 | 50         | 1200   | 45           |
| WHDN 100-1400 | 60         | 1400   | 50           |
| WHDN 100-1600 | 70         | 1600   | 55           |
| WHDN 100-1800 | 80         | 1800   | 60           |
| WHDN 100-2050 | 90         | 2050   | 66           |
| WHDN 100-2450 | 110        | 2450   | 76           |
| WHDN 100-2850 | 130        | 2850   | 86           |
| WHDN 100-3100 | 140        | 3100   | 92           |

## Dimensions WHDN 150



| Type          | Power [kW] | L [mm] | Weight* [kg] |
|---------------|------------|--------|--------------|
| WHDN 150-1200 | 100        | 1200   | 90           |
| WHDN 150-1300 | 110        | 1300   | 92           |
| WHDN 150-1500 | 130        | 1500   | 100          |
| WHDN 150-1700 | 150        | 1700   | 105          |
| WHDN 150-2000 | 175        | 2000   | 115          |
| WHDN 150-2250 | 200        | 2250   | 125          |
| WHDN 150-2500 | 225        | 2500   | 130          |
| WHDN 150-2750 | 250        | 2750   | 140          |
| WHDN 150-3100 | 284        | 3100   | 150          |

## Dimensions WHDN 200



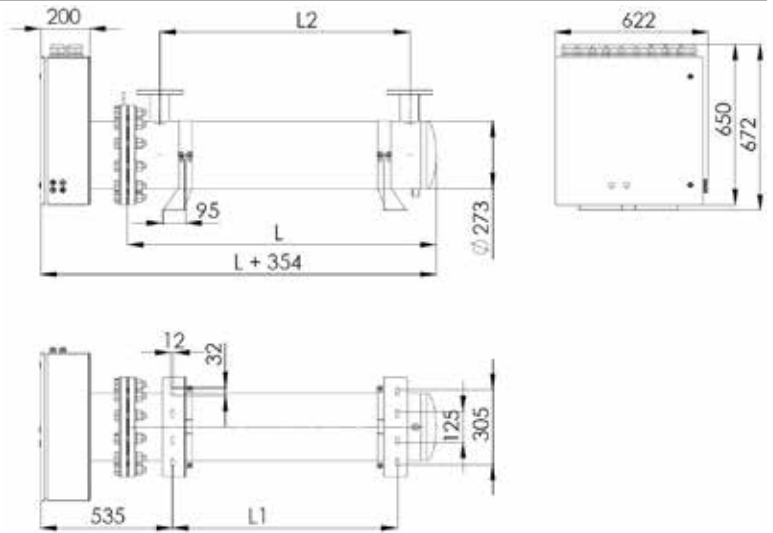
| Type          | Power [kW] | L [mm] | Weight* [kg] |
|---------------|------------|--------|--------------|
| WHDN 200-1100 | 150        | 1100   | 130          |
| WHDN 200-1250 | 175        | 1250   | 135          |
| WHDN 200-1400 | 200        | 1400   | 140          |
| WHDN 200-1700 | 250        | 1700   | 150          |
| WHDN 200-2025 | 300        | 2025   | 170          |
| WHDN 200-2350 | 350        | 2350   | 180          |
| WHDN 200-2650 | 400        | 2650   | 190          |
| WHDN 200-2950 | 450        | 2950   | 205          |
| WHDN 200-3100 | 475        | 3100   | 210          |

\* approximate weight



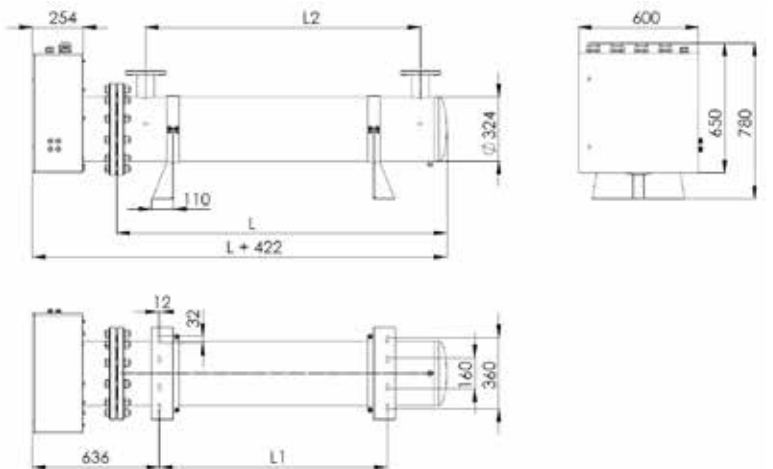
## Dimensions WHDN 250

| Type          | Power [kW] | L [mm] | Weight [kg] |
|---------------|------------|--------|-------------|
| WHDN 250-1375 | 350        | 1375   | 225         |
| WHDN 250-1550 | 400        | 1550   | 240         |
| WHDN 250-1750 | 460        | 1750   | 255         |
| WHDN 250-1900 | 500        | 1900   | 270         |
| WHDN 250-2050 | 550        | 2050   | 280         |
| WHDN 250-2250 | 600        | 2250   | 295         |
| WHDN 250-2400 | 650        | 2400   | 305         |
| WHDN 250-2600 | 700        | 2600   | 325         |
| WHDN 250-2750 | 750        | 2750   | 335         |
| WHDN 250-2925 | 800        | 2925   | 350         |
| WHDN 250-3100 | 850        | 3100   | 360         |



## Dimensions WHDN 300

| Type          | Power [kW] | L [mm] | Weight [kg] |
|---------------|------------|--------|-------------|
| WHDN 300-1600 | 700        | 1600   | 450         |
| WHDN 300-1825 | 800        | 1825   | 475         |
| WHDN 300-2025 | 900        | 2025   | 495         |
| WHDN 300-2250 | 1000       | 2250   | 520         |
| WHDN 300-2450 | 1100       | 2450   | 540         |
| WHDN 300-2650 | 1200       | 2650   | 575         |
| WHDN 300-2850 | 1300       | 2850   | 610         |
| WHDN 300-3100 | 1450       | 3100   | 650         |



## Overview WHDN

| Type                        | WHDN 100 | WHDN 150 | WHDN 200 | WHDN 250 | WHDN 300 |
|-----------------------------|----------|----------|----------|----------|----------|
| Diameter tank               | 114.3    | 168.3    | 219.1    | 273      | 323.9    |
| Main flange                 | DN100    | DN150    | DN200    | DN250    | DN300    |
| in-/out flange              |          |          |          |          |          |
| - Nipples 2"G Threaded male | √        | √        |          |          |          |
| - DN50                      | √        | √        | √        |          |          |
| - DN65                      | √        | √        | √        | √        | √        |
| - DN80                      |          |          | √        | √        | √        |
| - DN100                     |          |          |          |          | √        |
| Max working pressure        | 10       | 10       |          | 8        | 8        |
| Test pressure               | 16       | 16       |          | 12       | 12       |



## Coolant

| Water flow in L / minute | ΔT 10K | ΔT 15K | ΔT 20K |
|--------------------------|--------|--------|--------|
| power                    |        |        |        |
| 50                       | 85     | 55     | 42     |
| 75                       | 125    | 85     | 65     |
| 100                      | 170    | 110    | 85     |
| 200                      | 340    | 225    | 170    |
| 300                      | 500    | 340    | 250    |
| 400                      | 670    | 450    | 340    |
| 500                      | 840    | 560    | 420    |
| 700                      | 1200   | 790    | 590    |
| 1000                     | 1700   | 1100   | 840    |

