



# BACKER STANDARD PRODUCTS

INTELLIGENT HEATING & CONTROL



# WELCOME TO BACKER BHV AB

- OUR RESOURCES SOLVE YOUR HEATING DEMANDS -

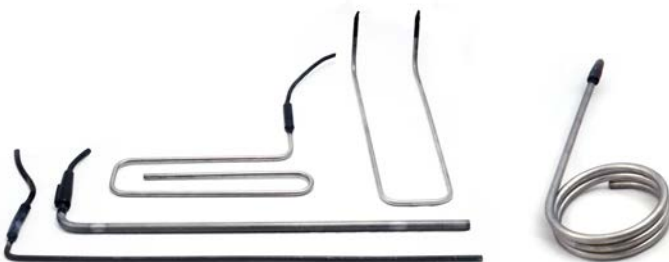
Our value added heating products together with our measurement and control devices offer our customers complete solutions. Bring us an idea or a problem and we will guide you to an optimal resolution. Our engineers will not only present answers, but they are able to take charge of the entire product development and testing process by utilizing our advanced technical tools and lab facilities. Our extensive experience and competence as well as our reliable quality and service guarantees your success. Our ambition is to not only be a supplier, but your preferred partner.

*Together we can make it happen!*



Stock-kept articles can be sent from  
Backer within 24 h after order

## EXAMPLES OF CUSTOMIZED SOLUTIONS



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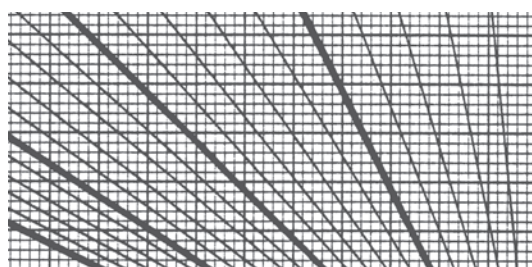
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# TUBULAR HEATING ELEMENTS

The following heating elements are kept in stock, semi-finished, in small quantities for quick deliveries. See the following pages for examples of possible ways to design the heating

element, fixing devices and connections. Elements with other dimensions, power, voltage, etc, are produced according to customer specification.

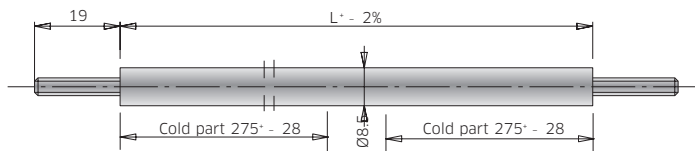
| Type 6N 4,5 |              |        |           |           |         |        |              |           |  |
|-------------|--------------|--------|-----------|-----------|---------|--------|--------------|-----------|--|
| TYPE        | ARTICLE NO.  | TUBE Ø | MATERIAL  | VOLTAGE V | POWER W | LENGTH | SURFACE LOAD | COLD PART |  |
| 6N4,5       | 2040 595 001 | 6.4    | EN 1.4828 | 230       | 250     | 400    | 4.44         | 60        |  |
| 6N4,5       | 2040 595 005 | 6.4    | EN 1.4828 | 230       | 1000    | 1230   | 4.48         | 60        |  |
| 6N4,5       | 2040 595 006 | 6.4    | EN 1.4828 | 230       | 1500    | 1780   | 4.50         | 60        |  |

| Type 9NL |              |        |           |           |         |        |              |           |  |
|----------|--------------|--------|-----------|-----------|---------|--------|--------------|-----------|--|
| TYPE     | ARTICLE NO.  | TUBE Ø | MATERIAL  | VOLTAGE V | POWER W | LENGTH | SURFACE LOAD | COLD PART |  |
| 9NL      | 2040 558 201 | 8.5    | EN 1.4541 | 230       | 75      | 900    | 0.40         | 100       |  |
| 9NL      | 2040 558 206 | 8.5    | EN 1.4541 | 230       | 125     | 2000   | 0.26         | 100       |  |
| 9NL      | 2040 558 205 | 8.5    | EN 1.4541 | 230       | 175     | 2500   | 0.29         | 100       |  |

| Type 9NL |              |        |           |           |         |        |              |           |  |
|----------|--------------|--------|-----------|-----------|---------|--------|--------------|-----------|--|
| TYPE     | ARTICLE NO.  | TUBE Ø | MATERIAL  | VOLTAGE V | POWER W | LENGTH | SURFACE LOAD | COLD PART |  |
| 9NF      | 2040 558 301 | 8.5    | EN 1.4541 | 230       | 1000    | 2930   | 1.37         | 100       |  |
| 9NF      | 2040 558 302 | 8.5    | EN 1.4541 | 230       | 1000    | 3430   | 1.16         | 100       |  |
| 9NF      | 2040 558 303 | 8.5    | EN 1.4541 | 400       | 1000    | 2930   | 1.37         | 100       |  |
| 9NF      | 2040 558 304 | 8.5    | EN 1.4541 | 400       | 1000    | 3430   | 1.16         | 100       |  |
| 9NF      | 2040 558 305 | 8.5    | EN 1.4541 | 440       | 1000    | 2930   | 1.37         | 100       |  |
| 9NF      | 2040 558 306 | 8.5    | EN 1.4541 | 440       | 1000    | 3430   | 1.16         | 100       |  |

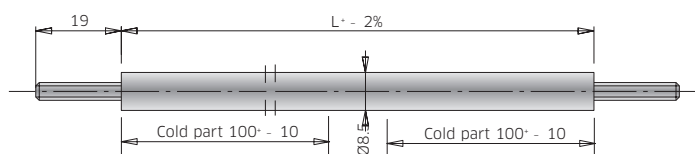
## CONT. TUBULAR HEATING ELEMENTS

Type 9ND 6



| TYPE | ARTICLE NO.  | TUBE Ø | MATERIAL  | VOLTAGE V | POWER W | LENGTH | SURFACE LOAD | COLD PART |
|------|--------------|--------|-----------|-----------|---------|--------|--------------|-----------|
| 9ND6 | 2040 634 401 | 8.5    | EN 1.4404 | 230       | 1000    | 1160   | 6.14         | 275       |
| 9ND6 | 2040 634 402 | 8.5    | EN 1.4404 | 230       | 1500    | 1450   | 6.24         | 275       |
| 9ND6 | 2040 634 403 | 8.5    | EN 1.4404 | 230       | 2000    | 1750   | 6.24         | 275       |
| 9ND6 | 2040 634 404 | 8.5    | EN 1.4404 | 230       | 2500    | 2040   | 6.29         | 275       |
| 9ND6 | 2040 634 405 | 8.5    | EN 1.4404 | 230       | 3000    | 2340   | 6.28         | 275       |
| 9ND6 | 2040 634 413 | 8.5    | EN 1.4404 | 230       | 4000    | 2930   | 6.30         | 275       |
| 9ND6 | 2040 634 406 | 8.5    | EN 1.4404 | 230       | 4500    | 3220   | 6.31         | 275       |
| 9ND6 | 2040 634 407 | 8.5    | EN 1.4404 | 400       | 1000    | 1160   | 6.14         | 275       |
| 9ND6 | 2040 634 408 | 8.5    | EN 1.4404 | 400       | 1500    | 1450   | 6.24         | 275       |
| 9ND6 | 2040 634 409 | 8.5    | EN 1.4404 | 400       | 2000    | 1750   | 6.24         | 275       |
| 9ND6 | 2040 634 410 | 8.5    | EN 1.4404 | 400       | 2500    | 2040   | 6.29         | 275       |
| 9ND6 | 2040 634 411 | 8.5    | EN 1.4404 | 400       | 3000    | 2340   | 6.28         | 275       |
| 9ND6 | 2040 634 414 | 8.5    | EN 1.4404 | 400       | 4000    | 2930   | 6.30         | 275       |
| 9ND6 | 2040 634 412 | 8.5    | EN 1.4404 | 400       | 4500    | 3220   | 6.31         | 275       |

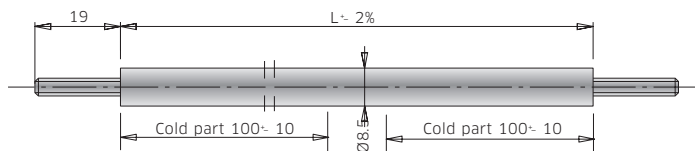
Type 9N 2,3



| TYPE  | ARTICLE NO.  | TUBE Ø | MATERIAL  | VOLTAGE V | POWER W | LENGTH | SURFACE LOAD | COLD PART |
|-------|--------------|--------|-----------|-----------|---------|--------|--------------|-----------|
| 9N2,3 | 2040 558 432 | 8.5    | EN 1.4404 | 230       | 330     | 760    | 2.21         | 100       |
| 9N2,3 | 2040 558 401 | 8.5    | EN 1.4404 | 230       | 500     | 900    | 2.68         | 100       |
| 9N2,3 | 2040 558 402 | 8.5    | EN 1.4404 | 230       | 670     | 1210   | 2.49         | 100       |
| 9N2,3 | 2040 558 403 | 8.5    | EN 1.4404 | 230       | 1000    | 1600   | 2.68         | 100       |
| 9N2,3 | 2040 558 404 | 8.5    | EN 1.4404 | 230       | 1330    | 2000   | 2.77         | 100       |
| 9N2,3 | 2040 558 405 | 8.5    | EN 1.4404 | 230       | 1500    | 2250   | 2.74         | 100       |
| 9N2,3 | 2040 558 406 | 8.5    | EN 1.4404 | 230       | 1670    | 2500   | 2.72         | 100       |
| 9N2,3 | 2040 558 407 | 8.5    | EN 1.4404 | 230       | 1800    | 2765   | 2.63         | 100       |
| 9N2,3 | 2040 558 408 | 8.5    | EN 1.4404 | 230       | 2000    | 2950   | 2.72         | 100       |
| 9N2,3 | 2040 558 425 | 8.5    | EN 1.4404 | 230       | 2330    | 3200   | 2.91         | 100       |
| 9N2,3 | 2040 558 428 | 8.5    | EN 1.4404 | 230       | 2500    | 3665   | 2.70         | 100       |
| 9N2,3 | 2040 558 433 | 8.5    | EN 1.4404 | 400       | 330     | 760    | 2.21         | 100       |
| 9N2,3 | 2040 558 417 | 8.5    | EN 1.4404 | 400       | 500     | 900    | 2.68         | 100       |
| 9N2,3 | 2040 558 418 | 8.5    | EN 1.4404 | 400       | 670     | 1210   | 2.49         | 100       |
| 9N2,3 | 2040 558 419 | 8.5    | EN 1.4404 | 400       | 1000    | 1600   | 2.68         | 100       |
| 9N2,3 | 2040 558 420 | 8.5    | EN 1.4404 | 400       | 1330    | 2000   | 2.77         | 100       |
| 9N2,3 | 2040 558 421 | 8.5    | EN 1.4404 | 400       | 1500    | 2250   | 2.74         | 100       |
| 9N2,3 | 2040 558 422 | 8.5    | EN 1.4404 | 400       | 1670    | 2500   | 2.72         | 100       |
| 9N2,3 | 2040 558 423 | 8.5    | EN 1.4404 | 400       | 1800    | 2765   | 2.63         | 100       |
| 9N2,3 | 2040 558 424 | 8.5    | EN 1.4404 | 400       | 2000    | 2950   | 2.72         | 100       |
| 9N2,3 | 2040 558 427 | 8.5    | EN 1.4404 | 400       | 2330    | 3200   | 2.91         | 100       |
| 9N2,3 | 2040 558 409 | 8.5    | EN 1.4404 | 290       | 500     | 900    | 2.68         | 100       |
| 9N2,3 | 2040 558 410 | 8.5    | EN 1.4404 | 290       | 670     | 1210   | 2.49         | 100       |
| 9N2,3 | 2040 558 411 | 8.5    | EN 1.4404 | 290       | 1000    | 1600   | 2.68         | 100       |
| 9N2,3 | 2040 558 412 | 8.5    | EN 1.4404 | 290       | 1330    | 2000   | 2.77         | 100       |
| 9N2,3 | 2040 558 413 | 8.5    | EN 1.4404 | 290       | 1500    | 2250   | 2.74         | 100       |
| 9N2,3 | 2040 558 414 | 8.5    | EN 1.4404 | 290       | 1670    | 2500   | 2.44         | 100       |
| 9N2,3 | 2040 558 415 | 8.5    | EN 1.4404 | 290       | 1800    | 2765   | 2.45         | 100       |
| 9N2,3 | 2040 558 416 | 8.5    | EN 1.4404 | 290       | 2000    | 2950   | 2.50         | 100       |
| 9N2,3 | 2040 558 426 | 8.5    | EN 1.4404 | 290       | 2330    | 3200   | 2.91         | 100       |

## CONT. TUBULAR HEATING ELEMENTS

Type 9N 3,5



| TYPE  | ARTICLE NO.  | TUBE Ø | MATERIAL  | VOLTAGE V | POWER W | LENGTH | SURFACE LOAD | COLD PART |
|-------|--------------|--------|-----------|-----------|---------|--------|--------------|-----------|
| 9N3,5 | 2040 558 501 | 8.5    | EN 1.4404 | 230       | 500     | 705    | 3.71         | 100       |
| 9N3,5 | 2040 558 502 | 8.5    | EN 1.4404 | 230       | 1000    | 1210   | 3.71         | 100       |
| 9N3,5 | 2040 558 503 | 8.5    | EN 1.4404 | 230       | 1330    | 1540   | 3.72         | 100       |
| 9N3,5 | 2040 558 504 | 8.5    | EN 1.4404 | 230       | 1500    | 1700   | 3.75         | 100       |
| 9N3,5 | 2040 558 505 | 8.5    | EN 1.4404 | 230       | 1670    | 1880   | 3.72         | 100       |
| 9N3,5 | 2040 558 506 | 8.5    | EN 1.4404 | 230       | 2000    | 2220   | 3.71         | 100       |
| 9N3,5 | 2040 558 507 | 8.5    | EN 1.4404 | 230       | 2500    | 2725   | 3.71         | 100       |
| 9N3,5 | 2040 558 508 | 8.5    | EN 1.4404 | 230       | 3000    | 3230   | 3.71         | 100       |
| 9N3,5 | 2040 558 509 | 8.5    | EN 1.4404 | 400       | 500     | 705    | 3.71         | 100       |
| 9N3,5 | 2040 558 510 | 8.5    | EN 1.4404 | 400       | 1000    | 1210   | 3.71         | 100       |
| 9N3,5 | 2040 558 511 | 8.5    | EN 1.4404 | 400       | 1330    | 1540   | 3.72         | 100       |
| 9N3,5 | 2040 558 512 | 8.5    | EN 1.4404 | 400       | 1500    | 1700   | 3.75         | 100       |
| 9N3,5 | 2040 558 513 | 8.5    | EN 1.4404 | 400       | 1670    | 1880   | 3.72         | 100       |
| 9N3,5 | 2040 558 514 | 8.5    | EN 1.4404 | 400       | 2000    | 2220   | 3.71         | 100       |
| 9N3,5 | 2040 558 515 | 8.5    | EN 1.4404 | 400       | 2500    | 2725   | 3.71         | 100       |
| 9N3,5 | 2040 558 516 | 8.5    | EN 1.4404 | 400       | 3000    | 3230   | 3.71         | 100       |

Type 9N 5,5

| TYPE  | ARTICLE NO.  | TUBE Ø | MATERIAL  | VOLTAGE V | POWER W | LENGTH | SURFACE LOAD | COLD PART |
|-------|--------------|--------|-----------|-----------|---------|--------|--------------|-----------|
| 9N5,5 | 2040 558 601 | 8.5    | EN 1.4828 | 230       | 500     | 525    | 5.76         | 100       |
| 9N5,5 | 2040 558 602 | 8.5    | EN 1.4828 | 230       | 1000    | 850    | 5.76         | 100       |
| 9N5,5 | 2040 558 603 | 8.5    | EN 1.4828 | 230       | 1500    | 1175   | 5.76         | 100       |
| 9N5,5 | 2040 558 604 | 8.5    | EN 1.4828 | 230       | 1670    | 1300   | 5.69         | 100       |
| 9N5,5 | 2040 558 605 | 8.5    | EN 1.4828 | 230       | 2000    | 1500   | 5.76         | 100       |
| 9N5,5 | 2040 558 606 | 8.5    | EN 1.4828 | 230       | 3000    | 2125   | 5.84         | 100       |
| 9N5,5 | 2040 558 615 | 8.5    | EN 1.4828 | 230       | 4000    | 2785   | 5.80         | 100       |
| 9N5,5 | 2040 558 607 | 8.5    | EN 1.4828 | 230       | 4500    | 3100   | 5.81         | 100       |
| 9N5,5 | 2040 558 609 | 8.5    | EN 1.4828 | 400       | 1000    | 850    | 5.76         | 100       |
| 9N5,5 | 2040 558 610 | 8.5    | EN 1.4828 | 400       | 1500    | 1175   | 5.76         | 100       |
| 9N5,5 | 2040 558 611 | 8.5    | EN 1.4828 | 400       | 1670    | 1300   | 5.69         | 100       |
| 9N5,5 | 2040 558 612 | 8.5    | EN 1.4828 | 400       | 2000    | 1500   | 5.76         | 100       |
| 9N5,5 | 2040 558 613 | 8.5    | EN 1.4828 | 400       | 3000    | 2125   | 5.84         | 100       |
| 9N5,5 | 2040 558 616 | 8.5    | EN 1.4828 | 400       | 4000    | 2785   | 5.80         | 100       |
| 9N5,5 | 2040 558 614 | 8.5    | EN 1.4828 | 400       | 4500    | 3100   | 5.81         | 100       |



## CONT. TUBULAR HEATING ELEMENTS

| Type 14RV |              |        |           |           |         |        |              |           |
|-----------|--------------|--------|-----------|-----------|---------|--------|--------------|-----------|
| TYPE      | ARTICLE NO.  | TUBE Ø | MATERIAL  | VOLTAGE V | POWER W | LENGTH | SURFACE LOAD | COLD PART |
| 14RV      | 2040 558 915 | 14.0   | EN 1.4541 | 230       | 400     | 158    | 10.34        | 35        |
| 14RV      | 2040 558 916 | 14.0   | EN 1.4541 | 230       | 550     | 208    | 7.23         | 35        |
| 14RV      | 2040 558 901 | 14.0   | EN 1.4541 | 230       | 325     | 258    | 3.32         | 35        |
| 14RV      | 2040 558 908 | 14.0   | EN 1.4541 | 230       | 650     | 258    | 6.63         | 35        |
| 14RV      | 2040 558 902 | 14.0   | EN 1.4541 | 230       | 400     | 308    | 3.33         | 35        |
| 14RV      | 2040 558 909 | 14.0   | EN 1.4541 | 230       | 800     | 308    | 6.67         | 35        |
| 14RV      | 2040 558 903 | 14.0   | EN 1.4541 | 230       | 450     | 358    | 3.17         | 35        |
| 14RV      | 2040 558 910 | 14.0   | EN 1.4541 | 230       | 900     | 358    | 6.34         | 35        |
| 14RV      | 2040 558 904 | 14.0   | EN 1.4541 | 230       | 500     | 408    | 3.05         | 35        |
| 14RV      | 2040 558 911 | 14.0   | EN 1.4541 | 230       | 1000    | 408    | 6.10         | 35        |
| 14RV      | 2040 558 905 | 14.0   | EN 1.4541 | 230       | 600     | 458    | 3.23         | 35        |
| 14RV      | 2040 558 912 | 14.0   | EN 1.4541 | 230       | 1200    | 458    | 6.45         | 35        |
| 14RV      | 2040 558 906 | 14.0   | EN 1.4541 | 230       | 650     | 508    | 3.13         | 35        |
| 14RV      | 2040 558 913 | 14.0   | EN 1.4541 | 230       | 1300    | 508    | 6.25         | 35        |
| 14RV      | 2040 558 907 | 14.0   | EN 1.4541 | 230       | 800     | 608    | 3.18         | 35        |
| 14RV      | 2040 558 914 | 14.0   | EN 1.4541 | 230       | 1600    | 608    | 6.35         | 35        |

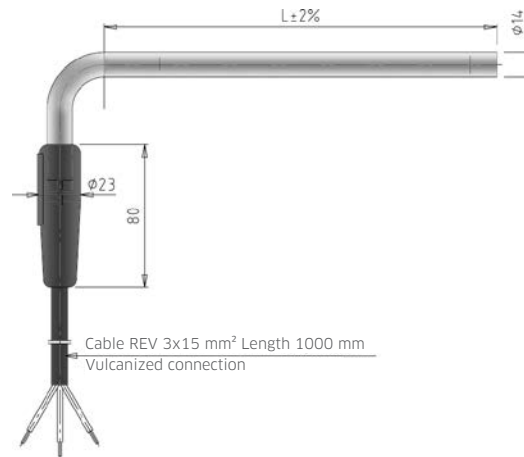
| Type 14NF |              |        |           |           |         |        |              |           |
|-----------|--------------|--------|-----------|-----------|---------|--------|--------------|-----------|
| TYPE      | ARTICLE NO.  | TUBE Ø | MATERIAL  | VOLTAGE V | POWER W | LENGTH | SURFACE LOAD | COLD PART |
| 14NF      | 2040 558 801 | 14.0   | EN 1.4404 | 230       | 650     | 430    | 4.62         | 110       |
| 14NF      | 2040 558 802 | 14.0   | EN 1.4404 | 230       | 750     | 530    | 4.06         | 110       |
| 14NF      | 2040 558 803 | 14.0   | EN 1.4404 | 230       | 1000    | 630    | 4.37         | 110       |
| 14NF      | 2040 558 804 | 14.0   | EN 1.4404 | 230       | 1000    | 730    | 3.67         | 110       |
| 14NF      | 2040 558 805 | 14.0   | EN 1.4404 | 230       | 1250    | 980    | 3.27         | 110       |
| 14NF      | 2040 558 807 | 14.0   | EN 1.4404 | 230       | 2000    | 1480   | 3.32         | 110       |
| 14NF      | 2040 558 808 | 14.0   | EN 1.4404 | 230       | 2000    | 1680   | 2.90         | 110       |
| 14NF      | 2040 558 809 | 14.0   | EN 1.4404 | 230       | 2000    | 1830   | 2.65         | 110       |
| 14NF      | 2040 558 810 | 14.0   | EN 1.4404 | 230       | 2000    | 1930   | 2.50         | 110       |
| 14NF      | 2040 558 811 | 14.0   | EN 1.4404 | 230       | 2500    | 2180   | 2.75         | 110       |
| 14NF      | 2040 558 812 | 14.0   | EN 1.4404 | 230       | 2500    | 2330   | 2.56         | 110       |
| 14NF      | 2040 558 813 | 14.0   | EN 1.4404 | 230       | 2500    | 2580   | 2.30         | 110       |
| 14NF      | 2040 558 814 | 14.0   | EN 1.4404 | 400       | 650     | 430    | 4.62         | 110       |
| 14NF      | 2040 558 815 | 14.0   | EN 1.4404 | 400       | 750     | 530    | 4.06         | 110       |
| 14NF      | 2040 558 816 | 14.0   | EN 1.4404 | 400       | 1000    | 630    | 4.37         | 110       |
| 14NF      | 2040 558 817 | 14.0   | EN 1.4404 | 400       | 1000    | 730    | 3.67         | 110       |
| 14NF      | 2040 558 818 | 14.0   | EN 1.4404 | 400       | 1250    | 980    | 3.27         | 110       |
| 14NF      | 2040 558 820 | 14.0   | EN 1.4404 | 400       | 2000    | 1480   | 3.32         | 110       |
| 14NF      | 2040 558 821 | 14.0   | EN 1.4404 | 400       | 2000    | 1680   | 2.90         | 110       |
| 14NF      | 2040 558 822 | 14.0   | EN 1.4404 | 400       | 2000    | 1830   | 2.65         | 110       |
| 14NF      | 2040 558 823 | 14.0   | EN 1.4404 | 400       | 2000    | 1930   | 2.50         | 110       |
| 14NF      | 2040 558 824 | 14.0   | EN 1.4404 | 400       | 2500    | 2180   | 2.75         | 110       |
| 14NF      | 2040 558 825 | 14.0   | EN 1.4404 | 400       | 2500    | 2330   | 2.56         | 110       |
| 14NF      | 2040 558 826 | 14.0   | EN 1.4404 | 400       | 2500    | 2580   | 2.30         | 110       |
| 14NF      | 2040 558 827 | 14.0   | EN 1.4404 | 400       | 3000    | 2830   | 2.51         | 110       |
| 14NF      | 2040 558 828 | 14.0   | EN 1.4404 | 440       | 650     | 430    | 4.62         | 110       |
| 14NF      | 2040 558 829 | 14.0   | EN 1.4404 | 440       | 750     | 530    | 4.06         | 110       |
| 14NF      | 2040 558 830 | 14.0   | EN 1.4404 | 440       | 1000    | 630    | 4.37         | 110       |
| 14NF      | 2040 558 831 | 14.0   | EN 1.4404 | 440       | 1000    | 730    | 3.67         | 110       |
| 14NF      | 2040 558 832 | 14.0   | EN 1.4404 | 440       | 1250    | 980    | 3.27         | 110       |
| 14NF      | 2040 558 834 | 14.0   | EN 1.4404 | 440       | 2000    | 1480   | 3.32         | 110       |
| 14NF      | 2040 558 835 | 14.0   | EN 1.4404 | 440       | 2000    | 1680   | 2.90         | 110       |

# TUBULAR HEATING ELEMENT FOR DEFROSTING

Examples of applications: Freezing - and cooling equipment, compressors, outdoor use, etc.

Below defrosting elements are kept in stock, semi-finished. Defrosting elements are produced in many designs according to customer specifications.

Defrosting elements type TP



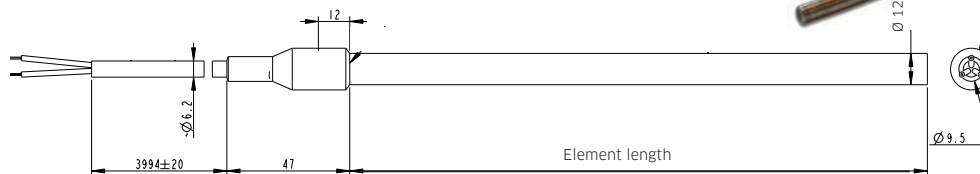
| TYPE    | POWER W | VOLTAGE V | INSERTION LENGTH mm | ARTICLE NO.  |
|---------|---------|-----------|---------------------|--------------|
| TP 350  | 650     | 230       | 350                 | 2540 619401  |
| TP 450  | 750     | 230       | 450                 | 2540 619402  |
| TP 550  | 1000    | 230       | 550                 | 2540 619403  |
| TP 650  | 1000    | 230       | 650                 | 2540 619404  |
| TP 900  | 1250    | 230       | 900                 | 2540 619405  |
| TP 1400 | 2000    | 230       | 1400                | 2540 619 407 |
| TP 1600 | 2000    | 230       | 1600                | 2540 619 408 |
| TP 1750 | 2000    | 230       | 1750                | 2540 619 409 |
| TP 1850 | 2000    | 230       | 1850                | 2540 619 410 |
| TP 2100 | 2500    | 230       | 2100                | 2540 619 411 |
| TP 2250 | 2500    | 230       | 2250                | 2540 619 412 |
| TP 2500 | 2500    | 230       | 2500                | 2540 619 413 |
| TP 350  | 650     | 400       | 350                 | 2540 484 701 |
| TP 450  | 750     | 400       | 450                 | 2540 484 702 |
| TP 550  | 1000    | 400       | 550                 | 2540 484 703 |
| TP 650  | 1000    | 400       | 650                 | 2540 484 704 |
| TP 900  | 1250    | 400       | 900                 | 2540 484 705 |
| TP 1400 | 2000    | 400       | 1400                | 2540 484 707 |
| TP 1600 | 2000    | 400       | 1600                | 2540 484 708 |
| TP 1750 | 2000    | 400       | 1750                | 2540 484 709 |
| TP 1850 | 2000    | 400       | 1850                | 2540 484 710 |
| TP 2100 | 2500    | 400       | 2100                | 2540 484 711 |
| TP 2250 | 2500    | 400       | 2250                | 2540 484 712 |
| TP 2500 | 2500    | 400       | 2500                | 2540 484 713 |
| TP 2750 | 3000    | 400       | 2750                | 2540 484 714 |
| TP 350  | 650     | 440       | 350                 | 2540 619 501 |
| TP 450  | 750     | 440       | 450                 | 2540 619 502 |
| TP 550  | 1000    | 440       | 550                 | 2540 619 503 |
| TP 650  | 1000    | 440       | 650                 | 2540 619 504 |
| TP 900  | 1250    | 440       | 900                 | 2540 619 505 |
| TP 1400 | 2000    | 440       | 1400                | 2540 619 507 |
| TP 1600 | 2000    | 440       | 1600                | 2540 619 508 |

# PTC HEATING ELEMENT 12 MM

Examples of applications: Radiators, towel dryers, evaporation of condensed water, defrosting

The element automatically adjusts its power consumption until it reaches the pre-set desired temperature (curie temp). Thanks to it's self-regulating properties there is no need for overheating protection and temperatureregulation and the same element can be used both for air- and water heating without any risk of overheating.

Tube in EN 1.4404 or EN 1.4301  
 Ø 12 mm  
 Vulcanized connection with cable 4000 mm  
 Voltage: 110-240 V  
 Temperature: 50-180°C

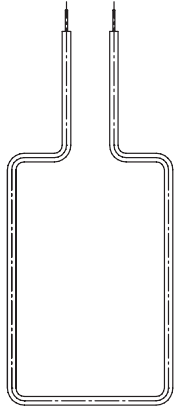


| POWER 0°C<br>WATER/AIR<br>110 V | POWER 0°C<br>WATER/AIR<br>230V | ELEMENT<br>LENGTH | ARTICLE NO.  |
|---------------------------------|--------------------------------|-------------------|--------------|
| 100W/15W                        | 140W/15W                       | 121 mm            | 2550 885 103 |
| 160W/20W                        | 30W/20W                        | 171 mm            | 2550 885 102 |
| 205W/25W                        | 330W/25W                       | 221 mm            | 2550 885 101 |

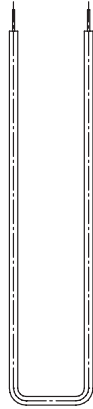
In addition to above standard range, unique PTC elements can be produced, e.g. with nipple and cable. Contact us for more information.



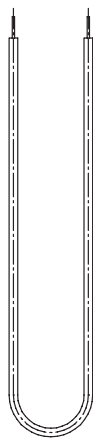
# EX. OF WAYS TO DESIGN TUBULAR HEATING ELEMENTS



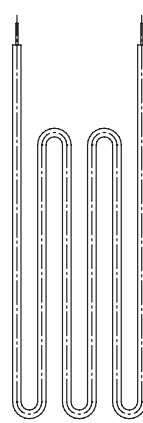
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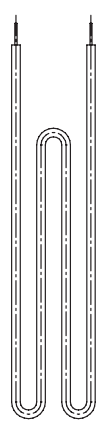
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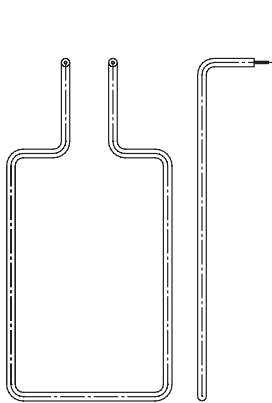
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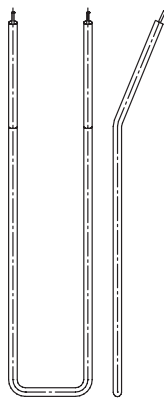
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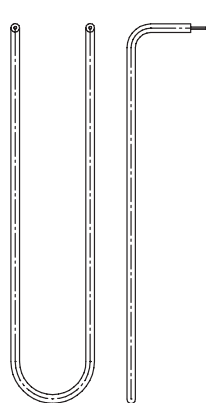
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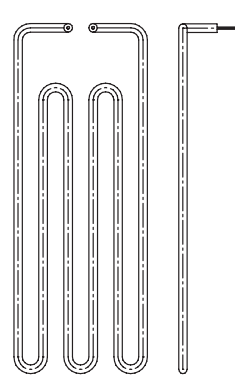
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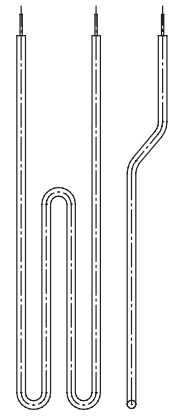
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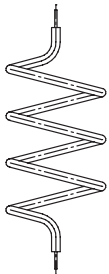
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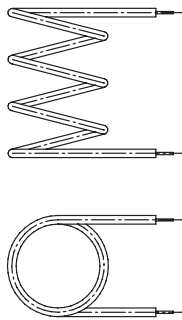
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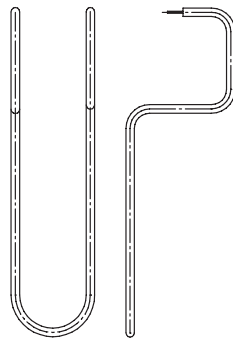
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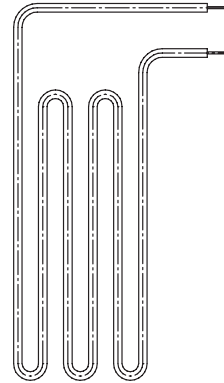
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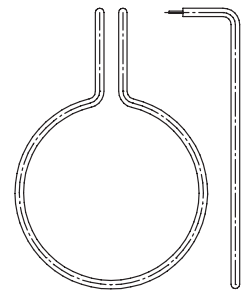
L



M



N



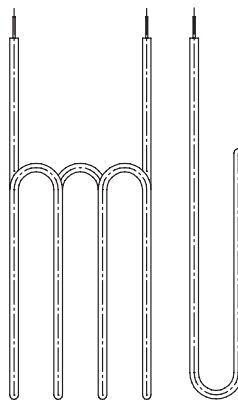
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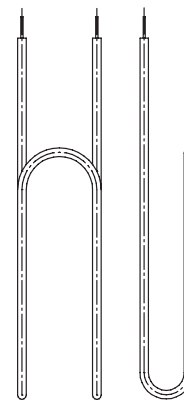
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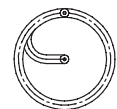
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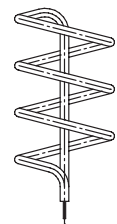
R



S



T



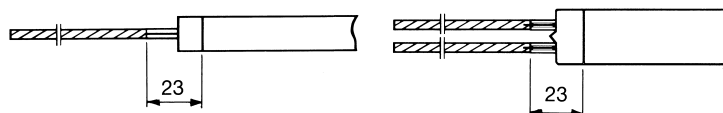
## FIXING AND CONNECTING DEVICES

When selecting connecting and fixing devices it is often important to bear in mind the size of the series. In this section we include the most frequent alternatives, which also can be considered as standard.

Cost savings can often be made if elements are fitted with connecting and fixing devices during manufacture. We can also supply special flanges and alternative methods of fixing, completely according to your requirements.

### WIRING TYPES

The heating elements may be supplied with connecting wiring which is normally spot welded to the terminal bolts. Uninsulated as well as insulated wiring is available. Uninsulated wiring can be fitted with insulative tubing. The joint between the wiring and the terminal bolt can also be fitted with insulative tubing if required.



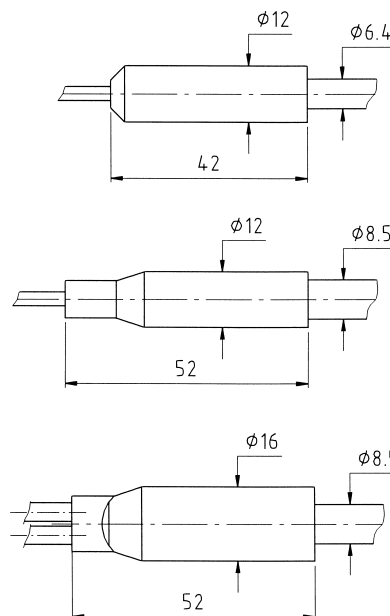
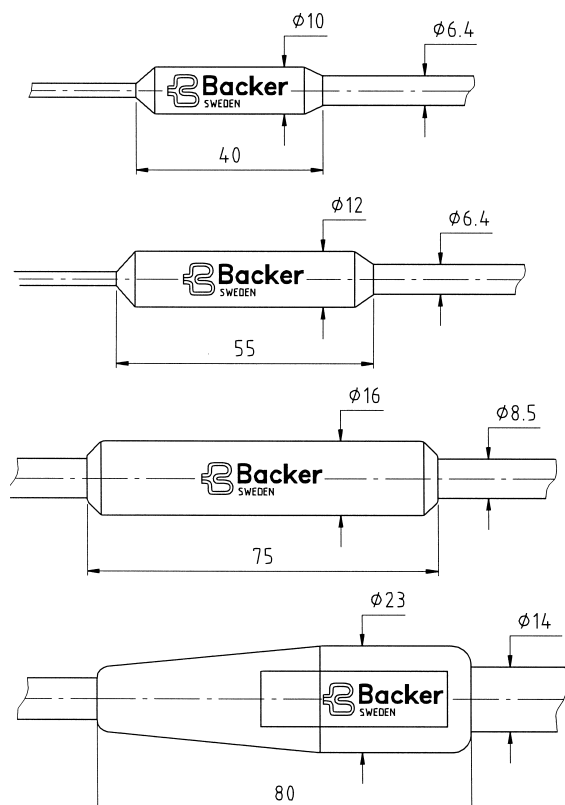
| Wiring material | Insulation material | Max. operating temperature (°C) |
|-----------------|---------------------|---------------------------------|
| Copper          | -                   | 180                             |
| Copper          | Silicone            | 180                             |
| Copper          | Fiberglass/silicone | 180                             |
| Nickel          | -                   | 400                             |
| Nickel          | Ceramic bushings    | 400                             |
| Nickel          | Fiberglass/silicone | 200                             |

### VULCANIZED/PLASTIC MOLDED CONNECTION

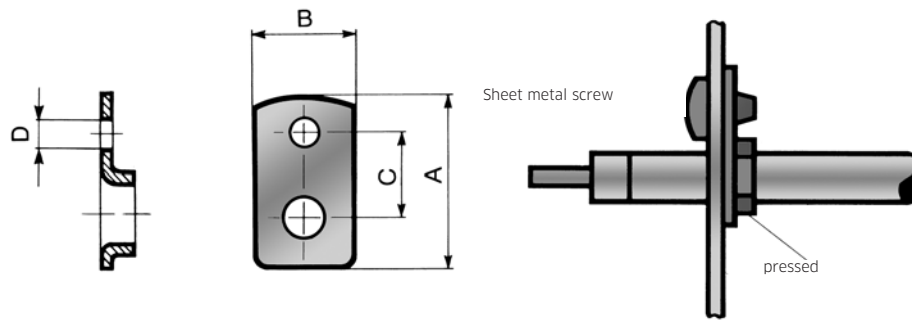
The heating elements may be vulcanized or molded with plastic together with rubber cable. The temperature of the element ends should not exceed 60°C. This design is suitable for instance at defrosting of refrigerators.

#### Vulcanized connections

#### Plastic molded connections

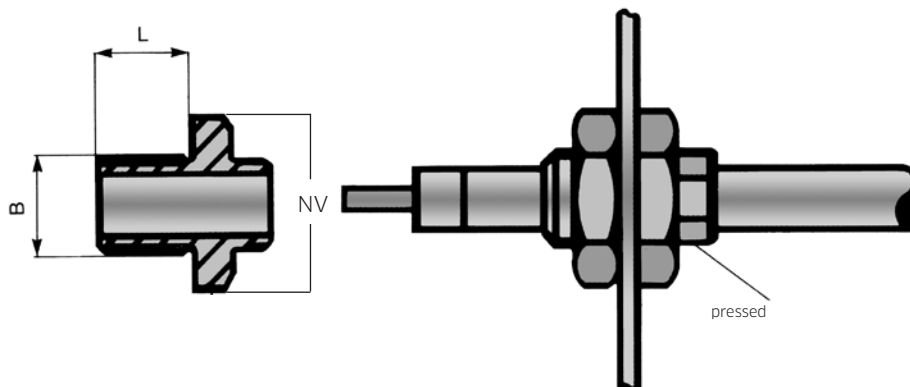


## FIXING PLATE PRESSED ON TO THE ELEMENT



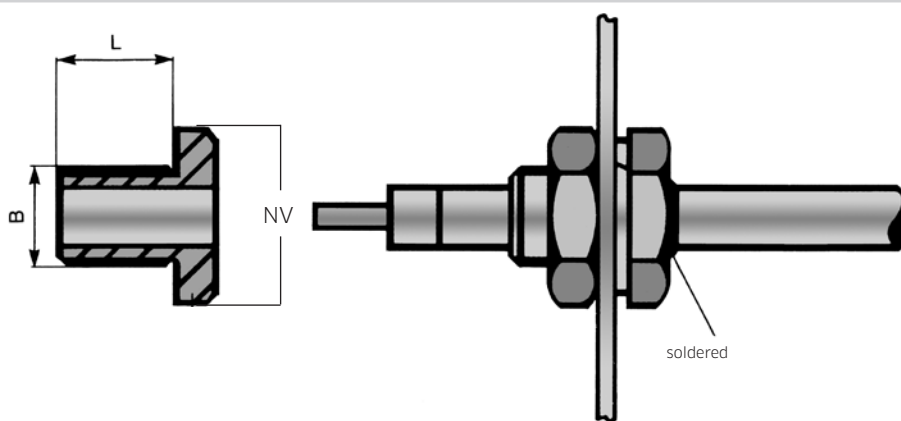
| ARTICLE NO.  | MATERIAL  | A  | B  | C  | D   | INTENDED FOR ELEMENT TYPES |     |     |
|--------------|-----------|----|----|----|-----|----------------------------|-----|-----|
|              |           |    |    |    |     | 064                        | 085 | 140 |
| 1140 544 004 | steel     | 25 | 12 | 15 | 3.3 | X                          |     |     |
| 1140 560 401 | steel     | 20 | 12 | 9  | 3.7 | X                          |     |     |
| 1140 519 104 | steell    | 36 | 15 | 20 | M4  |                            | X   |     |
| 1140 519 105 | steel     | 36 | 15 | 20 | 3.2 |                            | X   |     |
| 1140 563 201 | steel     | 24 | 15 | 11 | 4.2 |                            | X   |     |
| 1140 563 202 | steel     | 24 | 15 | 11 | 3.7 |                            | X   |     |
| 1140 563 203 | steel     | 24 | 15 | 11 | 2.8 |                            | X   |     |
| 1140 458 701 | steel     | 35 | 20 | 19 | 6.0 |                            |     | X   |
| 1140 458 703 | EN 1.4301 | 35 | 20 | 19 | 6.0 |                            |     | X   |

## NIPPLE - PRESSED ON TO THE ELEMENT



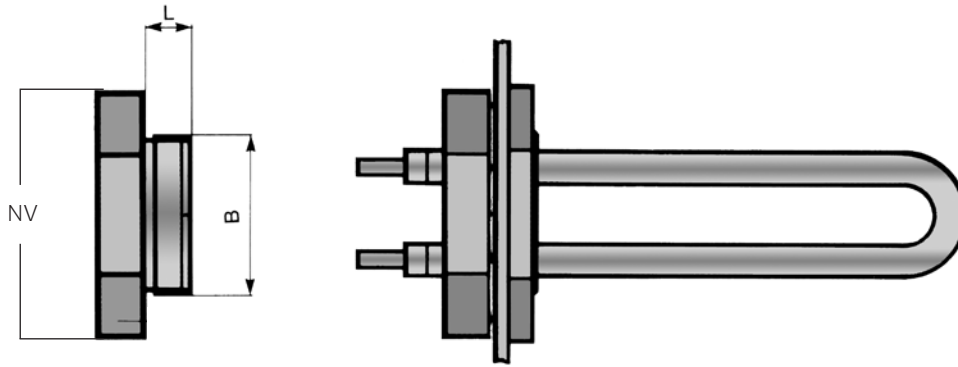
| ARTICLE NO.  | MATERIAL  | THREAD B   | THREAD LÄNGD L | NV   | INTENDED FOR ELEMENT TYPE |     |     |
|--------------|-----------|------------|----------------|------|---------------------------|-----|-----|
|              |           |            |                |      | 064                       | 085 | 140 |
| 1140 580 001 | AISI 1213 | M 10 x 1   | 10             | 16   | X                         |     |     |
| 1140 580 002 | AISI 303  | M 10 x 1   | 10             | 15   | X                         |     |     |
| 1140 580 003 | AISI 1213 | M 10 x 1   | 12             | 16   | X                         |     |     |
| 1140 720 501 | C 36000   | M 12 x 1   | 17             | 17   |                           | X   |     |
| 1140 723 401 | AISI 1213 | M 14 x 1.5 | 15             | 19   |                           | X   |     |
| 1140 723 403 | AISI 1213 | M 14 x 1.5 | 25             | 19   |                           | X   |     |
| 1140 723 404 | AISI 1213 | M 14 x 1.5 | 30             | 19   |                           | X   |     |
| 1140 723 405 | AISI 1213 | M 14 x 1.5 | 40             | 19   |                           | X   |     |
| 1140 723 408 | AISI 303  | M 14 x 1.5 | 15             | 19   |                           | X   |     |
| 1140 723 421 | AISI 1213 | M 14 x 1.5 | 10             | 19   |                           | X   |     |
| 1140 716 701 | AISI 1213 | M 24 x 1.5 | 15             | Ø 32 |                           |     | X   |
| 1140 549 602 | AISI 1213 | Pr 18.6    | 15             | 24   |                           |     | X   |
| 1140 549 603 | SS 2382   | Pr 18.6    | 15             | 24   |                           |     | X   |
| 1140 597 501 | AISI 1213 | Pr 22.5    | 10             | 24   |                           |     | X   |

## NIPPLE - SOLDERED TO THE ELEMENT



| ARTICLE NO.  | MATERIAL | THREAD B   | THREAD LENGTH L | NV   | INTENDED FOR ELEMENT TYPE |     |     |
|--------------|----------|------------|-----------------|------|---------------------------|-----|-----|
|              |          |            |                 |      | 064                       | 085 | 140 |
| 1140 519 801 | C 36000  | M 10 x 1   | 12              | 17   | X                         |     |     |
| 1140 519 803 | AISI 303 | M 10 x 1   | 12              | 17   | X                         |     |     |
| 1140 536 002 | C 36000  | M 12 x 1.5 | 16              | 18   | X                         |     |     |
| 1140 536 003 | AISI 303 | M 12 x 1.5 | 12              | 17   | X                         |     |     |
| 1140 722 801 | C 36000  | M 12 x 1   | 20              | 17   |                           | X   |     |
| 1140 723 202 | SS 1912  | M 14 x 1.5 | 15              | 19   |                           | X   |     |
| 1140 723 206 | SS 1912  | M 14 x 1.5 | 40              | 19   |                           | X   |     |
| 1140 723 208 | AISI 303 | M 14 x 1.5 | 12              | 19   |                           | X   |     |
| 1140 723 209 | AISI 303 | M 14 x 1.5 | 15              | 19   |                           | X   |     |
| 1140 723 210 | AISI 303 | M 14 x 1.5 | 20              | 19   |                           | X   |     |
| 1140 723 211 | AISI 303 | M 14 x 1.5 | 25              | 19   |                           | X   |     |
| 1140 723 213 | AISI 303 | M 14 x 1.5 | 40              | 19   |                           | X   |     |
| 1140 723 217 | C 36000  | M 14 x 1.5 | 12              | 19   |                           | X   |     |
| 1140 723 218 | C 36000  | M 14 x 1.5 | 15              | 19   |                           | X   |     |
| 1140 723 219 | C 36000  | M 14 x 1.5 | 20              | 19   |                           | X   |     |
| 1140 723 220 | C 36000  | M 14 x 1.5 | 25              | 19   |                           | X   |     |
| 1140 723 221 | C 36000  | M 14 x 1.5 | 30              | 19   |                           | X   |     |
| 1140 723 222 | C 36000  | M 14 x 1.5 | 40              | 19   |                           | X   |     |
| 1140 574 102 | C 36000  | M 14 x 1.5 | 10              | Ø 18 | X                         |     |     |
| 1140 544 901 | C 36000  | Pr 18.6    | 15              | 26   |                           |     | X   |
| 1140 544 903 | AISI 303 | Pr 18.6    | 15              | 27   |                           |     | X   |
| 1140 711 501 | SS 1912  | Pr 18.6    | 17              | Ø 31 |                           |     | X   |
| 1140 550 301 | C 36000  | G1/2"      | 15              | 26   |                           |     | X   |
| 1140 550 302 | AISI 303 | G1/2"      | 15              | 26   |                           |     | X   |

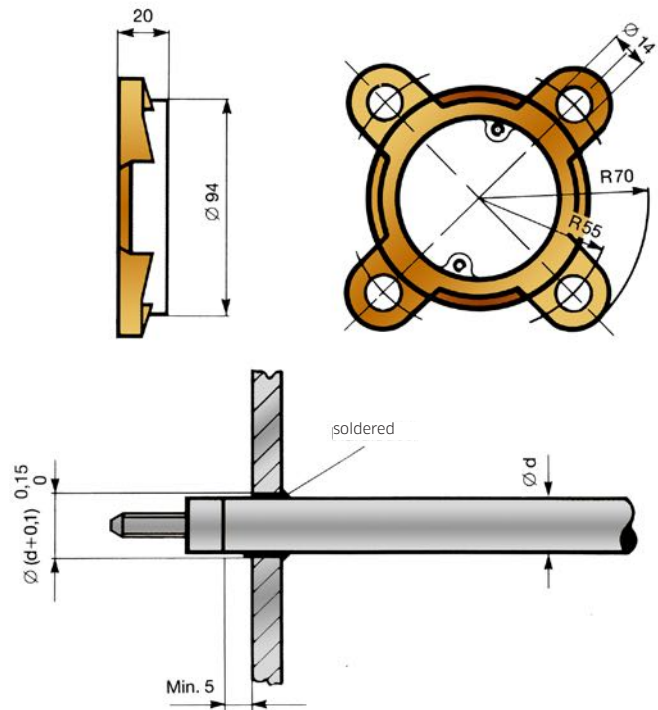
## ELEMENT HEAD - PIPE THREAD, SOLDERED ELEMENTS



| ARTICLE NO.  | MATERIAL      | THREAD B LENGTH L | THREAD | NV |
|--------------|---------------|-------------------|--------|----|
| 1140 629 605 | C 36000       | 1"                | 13     | 41 |
| 1140 514 901 | C 36000       | 1 1/4"            | 13     | 57 |
| 1140 536 503 | AISI 316      | 1 1/2"            | 16     | 57 |
| 1140 536 504 | SAE 1044/1045 | 1 1/2"            | 16     | 57 |
| 1140 679 001 | C 36000       | 1 1/2"            | 18     | 57 |
| 1140 547 101 | C 36000       | 2"                | 14     | 74 |
| 1140 667 603 | SAE 1044/1045 | 2"                | 19     | 74 |
| 1140 667 605 | AISI 303      | 2"                | 14     | 74 |
| 1140 667 602 | AISI 303      | 2"                | 19     | 74 |
| 1140 428 501 | C 36000       | 2 1/2"            | 16     | 74 |

## FLANGE - SOLDERED ELEMENTS

Over and above our standard, we can solder tubular heating elements to special flanges, nipples or plugs supplied either by ourselves or our clients. Such soldering would be carried out for instance according to this sketch.



| ARTICLE NO.  | MATERIAL |
|--------------|----------|
| 1130 360 001 | C 36000  |



# LIQUID HEATING



Water heating..... 18  
 Oil heating..... 19  
 Hydraulic oil heating..... 19



Accessories..... 20



Immersion heaters..... 21



Cast-in elements..... 23



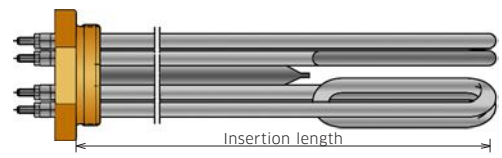
Barrel heaters..... 24



Flow through heaters..... 29

# SCREW PLUG IMMERSION HEATERS FOR WATER HEATING

## TUBULAR ELEMENTS IN COPPER

|  |  |
|--|--|
| <p>Tubular elements in copper C 12200<br/>                 Protective tubing with inner diam. 10.6 mm<br/>                 for thermostat and/or thermal cut-off.<br/>                 Brass plug.</p> |  |
|--|--|

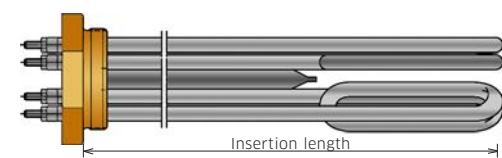
Brass plug G 11/4"

| TYPE | POWER<br>W      | VOLTAGE<br>V | INSERTION LENGTH<br>MM | ARTICLE NO.  |
|------|-----------------|--------------|------------------------|--------------|
| IU20 | 1x500+<br>2x750 | 230          | 215                    | 2530 607 301 |

Brass plug G 2"

| TYPE  | POWER<br>W | VOLTAGE<br>V | INSERTION LENGTH<br>MM | ARTICLE NO.  | TYPE  | POWER<br>W | VOLTAGE<br>V | INSERTION LENGTH<br>MM | ARTICLE NO.  |
|-------|------------|--------------|------------------------|--------------|-------|------------|--------------|------------------------|--------------|
| IU31  | 1500       | 230/400      | 180                    | 2520 341 001 | IU311 | 9000       | 230/400      | 390                    | 2520 341 009 |
| IU33  | 2250       | 230/400      | 230                    | 2520 341 002 | IU312 | 10500      | 230/400      | 860                    | 2520 341 010 |
| IU34  | 3000       | 230/400      | 280                    | 2520 341 003 | IU313 | 12000      | 230/400      | 985                    | 2520 341 011 |
| IU36  | 4500       | 230/400      | 390                    | 2520 341 005 | IU314 | 13500      | 230/400      | 1085                   | 2520 341 012 |
| IU39  | 6000       | 230/400      | 390                    | 2520 341 007 | IU315 | 15000      | 3 x 400      | 1235                   | 2520 341 013 |
| IU310 | 7500       | 230/400      | 390                    | 2520 341 008 | IU611 | 9000       | 230/400      | 400                    | 2520 539 302 |

## TUBULAR ELEMENTS IN STAINLESS STEEL WITH BRASS HEAD

|  |  |
|--|--|
| <p>Tubular element in stainless acidproof steel EN 1.4404.<br/>                 Protective tubing with inner diam. 10.6 mm for thermostat and/or thermal cut-off.<br/>                 Brass head.</p> |  |
|--|--|

Brass plug G 1" (without protective tubing)

| TYPE | POWER<br>W   | VOLTAGE<br>V | INSERTION LENGTH<br>MM | ARTICLE NO.  | TYPE | POWER<br>W    | VOLTAGE<br>V | INSERTION LENGTH<br>MM | ARTICLE NO.  |
|------|--------------|--------------|------------------------|--------------|------|---------------|--------------|------------------------|--------------|
| IU21 | 1x250+1x750  | 230          | 320                    | 3020 398 001 | IU23 | 1x725+1x1225  | 230          | 450                    | 3020 398 003 |
| IU22 | 1x500+1x1000 | 230          | 355                    | 3020 398 002 | IU24 | 1x1250+1x1750 | 230          | 475                    | 3020 398 004 |

Brass plug G 11/4"

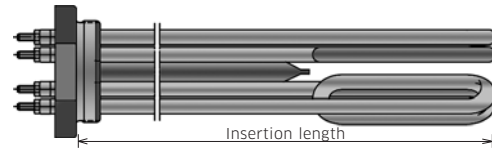
| TYPE | POWER<br>W   | VOLTAGE<br>V | INSERTION LENGTH<br>MM | ARTICLE NO.  | TYPE | POWER<br>W    | VOLTAGE<br>V | INSERTION LENGTH<br>MM | ARTICLE NO.  |
|------|--------------|--------------|------------------------|--------------|------|---------------|--------------|------------------------|--------------|
| IU25 | 1x500+1x500  | 230          | 160                    | 3020 398 101 | IU27 | 1x670+1x1330  | 230          | 255                    | 3020 398 103 |
| IU26 | 1x500+1x1000 | 230          | 255                    | 3020 398 102 | IU29 | 1x1000+1x2000 | 230          | 380                    | 3020 398 104 |

Brass plug G 2"

| TYPE   | POWER<br>W | VOLTAGE<br>V | INSERTION LENGTH<br>MM | ARTICLE NO.  | TYPE   | POWER<br>W | VOLTAGE<br>V | INSERTION LENGTH<br>MM | ARTICLE NO.  |
|--------|------------|--------------|------------------------|--------------|--------|------------|--------------|------------------------|--------------|
| IU31R  | 1500       | 230/400      | 180                    | 2520 391 501 | IU3R   | 12000      | 3x400        | 755                    | 2520 387 504 |
| IU3R   | 2000       | 230/400      | 260                    | 2520 391 502 | IU3R   | 15000      | 3x400        | 900                    | 2520 387 505 |
| IU34R  | 3000       | 230/400      | 280                    | 2520 548 001 | IU315R | 15000      | 3x400        | 1235                   | 2530 397 706 |
| IU36R  | 4500       | 230/400      | 390                    | 2520 548 002 | IU3R   | 20000      | 3x400        | 900                    | 2520 387 506 |
| IU39R  | 6000       | 230/400      | 390                    | 2520 548 003 | IU3R   | 23300      | 3x400        | 900                    | 2520 387 507 |
| IU311R | 9000       | 3x400        | 390                    | 2520 548 004 | IU611R | 9000       | 230/400      | 400                    | 2520 539 303 |
| IU3R   | 9000       | 3x400        | 755                    | 2520 548 005 |        |            |              |                        |              |

## TUBULAR ELEMENTS IN STAINLESS STEEL WITH STAINLESS STEEL PLUG

Tubular element in stainless steel EN 1.4404  
Protective tubing with inner diam 10.6 mm  
for thermostat and/or thermal cut-off.  
Plug G 2" in stainless steel EN 1.4305.



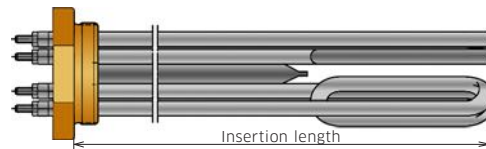
Stainless steel plug G2"

| TYPE  | POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  | TYPE  | POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  |
|-------|---------|-----------|---------------------|--------------|-------|---------|-----------|---------------------|--------------|
| IU34S | 3000    | 230/400   | 280                 | 2520 391 601 | IU39S | 6000    | 230/400   | 540                 | 2520 391 602 |

## SCREW PLUG IMMERSION HEATERS FOR OIL HEATING

### TUBULAR ELEMENTS IN STAINLESS STEEL WITH BRASS PLUG

Tubular elements in stainless acidproof steel EN 1.4404.  
Protective tubing with inner diam 10.6 mm for thermostat  
and/or thermal cut-off.  
Brass plug G 2"



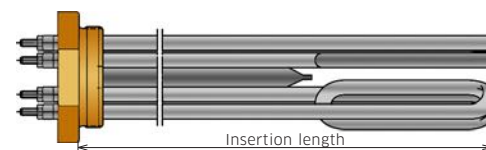
Surface load approx 2.7 W/cm<sup>2</sup>

| TYPE | POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  | TYPE | POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  |
|------|---------|-----------|---------------------|--------------|------|---------|-----------|---------------------|--------------|
| OE31 | 1000    | 230/400   | 270                 | 2530 341 405 | OE36 | 4500    | 230/400   | 815                 | 2530 341 403 |
| OE33 | 2000    | 230/400   | 435                 | 2530 341 401 | OE39 | 6000    | 230/400   | 1085                | 2530 341 404 |
| OE34 | 3000    | 230/400   | 555                 | 2530 341 402 |      |         |           |                     |              |

## SCREW PLUG IMMERSION HEATERS FOR HYDRAULIC OIL HEATING

### TUBULAR ELEMENT IN STAINLESS STEEL WITH BRASS HEAD


Tubular elements in stainless acidproof steel EN 1.4404.  
Protective tubing with inner diam 10,6 mm for thermostat  
and/or thermal cut-off.  
Brass plug G 2"





Surface load approx 0.9 W/cm<sup>2</sup>


| TYPE  | POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  | TYPE  | POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  |
|-------|---------|-----------|---------------------|--------------|-------|---------|-----------|---------------------|--------------|
| OE311 | 330     | 230/400   | 270                 | 2530 490 205 | OE361 | 1500    | 230/400   | 815                 | 2530 490 203 |
| OE331 | 670     | 230/400   | 435                 | 2530 490 201 | OE391 | 2000    | 230/400   | 1085                | 2530 490 204 |
| OE341 | 1000    | 230/400   | 555                 | 2530 490 202 |       |         |           |                     |              |


## ACCESSORIES FOR IMMERSION HEATERS

| Nut in brass. |              |  |
|---------------|--------------|---|
| DIMENSION     | ARTICLE NO.  |   |
| 1 ¼"          | 1140 485 403 |   |
| 1 ½"          | 1140 485 404 |   |
| 2"            | 1140 485 405 |   |

| Extension sleeve for G 2" immersion heaters |              |  |
|---|--------------|---|
| LENGTH MM                                   | ARTICLE NO.  |   |
| 50  | 1130 692 801 |   |
| 100   | 1130 692 802 |   |
| 150   | 1130 692 803 |   |
| 200   | 1130 692 804 |   |

| Reduction nipple |              |  |
|------------------|--------------|---|
| DIMENSION        | ARTICLE NO.  |   |
| 1 ½"-1 ¼"        | 1160 135 701 |   |

| Socket key for G 2" immersion heaters |              |  |
|---------------------------------------|--------------|---|
| DIMENSION                             | ARTICLE NO.  |   |
| 2"                                    | 1160 143 201 |   |

| Gasket    |          |  |
|-----------|----------|---|
| DIMENSION | MATERIAL | ARTICLE NO.   |
| 1 ¼"      | Copper   | 1140 408 702  |
| 1 ½"      | Copper   | 1140 408 703  |
| 2"        | Copper   | 1140 408 704  |
| 1 ¼"      | Fibre    | 1140 577 704  |
| 2"        | Fibre    | 1140 577 706  |

## OVER THE SIDE IMMERSION HEATERS

Examples of applications:

Chemical baths, baths for deacidification, batghs for degreasing etc.

Available in:

Protection class IP55

Teflon coating can be added.

Connection: cable

Over the side immersion heaters can also be produced after customer specification

Submersible oil heater

Material: Stainless steel EN 1.4301/SS 23333

Surface load: 0.9 W/cm

Connection: 4m cable, 3x1.0mm

Safety: CE-marked acc. to LVD, 2006/95/CE

Hysteresis: 11°C

Others: Heater complete with thermostat



| POWER W | VOLTAGE V | CUTTING TEMP.°C | DIMENSION L X B X Ø MM | ARTICLE NO.  |
|---------|-----------|-----------------|------------------------|--------------|
| 250     | 230       | 40              | 225 x 74 x 67          | 6150 432 301 |
| 500     | 230       | 40              | 325 x 74 x 67          | 6150 432 302 |
| 1000    | 230       | 40              | 525 x 74 x 67          | 6150 432 303 |
| 250     | 230       | 20              | 225 x 74 x 67          | 6150 432 304 |
| 500     | 230       | 20              | 325 x 74 x 67          | 6150 432 305 |
| 1000    | 230       | 20              | 525 x 74 x 67          | 6150 432 306 |
| 250     | 24        | 20              | 225 x 74 x 67          | 6150 432 307 |
| 250     | 24        | 40              | 225 x 74 x 67          | 6150 432 308 |

Tubular heating element in stainless steel EN 1.4404.

Cold part 400 mm.

Thermostat 30-90°C.

1500 mm connection cable.



| POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  |
|---------|-----------|---------------------|--------------|
| 1500    | 230       | 800                 | 3060 191 501 |

Tube in steel. Cold part 150 mm.

Diameter 80/42.5 mm

2000 mm connection cable.



| POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  | POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  |
|---------|-----------|---------------------|--------------|---------|-----------|---------------------|--------------|
| 1000    | 230       | 600                 | 3081 806 010 | 2500    | 3x400     | 800                 | 3081 808 040 |
| 1500    | 230       | 600                 | 3081 806 028 | 3250    | 400       | 1000                | 3081 801 011 |
| 1500    | 400       | 600                 | 3081 806 036 | 3250    | 3x400     | 1000                | 3081 801 029 |
| 1500    | 230       | 800                 | 3081 808 016 | 4000    | 400       | 1200                | 3081 801 219 |
| 2500    | 230       | 800                 | 3081 808 024 | 4000    | 3x400     | 1200                | 3081 801 227 |
| 2500    | 400       | 800                 | 3081 808 032 |         |           |                     |              |

Tube in stainless steel EN 1.4404. Cold part 150mm.

Diameter 80/42.5 mm.

2000 mm connection cable.



| POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  | POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  |
|---------|-----------|---------------------|--------------|---------|-----------|---------------------|--------------|
| 1000    | 230       | 600                 | 3081 806 218 | 2500    | 3x400     | 800                 | 3081 808 248 |
| 1500    | 230       | 600                 | 3081 806 226 | 3250    | 400       | 1000                | 3081 801 045 |
| 1500    | 400       | 600                 | 3081 806 234 | 3250    | 3x400     | 1000                | 3081 801 052 |
| 1500    | 230       | 800                 | 3081 808 214 | 4000    | 400       | 1200                | 3081 801 243 |
| 2500    | 230       | 800                 | 3081 808 222 | 4000    | 3x400     | 1200                | 3081 801 250 |
| 2500    | 400       | 800                 | 3081 808 230 |         |           |                     |              |

## CONT. OVER THE SIDE IMMERSION HEATERS

Tube in titanium. Cold part 150 mm.  
Diameter 80/40 mm  
2000 mm connection cable.



| POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  | POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  |
|---------|-----------|---------------------|--------------|---------|-----------|---------------------|--------------|
| 1000    | 230       | 600                 | 3081 806 416 | 2500    | 3x400     | 800                 | 3081 808 446 |
| 1500    | 230       | 600                 | 3081 806 424 | 3250    | 400       | 1000                | 3081 801 078 |
| 1500    | 400       | 600                 | 3081 806 432 | 3250    | 3x400     | 1000                | 3081 801 086 |
| 1500    | 230       | 800                 | 3081 808 412 | 4000    | 400       | 1200                | 3081 801 276 |
| 2500    | 230       | 800                 | 3081 808 420 | 4000    | 3x400     | 1200                | 3081 801 284 |
| 2500    | 400       | 800                 | 3081 808 438 |         |           |                     |              |

Tube in glass. Cold part 150 mm. Diameter 80/44 mm.  
2000 mm connection cable.



| POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  | POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  |
|---------|-----------|---------------------|--------------|---------|-----------|---------------------|--------------|
| 1000    | 230       | 600                 | 3080 806 110 | 2500    | 400       | 800                 | 3080 808 132 |
| 1500    | 230       | 600                 | 3080 806 128 | 2500    | 3x400     | 800                 | 3080 808 140 |
| 1500    | 400       | 600                 | 3080 806 136 | 3250    | 400       | 1000                | 3080 801 111 |
| 1500    | 230       | 800                 | 3080 808 116 | 3250    | 3x400     | 1000                | 3080 801 129 |
| 2500    | 230       | 800                 | 3080 808 124 |         |           |                     |              |

Tube in porcelain. Cold part 150 mm.  
Diameter 80/45 mm.  
2000 mm connection cable.



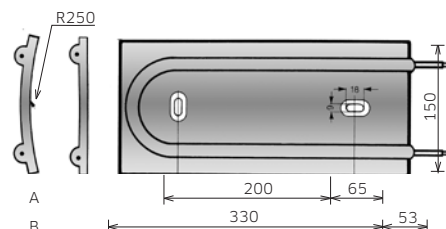
| POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  | POWER W | VOLTAGE V | INSERTION LENGTH MM | ARTICLE NO.  |
|---------|-----------|---------------------|--------------|---------|-----------|---------------------|--------------|
| 1000    | 230       | 600                 | 3080 806 011 | 2500    | 3x400     | 800                 | 3080 808 041 |
| 1500    | 230       | 600                 | 3080 806 029 | 3250    | 400       | 1000                | 3080 801 012 |
| 1500    | 400       | 600                 | 3080 806 037 | 3250    | 3x400     | 1000                | 3080 801 020 |
| 1500    | 230       | 800                 | 3080 808 017 | 4000    | 400       | 1200                | 3080 801 210 |
| 2500    | 230       | 800                 | 3080 808 025 | 4000    | 3x400     | 1200                | 3080 801 228 |
| 2500    | 400       | 800                 | 3080 808 033 |         |           |                     |              |

## CAST-IN TUBULAR HEATING ELEMENTS

Application area:  
Indirect liquid heating, heating tables, oil heating, etc.  
Assembly: Fixing to the object

### HEATING SHIELD

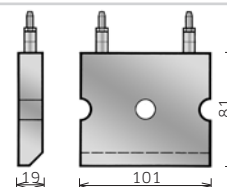
The heating shield consists of a  $\varnothing$  6.4 mm tubular element of stainless steel casted in silumin. The shield is positioned outside the tank and heats the liquid indirectly. As the heating is not in direct contact with the liquid it cannot be exposed to limescale or corrosion attacks.



| TYPE     | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE     | POWER W | VOLTAGE V | ARTICLE NO.  |
|----------|---------|-----------|--------------|----------|---------|-----------|--------------|
| A = Bent | 1000    | 230       | 2520 295 301 | B = Flat | 1000    | 230       | 2520 340 101 |
| A = Bent | 1000    | 400       | 2520 295 303 | B = Flat | 1000    | 400       | 2520 340 102 |

### HEATING PLATE

The heating plate consists of a  $\varnothing$  8.5 mm tubular element cast in silumin.



| TYPE          | POWER W | VOLTAGE V | ARTICLE NO.  |
|---------------|---------|-----------|--------------|
| Heating plate | 480     | 230       | 2530 396 901 |

### HEAT TRANSFER CEMENT

Heat transfer cement. Odourless, can be mixed with water.  
No danger of fire.  
0.8 kg is enough for 3 heating shields.



| TYPE | WEIGHT KG | ARTICLE NO.  | TYPE | WEIGHT KG | ARTICLE NO.  |
|------|-----------|--------------|------|-----------|--------------|
| Can  | 0.8       | 1160 123 801 | Can  | 6.5       | 1160 123 802 |

## DRUM & IBC HEATERS

Backer Drum and IBC heaters are specifically designed to heat viscous products and thereby facilitate emptying containers. They are also very effective for keeping heat and to avoid freezing. Ideal for heating water, oils, diesel, resin, petroleum jelly, wax e.g. lanolin, fats, butter e.g. butter oil, syrup, sugar and other industrial liquids or foods that must have a uniform temperature or viscosity.

The heaters are available with housings made of steel plate, silicone rubber, polyester and fiberglass fabric. They are also offered with different enclosure classes and are compatible with both digital or mechanical temperature control, depending on the purpose of use.

Can also be manufactured according to customer specifications.