Calculation of water coolant flow in liters per second is based on the formula:

$$Q = m \cdot C_{th} \cdot \Delta T$$

In which Q = energy (in Joules)

$C_{th}$  = thermal capacity of coolant. For water use 4.18 J/g.K

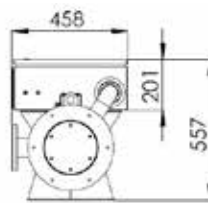
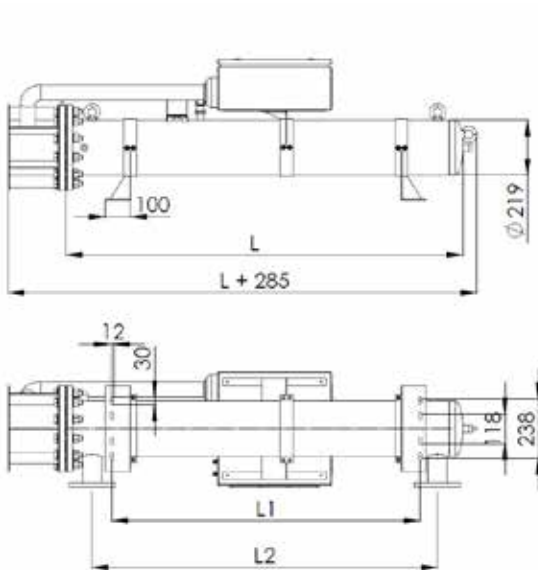
m = mass of coolant to pass the resistor per second

ΔT = temperature increase of the coolant (Outlet temp.–Inlet temp.)

When using glycol mixture obtain the correct thermal capacity of the coolant to re-calculate. Values may vary from 2.8 to 3.4 J/g.K

Not all water is effectively in contact with the resistor elements, therefore a factor of 0.85 should be applied to calculate the needed flow

WHDN type resistors are available in horizontal and vertical style. Hereunder you find as an example the mechanical drawing of type WHDN 200 V. Vertical types are limited in height.



WHDN 200 V





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WHHB aluminium housed resistor has a high working voltage. The active resistor wire is in direct contact with the coolant and must be cooled with de-ionized water with or without glycol. The water in-and outlet is at the rear side, opposite the electrical connectors.

WHBS 16 fully welded steel resistor can have three or six steel tubes of 16mm diameter, welded in a steel tank. The water in-and outlet can be on top of the resistor or at the rear side. The connection can be 'open style' with threaded rods M6, IP00, or the resistor can be fitted with a connection box IP65/IP66.

WHBS 32.4 fully welded steel resistor has mica insulated resistor elements. It has a high working voltage. The water in-and outlet is at the rear side of the resistor.

All fully welded steel resistor have a test pressure according EN 13445 of 12 psi.

WHB 16.3 has an aluminium housing with gaskets. It has three steel tube resistor elements and can be with or without connection box. The water in-and outlet is at the rear of the resistor.

HVB resistors are aluminum housed resistor for energy dump applications. They have a high working voltage. The resistor element is insulated and has a sand filling (SiO) or magnesium oxide (MgO) to handle high energy pulses.



**WHHB / WHBS / WHB**

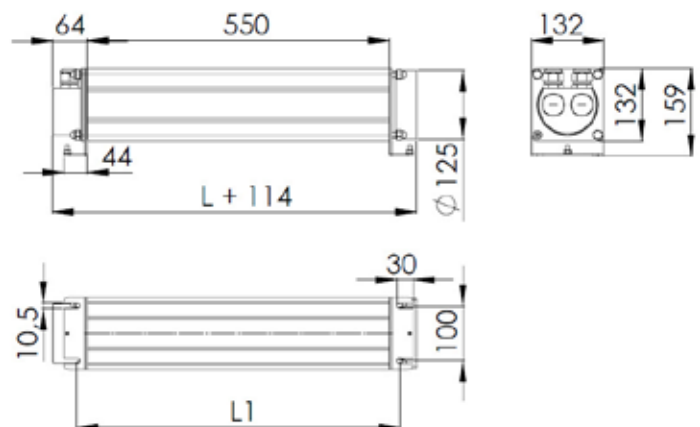
## General specifications WHHB

|                                       |                     |   |
|---------------------------------------|---------------------|---|
| Nominal power                         | standard            | 25 kW                                     |
| Working voltage                       |                     | 4.7 kVAC / 6.6 kVDC                       |
| Dielectric strength @ 50Hz, 1 min.    |                     | 20 kVAC                                   |
| Resistance tolerance                  | standard            | ± 10%                                     |
|                                       | optional            | ± 5%                                      |
| Max. current                          | 50 mm <sup>2</sup>  | 160 A                                     |
|                                       | 250 mm <sup>2</sup> | 500 A                                     |
| Protection degree                     |                     | IP00 / IP65                               |
| Cooling fluid                         |                     | Deionised water or deionised water-glycol |
| - Conductivity of fluid               |                     | ≤ 2 µS/cm                                 |
| - Maximum fluid inlet temperature     |                     | * 60 °C                                   |
| - ΔT inlet/outlet (recommended)       |                     | ≤ 15 K                                    |
| - Pressure drop @ 30L/min.            |                     | ≤ 0.5 bar                                 |
| Materials                             |                     |   |
| - housing (not in contact with fluid) | standard            | anodized aluminium                        |
| - resistor elements                   |                     | nickel chrome alloy                       |
| Operating pressure                    |                     | 6 bar @ 55 °C                             |
| Test pressure                         |                     | 10 bar @ 20 °C                            |

## Dimensions WHHB with 50mm<sup>2</sup> connectors

| Type     | Power [kW] | L [mm] | Weight [kg] |
|----------|------------|--------|-------------|
| WHHB 550 | 6 - 25     | 550    | ≈ 15        |

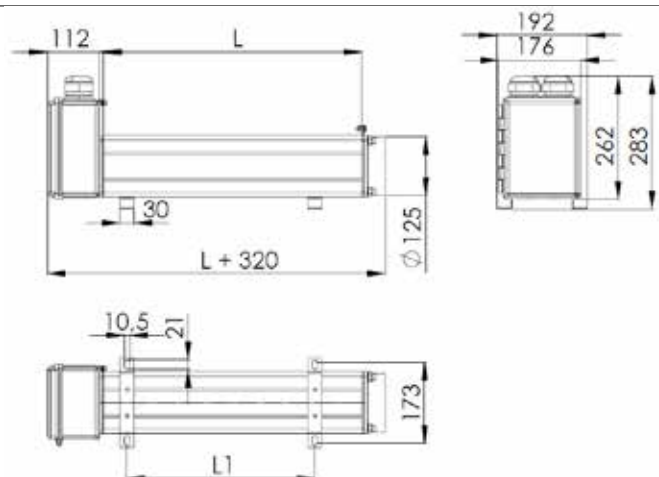
Ohmic range 1R - 200R



## Dimensions WHHB with 250mm<sup>2</sup> connectors

| Type     | Power [kW] | L [mm] | Weight [kg] |
|----------|------------|--------|-------------|
| WHHB 550 | 6 - 25     | 550    | ≈ 20        |

Ohmic range 50mR - 900mR



\* depends on cooling fluid pressure and additives

## General specifications WHBS 16

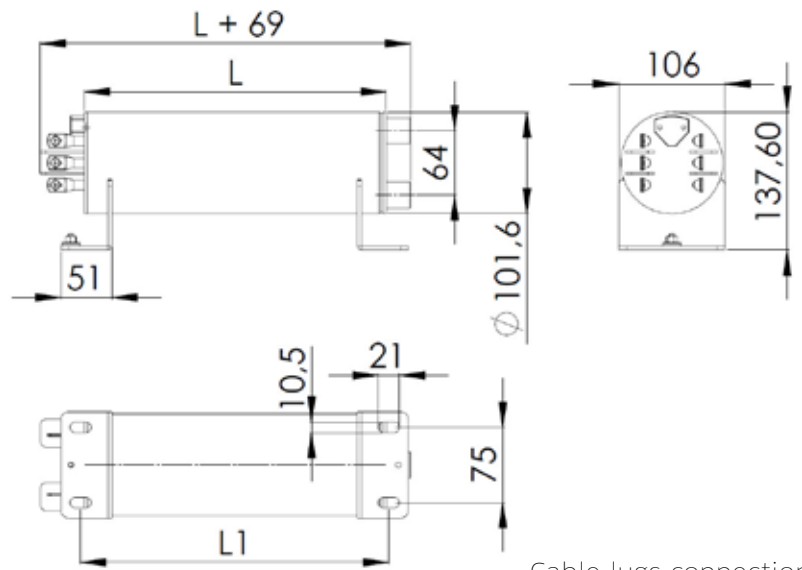
|                                    |                   |   |
|------------------------------------|-------------------|---|
| Nominal power                      |                   | 6 kW - 100 kW                                   |
| Working voltage                    |                   | 1000 VAC / 1400 VDC                             |
| Dielectric strength @ 50Hz, 1 min. |                   | 3,500 VAC                                       |
| Insulation resistance @ 5000 VDC   | dried condition   | >> 10 MΩ  |
| Overload @ 1s pulse / hour         |                   | 8 x Pn (depends on R value)                     |
| Overload @ 5s pulse / hour         |                   | 4 x Pn (depends on R value)                     |
| Resistance tolerance               | standard          | ± 10%   |
|                                    | <i>optional</i>   | ± 5% / ± 3%                                     |
| Temperature coefficient            | 20 °C - 400 °C    | 85 ppm/K  |
| Time constant for heating up       |                   | 30 s  |
| Protection degree                  |                   | IP00 / IP65 / IP66                              |
| Maximum liquid inlet temperature   |                   | * 60 °C   |
| ΔT inlet/outlet (recommended)      |                   | 10 K - 20 K                                     |
| Operating pressure                 |                   | 6 bar @ 55 °C                                   |
| Test pressure                      |                   | 12 bar @ 20 °C                                  |
| acc. EN 13445                      |                   | 16 bar @ 20 °C                                  |
| Pressure drop @ Pn and 20K         |                   | 0.5 bar   |
| Cooling fluid                      |                   | fresh water / water-glycol                      |
| Maximum temperature liquid inlet   | without de-rating | * 60 °C   |
| ΔT inlet/outlet (recommended)      |                   | 10 K - 20 K                                     |
| Materials                          |                   |   |
| - tank                             | standard          | AISI 304  |
|                                    | <i>optional</i>   | <i>AISI 316</i>                                 |
| - connection box                   | standard          | AISI 304  |
|                                    | <i>optional</i>   | <i>AISI 316</i>                                 |
| - resistor elements                | standard          | AISI 304  |
|                                    | <i>optional</i>   | <i>AISI 316 &amp; 321, incoloy800 &amp; 825</i> |
| Drain / air bubble release         | <i>optional</i>   |   |
| Temperature protection             | standard          | Thermostat                                      |
| - normally closed                  |                   | 16 A @ 230 VAC                                  |
| Temperature sensor PT100           | <i>optional</i>   |   |
| Air bubble protection              | <i>optional</i>   | <i>Thermostat</i>                               |
| Moisture protection                | <i>optional</i>   | <i>15 W - 30 W heating cable</i>                |
| - voltage                          | <i>optional</i>   | <i>230 V or 115 V</i>                           |



## Dimensions WHBS 16.3 with M6 terminals or cable lugs

| Type           | Power [kW] | L [mm] | Weight [kg] |
|----------------|------------|--------|-------------|
| WHBS 16.3.600  | 6          | 300    | 5           |
| WHBS 16.3.800  | 8          | 400    | 6           |
| WHBS 16.3.1000 | 11         | 500    | 7           |
| WHBS 16.3.1200 | 13         | 600    | 8           |
| WHBS 16.3.1400 | 15         | 700    | 10          |
| WHBS 16.3.1600 | 18         | 800    | 11          |
| WHBS 16.3.1800 | 20         | 900    | 12          |
| WHBS 16.3.2000 | 23         | 1000   | 13          |

- Protection degree IP00
- Very low Ohm values with M8/lugs and reduced power
- Other values with M6 rods

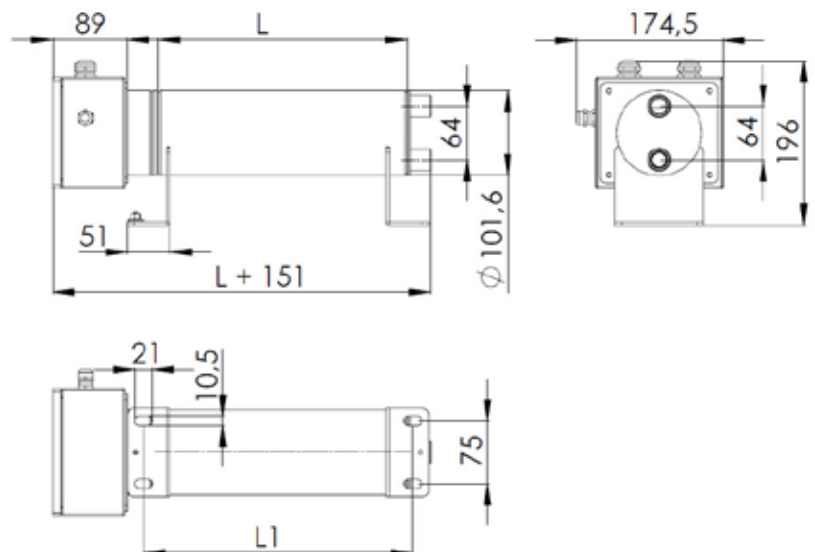


Cable lugs connection

## Dimensions WHBS 16.3 with connection box

| Type           | Power [kW] | L [mm] | Weight [kg] |
|----------------|------------|--------|-------------|
| WHBS 16.3.600  | 6          | 300    | 7           |
| WHBS 16.3.800  | 8          | 400    | 8           |
| WHBS 16.3.1000 | 11         | 500    | 9           |
| WHBS 16.3.1200 | 13         | 600    | 10          |
| WHBS 16.3.1400 | 15         | 700    | 12          |
| WHBS 16.3.1600 | 18         | 800    | 13          |
| WHBS 16.3.1800 | 20         | 900    | 14          |
| WHBS 16.3.2000 | 23         | 1000   | 15          |