### DRUM HEATER 30-110°C WITH CASING OF STEEL PLATE



| POWER W | VOLTAGE V | CONTAINER L | ARTICLE NO.  | POWER W | VOLTAGE V | CONTAINER L | ARTICLE NO.  |
|---------|-----------|-------------|--------------|---------|-----------|-------------|--------------|
| 1000    | 230       | 200         | 3056 800 113 | 2000    | 230       | 200         | 3056 800 139 |
| 1500    | 230       | 200         | 3056 800 121 |         |           |             |              |

### DRUM HEATER 0-120°C WITH CASING OF SILICONE RUBBER



| POWER W | VOLTAGE V | CONTAINER L | ARTICLE NO. | POWER W | VOLTAGE V | CONTAINER L | ARTICLE NO. |
|---------|-----------|-------------|-------------|---------|-----------|-------------|-------------|
| 1500    | 230       | 200         | 3051190701  | 800     | 230       | 200         | 3051190901  |
| 1000    | 230       | 200         | 3051190702  | 500     | 230       | 50-60       | 3051191001  |
| 1000    | 230       | 150         | 3051190801  | 300     | 230       | 25-30       | 3051191101  |



## DRUM HEATER 0-90°C WITH CASING OF POLYESTER



| POWER W | VOLTAGE V | CONTAINER L | ARTICLE NO. | POWER W | VOLTAGE V | CONTAINER L | ARTICLE NO. |
|---------|-----------|-------------|-------------|---------|-----------|-------------|-------------|
| 1200    | 230       | 200         | 3051191201  | 400     | 110       | 105         | 3051191403  |
| 1200    | 110       | 200         | 3051191203  | 300     | 230       | 50-60       | 3051191501  |
| 530     | 230       | 200         | 3051191301  | 300     | 110       | 50-60       | 3051191503  |
| 530     | 110       | 200         | 3051191303  | 225     | 230       | 25-30       | 3051191601  |
| 400     | 230       | 105         | 3051191401  | 225     | 110       | 25-30       | 3051191603  |

## DRUM HEATER 0-200°C WITH CASING OF GLASS FIBER FABRIC



| POWER W | VOLTAGE V | CONTAINER L | ARTICLE NO. | POWER W | VOLTAGE V | CONTAINER L | ARTICLE NO. |
|---------|-----------|-------------|-------------|---------|-----------|-------------|-------------|
| 1200    | 230       | 200         | 3051191701  | 700     | 230       | 105         | 3051191801  |
| 1200    | 110       | 200         | 3051191703  | 440     | 230       | 50          | 3051191901  |
| 1500    | 230       | 200         | 3051191702  | 380     | 230       | 25          | 3051192001  |

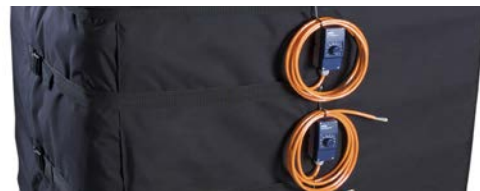
## CONT. DRUM & IBC HEATERS

### DRUM HEATER 0-120°C FOR FOOD & PHARMACEUTICALS



| POWER W | VOLTAGE V | CONTAINER L | ARTICLE NO. |
|---------|-----------|-------------|-------------|
| 1200    | 230       | 200         | 3051192101  |

### IBC HEATER 0-90°C WITH CASING OF POLYESTER



| POWER W | VOLTAGE V | SIZE MM   | ARTICLE NO. | POWER W | VOLTAGE V | SIZE MM   | ARTICLE NO. |
|---------|-----------|-----------|-------------|---------|-----------|-----------|-------------|
| 2x1000  | 230       | 4400-1000 | 3051192301  | 1300    | 230       | 4400-1000 | 3051192501  |
| 2x1000  | 110       | 4400-1000 | 3051192303  | 1300    | 110       | 4400-1000 | 3051192503  |
| 3x1000  | 230       | 4400-1000 | 3051192401  |         |           |           |             |

## BASE HEATER IN SILICONE FOR IBC CONTAINERS










| POWER W | VOLTAGE V | SIZE MM  | ARTICLE NO. |
|---------|-----------|----------|-------------|
| 2700    | 230       | 1035x851 | 3051393701  |

## BASE HEATER IN ALUMINIUM FOIL FOR IBC CONTAINERS



| POWER W | VOLTAGE V | SIZE MM  | ARTICLE NO. |
|---------|-----------|----------|-------------|
| 1080    | 230       | 1095x895 | 3051393802  |
| 1080    | 230       | 1095x895 | 3051393803  |
| 1400    | 230       | 1095x895 | 3051393801  |

## ACCESSORIES DRUM & IBC HEATERS

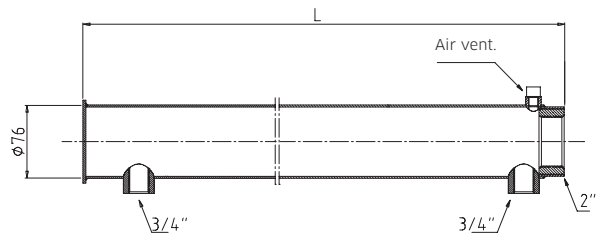
|  |                    |                         |   |                    |   |                    |
|--|--------------------|-------------------------|---|--------------------|---|--------------------|
| <p>Base drum heater<br/>50-300°C</p>                    |                    |                         | <p>Nylon insulation cover<br/>for 200L drums</p>       |                    | <p>Nylon insulation cover<br/>for IBC containers</p>   |                    |
| <b>DIMENSION<br/>MM</b>  | <b>W/V</b>         | <b>ARTICLE NO.</b>      | <b>DIMENSION</b>  | <b>ARTICLE NO.</b> | <b>DIMENSION</b>  | <b>ARTICLE NO.</b> |
| Ø555x105   | 1800W/230V         | 3051192702              | Other sizes on demand   | 3051192201         | Stand. size for 1000L cont.   | 3051393402         |
| <p>Base drum heater<br/>0-120°C</p>                    |                    |                         | <p>PVC protection cover<br/>for IBC containers</p>    |                    | <p>Cordura top protection<br/>for IBC containers</p>  |                    |
| <b>DIMENSION<br/>MM</b>  | <b>W/V</b>         | <b>ARTICLE NO.</b>      | <b>DIMENSION</b>  | <b>ARTICLE NO.</b> | <b>DIMENSION</b>  | <b>ARTICLE NO.</b> |
| Ø550x105   | 900W/230V          | 3051192701              | Stand. size for 1000L cont.   | 3051192602         | Stand. size for 1000L cont.   | 3051192601         |
| <p>Nylon insulation cover<br/>for IBC containers</p>  |                    |                         | <p>Cordura insulation cover for IBC containers</p>  |                    |   |                    |
| <b>DIMENSION</b>   | <b>ARTICLE NO.</b> | <b>DIMENSION<br/>MM</b> | <b>ARTICLE NO.</b>  |                    |   |                    |
| Stand. size for 1000L cont.  | 3051393501         | 4400x1000               | 3051393401  |                    |   |                    |

## TUBES FOR FLOW-THROUGH HEATERS

Application:  
Water heating, oil heating, etc.

### SUITED FOR IMMERSION HEATER WITH G 2" CONNECTION

Elements in stainless steel EN 1.4404 max. 5 bar. Connection G 3/4" for in - and outlet.  
Cell rubber insulation for mounting on tubes.  
Thickness 10 mm.



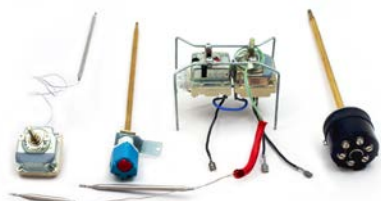
| LENGTH MM | ARTICLE NO.  | INSULATION FOR FLOW-THROUGH TUBE | ARTICLE NO.  |
|-----------|--------------|----------------------------------|--------------|
| 320       | 3050 308 301 | 3050 308 301                     | 1150 420 501 |
| 465       | 3050 308 302 | 3050 308 302                     | 1150 420 502 |
| 585       | 3050 308 303 | 3050 308 303                     | 1150 420 503 |
| 850       | 3050 308 304 | 3050 308 304                     | 1150 420 504 |
| 965       | 3050 308 305 | 3050 308 305                     | 1150 420 505 |



# TEMP.CONTROL/-MEASUREMENT AND TERMINAL BOXES



Terminal boxes..... 31



Thermostats/thermal cut-offs..... 33



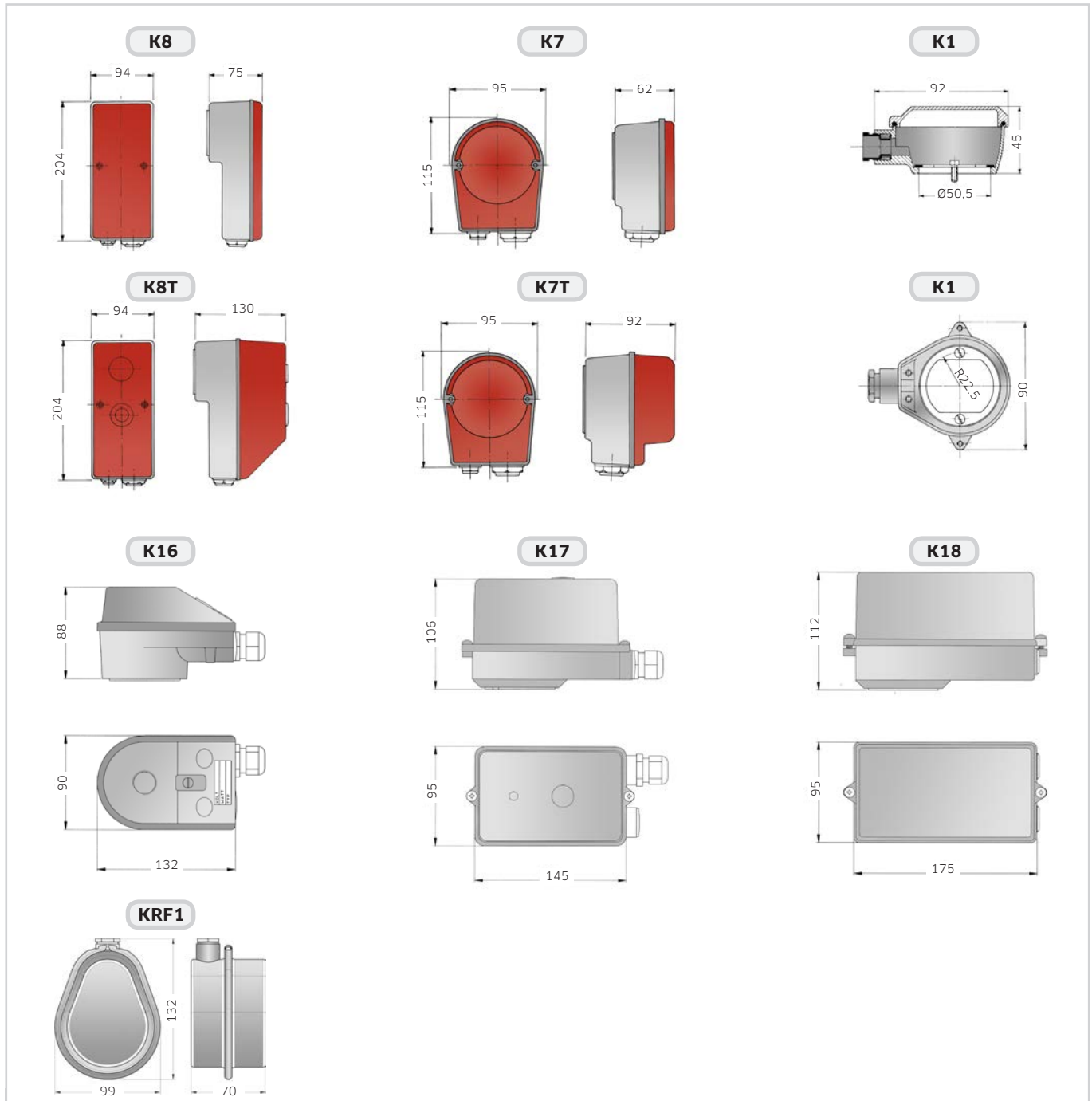
Control devices, regulators  
and sensors..... 36  
Backer temperature control unit - BCU..... 36  
Solid state relays ..... 37  
Temperature sensors ..... 37

# TERMINAL BOXES

For mounting on our standard or special manufactured immersion heaters for liquid heating.

The terminal boxes can be delivered empty or with thermostat and/or thermal cut-offs.

## TERMINAL BOXES



| TYPE | DESIGNED FOR | ARTICLE NO.  |
|------|--------------|--------------|
| K1   | 1 ¼"-1 ½"    | 1130 397 201 |
| K7   | 1 ¼"-2"      | 1130 541 001 |
| K7T  | 1 ¼"-2"      | 1130 541 101 |
| K8   | 2"           | 1125 001 003 |
| K8T  | 2"           | 1125 001 002 |
| K16  | 2"           | 1120 548 202 |
| K17  | 2"           | 1120 548 301 |
| K18  | 2"           | 1120 548 502 |
| KRF1 | 2"           | 3019 900 349 |

## TERMINAL BOXES WITH THERMOSTAT AND/OR THERMAL CUT-OFFS

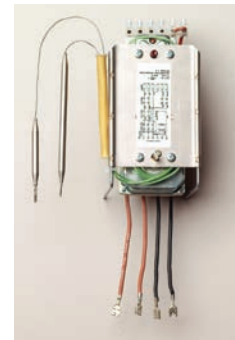
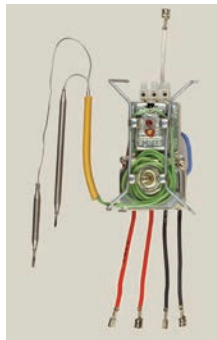
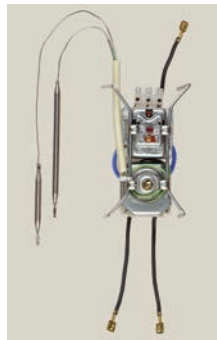
|      |              | K11/K12        |                       | K13                  |                       |              |  |
|------|--------------|----------------|-----------------------|----------------------|-----------------------|--------------|--|
|      |              |                |                       |                      |                       |              |  |
| TYPE | DESIGNED FOR | THERMOSTAT     | BREAKING CAPACITY A/V | THERMAL CUT-OFF PART | BREAKING-CAPACITY A/V | ARTICLE NO.  |  |
| K11A | 2"           | 2-pole 30-90°C | 16/400                | 3-pole 110°C         | 20/400                | 1120 332 701 |  |
| K12A | 2"           | 1-pole 30-90°C | 16/400                | 3-pole 110°C         | 20/400                | 1120 332 801 |  |
| K13A | 2"           | -              | -                     | 3-pole 110°C         | 20/400                | 1120 332 901 |  |
| K13A | 2"           | -              | -                     | 3-pole 65°C          | 20/400                | 1120 332 905 |  |
| K15A | 2"           | 2-pole 0-50°C  | 16/400                | 3-pole 65°C          | 20/400                | 1120 391 801 |  |

| <p>If mounting on 2" plugs assembly kit 1150710301 shall be used.</p> |              |                       |                 |                      |              |  |  |
|---|--------------|-----------------------|-----------------|----------------------|--------------|--|--|
| TYPE  | DESIGNED FOR | BREAKING CAPACITY A/V | THERMOSTAT PART | THERMAL CUT-OFF PART | ARTICLE NO.  |  |  |
| K31A  | 1 ½"-2"      | 20/400                | 3-pole 25-85°C  | 3-pole 110°C         | 1150 666     |  |  |
| Assembly kit  | 2"           |                       |                 |                      | 1150 710 301 |  |  |

| <p>Terminal box with electronic controller. User-friendly with push buttons for desired setpoint and hysteresis.</p> <p>LED display for monitoring setpoints, process value and setup. K7E fits our element heads from 1¼" to 2½".</p> <p>K7E is designed to operate stand-alone or with other external control systems.</p> |                            |  |                   |                |             |  |  |
|--|----------------------------|--|-------------------|----------------|-------------|--|--|
| TYPE   | SUPPLY VOLTAGE             | POWER RANGE OF HEATING UNITS USED            | MEASUREMENT RANGE | SETPOINT RANGE | ARTICLE NO. |  |  |
| K7E  | 230 VAC +N or 3x400 VAC +N | From 1000 W to 12000 W is adjustable 1- 10°C | -45°C - 195°C     | 5°C - 90°C     | 1151409701  |  |  |



## STEERING BASKETS FOR TERMINAL BOX K17 AND K18

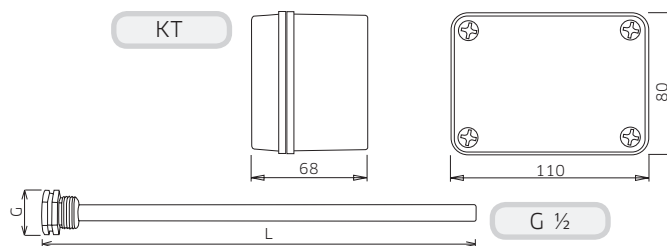


| TYPE | DESIGNED THERMOSTAT FOR | BREAKING CAPACITY A/V | THERMAL CUT-OFF | BREAKING CAPACITY A/V | ARTICLE NO.  |
|------|-------------------------|-----------------------|-----------------|-----------------------|--------------|
| S17A | K17 2-pole 30-90°C      | 16/400                | 3-pole 110°C    | 20/400                | 1130 685 401 |
| S17D | K17 -                   |                       | 3-pole 110°C    | 20/400                | 1130 710 201 |
| S17B | K17 2-pole 0-50°C       | 16/400                | 3-pole 65°C     | 20/400                | 1130 685 402 |
| S17C | K17 4-pole 30-90°C      | 16/400                | 3-pole 110°C    | 20/400                | 1130 685 801 |
| S18A | K18 4-pole 30-90°C      | 16/400                | 3-pole 110°C    | 20/400                | 1120 550 701 |

Contactor and time relay

## TERMINAL BOX AND PROTECTION TUBES

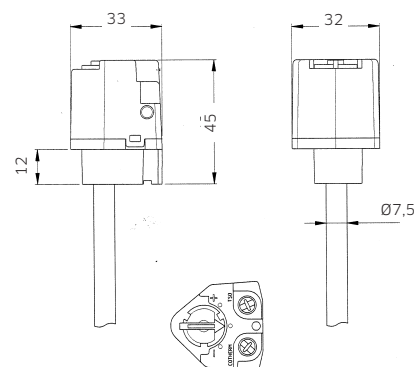
Plastic terminal box and protection tube designed to be used for separate mounting of stick thermostat type TSDH/TSDO



| TYPE | LENGTH MM | THREAD | ARTICLE NO.  |
|------|-----------|--------|--------------|
| KT   |           |        | 1140 839 001 |
| G1/2 | 140       | 1/2"   | 1160 052 501 |
| G1/2 | 280       | 1/2"   | 1160 052 502 |

## THERMOSTATS

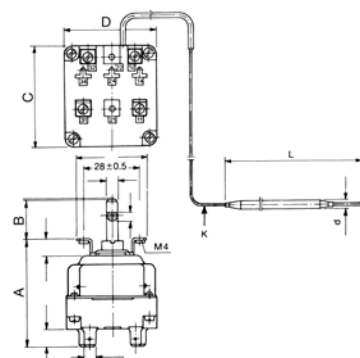
Rod type T-sprooved 120°C, breaking capacity 20A/240V



| TYPE      | FUNCTION        | CONTROL AREA °C | ROD LENGTH | ARTICLE NO.  |
|-----------|-----------------|-----------------|------------|--------------|
| TSDH 0702 | Breaking 1-pole | 10-90           | 180        | 1160 156 701 |
| TSDO 1103 | Breaking 1-pole | 3-55            | 270        | 1160 156 702 |
| TSDH 1104 | Breaking 1-pole | 38-90           | 270        | 1160 156 703 |
| TSDH 1103 | Breaking 1-pole | 58-110          | 270        | 1160 156 704 |
| TSDH 1102 | Breaking 1-pole | 98-150          | 270        | 1160 156 705 |
| TSDH 1106 | Breaking 1-pole | 130-182         | 270        | 1160 156 706 |

Capillary tube design T-approved 150°C, breaking capacity 16A/400V

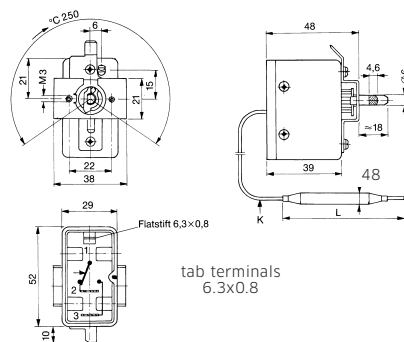
|                  | A mm | B mm | C mm | D mm | D bulb Ø mm | L Bulb length mm | K Capillary tube |
|------------------|------|------|------|------|-------------|------------------|------------------|
| 1-pole           | 28   | 18   | 51.5 | 35   | 4           | 240              | 370              |
| 2-pole           | 53.5 | 19   | 50   | 46   | 6           | 130              | 400              |
| 3-pole           | 53.5 | 19   | 50   | 46   | 6           | 240              | 420              |
| 4-pole           | 53.5 | 23   | 50   | 60   | 6           | 130              | 800              |
| 2-pole<br>0-50°C | 53.5 | 19   | 50   | 46   | 4           | 240              | 370              |



| TYPE | FUNCTION         | CONTROL-AREA °C | ARTICLE NO.  |
|------|------------------|-----------------|--------------|
| EGO  | Breaking 1-pole  | 30-90           | 1160 127 401 |
| EGO  | Breaking 2-pole  | 30-90           | 1160 119 201 |
| EGO  | Switching 3-pole | 30-90           | 1160 047 501 |
| EGO  | Breaking 4-pole  | 30-90           | 1160 210 401 |
| EGO  | Breaking 2-pole  | 0-50            | 1160 160 501 |

Capillary tube design T-approved 120°C.  
Breaking capacity 16A/240V

| Bulb diameter d mm | Bulb length L mm | Capillary tube length K mm |
|--------------------|------------------|----------------------------|
| 6                  | 92               | 1150                       |
| 8                  | 150              | 1000                       |

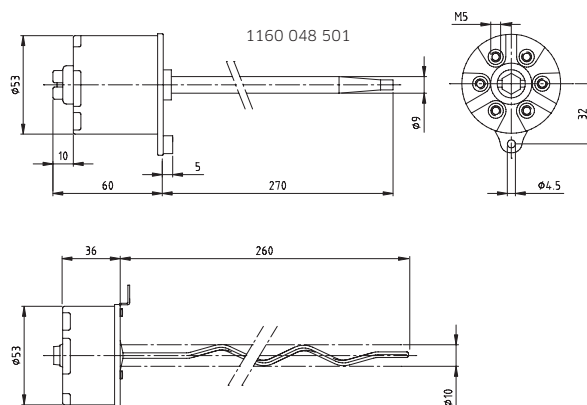


| TYPE | FUNCTION         | CONTROL AREA °C | ARTICLE NO.  |
|------|------------------|-----------------|--------------|
| Jumo | Switching 1-pole | 0-200           | 1160 156 301 |
| Jumo | Switching 2-pole | 20-500          | 1160 156 303 |

## THERMAL CUT-OFF

Rod type T-approved 100°C.  
Breaking capacity 40A/400V

| Rod diameter d mm | Rod length L mm |
|-------------------|-----------------|
| 9                 | 270             |
| 9                 | 270             |

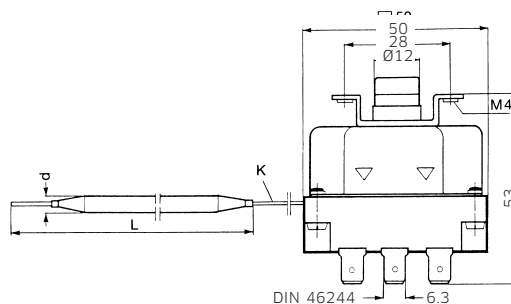


| TYPE   | FUNCTION        | BREAKING TEMP °C | RESETTING | ARTICLE NO.  |
|--------|-----------------|------------------|-----------|--------------|
| Stibel | Breaking 3-pole | 110 +0-15        | Manual    | 1160 048 501 |
| Stibel | Breaking 3-pole | 140 +0-30        | Manual    | 1160 048 601 |

## CONT. THERMOSTATS

Capillary tube design T-aorived 125°C,  
Breaking capacity 20A/400V

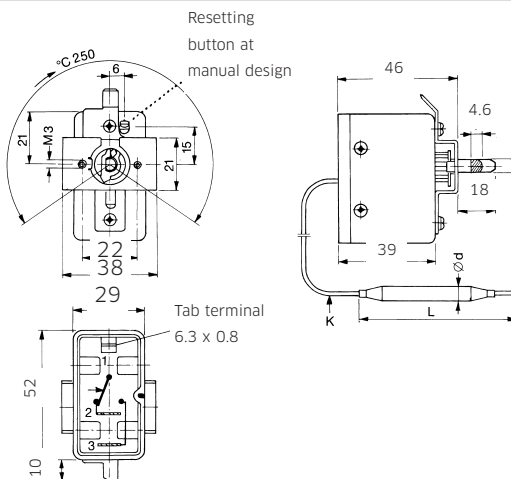
| Bulb diameter<br>d mm | Bulb lenght<br>L mm | Capillary tube<br>length K mm |
|-----------------------|---------------------|-------------------------------|
| 6                     | 75                  | 540                           |
| 4                     | 230                 | 420                           |



| TYPE | FUNCTION        | BREAKING TEMP °C | RESETTING | ARTICLE NO.  |
|------|-----------------|------------------|-----------|--------------|
| EGO  | Breaking 3-pole | 110 +0-8         | Manual    | 1160 119 301 |
| EGO  | Breaking 3-pole | 65 +0-6          | Manual    | 1160 160 601 |

Capillary tube design T-approved 120°C, Breaking capaci-  
ty 10A/400V

| Bulb diameter<br>d mm | Bulb length<br>L mm | Capillary tube<br>length K mm |
|-----------------------|---------------------|-------------------------------|
| 6                     | 92                  | 1150                          |
| 8                     | 150                 | 1000                          |



| TYPE | FUNCTION         | BREAKING TEMP °C | RESETTING | ARTICLE NO.  |
|------|------------------|------------------|-----------|--------------|
| JUMO | Switching 1-pole | 0-200            | Manual    | 1160 156 302 |
| JUMO | Switching 1-pole | 20-500           | Manual    | 1160 156 304 |

## REGULATORS AND SENSORS

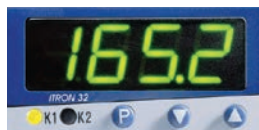
### iTRON 32

Display for actual or set value.

1 entrance free programmable for e.g. Pt100 temperature sensor or thermo element

2 exits, relay and 0/5V for solid state relay

Autotune, front frame 48x24 mm



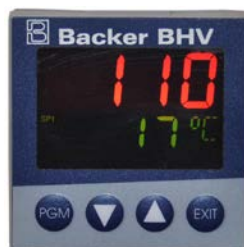
### dTRON 316

2 displays for actual or set value

1 entrance free programmable for e.g. Pt100 temperature sensor or thermo element, eg. "K" or "J".

5 exits, 3 relays and 2 0/12V for solid state relays

Autotune, front frame 48x48 mm



#### TYPE

#### ARTICLE NO.

iTRON 32

3000 382 105

dTRON 316

3000 345 761

## BACKER TEMPERATURE CONTROL UNIT - BCU

Complete and universal temperature control for smooth temperature control and high precision. Control box provided with Backer PID regulator, internal fuses, switches and inputs and outputs for supply and load. The effect is controlled by the internal solid state relay.

#### Advantages

- Plug and Play for accurate heat control
- Flexible device for several functions
- Stable and robust construction
- Ease to use

#### Applications

- Lab environment
- Tests and experiments
- Basic process control



| MAX OP. TEMP. | MAX LOAD     | CONNECTION   | DIMENSIONS          | SENSORS  | ARTICLE NO. |
|---------------|--------------|--|---------------------|--|-------------|
| 1300°C        | 10A vid 230V | supplied with 2.5m grounded power cord and separate male connector for temperature sensor type K | W170 x H95 x D235mm | The control box is designed for sensor type K with standard connectors | 6150870401  |

## SOLID STATE RELAYS

TYA 432-45/25 265  
TYA 432-45/50 530

TYA 432-100/30 265  
TYA 432-100/30 660

TYA 432-100/45  
660

GTS

GTZ

GTF



For DIN-socket (not TYA 432-45)

| TYPE                | TECHNICAL INFO                     | L x W x T           | ARTICLE NO.  |
|---------------------|------------------------------------|---------------------|--------------|
| TYA 432-45/25       | 25A, 265V                          | 59 x 45 x 29        | 3000 367 632 |
| TYA 432-45/50       | 50A, 530V                          | 59 x 45 x 32        | 3000 367 633 |
| TYA 432-100/30      | 30A, 265V with integr. heat sink   | 103/80 x 23 x 103   | 3000 367 634 |
| TYA 432-100/30      | 30A, 660V with integr. heat sink   | 103/80 x 23 x 103   | 3000 418 274 |
| TYA 432-100/45      | 45A, 660V with integr. heat sink   | 103/80 x 23 x 103   | 3000 367 636 |
| GTS-25/480-0        | 25A, 480V with integr. heat sink   | 122/100 x 24 x 107  | 3050 646 501 |
| GTS-40/480-0        | 40A, 480V with integr. heat sink   | 122/100 x 35 x 142  | 3050 646 502 |
| GTS-50/480-0        | 50A, 480V with integr. heat sink   | 122/100 x 60 x 142  | 3050 646 503 |
| GTS-60/480-0        | 60A, 480V with integr. heat sink   | 122/100 x 80 x 142  | 3050 646 504 |
| GTS-75/480-0        | 75A, 480V with integr. heat sink   | 122/100 x 127 x 142 | 3050 646 505 |
| GTS-90/480-0        | 90A, 480V with integr. heat sink   | 122/100 x 127 x 142 | 3050 646 506 |
| GTS-120/480-0       | 120A, 480V with integr. heat sink  | 122/100 x 127 x 142 | 3050 646 507 |
| GTZ-24/400-0-0      | 3x25A, 400V with integr. heat sink | 88/80 x 127 x 150   | 3050 596 301 |
| GTZ-25/480-0-0      | 3x25A, 480V with integr. heat sink | 88/88 x 127 x 150   | 3050 596 302 |
| GTZ-40/480-0-0      | 3x40A, 480V with integr. heat sink | 158/100 x 127 x 150 | 3050 596 303 |
| GTZ-55/480-0-0      | 3x55A, 480V with integr. heat sink | 158/100 x 127 x 150 | 3050 596 304 |
| GTF-25/480-0-0-0-0  | 25A, 480V with integr. heat sink   | 137/104 x 60 x 143  | 3050 968 401 |
| GTF-40/480-0-0-0-0  | 40A, 480V with integr. heat sink   | 137/104 x 60 x 143  | 3050 968 402 |
| GTF-50/480-0-0-0-0  | 50A, 480V with integr. heat sink   | 137/104 x 60 x 143  | 3050 968 403 |
| GTF-60/480-0-0-0-0  | 60A, 480V with integr. heat sink   | 148/104 x 80 x 143  | 3050 968 404 |
| GTF-75/480-0-0-0-0  | 75A, 480V with integr. heat sink   | 154/104 x 127 x 144 | 3050 968 405 |
| GTF-90/480-0-0-0-0  | 90A, 480V with integr. heat sink   | 154/104 x 127 x 144 | 3050 968 406 |
| GTF-120/480-0-0-0-0 | 120A, 480V with integr. heat sink  | 154/104 x 127 x 144 | 3050 968 407 |
| GTF-150/480-0-0-0-0 | 150A, 480V with integr. heat sink  | 302 x 109/84 x 158  | 3050 968 408 |
| GTF-200/480-0-0-0-0 | 200A, 480V with integr. heat sink  | 302 x 109/84 x 158  | 3050 968 409 |
| GTF-250/480-0-0-0-0 | 250A, 480V with integr. heat sink  | 302 x 109/84 x 158  | 3050 968 410 |

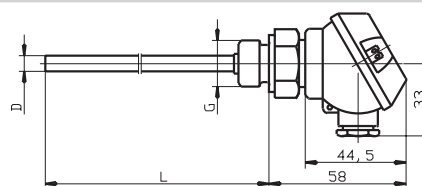
## TEMPERATURE SENSORS

Resistive sensors type Pt 100 for measuring of temperatures up to 600°C.

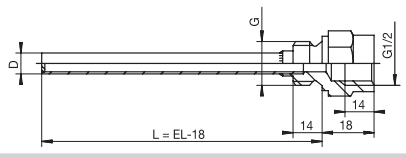
Thermo couple type J and K for measuring of temperatures up to 800 respectively 1150°C.

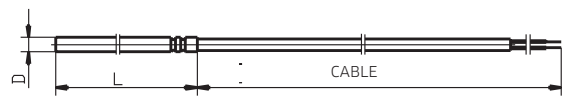
Typical application areas are ovens , climate-, cooling- and heating devices.

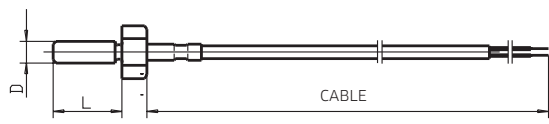
Pt 100 sensor for temperature measurement in gases and liquids

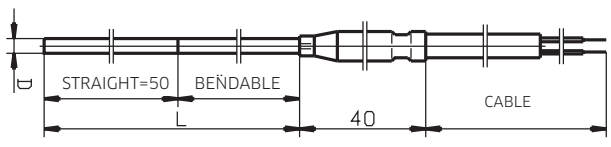


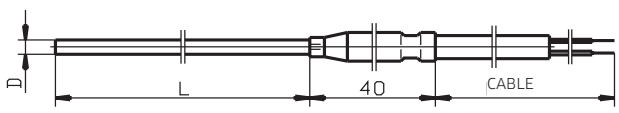
| TYPE          | DIA x L, TEMP      | G    | ARTICLE NO.  |
|---------------|--------------------|------|--------------|
| Pt 100 form J | 6 x 50 mm, 400 °C  | 1/2" | 3000 055 692 |
| Pt 100 form J | 6 x 100 mm, 400 °C | 1/2" | 3000 055 693 |
| Pt 100 form J | 6 x 200 mm, 400 °C | 1/2" | 3000 315 945 |

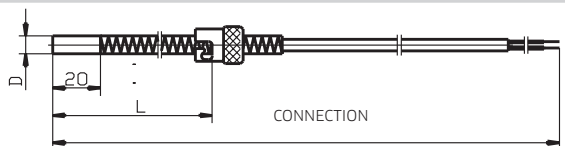
| Protection tube for Pt 100 sensor and thermo couple |  |      |              |
|---|--|------|--------------|
| TYPE  | DIA x L  | G    | ARTICLE NO.  |
| Protection tube                                     | 8/6.5 x 50 mm  | 1/2" | 3000 407 130 |
| Protection tube                                     | 8/6.5 x 100 mm   | 1/2" | 3000 323 363 |
| Protection tube                                     | 8/6.5 x 200 mm   | 1/2" | 3000 407 129 |

| Pt 100 cable sensor |  |              |
|---------------------|--|--------------|
| TYPE                | DIA x L, TEMP  | ARTICLE NO.  |
| Pt 100              | 6 x 50 mm, Technical spec. -70 - 400°C, connection cable max 180°C = 1,5 m         | 3000 407 307 |
| Pt 100              | 6 x 50 mm, Technical spec. -70 - 400°C, connection cable max 180°C = 3,5 m         | 3000 408 687 |

| Pt 100 screwing sensor |  |              |
|------------------------|--|--------------|
| TYPE                   | DIA x L, TEMP  | ARTICLE NO.  |
| Pt 100                 | M6 x 8 mm, 260°C, cable=2.5m   | 3050 038 001 |
| Pt 100                 | M8 x 25 mm, 300°C, cable=2.5 m   | 3000 055 732 |

| Pt 100 mantle sensor. Bendable with vibration resistant measuring device. |  |              |
|---|--|--------------|
| TYPE  | DIA x L, TEMP  | ARTICLE NO.  |
| Pt 100 mantle   | 3 x 200 mm, 600°C, cable= 2.5 m  | 3000 068 244 |
| Pt 100 mantle   | 3 x 300 mm, 600°C, cable= 2.5 m  | 3000 055 764 |
| Pt 100 mantle   | 3 x 500 mm, 600°C, cable= 2.5 m  | 3000 068 248 |

| Termo couple. Bendable mantle sensor with vibration resistant measuring device. |  |              |
|---|--|--------------|
| TYPE  | DIA x L, TEMP  | ARTICLE NO.  |
| Fe-CuNi type L  | 1,5 x 100 mm, 800°C, cable= 2.5 m  | 3000 056 809 |
| Fe-CuNi type L  | 3 x 100 mm, 800°C, cable= 2.5 m  | 3000 056 809 |
| Fe-CuNi type L  | 3 x 200 mm, 800°C, cable= 2.5 m  | 3000 068 433 |
| NiCr-Ni type K  | 3 x 100 mm, 1150°C, cable= 2.5 m   | 3000 056 813 |
| NiCr-Ni type K  | 3 x 200 mm, 1150°C, cable= 2.5 m   | 3000 068 441 |

| Insert sensor with bayonet connection and protection tube in stainless steel. Typical application area is injection moulding machines. |  |              |
|--|--|--------------|
| TYPE   | DIA x L, TEMP  | ARTICLE NO.  |
| Pt 100   | 6 x 20-175 mm, 260°C, cable= 2.5 m   | 3000 055 798 |
| Pt 100   | 8 x 20-175 mm, 350°C, cable= 2.5 m   | 3000 055 797 |
| Fe-CuNi type L   | 6 x 20-175 mm, 400°C, cable= 2.5 m   | 3000 055 784 |
| Fe-CuNi type L   | 8 x 20-175 mm, 400°C, cable= 2.5 m   | 3000 055 785 |

# CONTACT- AND TOOL HEATING



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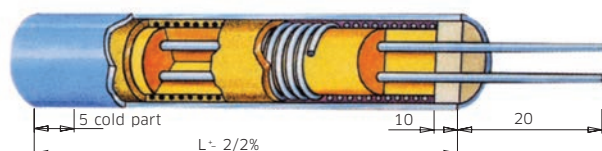
# CARTRIDGE HEATERS UTX

Cartridge heaters can, to a limited space, give very high power. Thanks to the design the heat is quickly distributed over the whole surface mantle of the element. The element fulfill high demands of impact resistance and vibration security. Fields of application are primarily tool heating within e.g. plastic -, rubber -, wood -, and paper industry, foundries, medicin technical and laboratorial heating of liquids. Types: surface mantle material in stainless steel EN 1.4541. The element is fitted with 300 mm nickle wires, insulated with teflon- and fibreglass. Cold part at connection end 10 mm and

at bottom end 5 mm. Reamed holes a smallest tolerance H7 are required.