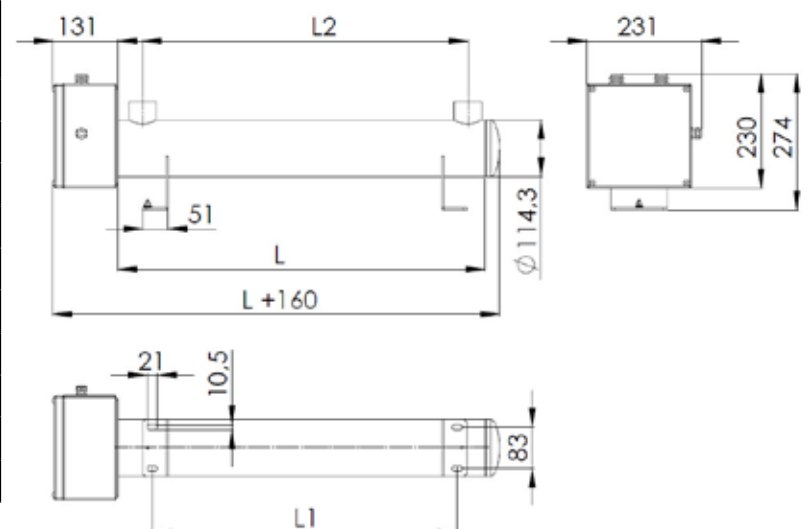
Protection degree IP65/IP66



## Dimensions WHBS 16.6 connection box

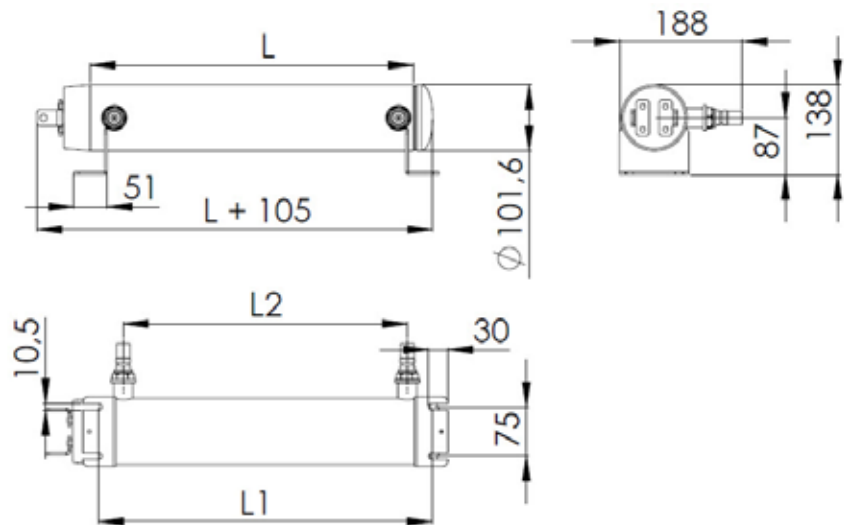
| Type           | Power [kW] | L [mm] | Weight [kg] |
|----------------|------------|--------|-------------|
| WHBS 16.6.800  | 16         | 400    | 16          |
| WHBS 16.6.1000 | 20         | 500    | 18          |
| WHBS 16.6.1400 | 30         | 700    | 22          |
| WHBS 16.6.1800 | 40         | 900    | 26          |
| WHBS 16.6.2200 | 50         | 1100   | 30          |
| WHBS 16.6.2600 | 60         | 1300   | 34          |
| WHBS 16.6.3000 | 70         | 1500   | 38          |
| WHBS 16.6.3400 | 80         | 1700   | 42          |
| WHBS 16.6.3800 | 90         | 1900   | 46          |
| WHBS 16.6.4200 | 100        | 2100   | 50          |

Protection degree IP65/IP66



## Dimensions WHBS 32.4.500

| Type          | L      | Weight |
|---------------|--------|--------|
| WHBS 32.4.485 | 485 mm | 15 kg  |



## General specifications WHBS 32.4.485

|                                    |                 |  |
|------------------------------------|-----------------|--|
| Nominal power                      |                 | 3 kW - 6 kW                              |
| Working voltage                    |                 | 1000 VAC - 3000 VAC                      |
| Dielectric strength @ 50Hz, 1 min. |                 | 10 kVAC                                  |
| Insulation resistance @ 5000 VDC   | dried condition | >> 20 MΩ                                 |
| Overload @ 1s pulse / hour         |                 | 20 x P <sub>n</sub> (depends on R value) |
| Overload @ 5s pulse / hour         |                 | 10 x P <sub>n</sub> (depends on R value) |
| Resistance tolerance               | standard        | ± 10%                                    |
|                                    | <i>optional</i> | ± 5% / ± 3%                              |
| Time constant for heating up       |                 | 60 s                                     |
| Protection degree                  |                 | IP00                                     |
| Maximum liquid inlet temperature   |                 | *60 °C                                   |
| ΔT inlet/outlet (recommended)      |                 | 10 K - 20 K                              |
| Operating pressure                 |                 | 6 bar @ 55 °C                            |
| Test pressure                      |                 | 10 bar @ 20 °C                           |
| acc. EN 13445                      |                 | 16 bar @ 20 °C                           |
| Pressure drop @ 9L/min             |                 | 0.5 bar                                  |
| Cooling fluid                      |                 | fresh water / water-glycol               |
| Material (tank fully welded)       | standard        | AISI 304                                 |

\* depends on cooling fluid pressure and additives





WHHB 550



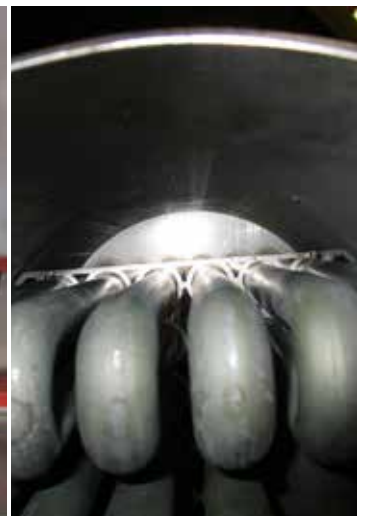
WHBS 32



WHB 16.3



WHBS 16.3



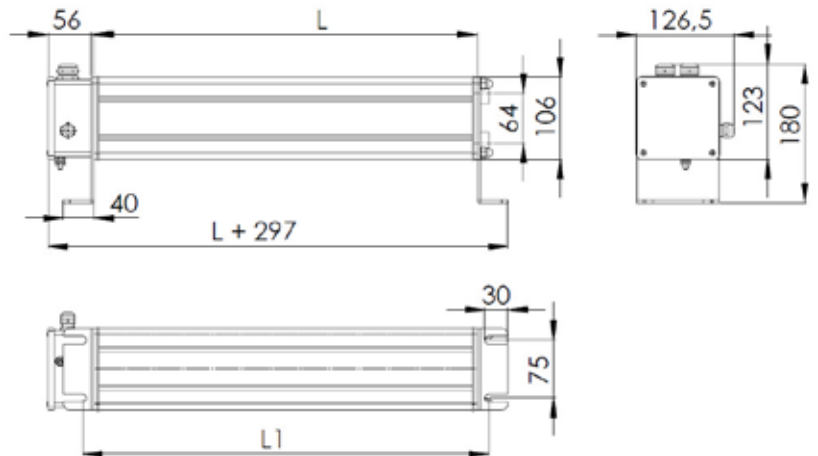


## General specifications WHB

|                                    |                 |                             |
|------------------------------------|-----------------|-----------------------------|
| Nominal power                      |                 | 6 kW - 23 kW                |
| Working voltage                    |                 | 1000 VAC / 1400 VDC         |
| Dielectric strength @ 50Hz, 1 min. |                 | 3,500 VAC                   |
| Insulation resistance @ 5000 VDC   | dried condition | >> 10 MΩ                    |
| Overload @ 1s pulse / hour         |                 | 8 x Pn (depends on R value) |
| Overload @ 5s pulse / hour         |                 | 4 x Pn (depends on R value) |
| Resistance tolerance               | standard        | ± 10%                       |
|                                    | <i>optional</i> | ± 5% / ± 3%                 |
| Temperature coefficient            | 20 °C - 400 °C  | 85 ppm/K                    |
| Time constant for heating up       |                 | 30 s                        |
| Maximum liquid inlet temperature   |                 | * 60 °C                     |
| ΔT inlet/outlet (recommended)      |                 | 10-20 K                     |
| Operating pressure                 |                 | 6 bar @ 55 °C               |
| Test pressure                      |                 | 10 bar @ 20 °C              |
| acc. EN 13445                      |                 | 11 bar @ 20 °C              |
| Pressure drop @ 9L/min             |                 | 0.5 bar                     |
| Cooling connection                 |                 | ¼" / ½"                     |
| Material housing                   |                 | anodized aluminium          |
| - connection box                   | <i>optional</i> | <i>aluminium</i>            |

## Dimensions WHB 16.3 cable box

| Type          | Power [kW] | L [mm] | Weight [kg] |
|---------------|------------|--------|-------------|
| WHB 16.3.600  | 6          | 300    | 7           |
| WHB 16.3.800  | 8          | 400    | 8           |
| WHB 16.3.1000 | 11         | 500    | 9           |
| WHB 16.3.1200 | 13         | 600    | 10          |
| WHB 16.3.1400 | 15         | 700    | 12          |
| WHB 16.3.1600 | 18         | 800    | 13          |
| WHB 16.3.1800 | 20         | 900    | 14          |
| WHB 16.3.2000 | 23         | 1000   | 15          |

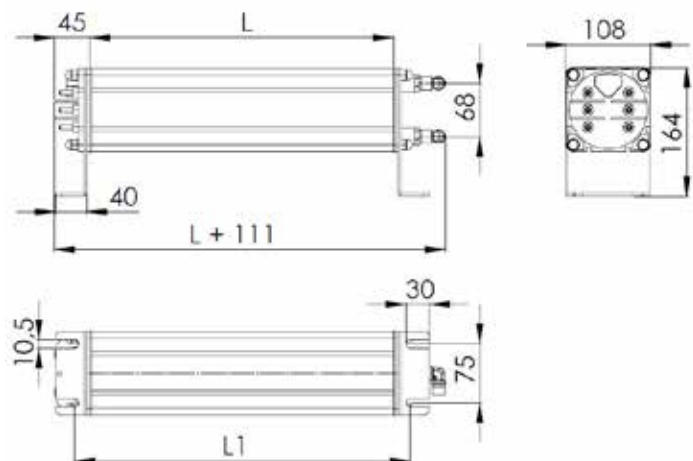


Protection degree IP65

connection treaded rods M6

## Dimensions WHB 16.3 connection with M6 treaded rods

| Type          | Power [kW] | L [mm] | Weight [kg] |
|---------------|------------|--------|-------------|
| WHB 16.3.600  | 6          | 300    | 6           |
| WHB 16.3.800  | 8          | 400    | 7           |
| WHB 16.3.1000 | 11         | 500    | 8           |
| WHB 16.3.1200 | 13         | 600    | 9           |
| WHB 16.3.1400 | 15         | 700    | 11          |
| WHB 16.3.1600 | 18         | 800    | 12          |
| WHB 16.3.1800 | 20         | 900    | 13          |
| WHB 16.3.2000 | 23         | 1000   | 14          |



- Protection degree IP00

- Very low Ohm values with M8/lugs and reduced power

- Other values with M6 rods

## General specifications HVB

|                                     |                 |                       |
|-------------------------------------|-----------------|-----------------------|
| Energy rating 5s*                   | HVB 70.400.1    | 150 kJ - 285 kJ       |
|                                     | HVB 70.400.2    | 300 kJ - 570 kJ       |
| Resistance tolerance                |                 | ± 10%                 |
| temperature coefficient             |                 | 100 ppm/K             |
| Working voltage                     |                 | 4,500 VAC / 6,360 VDC |
| Dielectric strength @ 50 Hz, 1 min. |                 | 10 kV                 |
| Insulation resistance @ 5 kVDC      | dried condition | ≥20 MΩ                |
| Connection                          | standard        | Radox cable 1000 mm   |
| Protection degree                   |                 | IP65                  |
| Cooling                             |                 | natural air cooled    |
| Material housing                    |                 | anodised aluminum     |



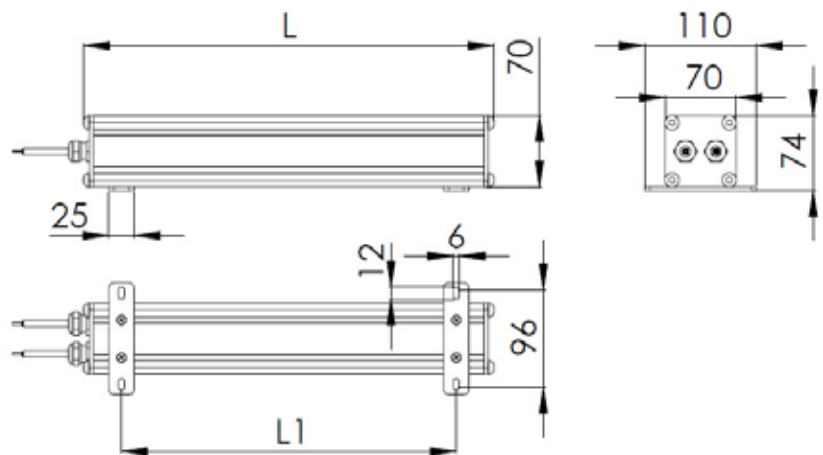
HVB 70.400.1



HVB 70.400.2

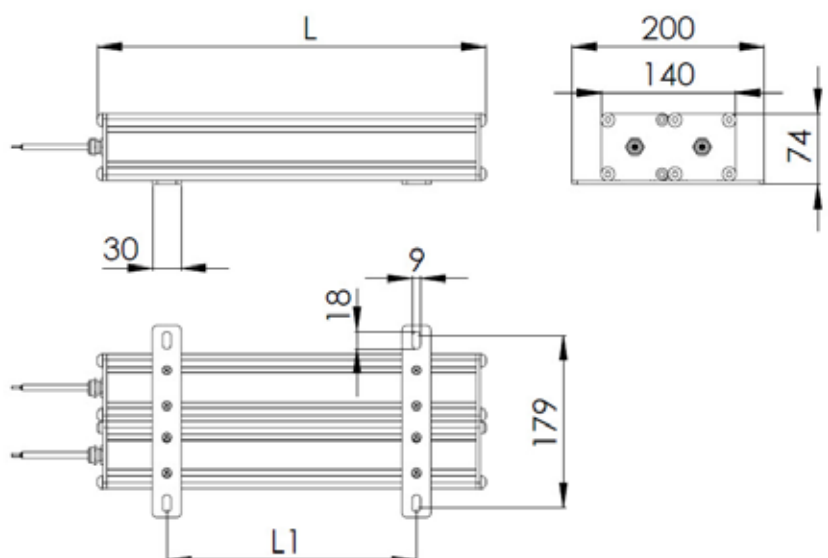
### Dimensions HVB 70.400.1

| Type         | L      | Weight |
|--------------|--------|--------|
| HVB 70.400.1 | 400 mm | 4.5 kg |



### Dimensions HVB 70.400.2

| Type         | L      | Weight |
|--------------|--------|--------|
| HVB 70.400.2 | 400 mm | 9 kg   |



\* depends on Ohmic value



# DANOTHERM™

TRV steel tubes forced air cooled resistors have two or four powerful ventilators as active cooling. The tubes can be made from different alloys to meet the environmental conditions. The frame work and connection box are offered in AISI304 and AISI316. Inside the connection box are the main terminals, the cabinet heater and all secondary circuits. Protection degree is IP65 or IP66.