Surface load over 20 W/cm<sup>2</sup> is requires individual adjustment. Designed for connection to rated voltage 230 V. Surface load up to 60 W/cm<sup>2</sup>. Design according to articles as shown below. The cartridges can also be fitted with connections as described (on following pages). Alternatively they can be be manufactured acc. to customer specification.

Surface mantle in stainless steel EN 1.4541, rated voltage 230V. Connection 300 mm fibreglass insulated nickle wire. Standard range.



| DIA X L | POWER W | SURF. LOAD W/CM <sup>2</sup> | VOLTAGE V | ARTICLE NO.  | DIA X L | POWER W | SURF. LOAD W/CM <sup>2</sup> | VOLTAGE V | ARTICLE NO.  |
|---------|---------|------------------------------|-----------|--------------|---------|---------|------------------------------|-----------|--------------|
| 6.5x25  | 75      | 25                           | 230       | 3060 250 075 | 6.5x160 | 150     | 5                            | 230       | 3061 600 150 |
| 6.5x25  | 100     | 33                           | 230       | 3060 250 100 | 6.5x160 | 200     | 7                            | 230       | 3061 600 200 |
| 6.5x25  | 150     | 50                           | 230       | 3060 250 150 | 6.5x160 | 300     | 10                           | 230       | 3061 600 300 |
| 6.5x25  | 175     | 58                           | 230       | 3060 250 175 | 6.5x160 | 350     | 12                           | 230       | 3061 600 350 |
| 6.5x40  | 100     | 18                           | 230       | 3060 400 100 | 6.5x160 | 400     | 14                           | 230       | 3061 600 400 |
| 6.5x40  | 125     | 22                           | 230       | 3060 400 125 | 6.5x160 | 500     | 17                           | 230       | 3061 600 500 |
| 6.5x40  | 150     | 27                           | 230       | 3060 400 150 | 8x40    | 125     | 18                           | 230       | 3080 400 125 |
| 6.5x40  | 175     | 31                           | 230       | 3060 400 175 | 8x40    | 150     | 21                           | 230       | 3080 400 150 |
| 6.5x40  | 200     | 36                           | 230       | 3060 400 200 | 8x40    | 200     | 28                           | 230       | 3080 400 200 |
| 6.5x40  | 250     | 44                           | 230       | 3060 400 250 | 8x50    | 125     | 13                           | 230       | 3080 500 125 |
| 6.5x50  | 125     | 17                           | 230       | 3060 500 125 | 8x50    | 150     | 16                           | 230       | 3080 500 150 |
| 6.5x50  | 150     | 20                           | 230       | 3060 500 150 | 8x50    | 200     | 22                           | 230       | 3080 500 200 |
| 6.5x50  | 175     | 24                           | 230       | 3060 500 175 | 8x50    | 250     | 27                           | 230       | 3080 500 250 |
| 6.5x50  | 200     | 27                           | 230       | 3060 500 200 | 8x60    | 125     | 11                           | 230       | 3080 600 125 |
| 6.5x50  | 250     | 34                           | 230       | 3060 500 250 | 8x60    | 150     | 13                           | 230       | 3080 600 150 |
| 6.5x60  | 125     | 13                           | 230       | 3060 600 125 | 8x60    | 200     | 17                           | 230       | 3080 600 200 |
| 6.5x60  | 150     | 16                           | 230       | 3060 600 150 | 8x60    | 250     | 21                           | 230       | 3080 600 250 |
| 6.5x60  | 175     | 19                           | 230       | 3060 600 175 | 8x60    | 300     | 25                           | 230       | 3080 600 300 |
| 6.5x60  | 200     | 21                           | 230       | 3060 600 200 | 8x60    | 400     | 34                           | 230       | 3080 600 400 |
| 6.5x60  | 250     | 26                           | 230       | 3060 600 250 | 8x80    | 150     | 9                            | 230       | 3080 800 150 |
| 6.5x60  | 300     | 32                           | 230       | 3060 600 300 | 8x80    | 175     | 11                           | 230       | 3080 800 175 |
| 6.5x80  | 125     | 9                            | 230       | 3060 800 125 | 8x80    | 200     | 12                           | 230       | 3080 800 200 |
| 6.5x80  | 175     | 13                           | 230       | 3060 800 175 | 8x80    | 250     | 15                           | 230       | 3080 800 250 |
| 6.5x80  | 200     | 15                           | 230       | 3060 800 200 | 8x80    | 300     | 18                           | 230       | 3080 800 300 |
| 6.5x80  | 250     | 19                           | 230       | 3060 800 250 | 8x80    | 400     | 24                           | 230       | 3080 800 400 |
| 6.5x80  | 300     | 22                           | 230       | 3060 800 300 | 8x100   | 175     | 8                            | 230       | 3081 000 175 |
| 6.5x100 | 125     | 7                            | 230       | 3061 000 125 | 8x100   | 200     | 9                            | 230       | 3081 000 200 |
| 6.5x100 | 150     | 9                            | 230       | 3061 000 150 | 8x100   | 250     | 12                           | 230       | 3081 000 250 |
| 6.5x100 | 200     | 12                           | 230       | 3061 000 200 | 8x100   | 300     | 14                           | 230       | 3081 000 300 |
| 6.5x100 | 250     | 15                           | 230       | 3061 000 250 | 8x100   | 400     | 19                           | 230       | 3081 000 400 |
| 6.5x100 | 300     | 17                           | 230       | 3061 000 300 | 8x130   | 175     | 6                            | 230       | 3081 300 175 |
| 6.5x100 | 350     | 20                           | 230       | 3061 000 350 | 8x130   | 200     | 7                            | 230       | 3081 300 200 |
| 6.5x100 | 400     | 23                           | 230       | 3061 000 400 | 8x130   | 250     | 9                            | 230       | 3081 300 250 |
| 6.5x130 | 125     | 7                            | 230       | 3061 300 125 | 8x130   | 300     | 10                           | 230       | 3081 300 300 |
| 6.5x130 | 150     | 8                            | 230       | 3061 300 150 | 8x130   | 400     | 14                           | 230       | 3081 300 400 |
| 6.5x130 | 200     | 9                            | 230       | 3061 300 200 | 8x160   | 200     | 6                            | 230       | 3081 600 200 |
| 6.5x130 | 250     | 11                           | 230       | 3061 300 250 |         |         |                              |           |              |
| 6.5x130 | 300     | 13                           | 230       | 3061 300 300 |         |         |                              |           |              |
| 6.5x130 | 350     | 15                           | 230       | 3061 300 350 |         |         |                              |           |              |
| 6.5x130 | 400     | 17                           | 230       | 3061 300 400 |         |         |                              |           |              |



## CONT. CARTRIDGE HEATERS UTX

| DIA X L | POWER W | SURF.LOAD W/CM <sup>2</sup> | VOLTAGE V | ARTICLE NO.  | DIA X L  | POWER W | SURF.LOAD W/CM <sup>2</sup> | VOLTAGE V | ARTICLE NO.  |
|---------|---------|-----------------------------|-----------|--------------|----------|---------|-----------------------------|-----------|--------------|
| 8x160   | 250     | 7                           | 230       | 3081 600 250 | 10x200   | 500     | 9                           | 230       | 3102 000 500 |
| 8x160   | 300     | 8                           | 230       | 3081 600 300 | 10x200   | 600     | 10                          | 230       | 3102 000 600 |
| 8x160   | 400     | 11                          | 230       | 3081 600 400 | 10x200   | 800     | 14                          | 230       | 3102 000 800 |
| 8x160   | 500     | 14                          | 230       | 3081 600 500 | 10x200   | 1000    | 18                          | 230       | 3102 001 000 |
| 8x160   | 600     | 17                          | 230       | 3081 600 600 |          |         |                             |           |              |
|         |         |                             |           |              | 12.5x40  | 125     | 13                          | 230       | 3120 400 125 |
| 10x25   | 75      | 16                          | 230       | 3100 250 075 | 12.5x40  | 160     | 16                          | 230       | 3120 400 160 |
| 10x25   | 100     | 21                          | 230       | 3100 250 100 | 12.5x40  | 200     | 20                          | 230       | 3120 400 200 |
| 10x25   | 150     | 32                          | 230       | 3100 250 150 | 12.5x40  | 250     | 25                          | 230       | 3120 400 250 |
| 10x25   | 200     | 43                          | 230       | 3100 250 200 | 12.5x40  | 300     | 30                          | 230       | 3120 400 300 |
|         |         |                             |           |              | 12.5x40  | 350     | 35                          | 230       | 3120 400 350 |
| 10x40   | 100     | 12                          | 230       | 3100 400 100 | 12.5x40  | 400     | 40                          | 230       | 3120 400 400 |
| 10x40   | 125     | 15                          | 230       | 3100 400 125 | 12.5x40  | 500     | 50                          | 230       | 3120 400 500 |
| 10x40   | 150     | 18                          | 230       | 3100 400 150 |          |         |                             |           |              |
| 10x40   | 200     | 24                          | 230       | 3100 400 200 | 12.5x50  | 160     | 12                          | 230       | 3120 500 160 |
| 10x40   | 250     | 30                          | 230       | 3100 400 250 | 12.5x50  | 200     | 15                          | 230       | 3120 500 200 |
| 10x40   | 300     | 37                          | 230       | 3100 400 300 | 12.5x50  | 250     | 18                          | 230       | 3120 500 250 |
|         |         |                             |           |              | 12.5x50  | 300     | 22                          | 230       | 3120 500 300 |
| 10x50   | 125     | 11                          | 230       | 3100 500 125 | 12.5x50  | 350     | 25                          | 230       | 3120 500 350 |
| 10x50   | 150     | 13                          | 230       | 3100 500 150 | 12.5x50  | 400     | 29                          | 230       | 3120 500 400 |
| 10x50   | 200     | 18                          | 230       | 3100 500 200 | 12.5x50  | 500     | 36                          | 230       | 3120 500 500 |
| 10x50   | 250     | 22                          | 230       | 3100 500 250 | 12.5x50  | 600     | 44                          | 230       | 3120 500 600 |
| 10x50   | 300     | 26                          | 230       | 3100 500 300 |          |         |                             |           |              |
| 10x50   | 400     | 36                          | 230       | 3100 500 400 | 12.5x60  | 125     | 7                           | 230       | 3120 600 125 |
|         |         |                             |           |              | 12.5x60  | 160     | 9                           | 230       | 3120 600 160 |
| 10x60   | 125     | 9                           | 230       | 3100 600 125 | 12.5x60  | 200     | 12                          | 230       | 3120 600 200 |
| 10x60   | 150     | 11                          | 230       | 3100 600 150 | 12.5x60  | 250     | 15                          | 230       | 3120 600 250 |
| 10x60   | 200     | 14                          | 230       | 3100 600 200 | 12.5x60  | 300     | 17                          | 230       | 3120 600 300 |
| 10x60   | 250     | 18                          | 230       | 3100 600 250 | 12.5x60  | 350     | 20                          | 230       | 3120 600 350 |
| 10x60   | 300     | 21                          | 230       | 3100 600 300 | 12.5x60  | 400     | 23                          | 230       | 3120 600 400 |
| 10x60   | 400     | 28                          | 230       | 3100 600 400 | 12.5x60  | 500     | 29                          | 230       | 3120 600 500 |
|         |         |                             |           |              | 12.5x60  | 600     | 35                          | 230       | 3120 600 600 |
| 10x80   | 150     | 7                           | 230       | 3100 800 150 |          |         |                             |           |              |
| 10x80   | 200     | 10                          | 230       | 3100 800 200 | 12.5x80  | 125     | 5                           | 230       | 3120 800 125 |
| 10x80   | 250     | 12                          | 230       | 3100 800 250 | 12.5x80  | 160     | 6                           | 230       | 3120 800 160 |
| 10x80   | 300     | 15                          | 230       | 3100 800 300 | 12.5x80  | 200     | 8                           | 230       | 3120 800 200 |
| 10x80   | 400     | 20                          | 230       | 3100 800 400 | 12.5x80  | 250     | 10                          | 230       | 3120 800 250 |
| 10x80   | 500     | 25                          | 230       | 3100 800 500 | 12.5x80  | 300     | 12                          | 230       | 3120 800 300 |
|         |         |                             |           |              | 12.5x80  | 350     | 14                          | 230       | 3120 800 350 |
| 10x100  | 200     | 8                           | 230       | 3101 000 200 | 12.5x80  | 400     | 16                          | 230       | 3120 800 400 |
| 10x100  | 250     | 9                           | 230       | 3101 000 250 | 12.5x80  | 500     | 20                          | 230       | 3120 800 500 |
| 10x100  | 300     | 11                          | 230       | 3101 000 300 | 12.5x80  | 600     | 24                          | 230       | 3120 800 600 |
| 10x100  | 350     | 13                          | 230       | 3101 000 350 | 12.5x80  | 750     | 30                          | 230       | 3120 800 750 |
| 10x100  | 400     | 15                          | 230       | 3101 000 400 |          |         |                             |           |              |
| 10x100  | 500     | 19                          | 230       | 3101 000 500 | 12.5x100 | 160     | 5                           | 230       | 3121 000 160 |
| 10x100  | 600     | 23                          | 230       | 3101 000 600 | 12.5x100 | 200     | 6                           | 230       | 3121 000 200 |
|         |         |                             |           |              | 12.5x100 | 250     | 8                           | 230       | 3121 000 250 |
| 10x130  | 250     | 7                           | 230       | 3101 300 250 | 12.5x100 | 300     | 9                           | 230       | 3121 000 300 |
| 10x130  | 300     | 8                           | 230       | 3101 300 300 | 12.5x100 | 400     | 12                          | 230       | 3121 000 400 |
| 10x130  | 400     | 11                          | 230       | 3101 300 400 | 12.5x100 | 500     | 15                          | 230       | 3121 000 500 |
| 10x130  | 500     | 14                          | 230       | 3101 300 500 | 12.5x100 | 600     | 18                          | 230       | 3121 000 600 |
| 10x130  | 600     | 17                          | 230       | 3101 300 600 | 12.5x100 | 800     | 25                          | 230       | 3121 000 800 |
| 10x130  | 800     | 22                          | 230       | 3101 300 800 | 12.5x100 | 1000    | 31                          | 230       | 3121 001 000 |
|         |         |                             |           |              |          |         |                             |           |              |
| 10x160  | 300     | 7                           | 230       | 3101 600 300 | 12.5x130 | 250     | 6                           | 230       | 3121 300 250 |
| 10x160  | 400     | 9                           | 230       | 3101 600 400 | 12.5x130 | 300     | 7                           | 230       | 3121 300 300 |
| 10x160  | 500     | 11                          | 230       | 3101 600 500 | 12.5x130 | 400     | 9                           | 230       | 3121 300 400 |
| 10x160  | 600     | 13                          | 230       | 3101 600 600 | 12.5x130 | 500     | 11                          | 230       | 3121 300 500 |
| 10x160  | 800     | 18                          | 230       | 3101 600 800 | 12.5x130 | 600     | 14                          | 230       | 3121 300 600 |
|         |         |                             |           |              | 12.5x130 | 800     | 18                          | 230       | 3121 300 800 |
| 10x200  | 400     | 7                           | 230       | 3102 000 400 | 12.5x130 | 1000    | 22                          | 230       | 3121 301 000 |
|         |         |                             |           |              |          |         |                             |           |              |
|         |         |                             |           |              | 12.5x160 | 400     | 7                           | 230       | 3121 600 400 |

## CONT. CARTRIDGE HEATERS UTX

| DIA X L  | POWER W | SURF.LOAD W/CM <sup>2</sup> | VOLTAGE V | ARTICLE NO.  | DIA X L | POWER W | SURF.LOAD W/CM <sup>2</sup> | VOLTAGE V | ARTICLE NO.  |
|----------|---------|-----------------------------|-----------|--------------|---------|---------|-----------------------------|-----------|--------------|
| 12.5x160 | 500     | 8                           | 230       | 3121 600 500 | 16x100  | 400     | 10                          | 230       | 3161 000 400 |
| 12.5x160 | 600     | 10                          | 230       | 3121 600 600 | 16x100  | 500     | 12                          | 230       | 3161 000 500 |
| 12.5x160 | 800     | 13                          | 230       | 3121 600 800 | 16x100  | 600     | 15                          | 230       | 3161 000 600 |
| 12.5x160 | 1000    | 17                          | 230       | 3121 601 000 | 16x100  | 800     | 20                          | 230       | 3161 000 800 |
| 12.5x160 | 1200    | 20                          | 230       | 3121 601 200 | 16x100  | 1000    | 25                          | 230       | 3161 001 000 |
|          |         |                             |           |              | 16x100  | 1200    | 30                          | 230       | 3161 001 200 |
| 12.5x200 | 300     | 4                           | 230       | 3122 000 300 |         |         |                             |           |              |
| 12.5x200 | 500     | 7                           | 230       | 3122 000 500 | 16x130  | 400     | 7                           | 230       | 3161 300 400 |
| 12.5x200 | 600     | 8                           | 230       | 3122 000 600 | 16x130  | 500     | 9                           | 230       | 3161 300 500 |
| 12.5x200 | 800     | 11                          | 230       | 3122 000 800 | 16x130  | 600     | 11                          | 230       | 3161 300 600 |
| 12.5x200 | 1000    | 14                          | 230       | 3122 001 000 | 16x130  | 800     | 14                          | 230       | 3161 300 800 |
| 12.5x200 | 1200    | 17                          | 230       | 3122 001 200 | 16x130  | 1000    | 18                          | 230       | 3161 301 000 |
| 12.5x200 | 1500    | 21                          | 230       | 3122 001 500 | 16x130  | 1200    | 22                          | 230       | 3161 301 200 |
|          |         |                             |           |              |         |         |                             |           |              |
| 12.5x250 | 500     | 5                           | 230       | 3122 500 500 | 16x160  | 400     | 6                           | 230       | 3161 600 400 |
| 12.5x250 | 800     | 9                           | 230       | 3122 500 800 | 16x160  | 500     | 7                           | 230       | 3161 600 500 |
| 12.5x250 | 1000    | 11                          | 230       | 3122 501 000 | 16x160  | 600     | 8                           | 230       | 3161 600 600 |
| 12.5x250 | 1250    | 14                          | 230       | 3122 501 250 | 16x160  | 800     | 11                          | 230       | 3161 600 800 |
| 12.5x250 | 1500    | 17                          | 230       | 3122 501 500 | 16x160  | 1000    | 14                          | 230       | 3161 601 000 |
| 12.5x250 | 2000    | 22                          | 230       | 3122 502 000 | 16x160  | 1300    | 19                          | 230       | 3161 601 300 |
|          |         |                             |           |              | 16x160  | 1600    | 23                          | 230       | 3161 601 600 |
| 12.5x300 | 500     | 5                           | 230       | 3123 000 500 |         |         |                             |           |              |
| 12.5x300 | 800     | 7                           | 230       | 3123 000 800 | 16x200  | 500     | 6                           | 230       | 3162 000 500 |
| 12.5x300 | 1000    | 9                           | 230       | 3123 001 000 | 16x200  | 800     | 9                           | 230       | 3162 000 800 |
| 12.5x300 | 1250    | 11                          | 230       | 3123 001 250 | 16x200  | 1000    | 11                          | 230       | 3162 001 000 |
| 12.5x300 | 1500    | 14                          | 230       | 3123 001 500 | 16x200  | 1250    | 14                          | 230       | 3162 001 250 |
| 12.5x300 | 2000    | 18                          | 230       | 3123 002 000 | 16x200  | 1500    | 17                          | 230       | 3162 001 500 |
|          |         |                             |           |              | 16x200  | 2000    | 22                          | 230       | 3162 002 000 |
| 16x40    | 160     | 13                          | 230       | 3160 400 160 |         |         |                             |           |              |
| 16x40    | 200     | 16                          | 230       | 3160 400 200 | 16x250  | 500     | 4                           | 230       | 3162 500 500 |
| 16x40    | 250     | 20                          | 230       | 3160 400 250 | 16x250  | 800     | 7                           | 230       | 3162 500 800 |
| 16x40    | 300     | 24                          | 230       | 3160 400 300 | 16x250  | 1000    | 9                           | 230       | 3162 501 000 |
| 16x40    | 400     | 32                          | 230       | 3160 400 400 | 16x250  | 1300    | 11                          | 230       | 3162 501 300 |
| 16x40    | 500     | 40                          | 230       | 3160 400 500 | 16x250  | 1600    | 14                          | 230       | 3162 501 600 |
|          |         |                             |           |              | 16x250  | 2000    | 17                          | 230       | 3162 502 000 |
| 16x50    | 160     | 9                           | 230       | 3160 500 160 |         |         |                             |           |              |
| 16x50    | 200     | 11                          | 230       | 3160 500 200 | 16x300  | 500     | 4                           | 230       | 3163 000 500 |
| 16x50    | 250     | 14                          | 230       | 3160 500 250 | 16x300  | 800     | 6                           | 230       | 3163 000 800 |
| 16x50    | 300     | 17                          | 230       | 3160 500 300 | 16x300  | 1000    | 7                           | 230       | 3163 001 000 |
| 16x50    | 400     | 23                          | 230       | 3160 500 400 | 16x300  | 1300    | 9                           | 230       | 3163 001 300 |
| 16x50    | 500     | 28                          | 230       | 3160 500 500 | 16x300  | 1500    | 11                          | 230       | 3163 001 500 |
| 16x50    | 600     | 30                          | 230       | 3160 500 600 | 16x300  | 1800    | 13                          | 230       | 3163 001 800 |
|          |         |                             |           |              | 16x300  | 2000    | 14                          | 230       | 3163 002 000 |
| 16x60    | 160     | 8                           | 230       | 3160 600 160 | 16x300  | 2500    | 18                          | 230       | 3163 002 500 |
| 16x60    | 200     | 10                          | 230       | 3160 600 200 |         |         |                             |           |              |
| 16x60    | 250     | 12                          | 230       | 3160 600 250 | 16x350  | 750     | 5                           | 230       | 3163 500 750 |
| 16x60    | 300     | 15                          | 230       | 3160 600 300 | 16x350  | 1000    | 6                           | 230       | 3163 501 000 |
| 16x60    | 400     | 20                          | 230       | 3160 600 400 | 16x350  | 1300    | 8                           | 230       | 3163 501 300 |
| 16x60    | 500     | 24                          | 230       | 3160 600 500 | 16x350  | 1600    | 10                          | 230       | 3163 501 600 |
| 16x60    | 600     | 30                          | 230       | 3160 600 600 | 16x350  | 2000    | 12                          | 230       | 3163 502 000 |
|          |         |                             |           |              | 16x350  | 2500    | 15                          | 230       | 3163 502 500 |
| 16x80    | 250     | 8                           | 230       | 3160 800 250 |         |         |                             |           |              |
| 16x80    | 300     | 10                          | 230       | 3160 800 300 | 16x400  | 1000    | 5                           | 230       | 3164 001 000 |
| 16x80    | 400     | 13                          | 230       | 3160 800 400 | 16x400  | 1300    | 7                           | 230       | 3164 001 300 |
| 16x80    | 500     | 16                          | 230       | 3160 800 500 | 16x400  | 1600    | 8                           | 230       | 3164 001 600 |
| 16x80    | 600     | 20                          | 230       | 3160 800 600 | 16x400  | 2000    | 10                          | 230       | 3164 002 000 |
| 16x80    | 800     | 26                          | 230       | 3160 800 800 | 16x400  | 2500    | 13                          | 230       | 3164 002 500 |
| 16x80    | 1000    | 33                          | 230       | 3160 801 000 |         |         |                             |           |              |
|          |         |                             |           |              | 20x60   | 200     | 8                           | 230       | 3200 600 200 |
| 16x100   | 300     | 7                           | 230       | 3161 000 300 | 20x60   | 300     | 12                          | 230       | 3200 600 300 |
|          |         |                             |           |              | 20x60   | 500     | 20                          | 230       | 3200 600 500 |
|          |         |                             |           |              | 20x60   | 600     | 24                          | 230       | 3200 600 600 |
|          |         |                             |           |              | 20x60   | 800     | 32                          | 230       | 3200 600 800 |
|          |         |                             |           |              | 20x80   | 300     | 8                           | 230       | 3200 800 300 |

## CONT. CARTRIDGE HEATERS UTX

| DIA X L | POWER W | SURF.LOAD W/CM <sup>2</sup> | VOLTAGE V | ARTICLE NO.  | DIA X L | POWER W | SURF.LOAD W/CM <sup>2</sup> | VOLTAGE V | ARTICLE NO.  |
|---------|---------|-----------------------------|-----------|--------------|---------|---------|-----------------------------|-----------|--------------|
| 20x80   | 400     | 11                          | 230       | 3200 800 400 | 20x450  | 2500    | 9                           | 230       | 3204 502 500 |
| 20x80   | 500     | 14                          | 230       | 3200 800 500 | 20x450  | 3000    | 11                          | 230       | 3204 503 000 |
| 20x80   | 600     | 16                          | 230       | 3200 800 600 | 20x450  | 3500    | 13                          | 230       | 3204 503 500 |
| 20x80   | 800     | 22                          | 230       | 3200 800 800 | 20x450  | 4000    | 15                          | 230       | 3204 504 000 |
| 20x80   | 1000    | 27                          | 230       | 3200 801 000 |         |         |                             |           |              |
| 20x80   | 1250    | 34                          | 230       | 3200 801 250 | 20x500  | 2000    | 7                           | 230       | 3205 002 000 |
|         |         |                             |           |              | 20x500  | 3000    | 10                          | 230       | 3205 003 000 |
| 20x100  | 400     | 8                           | 230       | 3201 000 400 | 20x500  | 4000    | 14                          | 230       | 3205 004 000 |
| 20x100  | 600     | 12                          | 230       | 3201 000 600 | 20x500  | 5000    | 17                          | 230       | 3205 005 000 |
| 20x100  | 800     | 16                          | 230       | 3201 000 800 |         |         |                             |           |              |
| 20x100  | 1000    | 20                          | 230       | 3201 001 000 |         |         |                             |           |              |
| 20x100  | 1300    | 27                          | 230       | 3201 001 300 |         |         |                             |           |              |
| 20x100  | 1600    | 32                          | 230       | 3201 001 600 |         |         |                             |           |              |
|         |         |                             |           |              |         |         |                             |           |              |
| 20x130  | 400     | 6                           | 230       | 3201 300 400 |         |         |                             |           |              |
| 20x130  | 500     | 7                           | 230       | 3201 300 500 |         |         |                             |           |              |
| 20x130  | 600     | 9                           | 230       | 3201 300 600 |         |         |                             |           |              |
| 20x130  | 800     | 12                          | 230       | 3201 300 800 |         |         |                             |           |              |
| 20x130  | 1000    | 15                          | 230       | 3201 301 000 |         |         |                             |           |              |
| 20x130  | 1500    | 22                          | 230       | 3201 301 500 |         |         |                             |           |              |
| 20x130  | 2000    | 30                          | 230       | 3201 302 000 |         |         |                             |           |              |
|         |         |                             |           |              |         |         |                             |           |              |
| 20x160  | 500     | 6                           | 230       | 3201 600 500 |         |         |                             |           |              |
| 20x160  | 800     | 9                           | 230       | 3201 600 800 |         |         |                             |           |              |
| 20x160  | 1000    | 12                          | 230       | 3201 601 000 |         |         |                             |           |              |
| 20x160  | 1500    | 18                          | 230       | 3201 601 500 |         |         |                             |           |              |
| 20x160  | 2000    | 23                          | 230       | 3201 602 000 |         |         |                             |           |              |
|         |         |                             |           |              |         |         |                             |           |              |
| 20x200  | 800     | 7                           | 230       | 3202 000 800 |         |         |                             |           |              |
| 20x200  | 1000    | 9                           | 230       | 3202 001 000 |         |         |                             |           |              |
| 20x200  | 1300    | 12                          | 230       | 3202 001 300 |         |         |                             |           |              |
| 20x200  | 1600    | 15                          | 230       | 3202 001 600 |         |         |                             |           |              |
| 20x200  | 2000    | 18                          | 230       | 3202 002 000 |         |         |                             |           |              |
| 20x200  | 2500    | 23                          | 230       | 3202 002 500 |         |         |                             |           |              |
|         |         |                             |           |              |         |         |                             |           |              |
| 20x250  | 800     | 6                           | 230       | 3202 500 800 |         |         |                             |           |              |
| 20x250  | 1000    | 7                           | 230       | 3202 501 000 |         |         |                             |           |              |
| 20x250  | 1500    | 11                          | 230       | 3202 501 500 |         |         |                             |           |              |
| 20x250  | 2000    | 14                          | 230       | 3202 502 000 |         |         |                             |           |              |
| 20x250  | 2500    | 18                          | 230       | 3202 502 500 |         |         |                             |           |              |
|         |         |                             |           |              |         |         |                             |           |              |
| 20x300  | 1000    | 6                           | 230       | 3203 001 000 |         |         |                             |           |              |
| 20x300  | 1500    | 9                           | 230       | 3203 001 500 |         |         |                             |           |              |
| 20x300  | 2000    | 12                          | 230       | 3203 002 000 |         |         |                             |           |              |
| 20x300  | 2500    | 15                          | 230       | 3203 002 500 |         |         |                             |           |              |
|         |         |                             |           |              |         |         |                             |           |              |
| 20x350  | 1500    | 7                           | 230       | 3203 501 500 |         |         |                             |           |              |
| 20x350  | 2000    | 10                          | 230       | 3203 502 000 |         |         |                             |           |              |
| 20x350  | 2500    | 12                          | 230       | 3203 502 500 |         |         |                             |           |              |
| 20x350  | 3000    | 15                          | 230       | 3203 503 000 |         |         |                             |           |              |
| 20x350  | 3500    | 17                          | 230       | 3203 503 500 |         |         |                             |           |              |
|         |         |                             |           |              |         |         |                             |           |              |
| 20x400  | 1500    | 6                           | 230       | 3204 001 500 |         |         |                             |           |              |
| 20x400  | 2000    | 9                           | 230       | 3204 002 000 |         |         |                             |           |              |
| 20x400  | 2500    | 11                          | 230       | 3204 002 500 |         |         |                             |           |              |
| 20x400  | 3000    | 13                          | 230       | 3204 003 000 |         |         |                             |           |              |
| 20x400  | 3500    | 15                          | 230       | 3204 003 500 |         |         |                             |           |              |
| 20x400  | 4000    | 17                          | 230       | 3204 004 000 |         |         |                             |           |              |
|         |         |                             |           |              |         |         |                             |           |              |
| 20x450  | 2000    | 8                           | 230       | 3204 502 000 |         |         |                             |           |              |

# CARTRIDGE HEATERS UTC

Design: Surface mantle in stainless steel EN 1.4541. The element is fitted with thermo elements Fe-CuNi type J and 1000 mm teflon and fibreglass insulated nickle wires.

Reamed holes with smallest tolerance H7 are required. At surface load over 20W/cm<sup>2</sup> individual adjustment is required. Designed for connection to rated voltage 230V. Surface load up to 60 W/cm<sup>2</sup>.

Design acc. to following articles as fitted below.

All elements on following pages can be furnished with thermo elements. The cartridges can also be furnished with connections described later in this section. Alternatively they can be manufactured acc. to customer specification.

Element UTC type 2 with built-in thermo element Fe-CuNi type J. Surface mantle in stainless steel EN 1.4541, rated voltage 230V. Connection 1000 mm fiberglass insulated nickle wire. Standard range.



| DIA X L | POWER W | SURF. LOAD W/CM <sup>2</sup> | VOLTAGE V | ARTICLE NO.  | DIA X L  | POWER W | SURF. LOAD W/CM <sup>2</sup> | VOLTAGE V | ARTICLE NO.  |
|---------|---------|------------------------------|-----------|--------------|----------|---------|------------------------------|-----------|--------------|
| 6.5x40  | 125     | 22                           | 230       | 3060 400 126 | 8x160    | 300     | 8                            | 230       | 3081 600 301 |
| 6.5x40  | 150     | 27                           | 230       | 3060 400 151 | 8x160    | 400     | 11                           | 230       | 3081 600 401 |
| 6.5x40  | 175     | 31                           | 230       | 3060 400 176 | 8x160    | 500     | 14                           | 230       | 3081 600 501 |
| 6.5x40  | 200     | 36                           | 230       | 3060 400 201 |          |         |                              |           |              |
| 6.5x50  | 150     | 20                           | 230       | 3060 500 151 | 10x40    | 150     | 18                           | 230       | 3100 400 151 |
| 6.5x50  | 175     | 24                           | 230       | 3060 500 176 | 10x40    | 200     | 24                           | 230       | 3100 400 201 |
| 6.5x50  | 200     | 27                           | 230       | 3060 500 201 | 10x40    | 250     | 30                           | 230       | 3100 400 251 |
| 6.5x50  | 250     | 34                           | 230       | 3060 500 251 |          |         |                              |           |              |
| 6.5x60  | 200     | 21                           | 230       | 3060 600 201 | 10x50    | 200     | 18                           | 230       | 3100 500 201 |
| 6.5x60  | 250     | 26                           | 230       | 3060 600 251 | 10x50    | 250     | 22                           | 230       | 3100 500 251 |
| 6.5x60  | 300     | 32                           | 230       | 3060 600 301 | 10x50    | 300     | 26                           | 230       | 3100 500 301 |
|         |         |                              |           |              |          |         |                              |           |              |
| 6.5x80  | 200     | 15                           | 230       | 3060 800 201 | 10x60    | 250     | 18                           | 230       | 3100 600 251 |
| 6.5x80  | 250     | 19                           | 230       | 3060 800 251 | 10x60    | 300     | 21                           | 230       | 3100 600 301 |
| 6.5x80  | 300     | 22                           | 230       | 3060 800 301 | 10x60    | 400     | 28                           | 230       | 3100 600 401 |
|         |         |                              |           |              |          |         |                              |           |              |
| 6.5x100 | 250     | 15                           | 230       | 3061 000 251 | 10x80    | 250     | 12                           | 230       | 3100 800 251 |
| 6.5x100 | 300     | 17                           | 230       | 3061 000 301 | 10x80    | 300     | 15                           | 230       | 3100 800 301 |
| 6.5x100 | 400     | 23                           | 230       | 3061 000 401 | 10x80    | 400     | 20                           | 230       | 3100 800 401 |
|         |         |                              |           |              |          |         |                              |           |              |
| 8x40    | 150     | 21                           | 230       | 3080 400 151 | 10x100   | 300     | 11                           | 230       | 3101 000 301 |
| 8x40    | 200     | 28                           | 230       | 3080 400 201 | 10x100   | 400     | 15                           | 230       | 3101 000 401 |
|         |         |                              |           |              | 10x100   | 500     | 19                           | 230       | 3101 000 501 |
| 8x50    | 150     | 16                           | 230       | 3080 500 151 |          |         |                              |           |              |
| 8x50    | 200     | 22                           | 230       | 3080 500 201 | 10x130   | 300     | 8                            | 230       | 3101 300 301 |
| 8x50    | 250     | 27                           | 230       | 3080 500 251 | 10x130   | 400     | 11                           | 230       | 3101 300 401 |
|         |         |                              |           |              | 10x130   | 500     | 14                           | 230       | 3101 300 501 |
| 8x60    | 200     | 17                           | 230       | 3080 600 201 |          |         |                              |           |              |
| 8x60    | 250     | 21                           | 230       | 3080 600 251 | 10x160   | 400     | 9                            | 230       | 3101 600 401 |
| 8x60    | 300     | 25                           | 230       | 3080 600 301 | 10x160   | 600     | 13                           | 230       | 3101 600 601 |
| 8x80    | 200     | 12                           | 230       | 3080 800 201 |          |         |                              |           |              |
| 8x80    | 250     | 15                           | 230       | 3080 800 251 | 12.5x40  | 200     | 20                           | 230       | 3120 400 201 |
| 8x80    | 300     | 18                           | 230       | 3080 800 301 | 12.5x40  | 250     | 25                           | 230       | 3120 400 251 |
| 8x80    | 400     | 24                           | 230       | 3080 800 401 |          |         |                              |           |              |
|         |         |                              |           |              | 12.5x50  | 300     | 22                           | 230       | 3120 500 301 |
| 8x100   | 200     | 9                            | 230       | 3081 000 201 | 12.5x50  | 400     | 29                           | 230       | 3120 500 401 |
| 8x100   | 250     | 12                           | 230       | 3081 000 251 |          |         |                              |           |              |
| 8x100   | 300     | 14                           | 230       | 3081 000 301 | 12.5x60  | 300     | 17                           | 230       | 3120 600 301 |
| 8x100   | 400     | 19                           | 230       | 3081 000 401 | 12.5x60  | 400     | 23                           | 230       | 3120 600 401 |
|         |         |                              |           |              |          |         |                              |           |              |
| 8x130   | 250     | 9                            | 230       | 3081 300 251 | 12.5x80  | 400     | 16                           | 230       | 3120 800 401 |
| 8x130   | 300     | 10                           | 230       | 3081 300 301 | 12.5x80  | 500     | 20                           | 230       | 3120 800 501 |
| 8x130   | 400     | 14                           | 230       | 3081 300 401 |          |         |                              |           |              |
|         |         |                              |           |              | 12.5x100 | 500     | 15                           | 230       | 3121 000 501 |
|         |         |                              |           |              |          |         |                              |           |              |
|         |         |                              |           |              | 12.5x130 | 600     | 14                           | 230       | 3121 300 601 |

## CONT. CARTRIDGE HEATERS UTC

| DIA X L  | POWER W | RUF.LOAD W/CM <sup>2</sup> | VOLTAGE V | ARTICLE NO. | DIA X L  | POWER W | RUF.LOAD W/CM <sup>2</sup> | VOLTAGE V | ARTICLE NO. |
|----------|---------|----------------------------|-----------|-------------|----------|---------|----------------------------|-----------|-------------|
| 12.5x160 | 800     | 13                         | 230       | 3121600801  | 12.5x250 | 1250    | 14                         | 230       | 3122501251  |
| 12.5x200 | 1000    | 14                         | 230       | 3122001001  | 12.5x300 | 1500    | 14                         | 230       | 3123001501  |

## CARTRIDGE HEATERS UTC WITH BUILT-IN THERMOCOUPLE

All UTC heaters can be manufactured with built-in thermocouple.