GxxRT are natural air cooled steel tubes resistors. They can have three, nine, ten or twelve tubes welded into a frame. The connection box contains the main terminals and any auxiliary circuits. The ingress protection degree is IP65. A protection grid is optional.



## TRV / GxxRT

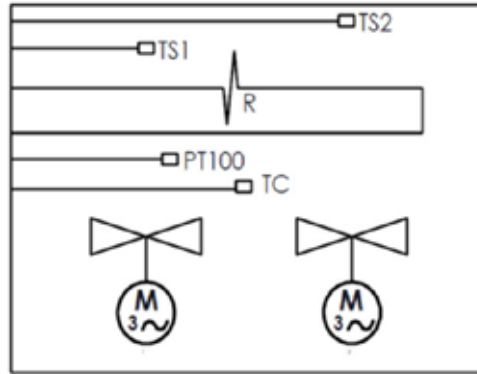
## General specifications TRV

|                                  |                   |   |
|----------------------------------|-------------------|---|
| Power ratings                    |                   | 50 kW - 275 kW                                  |
| Temperature coefficient          | 20 °C - 400 °C    | 85 ppm/K  |
| Working voltage                  |                   | 1000 VAC / 1400 VDC                             |
| Dielectric strength @ 50Hz       |                   | 3,500 VAC                                       |
| Insulation resistance @ 5000VDC  | dried condition   | >> 10 MΩ  |
| Overload @ 5s pulse / hour       |                   | 7 x Pn (depends on R value)                     |
| Overload @ 10s pulse / hour      |                   | 5 x Pn (depends on R value)                     |
| Resistance tolerance             | standard          | ± 10%   |
|                                  | optional          | ± 5% / ± 3%                                     |
| Electrical circuit configuration | standard          | single resistor unit                            |
|                                  | optional          | star/delta/split configuration                  |
| Environmental conditions         | temperature range | -20 °C - 40 °C                                  |
|                                  | altitude          | 1000 m  |
| Time constant for heating up     |                   | 60 s  |
| Protection degree                |                   | IP65 / IP66                                     |
| Fans                             | standard voltage  | 415 V, 3-phase, 50 Hz                           |
|                                  | optional voltage  | 430 V, 3-phase, 60 Hz                           |
|                                  | power             | 1.5 kW per motor                                |
|                                  | protection degree | IP66  |
|                                  | air flow          | 5000 m³/h per motor                             |
|                                  | motor             | steel, marine environment painted               |
| ΔT between inlet and outlet air  |                   | ~ 50 K  |
| Materials                        |                   |   |
| - support/panels                 | standard          | AISI 304  |
|                                  | <i>optional</i>   | <i>AISI 316</i>                                 |
| - connection box                 | standard          | AISI 304  |
|                                  | <i>optional</i>   | <i>AISI 316</i>                                 |
| - resistor elements              | standard          | AISI 304  |
|                                  | <i>optional</i>   | <i>AISI 316 &amp; 321, incoloy800 &amp; 825</i> |
| - cable gland                    | <i>optional</i>   | <i>nickel plated brass / AISI 304</i>           |
|                                  | standard          | undrilled plate                                 |
| Moisture protection              | standard          | 100 W - 120 W heating cable 230 V               |
| - voltage                        | <i>optional</i>   | <i>115 V</i>                                    |
| Factory acceptance test          | standard          |   |
|                                  |                   | - Aspect and dimensional Inspection             |
|                                  |                   | - Resistance value                              |
|                                  |                   | - Insulation resistance                         |
|                                  |                   | - Dielectric strength                           |
|                                  | <i>optional</i>   | <i>Certified Body witness test</i>              |

Please, read carefully the instructions on page 20 about contacts and sensors.

## Contacts and sensors

### 3.1 Schematic diagram

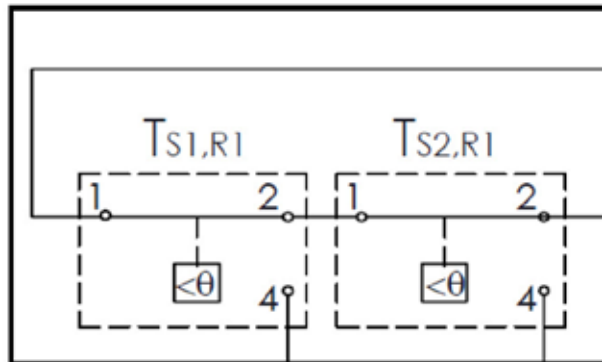


### 3.2 Thermal protections TS1 and TS2

Each resistor section has two protection thermo contacts. The sensors are placed opposite the corresponding Fan. Setting range 50 - 300 °C. Form-C contact, rated 20A-AC1. Advised setting 200 °C. These contacts serve to indicate malfunction from each Fan.

All contacts are wired in series as N.C. contact. The customer MUST connect this series connection to a control unit that MUST switch off the load in case this contact opens due to over temperature.

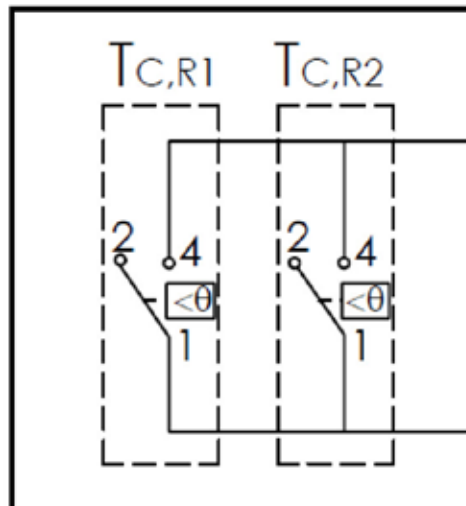
Connection diagram:



### 3.3 Temperature contact TC

Each resistor section has one thermal contact to start the cooling. It is positioned in the middle of each section. Setting range 0 - 100 °C. Form-C contact, rated 20A-AC1. Advised setting 70 °C. These contacts serve to start Fan-1&2 (at the same time).

Connection diagram:



### 3.4 Temperature sensor Pt100 (option)

This resistor unit is supplied with (multiple) Pt100 sensor(s), 4-wire type with/without signal convertor. These sensors serve to monitor the temperature from each section.

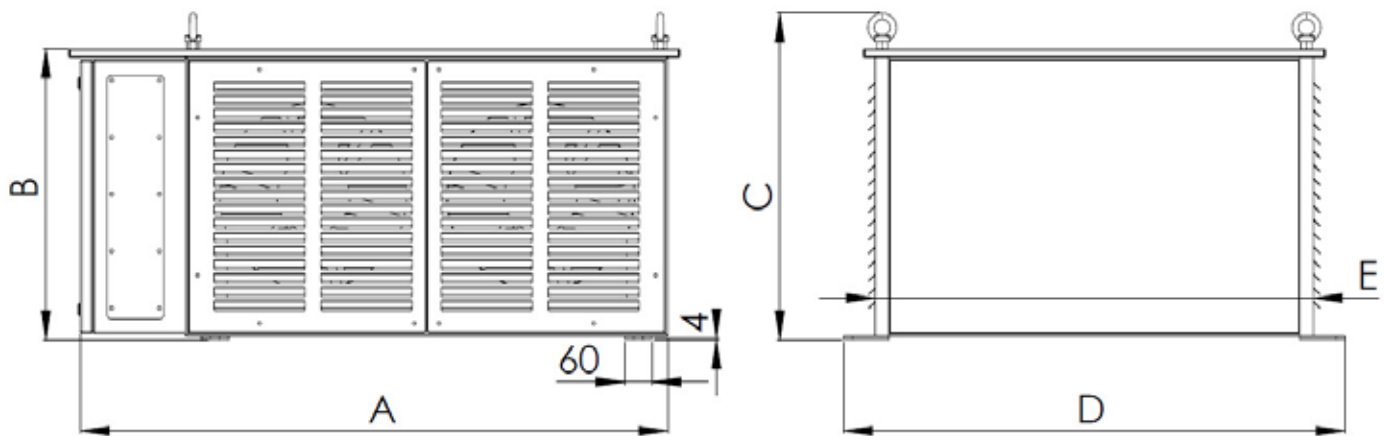
See wiring diagram for connections.

### 3.5 Moisture protection

The electrical connection box has a moisture protection inside the silicone potting. Electrical data: supply voltage 230 V AC/DC - consumption 120 W. The heater is self-regulating and keeps the temperature 10-20 °C above ambient, with a limit of 60 °C. The heater must always be 'ON', certainly, when the resistor is NOT operational.

## Dimensions TRV

| Type                  | Power | Airflow              | Weight |      |      | steel AISI 304 |      | steel AISI 316 |      |      |
|-----------------------|-------|----------------------|--------|------|------|----------------|------|----------------|------|------|
|                       |       |                      |        | A    | B    | C              | D    | E              | D    | E    |
|                       |       | m <sup>3</sup> /hour | Kg     | mm   | mm   | mm             | mm   | mm             | mm   | mm   |
| TRV 18.1950 _ 50 kW   | 50    | 10,000               | 200    | 1345 | 640  | 720            | 805  | 665            | 865  | 725  |
| TRV 28.1950 _ 75 kW   | 75    | 10,000               | 220    | 1345 | 640  | 720            | 805  | 665            | 865  | 725  |
| TRV 36.1950 _ 100 kW  | 100   | 10,000               | 240    | 1345 | 640  | 720            | 805  | 665            | 865  | 725  |
| TRV 45.1950 _ 125 kW  | 125   | 16,000               | 300    | 1345 | 640  | 720            | 1105 | 965            | 1165 | 1025 |
| TRV 55.1950 _ 150 kW  | 150   | 16,000               | 330    | 1345 | 640  | 720            | 1105 | 965            | 1165 | 1025 |
| TRV 64.1950 _ 175 kW  | 175   | 16,000               | 360    | 1345 | 640  | 720            | 1105 | 965            | 1165 | 1025 |
| TRV 72.1950 _ 200 kW  | 200   | 28,000               | 450    | 1395 | 1040 | 1120           | 955  | 815            | 1115 | 875  |
| TRV 82.1950 _ 225 kW  | 225   | 28,000               | 470    | 1395 | 1040 | 1120           | 955  | 815            | 1115 | 875  |
| TRV 90.1950 _ 250 kW  | 250   | 28,000               | 500    | 1395 | 1040 | 1120           | 955  | 815            | 1115 | 875  |
| TRV 100.1950 _ 275 kW | 275   | 28,000               | 550    | 1395 | 1040 | 1120           | 955  | 815            | 1115 | 875  |

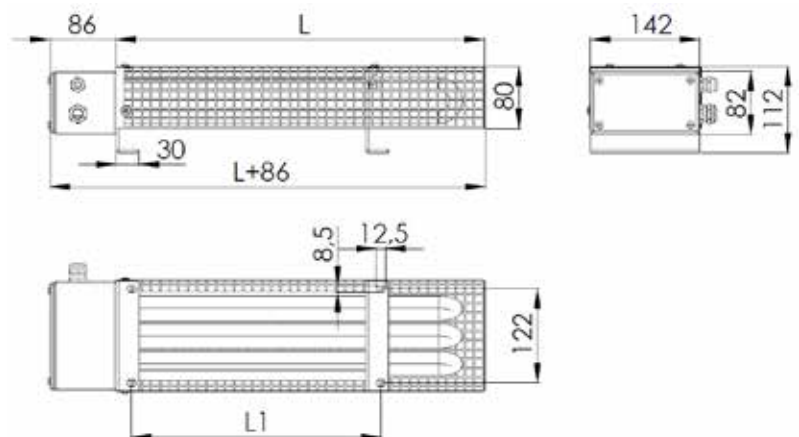


## General specifications GxxRT

|  |                  |   |
|--|------------------|---|
| Nominal power  |                  | 3 kW - 32 kW                                    |
| Working voltage  |                  | 1000 VAC / 1400 VDC                             |
| Dielectric strength @ 50Hz, 1 min.                             |                  | 3,500 VAC                                       |
| Insulation resistance @ 5000 VDC                               | dried conditions | >> 10 MΩ  |
| Overload @ 5 pulse / hour                                      |                  | 10 x Pn (depends on R value)                    |
| Overload @ 10s pulse / hour                                    |                  | 7 x Pn (depends on R value)                     |
| Resistance tolerance   | standard         | ± 5%  |
|  | <i>optional</i>  | ± 5% / ± 3%                                     |
| Temperature coefficient  |                  | 100 ppm/K                                       |
| Time constant for heating up                                   |                  |   |
| Protection degree  |                  | IP65  |
| Cooling  |                  | natural air cooled                              |
| Configuration  | standard         | single phase                                    |
|  | <i>optional</i>  | <i>delta/star 3 phase</i>                       |
|  | <i>optional</i>  | <i>multiple segments</i>                        |
| Thermal protection   | standard         | thermal switch                                  |
| - normally closed contact                                      |                  | 2 A @ 250 VAC, 50 Hz, cos 0.95                  |
| Moisture protection  | standard         | 7.5 W - 30 W heating cable 230 V                |
| - voltage  | <i>optional</i>  | 115 V   |
| Mechanical protection against direct contact with hot elements | <i>optional</i>  | <i>protection grid</i>                          |
| Materials  |                  |   |
| - Supporting structure   | standard         | AISI 304  |
|  | <i>optional</i>  | <i>AISI 316</i>                                 |
| - Terminal box   | standard         | AISI 304  |
|  | <i>optional</i>  | <i>AISI 316</i>                                 |
| - Resistor elements  | standard         | AISI 304  |
|  | <i>optional</i>  | <i>AISI 316 &amp; 321, incoloy800 &amp; 825</i> |
| Factory acceptance test  | standard         |   |
|  |                  | - Aspect and dimensional Inspection             |
|  |                  | - Resistance value                              |
|  |                  | - Insulation resistance                         |
|  |                  | - Dielectric strength                           |

## Dimensions G03RT

| type         | Power [kW] | L [mm] |
|--------------|------------|--------|
| G03RT16-900  | 3.00       | 450    |
| G03RT16-1200 | 4.00       | 600    |
| G03RT16-1500 | 5.00       | 750    |
| G03RT16-1700 | 6.00       | 850    |