The thermocouple joint can be positioned as follows:

### UTC TYPE 1

Grounded in a special bottom plate. Guarantees excellent reading of temperature and quick response. Generally used in injection systems for plastic materials.



### UTC TYPE 2

Insulated in proximity to the bottom plate. Suitable for avoiding disturbances to sensitive equipment.



### UTC TYPE 3

In contact with metal sheath within a 12 mm cold part, located at the center of the heater. Guarantees excellent reading of temperature and rapid response. Cannot be manufactured with diameters less than 10 mm.



### UTC TYPE 4

Insulated at the center of the heater. Makes it possible to evaluate the heater temperature and heat exchange in order to optimize the heater from energy point of view.



| CODE | POSITIVE | COLOR | NEGATIVE   | COLOR | TEMPERATURE AREA |
|------|----------|-------|------------|-------|------------------|
| J    | Iron     | Red   | Constantan | Blue  | -20 - +750°C     |
| K    | Chromel* | Red   | Alumel*    | Green | -20 - +1250°C    |

## IMPORTANT INFORMATION FOR SAFE USING OF UTC TYPE 1, 2, 3 AND 4

As shown in the drawings of UTC heaters type 1 and 2, the sensitive joint of the thermocouple is located on the tip of the heater and therefore in an area that is relatively colder than the body of the heater. If the heater, though introduced into a system equipped with automatic temperature control, is powered at rated voltage, there will be a drastic overheating of the cartridge body. The greater the density in  $W/cm^2$  of the heater, the greater the overheating will be. The reason for this is that the time which elapses before the generated heat reaches the thermocouple joint by thermal conduction is sometimes sufficient to the irreversibly damage the heater.

### **A. Example of turning on heaters with built-in TC 1-type thermocouple in the open air with temperature controlled by means of thermoregulator:**

Set the thermoregulator. the lower the temperature, the higher the watt density of the heater. For instance, with a TC 1 cartridge with dimension 10 x 100 mm, 500 W, surface load 19  $W/cm^2$ : set the thermoregulator at 80°C. Then set it up to 180°C, then another 100°C, then another 100°C, and so on until the required temperature is reached.

Please note that if the thermoregulator was set to the final temperature directly, for instance 500°C, before the thermocouple joint reached the intervention temperature, the central body of the heater would reach temperatures over 1000°C and the heater would be destroyed.

### **B. Example of turning on heaters with built-in TC1-type thermocouple, inserted in a metal ground with temperature controlled by means of a thermoregulator:**

1. If the metal ground is small and the heater has a density above 10  $W/cm^2$ , follow the instructions for elements in open air.
2. If the metal ground is large and the hole is reamed to tolerance H7, the thermoregulator can be set to working temperature directly.

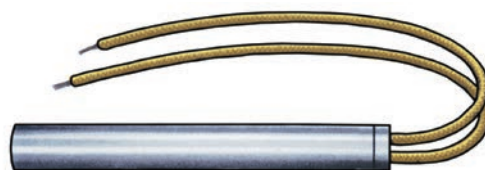
For UTC type 3 heaters, there is no need of special precautions as the thermocouple is positioned between two heating areas and by this is quicker influenced by the heat radiation from the element. A pre-heating case is however always advisable.

If the temperature control equipment has a soft-start effect, all of the above precautions can be considerably reduced. It is always recommended to run test cycles.

# CARTRIDGE HEATERS UTX AND UTC DIFFERENT CONNECTIONS AND SPECIAL DESIGNS

## S 1. FLEXIBLE CABLES

Suitable when a highly flexible cable also near the element head is required. Note that with this solution, the temperature of the cartridge connection end may not exceed 260°C.



## S 2. CABLES INSIDE PROTECTIVE TUBE

The cables are protected by a flexible tube of galvanized steel in the standard version. On demand a stainless protective tube is also offered. Advisable to protect the cables from being smashed, grazed or torn.



| Diam. of the protective tube |          |     |         |         |         |         |
|------------------------------|----------|-----|---------|---------|---------|---------|
| Element Ø                    | 6.5-1/4" | 8   | 10-3/8" | 12-1/2" | 16-5/8" | 20-3/4" |
| T                            | 6.7      | 7.5 | 8.5     | 10.5    | 12.5    | 13      |

## S 3. FLEXIBLE METAL BRAID

The cables are protected by a flexible metal braid in galvanized steel. On demand we also offer stainless protective braid. Advisable for protection of the cables against damages but with maximal preserved flexibility.



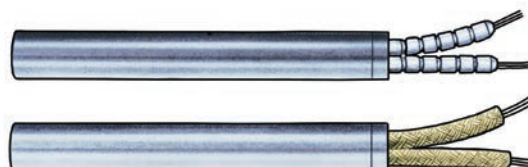
## S 4. SOLID NICKEL WIRES

The elements can be fitted with solid nickel wires, naked or insulated with a silicone hose, glass armoured silicone, teflon or ceramic bushings. Useful when the input wires, by mechanical needs or assembly purposes, need to be particularly rigid.



## S 5. INSULATED CABLES FOR HIGH TEMPERATURES

The elements can be fitted with nickel wires insulated with ceramic beads (A) or ceramic fibres (B). One of these solutions is demanded when the cables are exposed to a temperature continuously over 260°C.



## S 6. CORRUGATED, FLEXIBLE TUBE WITH CONTINUOUS WALL

The cables are protected by a corrugated, flexible and completely tight protective tube in stainless steel welded to the cartridge sheath. This solution is indispensable when the cables must go through areas with liquids, corrosive gases, etc.



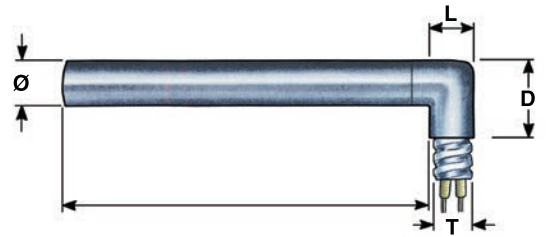
## S 7. SEALED HEATERS

All cartridge heaters can be produced completely sealed. Due to the high level of hygroscopicity of the insulating ceramic material, the heaters can easily absorb atmospheric humidity and thus decrease their electrical installation. Though this drawback can be remedied with a short period of pre-heating, the cartridges must be sealed to avoid humidity absorption. This is done by resins or silicone when the head temperature is below 260°C; or with the patented SC-sealing when the temperature is over 260°C. Sealing is indispensable when the cartridge head might be exposed to washing, oil leakage, corrosive gases, etc.



## S 8. CABLE OUTLET AT RIGHT ANGLE

The cables are protected by a flexible protective tube in galvanized steel.



## S 9. CABLE OUTLET AT RIGHT ANGLE

The cables are protected by a flexible metal braid in galvanized steel.

| Angular head dimensions              |          |         |         |           |         |         |
|--------------------------------------|----------|---------|---------|-----------|---------|---------|
| Ø                                    | 6.5-1/4" | 8-5/16" | 10-3/8" | 12.5-1/2" | 16-5/8" | 20-3/4" |
| L                                    | 7.5      | 8       | 10      | 12.5      | 16      | 20      |
| D                                    | 18       | 20      | 23      | 27        | 30      | 36      |
| Dimensions of tube or flexible braid |          |         |         |           |         |         |
| T                                    | 6.7      | 7.5     | 8.5     | 10.5      | 12.5    | 13      |



## S 10. CABLE OUTLET AT RIGHT ANGLE

Flexible cables coming out of the tube directly from bilateral opening in a 90° angle. Particularly suitable for very small spaces.

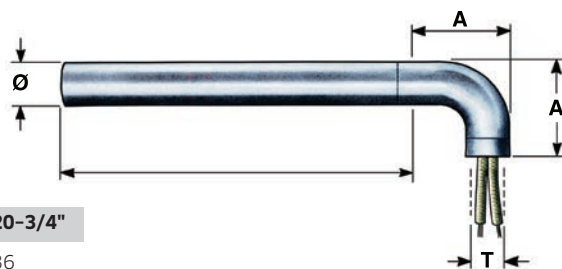
| Ø | 6.5-1/4" | 8-5/16" | 10-3/8" | 12.5-1/2" | 16-5/8" | 20-3/4" |
|---|----------|---------|---------|-----------|---------|---------|
| L | 8        | 8       | 10      | 12        | 14      | 16      |





## S 11. CABLE OUTLET AT RIGHT ANGLE

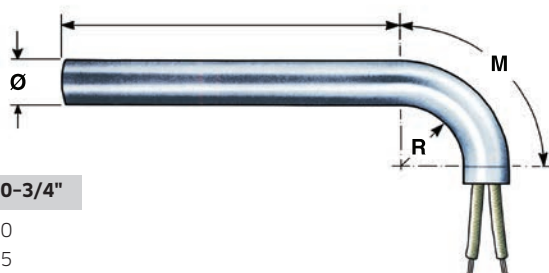
Connection with 90° bend in copper.



| Ø | 6.5-1/4" | 8-5/16" | 10-3/8" | 12.5-1/2" | 16-5/8" | 20-3/4" |
|---|----------|---------|---------|-----------|---------|---------|
| A | 20       | 21.5    | 23      | 26        | 34      | 36      |
| T | 6.7      | 7.5     | 8.5     | 10.5      | 12.5    | 13      |

## S 12. CABLE OUTLET - CURVED COLD PARTS

Element with curved cold part. Recommended to use in 90° outlets into high temperature environments and for incorporations in fusions. On request, the hot and cold part of the element can be manufactured with any length. Input cables can have S8 or S9 protection - see above.



| Ø | 6.5-1/4" | 8-5/16" | 10-3/8" | 12.5-1/2" | 16-5/8" | 20-3/4" |
|---|----------|---------|---------|-----------|---------|---------|
| R | 12       | 12      | 13      | 20        | 25      | 30      |
| M | 50       | 60      | 60      | 70        | 80      | 95      |

## S 13. THREADED PINS

Heaters with diameter 12.5 mm or more can be furnished with threaded pins, nuts and washers for electrical connection. This solution is useful when parallel coupling of two or several elements near one another is necessary.



## S 14. TAB TERMINALS

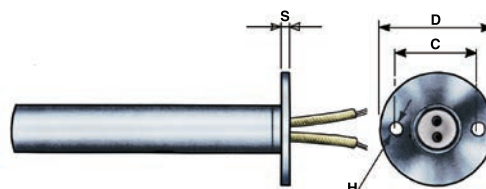
Heaters with a diameter of 14 mm or more can be furnished with tab terminals, build solidly into the cartridge head.



## S 15. FLANGE

All heaters can be supplied with a stainless steel flange.

| Ø        |           | DIMENSIONS STANDARD FLANGES |    |     |   |
|----------|-----------|-----------------------------|----|-----|---|
|          |           | D                           | C  | H   | S |
| 6.5-1/4" | 8-5/16"   | 25                          | 19 | 3.5 | 2 |
| 10-3/8"  | 12.5-1/2" |                             |    |     |   |
| 6.5-1/4" | 8-5/16"   | 35                          | 28 | 4.5 | 2 |
| 10-3/8"  | 12.5-1/2" |                             |    |     |   |
| 16-5/8"  | 20-3/4"   |                             |    |     |   |



### S 16. SINGLE SMALL RIGHT ANGLE FLANGE

### S 17. DOUBLE SMALL RIGHT ANGLE FLANGE

| Dimensions of small flanges |          |         |         |           |         |         |
|-----------------------------|----------|---------|---------|-----------|---------|---------|
| Ø                           | 6.5-1/4" | 8-5/16" | 10-3/8" | 12.5-1/2" | 16-5/8" | 20-3/4" |
| A                           | 10       | 11      | 13      | 15        | 18      | 22      |
| B                           | 6        | 7       | 9       | 10        | 13      | 15      |
| C                           | 8.7      | 10      | 13      | 15.8      | 18      | 23      |
| D                           | 3.2      | 3.2     | 4.2     | 5.3       | 5.4     | 6.2     |
| H                           | 6        | 7       | 9       | 11        | 13.5    | 16.6    |
| L                           | 5.7      | 6       | 6.6     | 6.8       | 10.3    | 12      |
| S                           | 1        | 1       | 1       | 1         | 1.5     | 2       |

### S 18, S 19, S 20. HEATERS WITH ELECTRICAL INPUTS AT BOTH ENDS

Elements with electrical input at both ends

S 18. With smooth nickel pins

S 19. With threaded pins and nuts for electrical connections

S 20. With flexible cables

### S 21, S 22. WELDED NIPPLE

The elements can be fitted with threaded fittings in stainless steel as indicated in the table below or acc. to particular specification. Particularly suitable for liquid heating.

| Standard stainless steel threaded fittings: |      |        |        |        |        |        |      |      |      |      |      |      |
|---|------|--------|--------|--------|--------|--------|------|------|------|------|------|------|
| ELEMENT DIAMETER                            |      |        |        |        |        |        |      |      |      |      |      |      |
| MM  | 6.5  | 8      | 10     | 12.5   | 16     | 20     | inch | 1/4" | 3/8" | 1/2" | 5/8" | 3/4" |
| A   | 11   | 13     | 15     | 17     | 20     | 25     |      | 11   | 15   | 17   | 20   | 25   |
| B   | 4    | 4.5    | 5      | 5.5    | 6      | 7      |      | 4    | 5    | 5.5  | 6    | 7    |
| C   | 12   | 14     | 17     | 19     | 24     | 30     |      | 12   | 17   | 19   | 24   | 30   |
| Thread                                      | 10x1 | 12x1.5 | 14x1.5 | 16x1.5 | 20x1.5 | 27x1.5 |      | 1/8" | 1/4" | 3/8" | 1/2" | 3/4" |

### S 23. DOUBLE THREADED NIPPLE

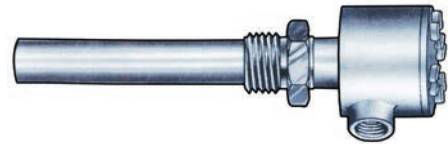
Fittings with double stainless steel thread:

| ELEMENT DIAMETER |     |     |    |      |    |    |      |      |      |      |      |      |
|------------------|-----|-----|----|------|----|----|------|------|------|------|------|------|
| MM               | 6.5 | 8   | 10 | 12.5 | 16 | 20 | inch | 1/4" | 3/8" | 1/2" | 5/8" | 3/4" |
| A1               | 7   | 8.5 | 10 | 11.5 | 14 | 18 |      | 7    | 10   | 11.5 | 14   | 18   |
| B                | 4   | 4.5 | 5  | 5.5  | 6  | 7  |      | 4    | 5    | 5.5  | 6    | 7    |

## S 24. EXPLOSION PROOF DESIGN PER CENELEC STANDARDS

The elements can be mounted on commercial boxes, approved for dangerous environments acc. to standard: EExd, IIC, T5 and IP65.

NOTE! The assembled element is not certified.



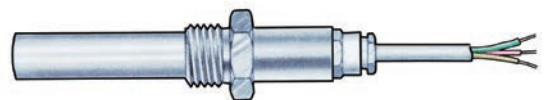
## S 25. CABLE CLAMP

The elements can be built with a threaded crown that facilitates extraction from the mounting position. The threaded crown can be welded onto either of the ends of the heater.



## S 26. CONNECTION CABLE WITH TENSILE UNLOADING

The elements can be built with a multi-polar input cable and connections protected from tears and external agents by a water-proof cable clamp.



## S 27. WATER-PROOF HEAD PROTECTION

In particular suitable when exposed to pouring water, for example in de-icing of industrial cooling equipments and evaporators.



## S 28. BUILT-IN THERMOSTAT

Heaters with built-in thermostat are an ideal solution when an extremely compact systems for heating and temperature control is demanded. They are especially suitable for liquid heating, in particular if effective control against exceeding maximum temperatures is demanded. The thermostat has a pre-adjusted, non-adjustable colibration.



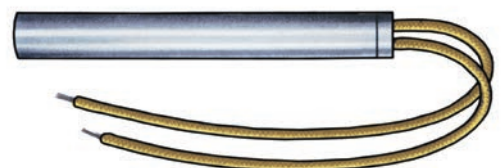
## S 29. CONTACTS FOR SLIDING SUPPLY

Suitable for heating of rotating cylinders.



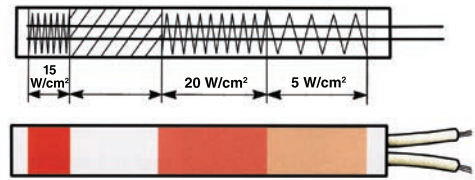
## S 30. TEFLON END BUSHING

The heaters can be furnished with head bushings in teflon instead of ceramic material. The teflon bushing offers a moderate protection from humidity and excellent protection against mechanical shocks.



### S 31. DIFFERENTIATED TEMPERATURE- OR NON-HEATING SECTIONS

The heaters can be produced with differentiated wattage density heating sections and with cold sections.

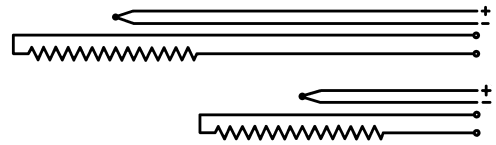


### S 32. INDIVIDUAL TEMPERATURE CONTROL AREAS

The heaters can be furnished with individual temperature control areas that allow diversified temperature control on pre-determined parts of the heating system.

These parts can have a constant or varying power and length, with internal or external thermocouples.

By order, please specify exact dimension, length, power and voltage as well as the position for the temperature control and thermocouples.



## WATER-PROOF SEALING TYPE SC 400

The magnesium oxide used in the cartridge heaters is an excellent electrical insulator and a good heat conductor. It has however a high hygroscopic level, implying that a non-opearting elements tend to loose their insulation and sometimes drop to values so low that during power-up they could cause the safety devices to intervene. In worst case the elements can be irreversibly damaged by short circuit.

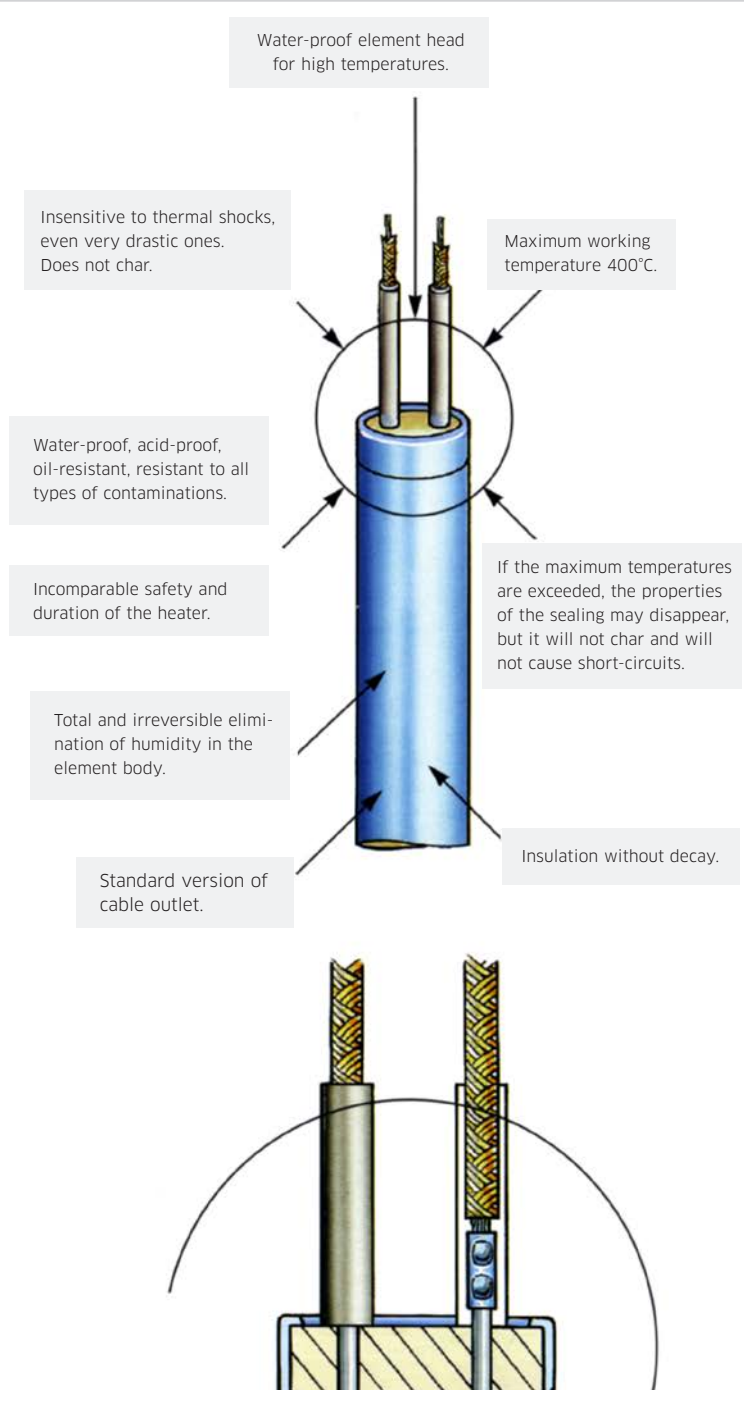
If the element end does not exceed 260°C, the sealing can be done by resins or silicone. In cases where higher temperature resistance or bigger safety margins are required other solutions are required, we offer the SC 400 solution. It is a completely water-proof sealing, irreversible, unorganic and resistant to high pressures and continuous high temperatures, up to 400°C.

The sealing does not undergo the aging process and is resistant to water, acids atompheric agents and it does not char.

SC 400 is an unorganic compound, fused to the heater head by a controlled cycle process, thus forming a cohesive seal adherent to the metal surfaces on a molecular level.

SC 400 protects the inner components completely from pollutants and oxydation, meaning a striking increase of the element life time.

The use of SC 400 is totally necessary in cases where high level of safety and reliability are needed, like in electric medical equipment, manual tools, aeronautics-, space-, nuclear- surgical- or military appliances.



## HIGH TEMPERATURE RESISTANT ASSEMBLY OIL NEVER SEEZ

Properties:

- Facilitates the mounting
- Prevents stuck burning of the element
- Keeps its properties up to 1100°C it can however arise harmful substances when heated over 700°C.

- Content 113 g



| TYPE         | ARTICLE NO.  |
|--------------|--------------|
| Assembly oil | 1160 099 401 |

## HIGH TEMPERATURE RESISTANT ASSEMBLY PASTE LUBRI-HOT

Properties:

- Improves the contact between the hole wall and the surface of the heater.
- Favors heat transfer, thus increases the life time of the heater.
- Eliminates corrosive effects caused by high temperatures.
- Maintains its properties up to 1200°C.

The paste can also be used for any kind of lubrication at high temperatures, even in extremely harsh environments and in the handling operations within the chemical -, and enamelling industry, foundries and steam valves, locking nuts in turbines, ovens and furnaces.

Content: 50 g



| TYPE           | ARTICLE NO.  |
|----------------|--------------|
| Assembly paste | 3050 027 501 |

## HIGH PENETRATION LUBRICATING SPRAY EXTRACTOR

Properties:

- Facilitates extraction of used heaters.
- Excellent penetration ability that reaches deeply, also when small tolerances between hole and element.
- Dissolves oxides and transforms them to a lubricating film that facilitates extraction of the element with minimal traction effort.
- Leaves the inner wall of the assembly hole intact, allowing the new element to be inserted directly.

The spray can also be used to loosen rusty and corroded mechanisms, dissolve grease, tar, glue and markings or clean and lubricate movable parts and counteract start problems in very humid climate areas.

The spray does not react with metals, neither with most plastics.

Content: 200 ml with CO<sub>2</sub> operating gas.



| TYPE             | ARTICLE NO.  |
|------------------|--------------|
| Deassembly spray | 3050 028 001 |

## TECHNICAL INFORMATION - RECOMMENDATIONS FOR INSTALLATION

- Distribute the required load over the highest possible number of heaters in order to reduce the density in W/cm<sup>2</sup> of each heater.
- Insert the cartridges in bored holes. Clearance as possible. Clearance between heater and hole reduces heat transmission, increases cartridge temperature, intensifies the oxidation process, increases energy consumption and considerably decreases heater life.
- If the heaters are mounted on moving parts of the machine, make sure the cables are well anchored a few centimeters upstream from the heater outlet to prevent movement that could result in break-downs. Even though small movements are generally acceptable, there is always a high risk of breakage. It is advisable to make a few extra turns of the cable upstream of the outlet to prolong its life. If the application requires continuous movements, it is indispensable to communicate the width and type of motion. In many cases an intermediate box is very useful for transferring motion to an additional cable that can easily be replaced.
- If there is a significant number of vibrations, it is advisable to use an intermediate connection box as described above.
- Protect cables and cartridge head, especially if not sealed, against contamination from oils, liquids, sprays, corrosive gases, splashes of water. With repeated hot/cold cycles, the cartridge absorbs any substance that comes into contact with the insulating material. Most substances char and produce short circuits. The only sealant that ensures total protection is SC400.
- If the cables remain in areas with a constant temperature above 250 °C, it is indispensable to use one of the following solutions:
  - Flexible nickel cables insulated with ceramic fiber or ceramic beads.
  - Rigid nickel conductors, not insulated alternatively insulated with a sheath of ceramic fiber or ceramic beads.
  - Extend cold zone of heater enough to bring the cables out of the high temperature area.
- Prevent the cartridge head, and, consequently the cables, from entering the hole. The heat of the metal ground could damage the insulating material and the sealant.
- Avoid using self-sticking tape near cartridge head. The adhesive of certain types of tape could enter the head, char and produce short circuits. If taping is unavoidable, use silicone-base adhesives.
- At high temperatures, it is always advisable to thermally insulate the heated parts. The following positive effects are obtained by insulation:
  - Energy consumption is lowered with up to 40%.
  - Less powerful and consequently longer lasting elements can be used.
  - Higher temperatures are reached in a shorter time.

### Standard tolerances

**Diameter:** The tolerance is indicated in correspondence to the various diameters listed in the catalogue.

**Length:**     ≤ 100 mm         ±2 mm  
                  >100 mm         ±2 %

**Power:**       +5 %    -10 %

**Resistance:** +10 %   -5 %

Resistance changes as the temperature varies. At ambient temperature, resistance is approximately 5 % lower than that of working temperature.

**Straightness:** For lengths up to 300 mm:

0.1 mm/150 mm.

For lengths >300 mm:

$L^2 \times 4$

1.000.000

L= length of heater in mm.

In any case, given the flexibility of the heater, the straightness can hardly represent a problem upon being inserted into the heater, even if the hole is very precise.

Tolerances stricter than standard can be accepted after agreement.

## TECHNICAL INFORMATION - RECOMMENDATIONS FOR INSTALLATION

- To improve heat conductivity and ease the extraction of the element, use the compound LUBRIHOT. Avoid polluting the element head with the paste as this can cause electricity leakage or short circuits.
- Place the external thermocouples no further than 10 mm from the cartridge and, if possible, in the centre area. This warning is extremely important when the heater has a high watt density.
- To achieve increased life time of the element, the use of proportional microprocessor thermoregulators is essential.
- Oxidation of the heaters and the hole in which they are inserted, produced by many hours of work at high temperatures, can make it difficult to extract the burnt element. Try first to loosen the element with the spray EXTRACTOR. Then drill a hole with a bit 2 to 3 tenths smaller than the nominal diameter of the heater. Remove the element, then use a boring machine to rebore the hole, if necessary, use an iron rod and a hammer as well.
- If used correctly, the heaters have a very long life. To obtain maximum performance it is important to supply an accurate specification of the element demand and the operation conditions.

## HEATING OF LIQUIDS

The compactness and high surface load of the cartridge heaters offer excellent solutions for heating liquids.

### General recommendations:

- Place the element as far away as possible from the walls of the container, allowing best possible circulation of the liquid by convection.
- Make sure that the liquid level is always at least 20 mm above the element.
- Avoid too frequent ON/OFF cycles, (use a proportional thermoregulator).
- Make sure there are no deposits of incrustation, lime deposits, substances etc. on the heater surface.
- To avoid emptying the container when a worn out element shall be replaced, it is recommended to use our supplementary sheaths .
- If there is a risk of the liquid overflowing, steam, high ambient humidity, contamination etc, sealed elements should be used.
- As far as possible, never exceed recommended surface loads, according to table beside.

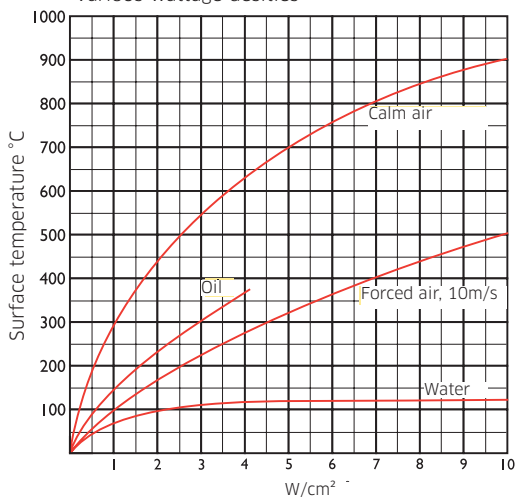
Recommended surface loads for different material. At forced circulation the density can be slightly increased. A lower density than indicated will increase the heater life time.

| Material                                | Max temp °C | Max W/cm <sup>2</sup> |
|---|-------------|-----------------------|
| Water                                   | 100         | 30                    |
| Asphalt, tar and other thick substances | 95          | 1.5                   |
|   | 150         | 1.2                   |
|   | 200         | 1.0                   |
|   | 250         | 0.8                   |
| Petrol - photogen                       | 150         | 3.5                   |
| Freon                                   | 150         | 0.5                   |
| Ethylene glycol                         | 150         | 4.5                   |
| Molasses                                | 40          | 0.7                   |
| Melt metal                              | 260-500     | 4.0                   |
| Heavy oil                               | 90          | 1.5                   |
| Heat conducting oil                     | 400         | 3.5                   |
| SAE 30 motor oil                        | 120         | 3.0                   |
| Vegetable oil                           | 200         | 4.5                   |
| Salt bath                               | 500         | 4.5                   |
| Caustic soda, NaOH 10 %                 | 90          | 4.0                   |
| Caustic soda, NaOH 75 %                 | 70          | 2.3                   |
| Acid solutions                          | 70          | 6.0                   |
| Alcalic solutions                       | 100         | 6.0                   |
| Decreasing solutions                    | 130         | 3.5                   |

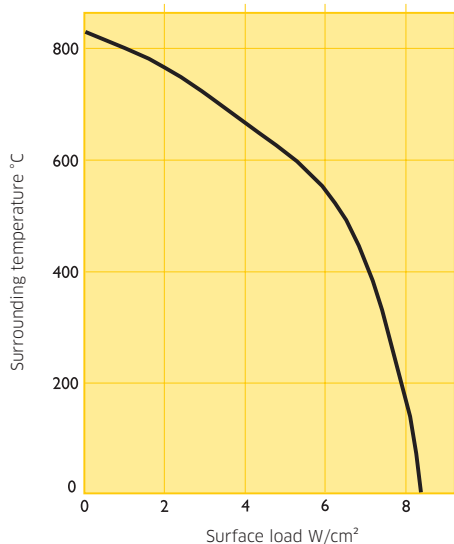


## TECHNICAL INFORMATION - RECOMMENDATION WHEN MOUNTING

Temperature taken on by sheath at various wattage densities



Maximum density on the heaters, used in high temperature environments



| W/cm <sup>2</sup> | Working temperature |       |       |       |       |       |       |       |
|-------------------|---------------------|-------|-------|-------|-------|-------|-------|-------|
|                   | 100°C               | 200°C | 300°C | 400°C | 500°C | 600°C | 700°C | 800°C |
| 2                 |                     |       |       |       |       |       |       | 1.30  |
| 3                 |                     |       |       |       |       |       |       | 0.35  |
| 4                 |                     |       |       |       |       |       | 1.00  | 0.15  |
| 5                 |                     |       |       |       | 2.00  | 1.50  | 0.60  | 0.080 |
| 6                 |                     | 2.00  | 1.75  | 1.30  | 1.50  | 0.70  | 0.30  | 0.040 |
| 7                 | 2.00                | 1.75  | 1.50  | 1.20  | 1.30  | 0.55  | 0.20  | 0.035 |
| 8                 | 1.75                | 1.50  | 1.30  | 1.00  | 1.00  | 0.45  | 0.15  | 0.030 |
| 9                 | 1.50                | 1.25  | 1.00  | 0.70  | 0.60  | 0.35  | 0.10  | 0.025 |
| 10                | 1.00                | 0.75  | 0.70  | 0.60  | 0.50  | 0.25  | 0.085 | 0.020 |
| 12                | 0.65                | 0.60  | 0.55  | 0.50  | 0.35  | 0.20  | 0.065 | 0.015 |
| 15                | 0.55                | 0.50  | 0.50  | 0.40  | 0.30  | 0.15  | 0.050 | 0.010 |
| 18                | 0.50                | 0.45  | 0.40  | 0.35  | 0.20  | 0.10  | 0.040 |       |
| 20                | 0.40                | 0.35  | 0.35  | 0.30  | 0.15  | 0.075 | 0.030 |       |
| 25                | 0.30                | 0.25  | 0.25  | 0.20  | 0.10  | 0.050 | 0.025 |       |
| 30                | 0.25                | 0.20  | 0.18  | 0.10  | 0.085 | 0.045 | 0.020 |       |
| 35                | 0.22                | 0.17  | 0.15  | 0.080 | 0.075 | 0.040 | 0.015 |       |
| 40                | 0.20                | 0.15  | 0.10  | 0.070 | 0.050 | 0.035 |       |       |
| 50                | 0.15                | 0.12  | 0.085 | 0.065 | 0.045 | 0.030 |       |       |
| 60                | 0.13                | 0.10  | 0.075 | 0.060 | 0.040 | 0.025 |       |       |
| 70                | 0.10                | 0.080 | 0.060 | 0.050 | 0.035 | 0.020 |       |       |
| 80                |                     |       |       |       |       |       |       |       |

For aluminium and brass, choose the clearance in the column corresponding to the temperature immediately superior that of the working temperature (+100°C)

The clearance is obtained by the difference between the hole diameter and the real diameter of the cartridge.

Example: hole diameter 12.6 mm

nominal diameter of cartridge 12.5 mm

12.6 mm - 12.42 mm (12.5 - 0.08 max catalog tolerance)

= 0.18 mm (max admissible clearance)

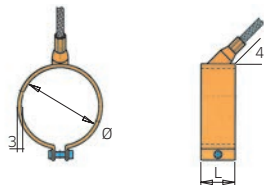
For optimum working conditions, energy saving and longer life time of the heater, it is advisable to bore holes with a tolerance of H7.