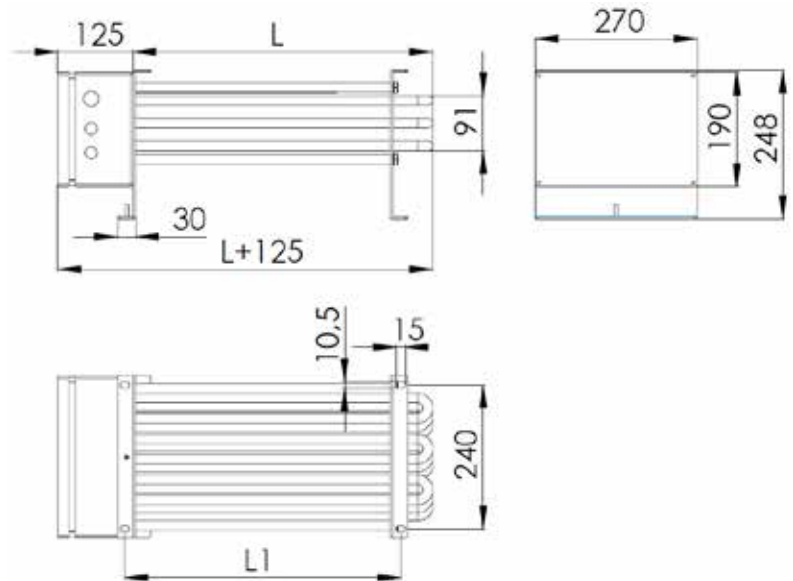


G03RT including optional protection grid



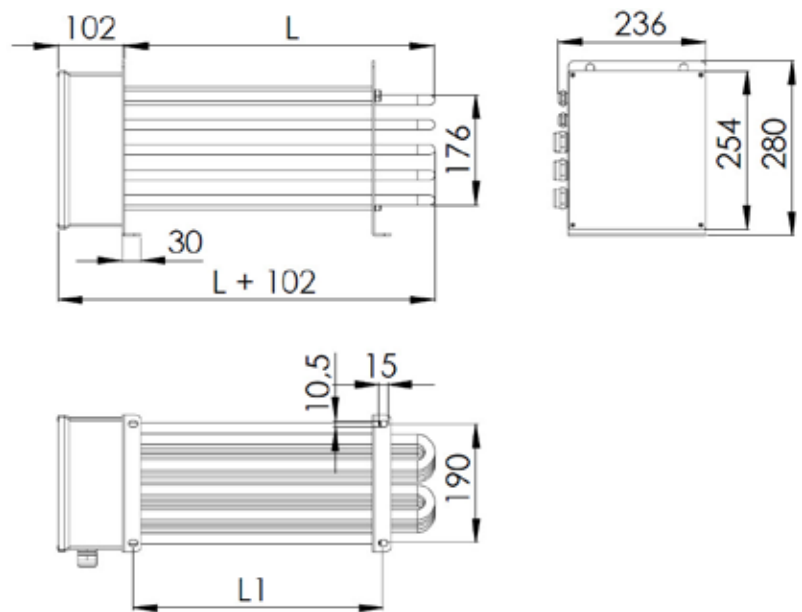
## Dimensions G09RT

| type         | Power [kW] | L [mm] |
|--------------|------------|--------|
| G09RT16.1000 | 7.00       | 500    |
| G09RT16.1100 | 7.75       | 550    |
| G09RT16.1300 | 9.50       | 650    |
| G09RT16.1500 | 11.00      | 750    |
| G09RT16.2200 | 16.50      | 1100   |



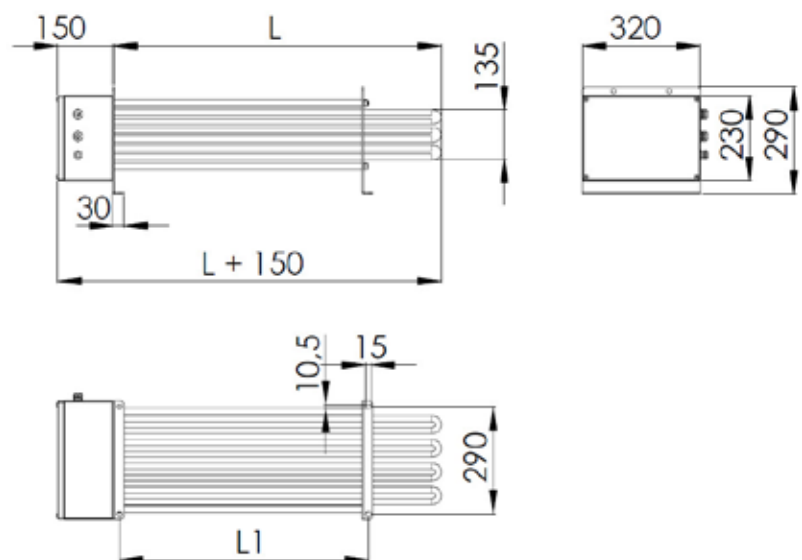
## Dimensions G10RT

| type         | Power [kW] | L [mm] |
|--------------|------------|--------|
| G10RT16.1000 | 7.50       | 500    |
| G10RT16.1200 | 9.50       | 600    |
| G10RT16.1400 | 11.25      | 700    |
| G10RT16.1600 | 13.00      | 800    |
| G10RT16.1800 | 14.75      | 900    |
| G10RT16.2000 | 16.50      | 1000   |
| G10RT16.2200 | 18.25      | 1100   |
| G10RT16.2400 | 20.00      | 1200   |
| G10RT16.2600 | 21.75      | 1300   |
| G10RT16.2800 | 23.50      | 1400   |
| G10RT16.3000 | 25.50      | 1500   |
| G10RT16.3200 | 27.00      | 1600   |



## Dimensions G12RT

| type         | Power [kW] | L [mm] |
|--------------|------------|--------|
| G12RT16.1000 | 9.00       | 500    |
| G12RT16.1200 | 11.40      | 600    |
| G12RT16.1400 | 13.50      | 700    |
| G12RT16.1600 | 15.60      | 800    |
| G12RT16.1800 | 17.70      | 900    |
| G12RT16.2000 | 19.80      | 1000   |
| G12RT16.2200 | 21.90      | 1100   |
| G12RT16.2400 | 24.00      | 1200   |
| G12RT16.2600 | 26.10      | 1300   |
| G12RT16.2800 | 28.20      | 1400   |
| G12RT16.3000 | 30.60      | 1500   |
| G12RT16.3200 | 32.40      | 1600   |



## Overview of the ALPHA resistor family (IP00-IP65)



|                    |                     |                     |                     |                     |
|--------------------|---------------------|---------------------|---------------------|---------------------|
| Power: 60-410W     | Power: 85W - 1.7kW  | Power: 410W - 12kW  | Power: 445W-15kW    | Power: 860W-25kW    |
|                    | 9-150kJ @5s         | 25-550kJ @5s        | 80kJ-2.5MJ @5s      | 6.4kJ-1.1MJ @5s     |
| - Applications     | - Applications      | - Applications      | - Applications      | - Applications      |
| Charge / Discharge | High Pulse load     | High Pulse load     | High Pulse load     | Short recovery time |
| Brake              | Brake               | Brake               | Brake               | Brake               |
| Filter             | Filter              | Filter              | Medium voltage      | Filter              |
| Charge / Discharge | Charge / High Pulse | Charge / High Pulse | Charge / High Pulse | High Pulse          |

## Other resistor types from Danotherm (IP00-IP65)



|                   |                  |                |               |                  |
|-------------------|------------------|----------------|---------------|------------------|
| Multi purpose     | Outdoor & Marine | Filter         | Medium & HV   | Filter & load    |
| Power: 100W-5kW   | Power: 1-500kW   | Power: 4-200kW | Power: 500W-> | Power: 5kW-1.5MW |
| Ceramic wirewound | Steel tube       | Wirewound      | Steel grid    | Steel tube       |

Official Danotherm dealer



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