# NOZZLE ELEMENTS

Nozzle elements are produced with high precision and with high surface loading to meet the high demands of quick and safe heating. During the manufacturing process the element is subject to very high pressure to reach high insulation resistance, good heat

transmission without internal voids in the element and a very smooth surface for optional and uniform heat transmission from the total surface of the element. The element is absolutely tight to avoid that for instance melted plastic, oil or gas can leak in.

Sheath of brass with 45 axial connection. The element is furnished with 1000 mm cable and earth connection protected by a housing of metal braid. Designed for connection to nominal voltage 230V. Surface load 4.5 W/cm<sup>2</sup>. Tensional stability 2 kV.



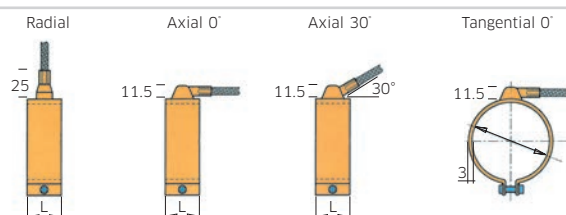
| DIA | DIA X L | POWER W | VOLTAGE V | ARTICLE NO.  | DIA | DIA X L | POWER W | VOLTAGE V | ARTICLE NO.  |
|-----|---------|---------|-----------|--------------|-----|---------|---------|-----------|--------------|
| 25  | 25 x 20 | 80      | 230       | 3002 520 080 | 55  | 55 x 20 | 155     | 230       | 3005 520 155 |
|     | 25 x 30 | 100     | 230       | 3002 530 100 |     | 55 x 25 | 190     | 230       | 3005 525 190 |
| 30  | 30 x 20 | 100     | 230       | 3003 020 100 | 55  | 55 x 30 | 230     | 230       | 3005 530 230 |
|     | 30 x 25 | 105     | 230       | 3003 025 105 |     | 55 x 35 | 270     | 230       | 3005 535 270 |
| 30  | 30 x 30 | 125     | 230       | 3003 030 125 | 55  | 55 x 40 | 310     | 230       | 3005 540 310 |
|     | 30 x 35 | 145     | 230       | 3003 035 145 |     | 55 x 50 | 385     | 230       | 3005 550 385 |
| 30  | 30 x 40 | 165     | 230       | 3003 040 170 | 60  | 60 x 20 | 165     | 230       | 3006 020 165 |
|     | 35 x 20 | 110     | 230       | 3003 520 110 |     | 60 x 25 | 210     | 230       | 3006 025 210 |
| 35  | 35 x 25 | 120     | 230       | 3003 525 120 | 60  | 60 x 30 | 250     | 230       | 3006 030 250 |
|     | 35 x 30 | 145     | 230       | 3003 530 145 |     | 60 x 35 | 295     | 230       | 3006 035 295 |
| 35  | 35 x 35 | 170     | 230       | 3003 535 170 | 60  | 60 x 40 | 335     | 230       | 3006 040 335 |
|     | 35 x 40 | 195     | 230       | 3003 540 195 |     | 60 x 50 | 420     | 230       | 3006 050 420 |
| 35  | 35 x 45 | 220     | 230       | 3003 545 220 | 60  | 60 x 60 | 505     | 230       | 3006 060 505 |
|     | 38 x 20 | 110     | 230       | 3003 820 110 |     | 65      | 65 x 20 | 180       | 230          |
| 38  | 38 x 25 | 140     | 230       | 3003 825 140 | 65  |         | 65 x 25 | 225       | 230          |
|     | 38 x 30 | 165     | 230       | 3003 830 165 |     | 65 x 30 | 275     | 230       | 3006 530 275 |
| 38  | 38 x 35 | 200     | 230       | 3003 835 200 | 65  | 65 x 35 | 320     | 230       | 3006 535 320 |
|     | 38 x 38 | 215     | 230       | 3003 838 215 |     | 65 x 40 | 365     | 230       | 3006 540 365 |
| 38  | 38 x 40 | 220     | 230       | 3003 840 220 | 65  | 65 x 50 | 455     | 230       | 3006 550 455 |
|     | 38 x 45 | 250     | 230       | 3003 845 250 |     | 65 x 60 | 550     | 230       | 3006 550 550 |
| 38  | 38 x 50 | 300     | 230       | 3003 850 300 | 70  | 70 x 20 | 195     | 230       | 3007 020 195 |
|     | 40 x 20 | 110     | 230       | 3004 020 110 |     | 70 x 25 | 245     | 230       | 3007 025 245 |
| 40  | 40 x 25 | 140     | 230       | 3004 025 140 | 70  | 70 x 30 | 295     | 230       | 3007 030 295 |
|     | 40 x 30 | 165     | 230       | 3004 030 165 |     | 70 x 35 | 345     | 230       | 3007 035 345 |
| 40  | 40 x 35 | 195     | 230       | 3004 035 195 | 70  | 70 x 40 | 395     | 230       | 3007 040 395 |
|     | 40 x 40 | 225     | 230       | 3004 040 225 |     | 70 x 50 | 490     | 230       | 3007 050 490 |
| 40  | 40 x 45 | 250     | 230       | 3004 045 250 | 70  | 70 x 60 | 590     | 230       | 3007 060 590 |
|     | 42 x 20 | 120     | 230       | 3004 220 120 |     | 75      | 75 x 20 | 210       | 230          |
| 42  | 42 x 25 | 145     | 230       | 3004 225 145 | 75  |         | 75 x 25 | 260       | 230          |
|     | 42 x 30 | 175     | 230       | 3004 230 175 |     | 75 x 30 | 315     | 230       | 3007 530 315 |
| 42  | 42 x 35 | 205     | 230       | 3004 235 205 | 75  | 75 x 35 | 370     | 230       | 3007 535 370 |
|     | 42 x 40 | 235     | 230       | 3004 240 235 |     | 75 x 40 | 420     | 230       | 3007 540 420 |
| 45  | 45 x 20 | 130     | 230       | 3004 520 130 | 75  | 75 x 50 | 525     | 230       | 3007 550 525 |
|     | 45 x 25 | 155     | 230       | 3004 525 155 |     | 75 x 60 | 635     | 230       | 3007 560 635 |
| 45  | 45 x 30 | 190     | 230       | 3004 530 190 | 80  | 80 x 20 | 225     | 230       | 3008 020 225 |
|     | 45 x 35 | 220     | 230       | 3004 535 220 |     | 80 x 25 | 280     | 230       | 3008 025 280 |
| 45  | 45 x 40 | 250     | 230       | 3004 540 250 | 80  | 80 x 30 | 335     | 230       | 3008 030 335 |
|     | 45 x 45 | 285     | 230       | 3004 545 285 |     | 80 x 35 | 395     | 230       | 3008 035 395 |
| 45  | 45 x 50 | 315     | 230       | 3004 550 315 | 80  | 80 x 40 | 450     | 230       | 3008 040 450 |
|     | 45 x 55 | 345     | 230       | 3004 555 345 |     | 80 x 50 | 565     | 230       | 3008 050 565 |
| 48  | 48 x 20 | 135     | 230       | 3004 820 135 | 85  | 80 x 60 | 675     | 230       | 3008 060 675 |
|     | 48 x 30 | 200     | 230       | 3004 830 200 |     | 85 x 20 | 240     | 230       | 3008 520 240 |
| 48  | 48 x 50 | 380     | 230       | 3004 850 380 | 85  | 85 x 25 | 300     | 230       | 3008 525 300 |
|     | 50 x 20 | 140     | 230       | 3005 020 140 |     | 85 x 30 | 360     | 230       | 3008 530 360 |
| 50  | 50 x 25 | 175     | 230       | 3005 025 175 | 85  | 85 x 35 | 420     | 230       | 3008 535 420 |
|     | 50 x 30 | 210     | 230       | 3005 030 210 |     | 85 x 40 | 480     | 230       | 3008 540 480 |
| 50  | 50 x 35 | 245     | 230       | 3005 035 245 | 85  | 85 x 50 | 600     | 230       | 3008 550 600 |
|     | 50 x 40 | 280     | 230       | 3005 040 280 |     | 85 x 60 | 720     | 230       | 3008 560 720 |
| 50  | 50 x 50 | 350     | 230       | 3005 050 350 |     |         |         |           |              |
|     | 50 x 60 | 420     | 230       | 3005 060 420 |     |         |         |           |              |

## CONT. NOZZLE ELEMENTS

| DIA | DIA X L | POWER W | VOLTAGE V | ARTICLE NO.  | DIA | DIA X L  | POWER W | VOLTAGE V | ARTICLE NO.  |
|-----|---------|---------|-----------|--------------|-----|----------|---------|-----------|--------------|
| 90  | 90 x 20 | 250     | 230       | 3009 020 250 | 95  | 95 x 40  | 535     | 230       | 3009 540 535 |
|     | 90 x 25 | 315     | 230       | 3009 025 315 |     | 95 x 50  | 670     | 230       | 3009 550 670 |
|     | 90 x 30 | 380     | 230       | 3009 030 380 |     | 95 x 60  | 800     | 230       | 3009 560 800 |
|     | 90 x 35 | 445     | 230       | 3009 035 445 | 100 | 100 x 20 | 280     | 230       | 3010 020 280 |
|     | 90 x 40 | 505     | 230       | 3009 040 505 |     | 100 x 25 | 350     | 230       | 3010 025 350 |
|     | 90 x 50 | 635     | 230       | 3009 050 635 |     | 100 x 30 | 420     | 230       | 3010 030 420 |
|     | 90 x 60 | 760     | 230       | 3009 060 760 |     | 100 x 35 | 490     | 230       | 3010 035 490 |
| 95  | 95 x 20 | 265     | 230       | 3009 520 265 |     | 100 x 40 | 560     | 230       | 3010 040 560 |
|     | 95 x 25 | 335     | 230       | 3009 525 335 |     | 100 x 50 | 700     | 230       | 3010 050 700 |
|     | 95 x 30 | 400     | 230       | 3009 530 400 |     | 100 x 60 | 840     | 230       | 3010 060 840 |
|     | 95 x 35 | 465     | 230       | 3009 535 465 |     |          |         |           |              |

### NOZZLE ELEMENTS- SPECIAL DESIGN

Sheath in stainless steel for very corrosive environments like injection moulding of details in PVC plastic, which also allows a higher temperature and surface loading 7 W/cm<sup>2</sup>. Thermo sensor type J for temperature regulation. Alternative connections see beside.



### NOZZLE ELEMENTS- ASSEMBLY INSTRUCTIONS

Socket head cap wrench 4 mm is used. It is very important that the nozzle element is assembled tightly to avoid any internal voids between the element and for instance the nozzle of an injection moulder. After the first heating the nozzle element must be after-stretched.

Bending of the connection cable close to the element should be avoided. Remaining plastic material at element surface can be removed by heating to melting point. Avoid blows at the element and take good care when removing plastic.

## RING- AND BAND ELEMENTS

We produce ring- and band elements according to customer specification.

**Examples of application areas:**

Injection moulding machines-extruders, containers, tanks, moulds, tools, etc.

**Design:**

Micanite with plate casing

Ceramics with plate casing

According to customer specification

**Examples of connection options:**

Terminal box

Cabinet inlet

Nickel wire

Tab terminal

Screw and nut, etc.

Contact us for further info/order form or order.

Band element in micanite with sheet metal casing



Ring element in ceramics with sheet metal casing



Ring element in micanite with sheet metal casing



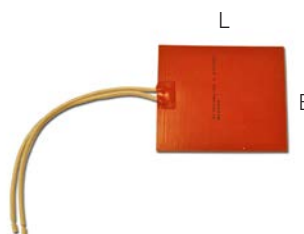
# HEATING FOIL ELEMENTS

Backer has a range of foil elements in stock for direct delivery. The elements have a certain resistance and give different powers depending on connected voltage according tables below. The ele-

ments can be used directly in your application or to be tested for an appropriate dimension or quality before order of a special designed heater.

## SILICONE

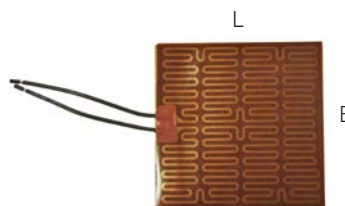
Silicone rubber is a flexible material with good heat resistance, max 200°C. Silicone rubber has a high resistance towards many chemicals. One side of the foil element is furnished with an adhesive substance. Connection cables length 200mm.



| SILICONE |      |                      |                | 12V Power W | 24V Power W | 48V Power W | 110V Power W | 230V Power W | 400V Power W | ARTICLE NO. |
|----------|------|----------------------|----------------|-------------|-------------|-------------|--------------|--------------|--------------|-------------|
| B mm     | L mm | AREA CM <sup>2</sup> | RESISTANCE OHM |             |             |             |              |              |              |             |
| 25       | 50   | 12.5                 | 56.9           | 2.5         | 10          | 40          |              |              |              | SI102985-00 |
| 50       | 50   | 25                   | 28.8           | 5           | 20          | 80          |              |              |              | SI102987-00 |
| 50       | 100  | 50                   | 14.4           | 10          | 40          | 160         |              |              |              | SI102989-00 |
| 95       | 100  | 100                  | 151            |             |             | 15          | 80           | 350          |              | SI102991-00 |
| 95       | 200  | 200                  | 75.5           |             |             | 30          | 160          | 700          |              | SI102993-00 |
| 95       | 200  | 200                  | 331            |             |             |             | 36           | 160          | 483          | SI102995-00 |
| 190      | 200  | 400                  | 37.8           |             |             | 61          | 320          | 1399         |              | SI102997-00 |
| 190      | 300  | 600                  | 110            |             |             |             | 110          | 480          | 1454         | SI103001-00 |
| ø 70     |      | 38                   | 19.2           | 7.5         | 30          | 120         |              |              |              | SI103005-00 |
| ø 150    |      | 177                  | 16.5           |             | 35          | 139         | 733          |              |              | SI103009-00 |
| ø 200    |      | 314                  | 211.6          |             |             |             | 57           | 250          | 756          | SI103011-00 |

## POLYIMIDE

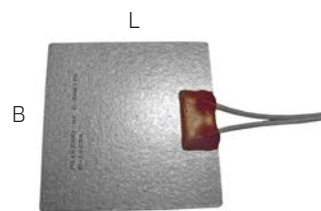
Polyimide is a thin semi-transparent material with good electrical insulation ability. It is also resistant towards a great number of acids and bases. It can be used in environments with temperatures from -271°C to 220°C. One side of the foil element is furnished with an adhesive substance. Connection cables length 200mm



| POLYIMIDE |      |                      |                | 1.5V Power W | 3V Power W | 4.5V Power W | 6V Power W | 9V Power W | 12V Power W | 24V Power W | 48V Power W | ARTICLE NO. |
|-----------|------|----------------------|----------------|--------------|------------|--------------|------------|------------|-------------|-------------|-------------|-------------|
| B mm      | L mm | AREA CM <sup>2</sup> | RESISTANCE OHM |              |            |              |            |            |             |             |             |             |
| 25        | 50   | 12.5                 | 1.9            | 1.2          | 4.7        | 10.7         | 19         |            |             |             |             | PI102831-00 |
| 50        | 50   | 25                   | 3.6            | 0.6          | 2.5        | 5.6          | 10         | 22         | 40          |             |             | PI102833-00 |
| 50        | 100  | 50                   | 1.8            | 1.3          | 5          | 11.3         | 20         | 45         | 80          |             |             | PI102835-00 |
| 100       | 100  | 100                  | 3.6            |              | 2.5        | 5.6          | 10         | 22         | 40          | 160         |             | PI102837-00 |
| 100       | 200  | 200                  | 1.8            |              | 5.0        | 11.3         | 20         | 45         | 80          | 320         |             | PI102839-00 |
| 195       | 200  | 400                  | 3.6            |              |            |              | 10         | 22         | 40          | 160         | 640         | PI102841-00 |
| 195       | 300  | 600                  | 2.4            |              |            |              | 15         | 33         | 60          | 240         | 960         | PI102843-00 |

# MICANITE

Foil heating element between micarite plates.  
 Heat resistance max 400°C  
 Connection cables length 200mm



| MICANITE |             |                      |            | 12V        | 24V        | 48V        | 110V       | 230V       | 400V       | ARTICLE NO. |
|----------|-------------|----------------------|------------|------------|------------|------------|------------|------------|------------|-------------|
| L mm     | B mm<br>OHM | AREA CM <sup>2</sup> | RESISTANCE | Power<br>W | Power<br>W | Power<br>W | Power<br>W | Power<br>W | Power<br>W |             |
| 100      | 100         | 100                  | 353        |            |            | 6.5        | 34         | 150        | 453        | MI102981-00 |
| 180      | 200         | 400                  | 400        |            |            | 26         | 137        | 599        | 1814       | MI102983-00 |

# COMPRESSOR AND CRANK CASE HEATERS

Standard range of heating products for crank cases of compressors to heat pumps, etc. The main purpose is to avoid starts with cold

oil in the crank case and as a result prolong the life time of the compressor. The heaters can also be customized.

Crankcase heater with a shell of aluminium and a constant power. Voltage 220-240 V.



| DIAMETER MM | DIA. MIN-MAX MM | POWER W | ARTICLE NO.  |
|-------------|-----------------|---------|--------------|
| 139         | 124-178         | 40      | 3840 028 001 |
| 168         | 165-200         | 40      | 3840 028 010 |
| 186         | 172-226         | 70      | 3840 028 017 |
| 233         | 227-281         | 90      | 3840 028 024 |
| 273         | 248-302         | 70      | 3840 028 027 |
| 273         | 275-330         | 120     | 3840 028 035 |
| 334         | 319-373         | 140     | 3840 028 040 |

A self-regulating heating cable with operating temperature 65°C furnished with a connection cable and an UV-resistant bundle band for fixing around the crank case of the compressor.



| VOLTAGE V | POWER AT 10°C W | LENGTH V-CABLE MM | LENGTH BUNDLE BAND MM | LENGTH CONNECTION CABLE MM | ARTICLE NO.  |
|-----------|-----------------|-------------------|-----------------------|----------------------------|--------------|
| 230       | 12              | 300               | 550                   | 1000                       | 6150 410 201 |

Compressor heater in silicone rubber that can manage a surrounding temperature from -50 °C to 200 °C. The heaters are furnished with a feather for fixing around the crankcase of the compressor.

For better fixing and better contact we recommend the use of our stainless steel bundle band.



| VOLTAGE V | POWER W | LENGTH H-CABLE MM | LENGTH BUNDLE BAND MM | LENGTH CONNECTION CABLE MM | ARTICLE NO.  |
|-----------|---------|-------------------|-----------------------|----------------------------|--------------|
| 230       | 45      | 640               | 14                    | 1000                       | 3050 810 001 |
| 230       | 45      | 490               | 14                    | 1000                       | 3050 810 101 |

Stainless steel bundle band for mounting of compressor heater.



| MATERIAL  | LENGTH MM | WIDTH MM | ARTICLE NO.  |
|-----------|-----------|----------|--------------|
| EN 1.4301 | 838       | 4.6      | 1150 810 201 |

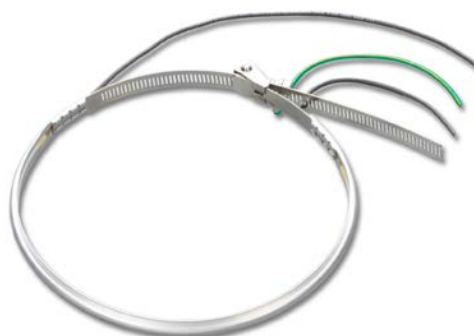
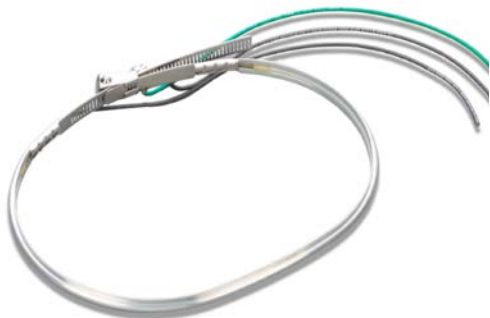
## CONT. COMPRESSOR HEATERS

Backer is a leading producer of compressor heaters and develop products in aluminium and polymer according to the latest know technologies.

With manufacturers of compressors and heat pumps as well as other big volume users in mind, Backer offer a big standard range of compressor heaters. In close cooperation with our customers we also produce tailor made solutions.

Example of designs:

Please contact us for more information and prices.





# RADIANT- AND AIR HEATING



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## IR ELEMENTS

### Examples of application areas:

Plastic moulding, sterilization, gluing, screen printing, drying of varnish and printing, heating at animal breeding, etc.

### Material:

Ceramics, quartz glass, quartz glass with halogen.  
Operating temperature: 150-2400°C

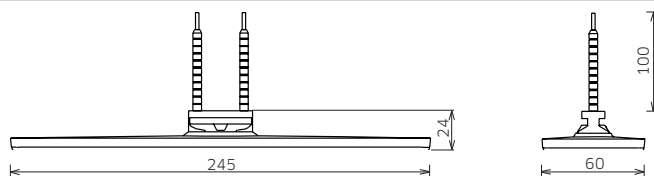
## CERAMICS

| IR-elements in ceramics type LFFE incl. lock - and spring washer. |          |         |           |              |        |          |         |           |              |
|---|----------|---------|-----------|--------------|--------|----------|---------|-----------|--------------|
| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
| LFFE  | 245x95   | 750     | 230       | 3054 400 750 | LFFE   | 245x95   | 1200    | 230       | 3054 401 200 |
| LFFE  | 245x95   | 1000    | 230       | 3054 401 000 | LFFE   | 245x95   | 1400    | 230       | 3054 401 400 |
| Type LFFE with built-in thermo element NiCr-Hi type K.            |          |         |           |              |        |          |         |           |              |
| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
| LFFE-K  | 245x95   | 750     | 230       | 3054 400 751 | LFFE-K | 245x95   | 1200    | 230       | 3054 401 201 |
| LFFE-K  | 245x95   | 1000    | 230       | 3054 401 001 | LFFE-K | 245x95   | 1400    | 230       | 3054 401 401 |
| Type LFFE with built-in thermo element Fe-CuNi type J.            |          |         |           |              |        |          |         |           |              |
| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
| LFFE-J  | 245x95   | 750     | 230       | 3054 400 752 | LFFE-J | 245x95   | 1200    | 230       | 3054 401 202 |
| LFFE-J  | 245x95   | 1000    | 230       | 3054 401 002 | LFFE-J | 245x95   | 1400    | 230       | 3054 401 402 |

| IR-elements in ceramics type LFTE incl. lock - and spring washer. |          |         |           |              |        |          |         |           |              |
|---|----------|---------|-----------|--------------|--------|----------|---------|-----------|--------------|
| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
| LFTE  | 245x110  | 750     | 230       | 3054 410 750 | LFTE   | 245x110  | 1200    | 230       | 3054 411 200 |
| LFTE  | 245x110  | 1000    | 230       | 3054 411 000 | LFTE   | 245x110  | 1400    | 230       | 3054 411 400 |
| Type LFTE with built-in thermo element type K.                    |          |         |           |              |        |          |         |           |              |
| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
| LFTE-K  | 245x110  | 750     | 230       | 3054 410 751 | LFTE-K | 245x110  | 1200    | 230       | 3054 411 201 |
| LFTE-K  | 245x110  | 1000    | 230       | 3054 411 001 | LFTE-K | 245x110  | 1400    | 230       | 3054 411 401 |
| Ditto, type LFTE with built-in thermo element type J.             |          |         |           |              |        |          |         |           |              |
| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
| LFTE-J  | 245x110  | 750     | 230       | 3054 410 752 | LFTE-J | 245x110  | 1200    | 230       | 3054 411 202 |
| LFTE-J  | 245x110  | 1000    | 230       | 3054 411 002 | LFTE-J | 245x110  | 1400    | 230       | 3054 411 402 |

## CONT. IR-ELEMENTS, CERAMICS

IR-elements in ceramics type FFE incl. lock - and spring washer.



| TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------|---------|-----------|--------------|------|----------|---------|-----------|--------------|
| FFE  | 245x60   | 150     | 230       | 3054 190 150 | FFE  | 245x60   | 500     | 230       | 3054 190 500 |
| FFE  | 245x60   | 250     | 230       | 3054 190 250 | FFE  | 245x60   | 650     | 230       | 3054 190 650 |
| FFE  | 245x60   | 300     | 230       | 3054 190 300 | FFE  | 245x60   | 750     | 230       | 3054 190 750 |
| FFE  | 245x60   | 350     | 230       | 3054 190 350 | FFE  | 245x60   | 800     | 230       | 3054 190 800 |
| FFE  | 245x60   | 400     | 230       | 3054 190 400 | FFE  | 245x60   | 1000    | 230       | 3054 191 000 |

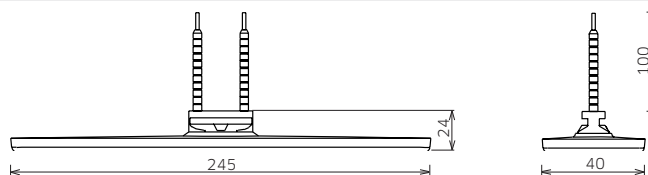
Type FFE with built-in thermo element NiCr-Ni type K.

| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|-------|----------|---------|-----------|--------------|-------|----------|---------|-----------|--------------|
| FFE-K | 245x60   | 150     | 230       | 3054 190 151 | FFE-K | 245x60   | 500     | 230       | 3054 190 501 |
| FFE-K | 245x60   | 250     | 230       | 3054 190 251 | FFE-K | 245x60   | 650     | 230       | 3054 190 651 |
| FFE-K | 245x60   | 300     | 230       | 3054 190 301 | FFE-K | 245x60   | 750     | 230       | 3054 190 751 |
| FFE-K | 245x60   | 350     | 230       | 3054 190 351 | FFE-K | 245x60   | 800     | 230       | 3054 190 801 |
| FFE-K | 245x60   | 400     | 230       | 3054 190 401 | FFE-K | 245x60   | 1000    | 230       | 3054 191 001 |

Type FFE with built-in thermo element FeCu-Ni type J.

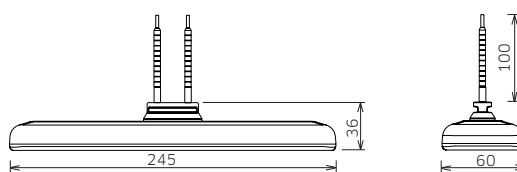
| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|-------|----------|---------|-----------|--------------|-------|----------|---------|-----------|--------------|
| FFE-J | 245x60   | 150     | 230       | 3054 190 152 | FFE-J | 245x60   | 500     | 230       | 3054 190 502 |
| FFE-J | 245x60   | 250     | 230       | 3054 190 252 | FFE-J | 245x60   | 650     | 230       | 3054 190 652 |
| FFE-J | 245x60   | 300     | 230       | 3054 190 302 | FFE-J | 245x60   | 750     | 230       | 3054 190 752 |
| FFE-J | 245x60   | 350     | 230       | 3054 190 352 | FFE-J | 245x60   | 800     | 230       | 3054 190 802 |
| FFE-J | 245x60   | 400     | 230       | 3054 190 402 | FFE-J | 245x60   | 1000    | 230       | 3054 191 002 |

IR-elements in ceramics type FFES incl. lock - and spring washer.



| TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------|---------|-----------|--------------|------|----------|---------|-----------|--------------|
| FFES | 245x40   | 150     | 230       | 3054 180 150 | FFES | 245x40   | 400     | 230       | 3054 180 400 |
| FFES | 245x40   | 250     | 230       | 3054 180 250 | FFES | 245x40   | 500     | 230       | 3054 180 500 |
| FFES | 245x40   | 300     | 230       | 3054 180 300 | FFES | 245x40   | 650     | 230       | 3054 180 650 |
| FFES | 245x40   | 350     | 230       | 3054 180 350 |      |          |         |           |              |

IR-elements in ceramics type FFEH incl. lock - and spring washer.



| TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------|---------|-----------|--------------|------|----------|---------|-----------|--------------|
| FFEH | 245x60   | 150     | 230       | 3054 590 150 | FFEH | 245x60   | 500     | 230       | 3054 590 500 |
| FFEH | 245x60   | 250     | 230       | 3054 590 250 | FFEH | 245x60   | 650     | 230       | 3054 590 650 |
| FFEH | 245x60   | 300     | 230       | 3054 590 300 | FFEH | 245x60   | 750     | 230       | 3054 590 750 |
| FFEH | 245x60   | 350     | 230       | 3054 590 350 | FFEH | 245x60   | 800     | 230       | 3054 590 800 |
| FFEH | 245x60   | 400     | 230       | 3054 590 400 |      |          |         |           |              |

## CONT. IR-ELEMENTS, CERAMICS

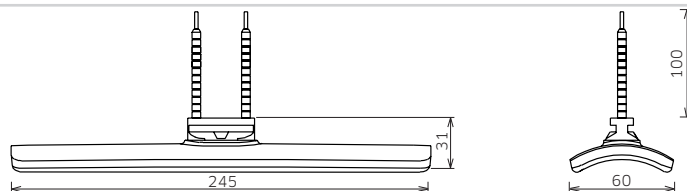
Type FFEH with built-in thermo element NiCr-Ni type K.

| TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|--------|----------|---------|-----------|--------------|--------|----------|---------|-----------|--------------|
| FFEH-K | 245x60   | 150     | 230       | 3054 590 151 | FFEH-K | 245x60   | 500     | 230       | 3054 590 501 |
| FFEH-K | 245x60   | 250     | 230       | 3054 590 251 | FFEH-K | 245x60   | 650     | 230       | 3054 590 651 |
| FFEH-K | 245x60   | 300     | 230       | 3054 590 301 | FFEH-K | 245x60   | 750     | 230       | 3054 590 751 |
| FFEH-K | 245x60   | 350     | 230       | 3054 590 351 | FFEH-K | 245x60   | 800     | 230       | 3054 590 801 |
| FFEH-K | 245x60   | 400     | 230       | 3054 590 401 |        |          |         |           |              |

Type FFEH with built-in thermo element FeCu-Ni type J.

| TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|--------|----------|---------|-----------|--------------|--------|----------|---------|-----------|--------------|
| FFEH-J | 245x60   | 150     | 230       | 3054 590 152 | FFEH-J | 245x60   | 500     | 230       | 3054 590 502 |
| FFEH-J | 245x60   | 250     | 230       | 3054 590 252 | FFEH-J | 245x60   | 650     | 230       | 3054 590 652 |
| FFEH-J | 245x60   | 300     | 230       | 3054 590 302 | FFEH-J | 245x60   | 750     | 230       | 3054 590 752 |
| FFEH-J | 245x60   | 350     | 230       | 3054 590 352 | FFEH-J | 245x60   | 800     | 230       | 3054 590 802 |
| FFEH-J | 245x60   | 400     | 230       | 3054 590 402 |        |          |         |           |              |

IR-elements in ceramics type FTE incl. lock - and spring washer.



| TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------|---------|-----------|--------------|------|----------|---------|-----------|--------------|
| FTE  | 245x60   | 150     | 230       | 3054 110 150 | FTE  | 245x60   | 500     | 230       | 3054 110 500 |
| FTE  | 245x60   | 250     | 230       | 3054 110 250 | FTE  | 245x60   | 650     | 230       | 3054 110 650 |
| FTE  | 245x60   | 300     | 230       | 3054 110 300 | FTE  | 245x60   | 750     | 230       | 3054 110 750 |
| FTE  | 245x60   | 350     | 230       | 3054 110 350 | FTE  | 245x60   | 800     | 230       | 3054 110 800 |
| FTE  | 245x60   | 400     | 230       | 3054 110 400 | FTE  | 245x60   | 1000    | 230       | 3054 111 000 |

Ditto, type FTE with built-in thermo element NiCr-Ni type K.

| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|-------|----------|---------|-----------|--------------|-------|----------|---------|-----------|--------------|
| FTE-K | 245x60   | 150     | 230       | 3054 110 151 | FTE-K | 245x60   | 500     | 230       | 3054 110 501 |
| FTE-K | 245x60   | 250     | 230       | 3054 110 251 | FTE-K | 245x60   | 650     | 230       | 3054 110 651 |
| FTE-K | 245x60   | 300     | 230       | 3054 110 301 | FTE-K | 245x60   | 750     | 230       | 3054 110 751 |
| FTE-K | 245x60   | 350     | 230       | 3054 110 351 | FTE-K | 245x60   | 800     | 230       | 3054 110 801 |
| FTE-K | 245x60   | 400     | 230       | 3054 110 401 | FTE-K | 245x60   | 1000    | 230       | 3054 111 001 |

Ditto, type FTE with built-in thermo element FeCu-Ni type J.

| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|-------|----------|---------|-----------|--------------|-------|----------|---------|-----------|--------------|
| FTE-J | 245x60   | 150     | 230       | 3054 110 152 | FTE-J | 245x60   | 500     | 230       | 3054 110 502 |
| FTE-J | 245x60   | 250     | 230       | 3054 110 252 | FTE-J | 245x60   | 650     | 230       | 3054 110 652 |
| FTE-J | 245x60   | 300     | 230       | 3054 110 302 | FTE-J | 245x60   | 750     | 230       | 3054 110 752 |
| FTE-J | 245x60   | 350     | 230       | 3054 110 352 | FTE-J | 245x60   | 800     | 230       | 3054 110 802 |
| FTE-J | 245x60   | 400     | 230       | 3054 110 402 | FTE-J | 245x60   | 1000    | 230       | 3054 111 002 |

## CONT. IR-ELEMENTS, CERAMICS

IR-elements in ceramics type HFE incl. lock and spring washer.



| TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------|---------|-----------|--------------|------|----------|---------|-----------|--------------|
| HFE  | 122x60   | 125     | 230       | 305 4140 125 | HFE  | 122x60   | 325     | 230       | 305 4140 325 |
| HFE  | 122x60   | 150     | 230       | 305 4140 150 | HFE  | 122x60   | 400     | 230       | 305 4140 400 |
| HFE  | 122x60   | 200     | 230       | 305 4140 200 | HFE  | 122x60   | 500     | 230       | 305 4140 500 |
| HFE  | 122x60   | 250     | 230       | 305 4140 250 |      |          |         |           |              |

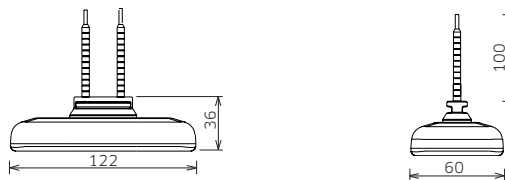
Ditto, type HFE with built-in thermo element NiCr-Ni type K.

| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|-------|----------|---------|-----------|--------------|-------|----------|---------|-----------|--------------|
| HFE-K | 122x60   | 125     | 230       | 3054 140 126 | HFE-K | 122x60   | 325     | 230       | 3054 140 326 |
| HFE-K | 122x60   | 150     | 230       | 3054 140 151 | HFE-K | 122x60   | 400     | 230       | 3054 140 401 |
| HFE-K | 122x60   | 200     | 230       | 3054 140 201 | HFE-K | 122x60   | 500     | 230       | 3054 140 501 |
| HFE-K | 122x60   | 250     | 230       | 3054 140 251 |       |          |         |           |              |

Type HFE with built-in thermo element FeCu-Ni type J.

| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|-------|----------|---------|-----------|--------------|-------|----------|---------|-----------|--------------|
| HFE-J | 122x60   | 125     | 230       | 3054 140 127 | HFE-J | 122x60   | 325     | 230       | 3054 140 327 |
| HFE-J | 122x60   | 150     | 230       | 3054 140 152 | HFE-J | 122x60   | 400     | 230       | 3054 140 402 |
| HFE-J | 122x60   | 200     | 230       | 3054 140 202 | HFE-J | 122x60   | 500     | 230       | 3054 140 502 |
| HFE-J | 122x60   | 250     | 230       | 3054 140 252 |       |          |         |           |              |

IR-elements in ceramics type HFEH incl. lock - and spring washer.



| TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------|---------|-----------|--------------|------|----------|---------|-----------|--------------|
| HFEH | 122x60   | 125     | 230       | 3054 540 125 | HFEH | 122x60   | 250     | 230       | 3054 540 250 |
| HFEH | 122x60   | 150     | 230       | 3054 540 150 | HFEH | 122x60   | 325     | 230       | 3054 540 325 |
| HFEH | 122x60   | 200     | 230       | 3054 540 200 | HFEH | 122x60   | 400     | 230       | 3054 540 400 |

Type HFEH with built-in thermo element NiCr-Ni type K.

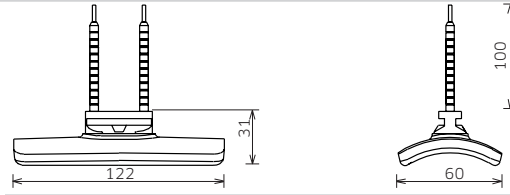
| TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|--------|----------|---------|-----------|--------------|--------|----------|---------|-----------|--------------|
| HFEH-K | 122x60   | 125     | 230       | 3054 540 126 | HFEH-K | 122x60   | 250     | 230       | 3054 540 251 |
| HFEH-K | 122x60   | 150     | 230       | 3054 540 151 | HFEH-K | 122x60   | 325     | 230       | 3054 540 326 |
| HFEH-K | 122x60   | 200     | 230       | 3054 540 201 | HFEH-K | 122x60   | 400     | 230       | 3054 540 401 |

Type HFEH with built-in thermo element FeCu-Ni type J.

| TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|--------|----------|---------|-----------|--------------|--------|----------|---------|-----------|--------------|
| HFEH-J | 122x60   | 125     | 230       | 3054 540 127 | HFEH-J | 122x60   | 250     | 230       | 3054 540 252 |
| HFEH-J | 122x60   | 150     | 230       | 3054 540 152 | HFEH-J | 122x60   | 325     | 230       | 3054 540 327 |
| HFEH-J | 122x60   | 200     | 230       | 3054 540 202 | HFEH-J | 122x60   | 400     | 230       | 3054 540 402 |

## CONT. IR-ELEMENTS, CERAMICS

IR-elements in ceramics type HTE incl. lock - and spring washer.



| TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------|---------|-----------|--------------|------|----------|---------|-----------|--------------|
| HTE  | 122x60   | 125     | 230       | 3054 120 125 | HTE  | 122x60   | 325     | 230       | 3054 120 325 |
| HTE  | 122x60   | 150     | 230       | 3054 120 150 | HTE  | 122x60   | 400     | 230       | 3054 120 400 |
| HTE  | 122x60   | 200     | 230       | 3054 120 200 | HTE  | 122x60   | 500     | 230       | 3054 120 500 |
| HTE  | 122x60   | 250     | 230       | 3054 120 250 |      |          |         |           |              |

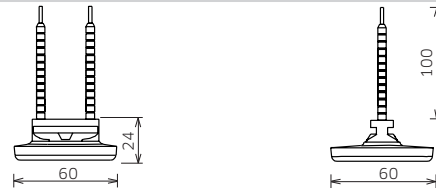
Type HTE with built-in thermo element NiCr-Ni type K.

| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|-------|----------|---------|-----------|--------------|-------|----------|---------|-----------|--------------|
| HTE-K | 122x60   | 125     | 230       | 3054 120 126 | HTE-K | 122x60   | 325     | 230       | 3054 120 326 |
| HTE-K | 122x60   | 150     | 230       | 3054 120 151 | HTE-K | 122x60   | 400     | 230       | 3054 120 401 |
| HTE-K | 122x60   | 200     | 230       | 3054 120 201 | HTE-K | 122x60   | 500     | 230       | 3054 120 501 |
| HTE-K | 122x60   | 250     | 230       | 3054 120 251 |       |          |         |           |              |

Type HTE with built-in thermo element FeCu-Ni type J.

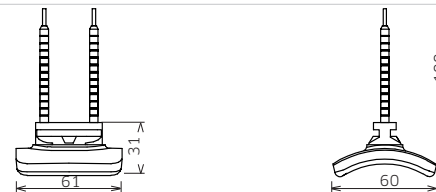
| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|-------|----------|---------|-----------|--------------|-------|----------|---------|-----------|--------------|
| HTE-J | 122x60   | 125     | 230       | 3054 120 127 | HTE-J | 122x60   | 325     | 230       | 3054 120 327 |
| HTE-J | 122x60   | 150     | 230       | 3054 120 152 | HTE-J | 122x60   | 400     | 230       | 3054 120 402 |
| HTE-J | 122x60   | 200     | 230       | 3054 120 202 | HTE-J | 122x60   | 500     | 230       | 3054 120 502 |
| HTE-J | 122x60   | 250     | 230       | 3054 120 252 |       |          |         |           |              |

IR-elements in ceramics type QFE incl. lock - and spring washer.



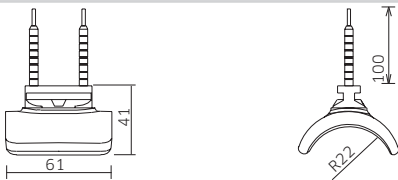
| TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------|---------|-----------|--------------|------|----------|---------|-----------|--------------|
| QFE  | 60x60    | 125     | 230       | 3054 350 125 | QFE  | 60x60    | 250     | 230       | 3054 350 250 |

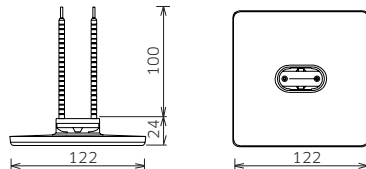
IR-elements in ceramics type QTE incl. lock - and spring washer.

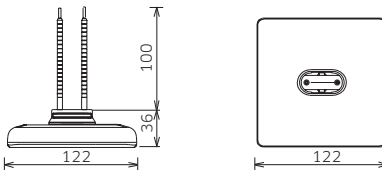


| TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------|---------|-----------|--------------|------|----------|---------|-----------|--------------|
| QTE  | 61x60    | 125     | 230       | 3054 150 125 | QTE  | 61x60    | 250     | 230       | 3054 150 250 |

## CONT. IR-ELEMENTS, CERAMICS

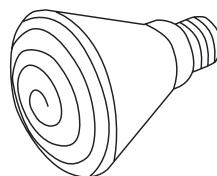
| IR-elements in ceramics type QCE incl. lock - and spring washer. |          |         |           |              |  |          |         |           |              |
|--|----------|---------|-----------|--------------|--|----------|---------|-----------|--------------|
| TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
| QCE  | 61x60    | 150     | 230       | 3054 360 150 | QCE  | 61x60    | 250     | 230       | 3054 360 250 |

| IR-elements in ceramics type SFSE incl. lock - and spring washer. |          |         |           |              |  |          |         |           |              |
|---|----------|---------|-----------|--------------|--|----------|---------|-----------|--------------|
| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE   | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
| SFSE  | 122x122  | 150     | 230       | 3054 130 150 | SFSE   | 122x122  | 400     | 230       | 3054 130 400 |
| SFSE  | 122x122  | 250     | 230       | 3054 130 250 | SFSE   | 122x122  | 500     | 230       | 3054 130 500 |
| SFSE  | 122x122  | 300     | 230       | 3054 130 300 | SFSE   | 122x122  | 650     | 230       | 3054 130 650 |
| SFSE  | 122x122  | 350     | 230       | 3054 130 350 | SFSE   | 122x122  | 750     | 230       | 3054 130 750 |

| IR-elements in ceramics type SFEH incl. lock - and spring washer. |          |         |           |              |  |          |         |           |              |
|---|----------|---------|-----------|--------------|---|----------|---------|-----------|--------------|
| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
| SFEH  | 122x122  | 250     | 230       | 3054 530 250 | SFEH  | 122x122  | 500     | 230       | 3054 530 500 |
| SFEH  | 122x122  | 300     | 230       | 3054 530 300 | SFEH  | 122x122  | 650     | 230       | 3054 530 650 |
| SFEH  | 122x122  | 350     | 230       | 3054 530 350 | SFEH  | 122x122  | 750     | 230       | 3054 530 750 |
| SFEH  | 122x122  | 400     | 230       | 3054 530 400 | SFEH  | 122x122  | 800     | 230       | 3054 530 800 |

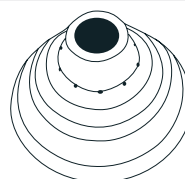
## CONT. IR-ELEMENTS, CERAMICS

IR-lamp in ceramics type ESE.



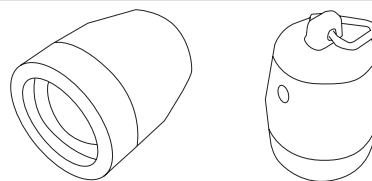
| TYPE | DIA X L mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE  | DIA X L mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|------------|---------|-----------|--------------|-------|------------|---------|-----------|--------------|
| ESES | 80x110     | 60      | 230       | 3054 160 060 | ESEL  | 95x140     | 250     | 230       | 3054 160 250 |
| ESES | 80x110     | 100     | 230       | 3054 160 100 | ESEXL | 145x140    | 500     | 230       | 3054 160 500 |
| ESEL | 95x140     | 150     | 230       | 3054 160 150 |       |            |         |           |              |

Reflector adapted to IR-lamp type ESE.



| TYPE | DIA X L mm | VOLTAGE V | ARTICLE NO.  |
|------|------------|-----------|--------------|
| ESE  | 210x117    | 230       | 3005 020 308 |

E27 lamp holder in ceramics adapted for IR-lamp type ESE.

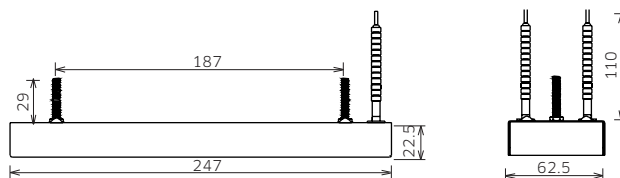


| TYPE | DIA X L mm | VOLTAGE V | ARTICLE NO.  |
|------|------------|-----------|--------------|
| ESE  | 53x74      | 230       | 3016 120 201 |



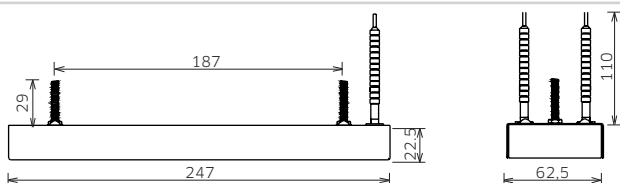
## QUARTZ GLASS

IR-elements in quartz glass type FQE with 2 pcs M5x30 mm.



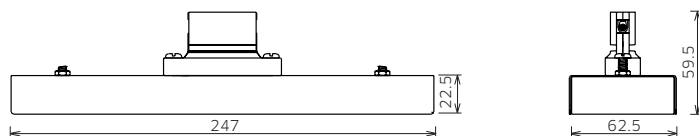
| TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------|---------|-----------|--------------|------|----------|---------|-----------|--------------|
| FQE  | 247x62.5 | 250     | 230       | 3054 220 250 | FQE  | 247x62.5 | 500     | 230       | 3054 220 500 |
| FQE  | 247x62.5 | 300     | 230       | 3054 220 300 | FQE  | 247x62.5 | 650     | 230       | 3054 220 650 |
| FQE  | 247x62.5 | 350     | 230       | 3054 220 350 | FQE  | 247x62.5 | 750     | 230       | 3054 220 750 |
| FQE  | 247x62.5 | 400     | 230       | 3054 220 400 | FQE  | 247x62.5 | 1000    | 230       | 3054 221 000 |

IR-elements in quartz glass type FQEG with gilt reflector and 2 pcs. M5x30 mm.



| TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------|---------|-----------|--------------|------|----------|---------|-----------|--------------|
| FQEG | 247x62.5 | 250     | 230       | 3054 250 250 | FQEG | 247x62.5 | 500     | 230       | 3054 250 500 |
| FQEG | 247x62.5 | 300     | 230       | 3054 250 300 | FQEG | 247x62.5 | 650     | 230       | 3054 250 650 |
| FQEG | 247x62.5 | 350     | 230       | 3054 250 350 | FQEG | 247x62.5 | 750     | 230       | 3054 250 750 |
| FQEG | 247x62.5 | 400     | 230       | 3054 250 400 | FQEG | 247x62.5 | 1000    | 230       | 3054 251 000 |

IR-elements in quartz glass type PFQE incl. lock - and spring washer.



| TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------|---------|-----------|--------------|------|----------|---------|-----------|--------------|
| PFQE | 247x62.5 | 250     | 230       | 3054 230 250 | PFQE | 247x62.5 | 500     | 230       | 3054 230 500 |
| PFQE | 247x62.5 | 300     | 230       | 3054 230 300 | PFQE | 247x62.5 | 650     | 230       | 3054 230 650 |
| PFQE | 247x62.5 | 350     | 230       | 3054 230 350 | PFQE | 247x62.5 | 750     | 230       | 3054 230 750 |
| PFQE | 247x62.5 | 400     | 230       | 3054 230 400 | PFQE | 247x62.5 | 1000    | 230       | 3054 231 000 |

## CONT. IR-ELEMENTS, QUARTZ GLASS

| IR-elements in quartz glass type HQE with 2 pcs. M5x30 mm. |            |         |           |              |      |            |         |           |              |
|--|------------|---------|-----------|--------------|------|------------|---------|-----------|--------------|
| TYPE   | L X W mm   | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE | L X W mm   | POWER W | VOLTAGE V | ARTICLE NO.  |
| HQE  | 123.5x62.5 | 125     | 230       | 3054 210 125 | HQE  | 123.5x62.5 | 325     | 230       | 3054 210 325 |
| HQE  | 123.5x62.5 | 150     | 230       | 3054 210 150 | HQE  | 123.5x62.5 | 400     | 230       | 3054 210 400 |
| HQE  | 123.5x62.5 | 200     | 230       | 3054 210 200 | HQE  | 123.5x62.5 | 500     | 230       | 3054 210 500 |
| HQE  | 123.5x62.5 | 250     | 230       | 3054 210 250 |      |            |         |           |              |

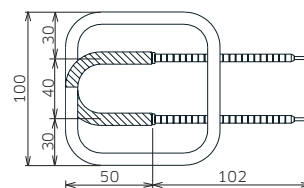
| IR-elements in quartz glass type PHQE incl. lock - and spring washer. |            |         |           |              |      |            |         |           |              |
|---|------------|---------|-----------|--------------|------|------------|---------|-----------|--------------|
| TYPE  | L X W mm   | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE | L X W mm   | POWER W | VOLTAGE V | ARTICLE NO.  |
| PHQE  | 123.5x62.5 | 125     | 230       | 3054 270 125 | PHQE | 123.5x62.5 | 250     | 230       | 3054 270 250 |
| PHQE  | 123.5x62.5 | 150     | 230       | 3054 270 150 | PHQE | 123.5x62.5 | 325     | 230       | 3054 270 325 |
| PHQE  | 123.5x62.5 | 200     | 230       | 3054 270 200 | PHQE | 123.5x62.5 | 500     | 230       | 3054 270 500 |

| IR-elements in quartz glass type QQE with 2 pcs. M5x30 mm. |           |         |           |              |      |           |         |           |              |
|--|-----------|---------|-----------|--------------|------|-----------|---------|-----------|--------------|
| TYPE   | L X W mm  | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE | L X W mm  | POWER W | VOLTAGE V | ARTICLE NO.  |
| QQE  | 62.5x62.5 | 125     | 230       | 3054 240 125 | QQE  | 62.5x62.6 | 250     | 230       | 3054 240 250 |

| IR-elements in quartz glass type SQE with 2 pcs M5x30 mm. |             |         |           |              |      |             |         |           |              |
|---|-------------|---------|-----------|--------------|------|-------------|---------|-----------|--------------|
| TYPE  | L X W mm    | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE | L X W mm    | POWER W | VOLTAGE V | ARTICLE NO.  |
| SQE   | 123.5x123.5 | 150     | 230       | 3054 260 150 | SQE  | 123.5x123.5 | 500     | 230       | 3054 260 500 |
| SQE   | 123.5x123.5 | 250     | 230       | 3054 260 250 | SQE  | 123.5x123.5 | 650     | 230       | 3054 260 650 |
| SQE   | 123.5x123.5 | 300     | 230       | 3054 260 300 | SQE  | 123.5x123.5 | 750     | 230       | 3054 260 750 |
| SQE   | 123.5x123.5 | 350     | 230       | 3054 260 350 | SQE  | 123.5x123.5 | 1000    | 230       | 3054 261 000 |
| SQE   | 123.5x123.5 | 400     | 230       | 3054 260 400 |      |             |         |           |              |

## CONT. IR-ELEMENTS, QUARTZ GLASS

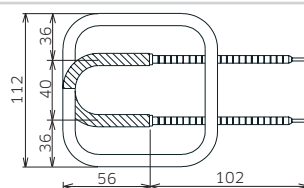
IR-elements in quartz glass type STQH 100.



| TYPE | L X W X DIA mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------------|---------|-----------|--------------|
| STQH | 100x100x8      | 150     | 230       | 3220 202 150 |
| STQH | 100x100x8      | 200     | 230       | 3220 202 200 |

| TYPE | L X W X DIA mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------------|---------|-----------|--------------|
| STQH | 100x100x8      | 250     | 230       | 3220 202 250 |
| STQH | 100x100x8      | 400     | 230       | 3220 202 400 |

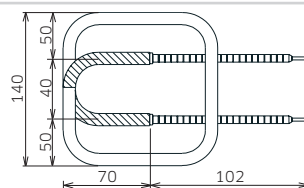
IR-elements in quartz glass type STQH 112.



| TYPE | L X W X DIA mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------------|---------|-----------|--------------|
| STQH | 112x112x8      | 150     | 230       | 3040 401 150 |
| STQH | 112x112x8      | 200     | 230       | 3040 401 200 |

| TYPE | L X W X DIA mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------------|---------|-----------|--------------|
| STQH | 112x112x8      | 250     | 230       | 3040 401 250 |
| STQH | 112x112x8      | 400     | 230       | 3040 401 400 |

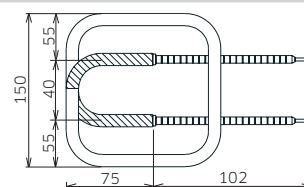
IR-elements in quartz glass type STQH 140.



| TYPE | L X W X DIA mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------------|---------|-----------|--------------|
| STQH | 140x140x8      | 150     | 230       | 3230 402 150 |
| STQH | 140x140x8      | 200     | 230       | 3230 402 200 |
| STQH | 140x140x8      | 250     | 230       | 3230 402 250 |

| TYPE | L X W X DIA mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------------|---------|-----------|--------------|
| STQH | 140x140x8      | 400     | 230       | 3230 402 400 |
| STQH | 140x140x8      | 500     | 230       | 3230 402 500 |
| STQH | 140x140x8      | 650     | 230       | 3230 402 650 |

IR-elements in quartz glass type STQH 150.

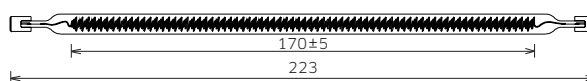


| TYPE | L X W X DIA mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------------|---------|-----------|--------------|
| STQH | 150x150x8      | 150     | 230       | 3130 600 150 |
| STQH | 150x150x8      | 200     | 230       | 3130 600 200 |
| STQH | 150x150x8      | 250     | 230       | 3130 600 250 |

| TYPE | L X W X DIA mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|----------------|---------|-----------|--------------|
| STQH | 150x150x8      | 400     | 230       | 3130 600 400 |
| STQH | 150x150x8      | 500     | 230       | 3130 600 500 |
| STQH | 150x150x8      | 650     | 230       | 3130 600 650 |

## QUARTZ GLASS AND VOLFRAM

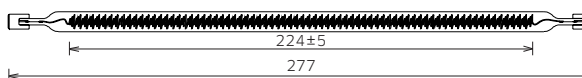
IR-elements type QTS in quartz glass and wolfram filled with nitrogen and furnished with R7s connections.  
Wire temperature max 1450°C, wave length approx. 1.6 micron. Ditto, type QHS filled with halogen gas.  
Max 2520°C, approx. 1 micron.



| TYPE | DIA X L mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|------------|---------|-----------|--------------|
| QTS  | 10x223     | 750     | 240       | 3054 280 750 |
| QHS  | 10x223     | 750     | 240       | 3054 290 750 |

| TYPE | DIA X L mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|------------|---------|-----------|--------------|
| QHS  | 10x223     | 1000    | 480       | 3054 301 000 |

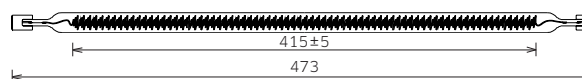
IR-elements type QTM in quartz glass and wolfram filled with nitrogen and furnished with R7s connections.  
Wire temperature max 1450°C, wave length approx. 1.6 micron. Ditto, typw QHM filled with halogen gas.  
Max 2410°C, some 1 micron.



| TYPE | DIA X L mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|------------|---------|-----------|--------------|
| QTM  | 10x277     | 1000    | 240       | 3054 281 000 |

| TYPE | DIA X L mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|------------|---------|-----------|--------------|
| QHM  | 10x277     | 1000    | 240       | 3054 291 000 |

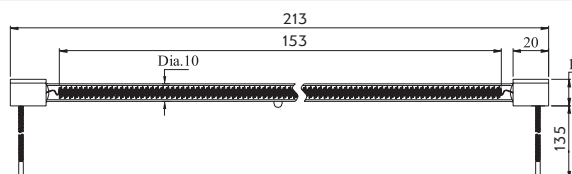
IR-elements type QTL in quartz glass and wolfram filled with nitrogen and furnished with R7s connections.  
Wire temperature max 1500°C, wave length approx. 1.6 micron. Ditto, typ QHL filled with halogen gas.  
Max 2390°C, approx. 1 micron



| TYPE | DIA X L mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|------------|---------|-----------|--------------|
| QTL  | 10x473     | 1500    | 240       | 3054 281 500 |
| QTL  | 10x473     | 1750    | 240       | 3054 281 750 |

| TYPE | DIA X L mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|------------|---------|-----------|--------------|
| QTL  | 10x473     | 2000    | 240       | 3054 282 000 |
| QHL  | 10x473     | 2000    | 240       | 3054 292 000 |

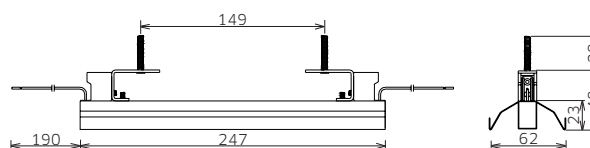
IR-elements in quartz glass and halogen with connection cables length 135 mm. Type QTRH has reflecting coating.



| TYPE | DIA X L mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|------------|---------|-----------|--------------|
| QTHS | 10x118     | 300     | 240       | 3050 384 801 |
| QTHM | 10x213     | 700     | 240       | 3050 129 701 |

| TYPE | DIA X L mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|------------|---------|-----------|--------------|
| QTRH | 10x213     | 700     | 240       | 3050 129 801 |

IR-reflector type QTRS with R7s holder adapted for element type QTS and QHS.



| TYPE | L X W mm | ARTICLE NO.  |
|------|----------|--------------|
| QTRS | 247x62   | 3054 280 751 |

## CONT. IR-ELEMENTS, QUARTZ GLASS AND VOLFRAM, IR-HEATERS

| <p>IR-reflector type QTMR with R7s holder adapted for element type QTM/QHM.</p> |          |              |  |
|---|----------|--------------|--|
| TYPE  | L X W mm | ARTICLE NO.  |  |
| QTMR  | 301x62   | 3054 281 001 |  |

| <p>IR-reflector type QTLR with R7s holder adapted for element type QTL/QHL.</p> |          |              |  |
|---|----------|--------------|--|
| TYPE  | L X W mm | ARTICLE NO.  |  |
| QTLR  | 497x62   | 3054 281 501 |  |

### IR-HEATERS

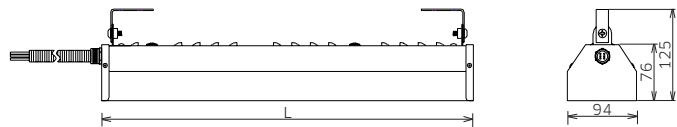
| <p>IR heater Fast IR 305 with 2000mm connection cable, protected with a 1500mm flexible metal hose. IR elements type QTM alt. QHM are not included.</p> |          |         |           |              |
|---|----------|---------|-----------|--------------|
| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
| Fast IR 305   | 305x305  | 4x1000  | 230/400   | 3050 129 901 |
| Fast IR 305   | 305x305  | 5x1000  | 230/400   | 3050 130 001 |

| <p>IR heater Fast IR 505 with 2000mm connection cable, protected with a 1500mm flexible metal hose. IR elements type QTL alt. QHL are not included.</p> |          |         |           |              |
|---|----------|---------|-----------|--------------|
| TYPE  | L X W mm | POWER W | VOLTAGE V | ARTICLE NO.  |
| Fast IR 505   | 500x500  | 6x2000  | 230/400   | 3050 130 101 |
| Fast IR 505   | 500x500  | 7x2000  | 230/400   | 3050 130 201 |

| <p>IR-heater type PAS without elements in ceramics or quartz glass. Flexible protective hose in galvanized steel length 1500 mm and connection cables length 1750 mm included.</p> |              |              |       |              |              |
|--|--------------|--------------|-------|--------------|--------------|
| TYPE   | W X H X L mm | ARTICLE NO.  | TYPE  | W X H X L mm | ARTICLE NO.  |
| PAS 1  | 94x76x258    | 3050 068 701 | PAS 4 | 94x76x1008   | 3050 069 001 |
| PAS 2  | 94x76x508    | 3050 068 801 | PAS 5 | 94x76x1258   | 3050 069 101 |
| PAS 3  | 94x76x758    | 3050 068 901 |       |              |              |

## CONT. IR-HEATERS

IR-heaters type PAS with IR-elements in ceramics type FTE. Flexible protective hose in galvanized steel length 1500 mm and connection cables length 1750 mm included.



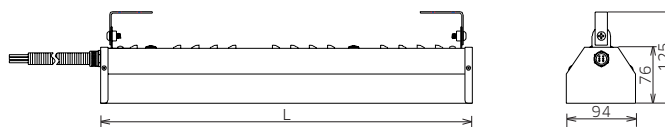
| TYPE  | W X H X L mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE  | W X H X L mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|-------|--------------|---------|-----------|--------------|-------|--------------|---------|-----------|--------------|
| PAS 1 | 94x76x258    | 1x150   | 230       | 3050 067 701 | PAS 3 | 94x76x758    | 3x400   | 230       | 3050 067 905 |
| PAS 1 | 94x76x258    | 1x250   | 230       | 3050 067 702 | PAS 3 | 94x76x758    | 3x500   | 230       | 3050 067 906 |
| PAS 1 | 94x76x258    | 1x300   | 230       | 3050 067 703 | PAS 3 | 94x76x758    | 3x650   | 230       | 3050 067 907 |
| PAS 1 | 94x76x258    | 1x350   | 230       | 3050 067 704 | PAS 4 | 94x76x1008   | 4x150   | 230       | 3050 068 001 |
| PAS 1 | 94x76x258    | 1x400   | 230       | 3050 067 705 | PAS 4 | 94x76x1008   | 4x250   | 230       | 3050 068 002 |
| PAS 1 | 94x76x258    | 1x500   | 230       | 3050 067 706 | PAS 4 | 94x76x1008   | 4x300   | 230       | 3050 068 003 |
| PAS 1 | 94x76x258    | 1x650   | 230       | 3050 067 707 | PAS 4 | 94x76x1008   | 4x350   | 230       | 3050 068 004 |
| PAS 2 | 94x76x508    | 2x150   | 230       | 3050 067 801 | PAS 4 | 94x76x1008   | 4x400   | 230       | 3050 068 005 |
| PAS 2 | 94x76x508    | 2x250   | 230       | 3050 067 802 | PAS 4 | 94x76x1008   | 4x500   | 230       | 3050 068 006 |
| PAS 2 | 94x76x508    | 2x300   | 230       | 3050 067 803 | PAS 4 | 94x76x1008   | 4x650   | 230       | 3050 068 007 |
| PAS 2 | 94x76x508    | 2x350   | 230       | 3050 067 804 | PAS 5 | 94x76x1258   | 5x150   | 230       | 3050 068 101 |
| PAS 2 | 94x76x508    | 2x400   | 230       | 3050 067 805 | PAS 5 | 94x76x1258   | 5x250   | 230       | 3050 068 102 |
| PAS 2 | 94x76x508    | 2x500   | 230       | 3050 067 806 | PAS 5 | 94x76x1258   | 5x300   | 230       | 3050 068 103 |
| PAS 2 | 94x76x508    | 2x650   | 230       | 3050 067 807 | PAS 5 | 94x76x1258   | 5x350   | 230       | 3050 068 104 |
| PAS 3 | 94x76x758    | 3x150   | 230       | 3050 067 901 | PAS 5 | 94x76x1258   | 5x400   | 230       | 3050 068 105 |
| PAS 3 | 94x76x758    | 3x250   | 230       | 3050 067 902 | PAS 5 | 94x76x1258   | 5x500   | 230       | 3050 068 106 |
| PAS 3 | 94x76x758    | 3x300   | 230       | 3050 067 903 | PAS 5 | 94x76x1258   | 5x650   | 230       | 3050 068 107 |
| PAS 3 | 94x76x758    | 3x350   | 230       | 3050 067 904 |       |              |         |           |              |

IR-heaters type PAS ditto, with built-in thermo element NiCr-Ni type K in one of the elements.

| TYPE  | W X H X L mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE  | W X H X L mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|-------|--------------|---------|-----------|--------------|-------|--------------|---------|-----------|--------------|
| PAS 1 | 94x76x258    | 1x150   | 230       | 3050 068 201 | PAS 3 | 94x76x758    | 3x400   | 230       | 3050 068 405 |
| PAS 1 | 94x76x258    | 1x250   | 230       | 3050 068 202 | PAS 3 | 94x76x758    | 3x500   | 230       | 3050 068 406 |
| PAS 1 | 94x76x258    | 1x300   | 230       | 3050 068 203 | PAS 3 | 94x76x758    | 3x650   | 230       | 3050 068 407 |
| PAS 1 | 94x76x258    | 1x350   | 230       | 3050 068 204 | PAS 4 | 94x76x1008   | 4x150   | 230       | 3050 068 501 |
| PAS 1 | 94x76x258    | 1x400   | 230       | 3050 068 205 | PAS 4 | 94x76x1008   | 4x250   | 230       | 3050 068 502 |
| PAS 1 | 94x76x258    | 1x500   | 230       | 3050 068 206 | PAS 4 | 94x76x1008   | 4x300   | 230       | 3050 068 503 |
| PAS 1 | 94x76x258    | 1x650   | 230       | 3050 068 207 | PAS 4 | 94x76x1008   | 4x350   | 230       | 3050 068 504 |
| PAS 2 | 94x76x508    | 2x150   | 230       | 3050 068 301 | PAS 4 | 94x76x1008   | 4x400   | 230       | 3050 068 505 |
| PAS 2 | 94x76x508    | 2x250   | 230       | 3050 068 302 | PAS 4 | 94x76x1008   | 4x500   | 230       | 3050 068 506 |
| PAS 2 | 94x76x508    | 2x300   | 230       | 3050 068 303 | PAS 4 | 94x76x1008   | 4x650   | 230       | 3050 068 507 |
| PAS 2 | 94x76x508    | 2x350   | 230       | 3050 068 304 | PAS 5 | 94x76x1258   | 5x150   | 230       | 3050 068 601 |
| PAS 2 | 94x76x508    | 2x400   | 230       | 3050 068 305 | PAS 5 | 94x76x1258   | 5x250   | 230       | 3050 068 602 |
| PAS 2 | 94x76x508    | 2x500   | 230       | 3050 068 306 | PAS 5 | 94x76x1258   | 5x300   | 230       | 3050 068 603 |
| PAS 2 | 94x76x508    | 2x650   | 230       | 3050 068 307 | PAS 5 | 94x76x1258   | 5x350   | 230       | 3050 068 604 |
| PAS 3 | 94x76x758    | 3x150   | 230       | 3050 068 401 | PAS 5 | 94x76x1258   | 5x400   | 230       | 3050 068 605 |
| PAS 3 | 94x76x758    | 3x250   | 230       | 3050 068 402 | PAS 5 | 94x76x1258   | 5x500   | 230       | 3050 068 606 |
| PAS 3 | 94x76x758    | 3x300   | 230       | 3050 068 403 | PAS 5 | 94x76x1258   | 5x650   | 230       | 3050 068 607 |
| PAS 3 | 94x76x758    | 3x350   | 230       | 3050 068 404 |       |              |         |           |              |

## CONT. IR-HEATERS

IR-heaters type PAS with IR-elements in ceramics type FTELN. Insulated for position out-door under roof, red-varnished and with connection cable length 1400 mm



| TYPE   | W X H X L mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE   | W X H X L mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|--------|--------------|---------|-----------|--------------|--------|--------------|---------|-----------|--------------|
| PAS 1R | 94x76x258    | 1x650   | 230       | 3050 135 106 | PAS 4R | 94x76x1008   | 4x650   | 230       | 3050 135 406 |
| PAS 2R | 94x76x508    | 2x650   | 230       | 3050 135 206 | PAS 5R | 94x76x1258   | 5x650   | 230       | 3050 135 506 |
| PAS 3R | 94x76x758    | 3x650   | 230       | 3050 135 306 |        |              |         |           |              |

## IR-REFLECTORS

IR-reflector type RAS with 300 mm connection cables without element.



| TYPE  | W X H X L mm | VOLTAGE V | ARTICLE NO.  | TYPE  | W X H X L mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|-------|--------------|-----------|--------------|-------|--------------|---------|-----------|--------------|
| RAS 1 | 100x63x254   | 230       | 3050 018 101 | RAS 4 | 100x63x1004  | 230     | 230       | 3050 018 401 |
| RAS 2 | 100x63x504   | 230       | 3050 018 201 | RAS 5 | 100x63x1254  | 230     | 230       | 3050 018 501 |
| RAS 3 | 100x63x754   | 230       | 3050 018 301 |       |              |         |           |              |

## CONT. IR-HEATERS, REFLECTORS

IR-reflector type RAS with IR-element in ceramics type FTE and 300 mm connection cables.



| TYPE  | W X H X L mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYP   | W X H X L mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|-------|--------------|---------|-----------|--------------|-------|--------------|---------|-----------|--------------|
| RAS 1 | 100x63x254   | 1x150   | 230       | 3050 070 201 | RAS 3 | 100x63x754   | 3x500   | 230       | 3050 070 406 |
| RAS 1 | 100x63x254   | 1x250   | 230       | 3050 070 202 | RAS 3 | 100x63x754   | 3x650   | 230       | 3050 070 407 |
| RAS 1 | 100x63x254   | 1x300   | 230       | 3050 070 203 | RAS 3 | 100x63x754   | 3x750   | 230       | 3050 070 408 |
| RAS 1 | 100x63x254   | 1x350   | 230       | 3050 070 204 | RAS 3 | 100x63x754   | 3x1000  | 230       | 3050 070 409 |
| RAS 1 | 100x63x254   | 1x400   | 230       | 3050 070 205 | RAS 4 | 100x63x1004  | 4x150   | 230       | 3050 070 501 |
| RAS 1 | 100x63x254   | 1x500   | 230       | 3050 070 206 | RAS 4 | 100x63x1004  | 4x250   | 230       | 3050 070 502 |
| RAS 1 | 100x63x254   | 1x650   | 230       | 3050 070 207 | RAS 4 | 100x63x1004  | 4x300   | 230       | 3050 070 503 |
| RAS 1 | 100x63x254   | 1x750   | 230       | 3050 070 208 | RAS 4 | 100x63x1004  | 4x350   | 230       | 3050 070 504 |
| RAS 1 | 100x63x254   | 1x1000  | 230       | 3050 070 209 | RAS 4 | 100x63x1004  | 4x400   | 230       | 3050 070 505 |
| RAS 2 | 100x63x504   | 2x150   | 230       | 3050 070 301 | RAS 4 | 100x63x1004  | 4x500   | 230       | 3050 070 506 |
| RAS 2 | 100x63x504   | 2x250   | 230       | 3050 070 302 | RAS 4 | 100x63x1004  | 4x650   | 230       | 3050 070 507 |
| RAS 2 | 100x63x504   | 2x300   | 230       | 3050 070 303 | RAS 4 | 100x63x1004  | 4x750   | 230       | 3050 070 508 |
| RAS 2 | 100x63x504   | 2x350   | 230       | 3050 070 304 | RAS 4 | 100x63x1004  | 4x1000  | 230       | 3050 070 509 |
| RAS 2 | 100x63x504   | 2x400   | 230       | 3050 070 305 | RAS 5 | 100x63x1254  | 5x150   | 230       | 3050 070 601 |
| RAS 2 | 100x63x504   | 2x500   | 230       | 3050 070 306 | RAS 5 | 100x63x1254  | 5x250   | 230       | 3050 070 602 |
| RAS 2 | 100x63x504   | 2x650   | 230       | 3050 070 307 | RAS 5 | 100x63x1254  | 5x300   | 230       | 3050 070 603 |
| RAS 2 | 100x63x504   | 2x750   | 230       | 3050 070 308 | RAS 5 | 100x63x1254  | 5x350   | 230       | 3050 070 604 |
| RAS 2 | 100x63x504   | 2x1000  | 230       | 3050 070 309 | RAS 5 | 100x63x1254  | 5x400   | 230       | 3050 070 605 |
| RAS 3 | 100x63x754   | 3x150   | 230       | 3050 070 401 | RAS 5 | 100x63x1254  | 5x500   | 230       | 3050 070 606 |
| RAS 3 | 100x63x754   | 3x250   | 230       | 3050 070 402 | RAS 5 | 100x63x1254  | 5x650   | 230       | 3050 070 607 |
| RAS 3 | 100x63x754   | 3x300   | 230       | 3050 070 403 | RAS 5 | 100x63x1254  | 5x750   | 230       | 3050 070 608 |
| RAS 3 | 100x63x754   | 3x350   | 230       | 3050 070 404 | RAS 5 | 100x63x1254  | 5x1000  | 230       | 3050 070 609 |
| RAS 3 | 100x63x754   | 3x400   | 230       | 3050 070 405 |       |              |         |           |              |

IR-reflector type RAS with IR-element in ceramics type FTE, 300 mm connection cables and built-in thermo element NiCr-Ni type K, in one of the elements.



| TYPE  | W X H X L mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE  | W X H X L mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|-------|--------------|---------|-----------|--------------|-------|--------------|---------|-----------|--------------|
| RAS 1 | 100x63x254   | 1x150   | 230       | 3050 070 701 | RAS 3 | 100x63x754   | 3x500   | 230       | 3050 070 906 |
| RAS 1 | 100x63x254   | 1x250   | 230       | 3050 070 702 | RAS 3 | 100x63x754   | 3x650   | 230       | 3050 070 907 |
| RAS 1 | 100x63x254   | 1x300   | 230       | 3050 070 703 | RAS 3 | 100x63x754   | 3x750   | 230       | 3050 070 908 |
| RAS 1 | 100x63x254   | 1x350   | 230       | 3050 070 704 | RAS 3 | 100x63x754   | 3x1000  | 230       | 3050 070 909 |
| RAS 1 | 100x63x254   | 1x400   | 230       | 3050 070 705 | RAS 4 | 100x63x1004  | 4x150   | 230       | 3050 071 001 |
| RAS 1 | 100x63x254   | 1x500   | 230       | 3050 070 706 | RAS 4 | 100x63x1004  | 4x250   | 230       | 3050 071 002 |
| RAS 1 | 100x63x254   | 1x650   | 230       | 3050 070 707 | RAS 4 | 100x63x1004  | 4x300   | 230       | 3050 071 003 |
| RAS 1 | 100x63x254   | 1x750   | 230       | 3050 070 708 | RAS 4 | 100x63x1004  | 4x350   | 230       | 3050 071 004 |
| RAS 1 | 100x63x254   | 1x1000  | 230       | 3050 070 709 | RAS 4 | 100x63x1004  | 4x400   | 230       | 3050 071 005 |
| RAS 2 | 100x63x504   | 2x150   | 230       | 3050 070 801 | RAS 4 | 100x63x1004  | 4x500   | 230       | 3050 071 006 |
| RAS 2 | 100x63x504   | 2x250   | 230       | 3050 070 802 | RAS 4 | 100x63x1004  | 4x650   | 230       | 3050 071 007 |
| RAS 2 | 100x63x504   | 2x300   | 230       | 3050 070 803 | RAS 4 | 100x63x1004  | 4x750   | 230       | 3050 071 008 |
| RAS 2 | 100x63x504   | 2x350   | 230       | 3050 070 804 | RAS 4 | 100x63x1004  | 4x1000  | 230       | 3050 071 009 |
| RAS 2 | 100x63x504   | 2x400   | 230       | 3050 070 805 | RAS 5 | 100x63x1254  | 5x150   | 230       | 3050 071 101 |
| RAS 2 | 100x63x504   | 2x500   | 230       | 3050 070 806 | RAS 5 | 100x63x1254  | 5x250   | 230       | 3050 071 102 |
| RAS 2 | 100x63x504   | 2x650   | 230       | 3050 070 807 | RAS 5 | 100x63x1254  | 5x300   | 230       | 3050 071 103 |
| RAS 2 | 100x63x504   | 2x750   | 230       | 3050 070 808 | RAS 5 | 100x63x1254  | 5x350   | 230       | 3050 071 104 |
| RAS 2 | 100x63x504   | 2x1000  | 230       | 3050 070 809 | RAS 5 | 100x63x1254  | 5x400   | 230       | 3050 071 105 |
| RAS 3 | 100x63x754   | 3x150   | 230       | 3050 070 901 | RAS 5 | 100x63x1254  | 5x500   | 230       | 3050 071 106 |
| RAS 3 | 100x63x754   | 3x250   | 230       | 3050 070 902 | RAS 5 | 100x63x1254  | 5x650   | 230       | 3050 071 107 |
| RAS 3 | 100x63x754   | 3x300   | 230       | 3050 070 903 | RAS 5 | 100x63x1254  | 5x750   | 230       | 3050 071 108 |
| RAS 3 | 100x63x754   | 3x350   | 230       | 3050 070 904 | RAS 5 | 100x63x1254  | 5x1000  | 230       | 3050 071 109 |
| RAS 3 | 100x63x754   | 3x400   | 230       | 3050 070 905 |       |              |         |           |              |



## IR-HEATING PANEL

IR-heating panels with elements in ceramics or quartz glass. Customer adapted design to be mounted in for instance in a thermo forming machine with or without control equipment.



## SPECIAL DESIGN AND ACCESSORIES/CONNECTIONS

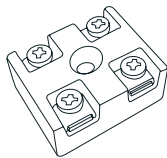
Cable type NPC 2.5 mm<sup>2</sup> 14 A 320°C.

| TYPE       | ARTICLE NO.  |
|------------|--------------|
| 100 m coil | 3072 218 121 |
| per m      | 3050 079 001 |

Cable type NPC 1.0 mm<sup>2</sup> 7A 320°C.

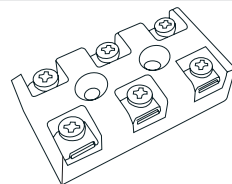
| TYPE       | ARTICLE NO.  |
|------------|--------------|
| 100 m coil | 3072 227 501 |
| per m      | 3050 078 901 |

Terminal block 2P in ceramics with screw connections.



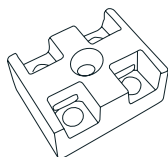
| TYPE | L X W X H mm | ARTICLE NO.  |
|------|--------------|--------------|
| 2P   | 40x32x20     | 3005 020 301 |

Terminal block 3P in ceramics with screw connections.



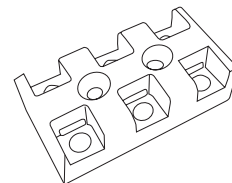
| TYPE | L X W X H mm | ARTICLE NO.  |
|------|--------------|--------------|
| 3P   | 62x32x20     | 3005 020 306 |

Terminal block 2P in ceramics without screw connections.



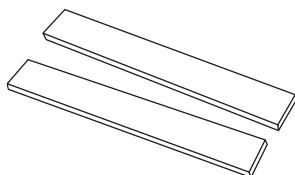
| TYPE | L X W X H mm | ARTICLE NO.  |
|------|--------------|--------------|
| 2P   | 40x32x20     | 3005 020 302 |

Terminal block 3P in ceramics without screw connections.



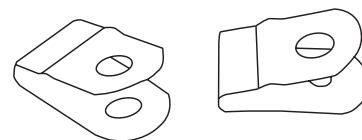
| TYPE | L X W X H mm | ARTICLE NO.  |
|------|--------------|--------------|
| 3P   | 62x32x20     | 3005 020 307 |

Coupling rail in stainless steel.



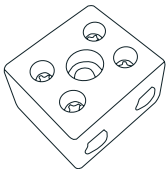
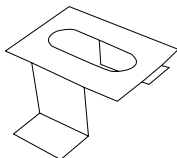
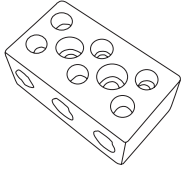
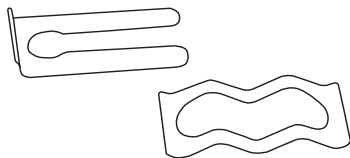
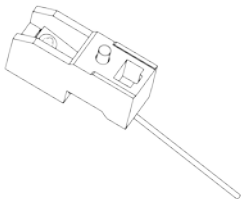
| L X W X H mm | ARTICLE NO.  |
|--------------|--------------|
| 1000x8x2     | 3005 020 305 |

V-clamps.



| ARTICLE NO.  |
|--------------|
| 3006 020 301 |

## CONT. SPECIAL DESIGN AND ACCESSORIES/CONNECTIONS

| <p>Terminal block TB2C in ceramics.<br/>16 mm<sup>2</sup></p>  |   | <p>Socket for element in ceramics.</p>  |  |             |              |          |              |   |  |             |              |
|--|--|---|---|-------------|--------------|----------|--------------|---|--|-------------|--------------|
| <table border="1"> <thead> <tr> <th>TYPE</th> <th>L X W B X H mm</th> <th>ARTICLE NO.</th> </tr> </thead> <tbody> <tr> <td>TB2C</td> <td>35x31x23</td> <td>3005 020 303</td> </tr> </tbody> </table> |  | TYPE  | L X W B X H mm  | ARTICLE NO. | TB2C         | 35x31x23 | 3005 020 303 | <table border="1"> <thead> <tr> <th>ARTICLE NO.</th> </tr> </thead> <tbody> <tr> <td>3009 010 301</td> </tr> </tbody> </table> |  | ARTICLE NO. | 3009 010 301 |
| TYPE   | L X W B X H mm   | ARTICLE NO.   |   |             |              |          |              |   |  |             |              |
| TB2C   | 35x31x23   | 3005 020 303  |   |             |              |          |              |   |  |             |              |
| ARTICLE NO.  |  |   |   |             |              |          |              |   |  |             |              |
| 3009 010 301   |  |   |   |             |              |          |              |   |  |             |              |
| <p>Terminal block TB3C in ceramics.<br/>16 mm<sup>2</sup></p>  |   | <p>Lock - and spring washer</p>   |  |             |              |          |              |   |  |             |              |
| <table border="1"> <thead> <tr> <th>TYPE</th> <th>L X W X H mm</th> <th>ARTICLE NO.</th> </tr> </thead> <tbody> <tr> <td>TB3C</td> <td>51x31x23</td> <td>3005 020 304</td> </tr> </tbody> </table>   |  | TYPE  | L X W X H mm  | ARTICLE NO. | TB3C         | 51x31x23 | 3005 020 304 | <table border="1"> <thead> <tr> <th>ARTICLE NO.</th> </tr> </thead> <tbody> <tr> <td>3050 138 001</td> </tr> </tbody> </table> |  | ARTICLE NO. | 3050 138 001 |
| TYPE   | L X W X H mm   | ARTICLE NO.   |   |             |              |          |              |   |  |             |              |
| TB3C   | 51x31x23   | 3005 020 304  |   |             |              |          |              |   |  |             |              |
| ARTICLE NO.  |  |   |   |             |              |          |              |   |  |             |              |
| 3050 138 001   |  |   |   |             |              |          |              |   |  |             |              |
| <p>R7s clips i ceramics<br/>with 190 mm wiring</p>   |  | <p>FOR AN ADDITIONAL CHARGE WE OFFER:</p> <ul style="list-style-type: none"> <li>• Extra length of connection with ceramic bushings.</li> <li>• Other voltage than standard 230V.</li> <li>• Ceramic elements in yellow.</li> </ul> |   |             |              |          |              |   |  |             |              |
| <table border="1"> <thead> <tr> <th>TYPE</th> <th>ARTICLE NO.</th> </tr> </thead> <tbody> <tr> <td>R7s</td> <td>3050 234 701</td> </tr> </tbody> </table>  |  | TYPE  | ARTICLE NO.   | R7s         | 3050 234 701 |          |              |   |  |             |              |
| TYPE   | ARTICLE NO.  |   |   |             |              |          |              |   |  |             |              |
| R7s  | 3050 234 701   |   |   |             |              |          |              |   |  |             |              |

## ANTI-CONDENSATION HEATERS

Example of application areas:  
Cabinets, electric plants, information tables.  
Design: Anodized aluminium, neutral or black.

Protection class IP55.  
Connection: Cable

Voltage: Heating unit: 230VAC, Fan: 24VDC  
Mounting: DIN socket  
Material: Anodized aluminium  
Protection class: IP20








| TYPE   | POWER AT 10°C | L X W X H mm | ARTICLE NO.  |
|--------|---------------|--------------|--------------|
| ACHF01 | 200           | 126.5x41x41  | 2550 645 901 |
| ACHF01 | 120           | 102x41x41    | 2550 645 902 |
| ACHF01 | 80            | 78.5x41x41   | 2550 645 903 |

Cabinet heater in black anodized aluminium with cable.



| TYPE       | L X W X H mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------------|--------------|---------|-----------|--------------|
| PTC        | 75x72x57     | 15      | 12-48     | 3060 505 005 |
| PTC        | 75x72x57     | 15      | 110-240   | 3060 505 013 |
| Thermostat | 145x72x57    | 75      | 240       | 3060 505 021 |
| PTC        | 100x116x33   | 20      | 12-48     | 3060 505 039 |
| PTC        | 100x116x33   | 20      | 110-240   | 3060 505 047 |
| PTC        | 100x116x33   | 20      | 220-440   | 3060 505 054 |
| PTC        | 250x116x33   | 40      | 12-48     | 3060 505 062 |
| PTC        | 250x116x33   | 40      | 110-240   | 3060 505 070 |
| PTC        | 250x116x33   | 40      | 220-440   | 3060 505 088 |
| Thermostat | 250x116x33   | 100     | 230       | 3060 505 096 |
| Thermostat | 250x116x33   | 160     | 230       | 3060 505 104 |

## ACCESSORIES FOR ANTI-CONDENSATION HEATERS

| <p>Thermostat type KTO/KTS<br/>For DIN socket<br/>Max load 10A AC 250V<br/>Temperature area 0-60°C</p>  |     |                    |                    |              |          |                      |              |              |     |                     |      |              |  |
|---|---|--------------------|--------------------|--------------|----------|----------------------|--------------|--------------|-----|---------------------|------|--------------|--|
| <table border="1"> <thead> <tr> <th>TYPE</th> <th>FUNCTION</th> <th>REGULATION AREA °C</th> <th>ARTICLE NO.</th> </tr> </thead> <tbody> <tr> <td>KTO</td> <td>Breaking (NC) 1-pole</td> <td>0-60</td> <td>3000 032 011</td> </tr> <tr> <td>KTS</td> <td>Closing (NO) 1-pole</td> <td>0-60</td> <td>3000 032 010</td> </tr> </tbody> </table> | TYPE  | FUNCTION           | REGULATION AREA °C | ARTICLE NO.  | KTO      | Breaking (NC) 1-pole | 0-60         | 3000 032 011 | KTS | Closing (NO) 1-pole | 0-60 | 3000 032 010 |  |
| TYPE  | FUNCTION  | REGULATION AREA °C | ARTICLE NO.        |              |          |                      |              |              |     |                     |      |              |  |
| KTO   | Breaking (NC) 1-pole  | 0-60               | 3000 032 011       |              |          |                      |              |              |     |                     |      |              |  |
| KTS   | Closing (NO) 1-pole   | 0-60               | 3000 032 010       |              |          |                      |              |              |     |                     |      |              |  |
| <p>Electronic thermostat Termonic with a high level of accuracy.<br/>Max load 10A AC 250V Changing relay contact<br/>Adjustable hysteresis 1-10°K<br/>including sensor of type NTC (permits cabling up to 50m) For DIN socket.</p>  |    |                    |                    |              |          |                      |              |              |     |                     |      |              |  |
| <table border="1"> <thead> <tr> <th>TYPE</th> <th>FUNCTION</th> <th>REGULATION AREA °C</th> <th>ARTICLE NO.</th> </tr> </thead> <tbody> <tr> <td>Termonic</td> <td>Changing 1-pole</td> <td>-15 till +95</td> <td>3000 026 090</td> </tr> </tbody> </table>   | TYPE  | FUNCTION           | REGULATION AREA °C | ARTICLE NO.  | Termonic | Changing 1-pole      | -15 till +95 | 3000 026 090 |     |                     |      |              |  |
| TYPE  | FUNCTION  | REGULATION AREA °C | ARTICLE NO.        |              |          |                      |              |              |     |                     |      |              |  |
| Termonic  | Changing 1-pole   | -15 till +95       | 3000 026 090       |              |          |                      |              |              |     |                     |      |              |  |
| <p>Hygrostat type MFR012<br/>Simple model with changing relay contact<br/>Max load 5A AC 230V<br/>For DIN socket.</p>   |   |                    |                    |              |          |                      |              |              |     |                     |      |              |  |
| <table border="1"> <thead> <tr> <th>TYPE</th> <th>FUNCTION</th> <th>REGULATION AREA °C</th> <th>ARTICLE NO.</th> </tr> </thead> <tbody> <tr> <td>MFR012</td> <td>Changing 1-pole</td> <td>35-95</td> <td>3000 032 038</td> </tr> </tbody> </table>  | TYPE  | FUNCTION           | REGULATION AREA °C | ARTICLE NO.  | MFR012   | Changing 1-pole      | 35-95        | 3000 032 038 |     |                     |      |              |  |
| TYPE  | FUNCTION  | REGULATION AREA °C | ARTICLE NO.        |              |          |                      |              |              |     |                     |      |              |  |
| MFR012  | Changing 1-pole   | 35-95              | 3000 032 038       |              |          |                      |              |              |     |                     |      |              |  |
| <p>Combined electronic thermo/hygrostat type ETF012<br/>Regulation area 0-60°C 50-90%RH<br/>Max load 8A AC 240V<br/>For DIN socket</p>  |  |                    |                    |              |          |                      |              |              |     |                     |      |              |  |
| <table border="1"> <thead> <tr> <th>TYPE</th> <th>FUNCTION</th> <th>REGULATION AREA °C</th> <th>ARTICLE NO.</th> </tr> </thead> <tbody> <tr> <td>ETF012</td> <td>Changing 1-pole</td> <td>0-60</td> <td>3000 031 984</td> </tr> </tbody> </table>   | TYPE  | FUNCTION           | REGULATION AREA °C | ARTICLE NO.  | ETF012   | Changing 1-pole      | 0-60         | 3000 031 984 |     |                     |      |              |  |
| TYPE  | FUNCTION  | REGULATION AREA °C | ARTICLE NO.        |              |          |                      |              |              |     |                     |      |              |  |
| ETF012  | Changing 1-pole   | 0-60               | 3000 031 984       |              |          |                      |              |              |     |                     |      |              |  |
| <p>Current supply MDR-20-24<br/>Power pack for DIN socket<br/>Input voltage 100-240VAC<br/>Output voltage 24VDC max 1A adjustable between 21.6-26.4VDC<br/>For DIN socket</p>   |  |                    |                    |              |          |                      |              |              |     |                     |      |              |  |
| <table border="1"> <thead> <tr> <th>TYPE</th> <th>ARTICLE NO.</th> </tr> </thead> <tbody> <tr> <td>MDR-20-24</td> <td>3050 843 601</td> </tr> </tbody> </table>   | TYPE  | ARTICLE NO.        | MDR-20-24          | 3050 843 601 |          |                      |              |              |     |                     |      |              |  |
| TYPE  | ARTICLE NO.   |                    |                    |              |          |                      |              |              |     |                     |      |              |  |
| MDR-20-24   | 3050 843 601  |                    |                    |              |          |                      |              |              |     |                     |      |              |  |

# HEATING ELEMENTS IN ALUMINIUM PROFILE

Example of application areas: Radiators, frost protection, etc.  
Types of heating: Radiation, convection.

Design: One alt. two powers/profile, one alt. two side connection.  
The elements can be produced according to customer specification in other dimensions and with other powers.

Type I 100

| TYPE  | LENGTH mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE  | LENGTH mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|-------|-----------|---------|-----------|--------------|-------|-----------|---------|-----------|--------------|
| I 100 | 425       | 500     | 230       | 2550 134 401 | I 100 | 850       | 1000    | 230       | 2550 134 402 |

Type I 100

| TYPE  | LENGTH mm | POWER W | VOLTAGE V | ARTICLE NO.  | TYPE  | LENGTH mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|-------|-----------|---------|-----------|--------------|-------|-----------|---------|-----------|--------------|
| I 100 | 425       | 250     | 230       | 2550 134 501 | I 100 | 850       | 500     | 230       | 2550 134 502 |

# CONT. HEATING ELEMENTS IN ALUMINIUM PROFILE

Type X

| Var. | A   | B  |
|------|-----|----|
| 01   | 700 | 83 |
| 02   | 350 | 83 |

| TYPE | LENGTH mm | POWER W | VOLTAGE V | ARTICLE NO.  |
|------|-----------|---------|-----------|--------------|
| X    | 350       | 500     | 230       | 2550 134 601 |
| X    | 700       | 1000    | 230       | 2550 134 602 |

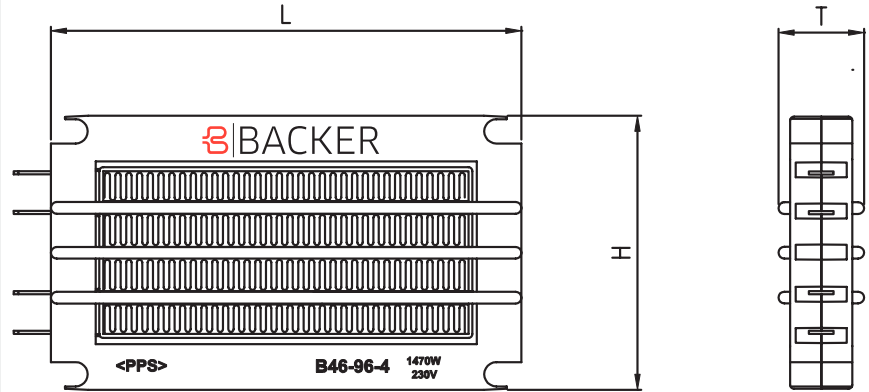
Type X

| TYPE | LENGTH mm | POWER W  | VOLTAGE V | ARTICLE NO.  |
|------|-----------|----------|-----------|--------------|
| X    | 680       | 1000/500 | 230       | 2550 134 701 |

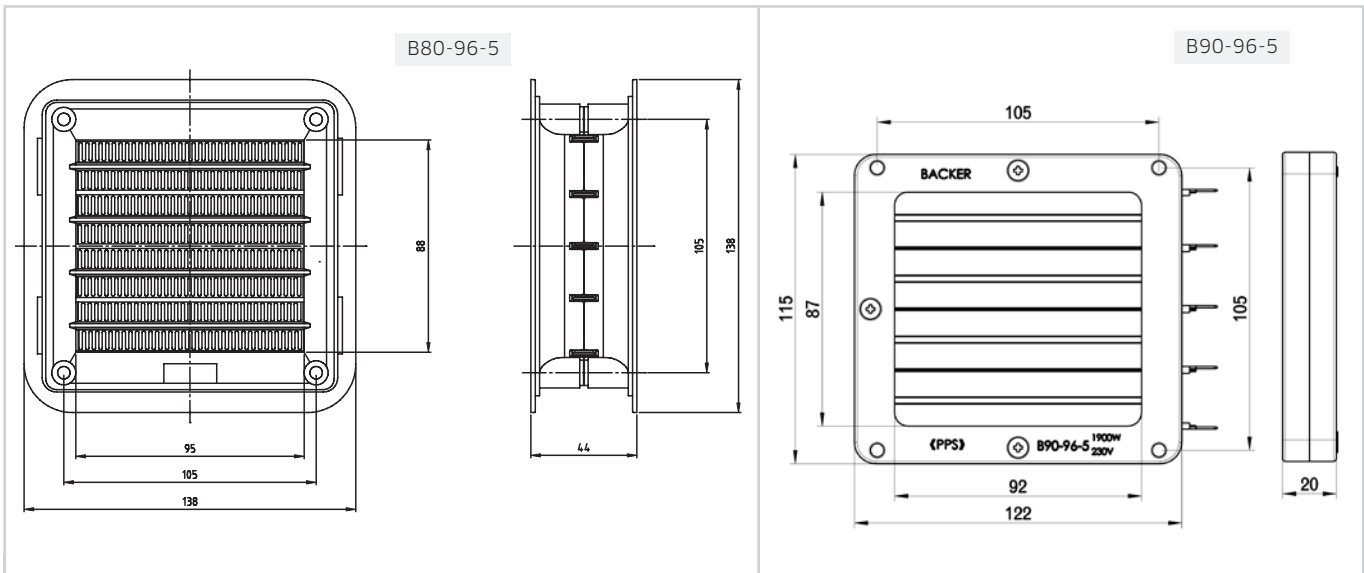
# PTC-HEATING ELEMENTS

Our standard PTC-heaters are constructed for heating of forced air and can be built into several heating devices and systems.

The PTC technology offers many advantages compared to conventional resistant heating elements, for instance the self-regulating automatic temperature control gives an increased security and eliminates the need of further thermal cut-off.



| TYPE      | NOM VOLTAGE | NOMINAL POWER                          | DIMENSION LxHxT mm | ARTICLE NO.  |
|-----------|-------------|--|--------------------|--------------|
| B34-96-3  | 230 VAC     | 820W±10% @ 48m <sup>3</sup> /h, 25°C   | 120x53x22          | 3050 230 901 |
| B46-96-3  | 230 VAC     | 840W±10% @ 48m <sup>3</sup> /h, 25°C   | 120.5x70.5x22      | 3050 231 001 |
| B46-96-4  | 230 VAC     | 1100W±10% @ 72m <sup>3</sup> /h, 25°C  | 120.5x70.5x22      | 3050 231 101 |
| B46-96-4  | 110 VAC     | 1100W±10% @ 72m <sup>3</sup> /h, 25°C  | 120.5x70.5x22      | 3050 231 102 |
| B46-148-3 | 230 VAC     | 1250W±10% @ 72m <sup>3</sup> /h, 25°C  | 173x70.5x22        | 3050 231 201 |
| B46-148-4 | 230 VAC     | 1900W±10% @ 110m <sup>3</sup> /h, 25°C | 173x70.5x22        | 3050 231 301 |



| TYPE     | NOMINAL VOLTAGE | VAC NOMINAL POWER                     | DIMENSION LXHXHT mm | ARTICLE NO.  |
|----------|-----------------|---------------------------------------|---------------------|--------------|
| B80-96-5 | 230             | 1900W±10% @ 96m <sup>3</sup> /h, 25°C | See drawing         | 3050 231 401 |
| B90-96-5 | 230             | 1900W±10% @ 96m <sup>3</sup> /h, 25°C | See drawing         | 3050 863 101 |



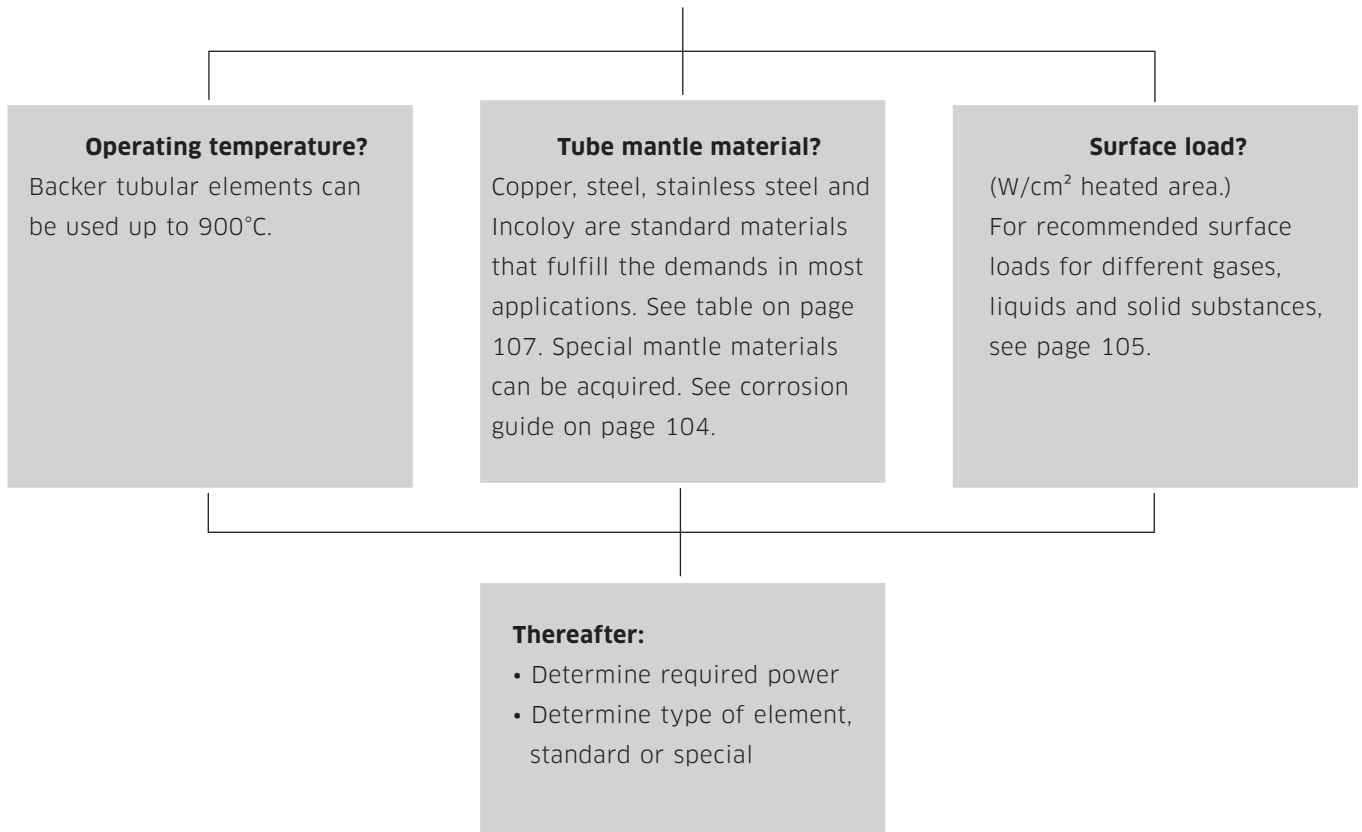
# CALCULATION DOCUMENTATION & TECHNICAL INFORMATION

In this chapter we have accumulated both general and specific technical information for Backer's tubular elements. Here you will find tables, formulas, diagrams and check-lists for the design work.

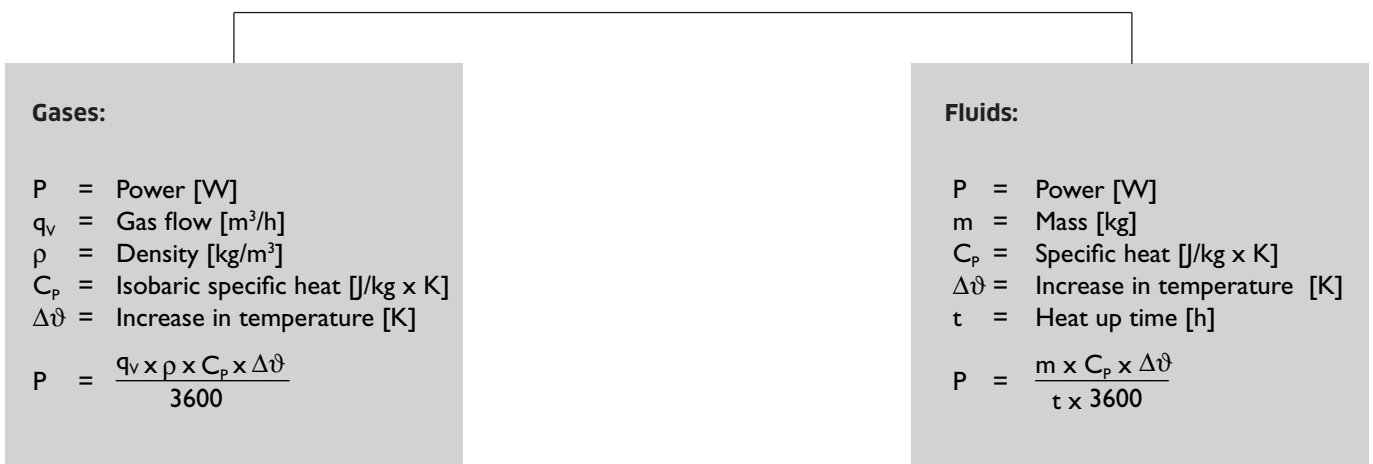
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|---|-----|
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| Thermology/science of electricity ..... | 92  |
| Charts .....                            | 96  |
| Base for calculation .....              | 100 |
| Tables .....                            | 102 |
| Design check list .....                 | 106 |

# GUIDE

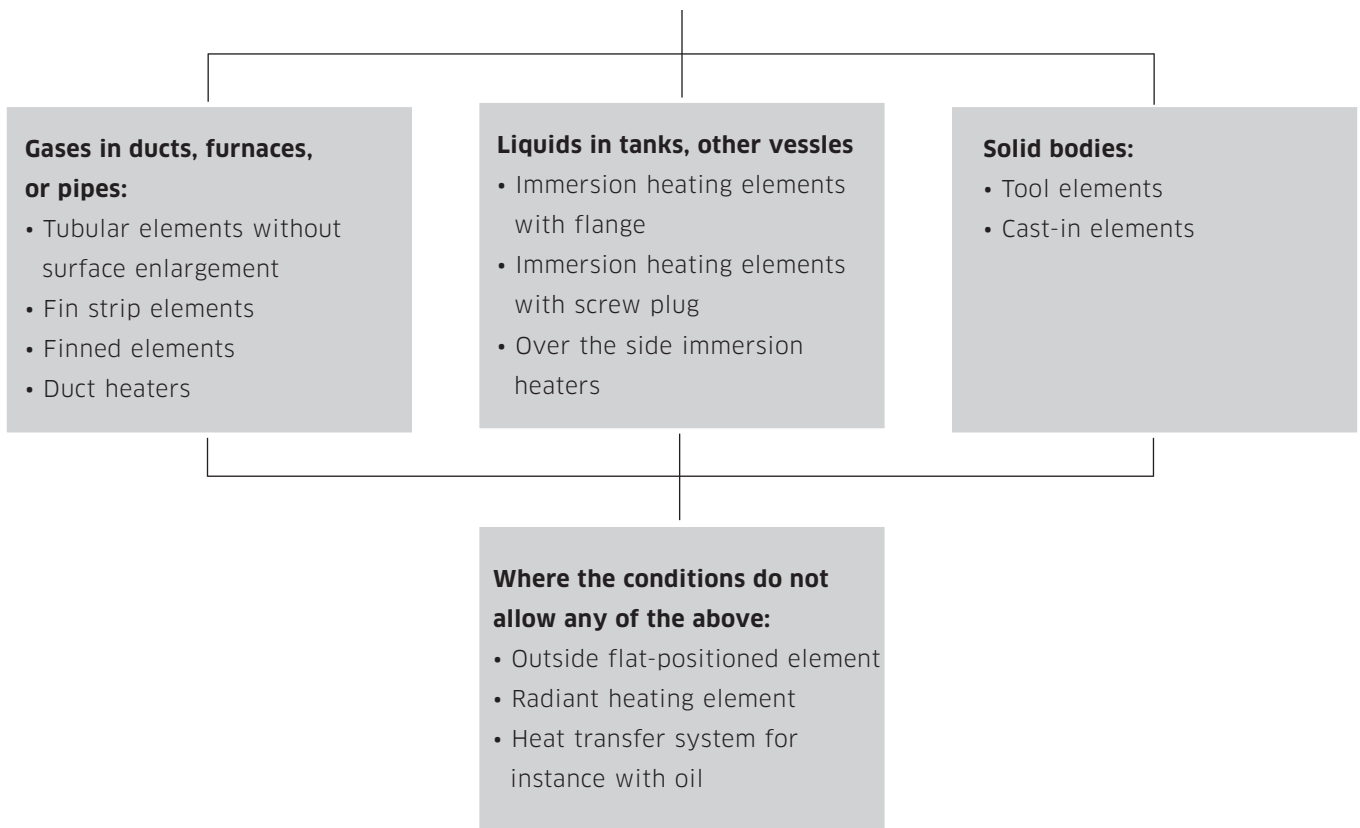
## Guide



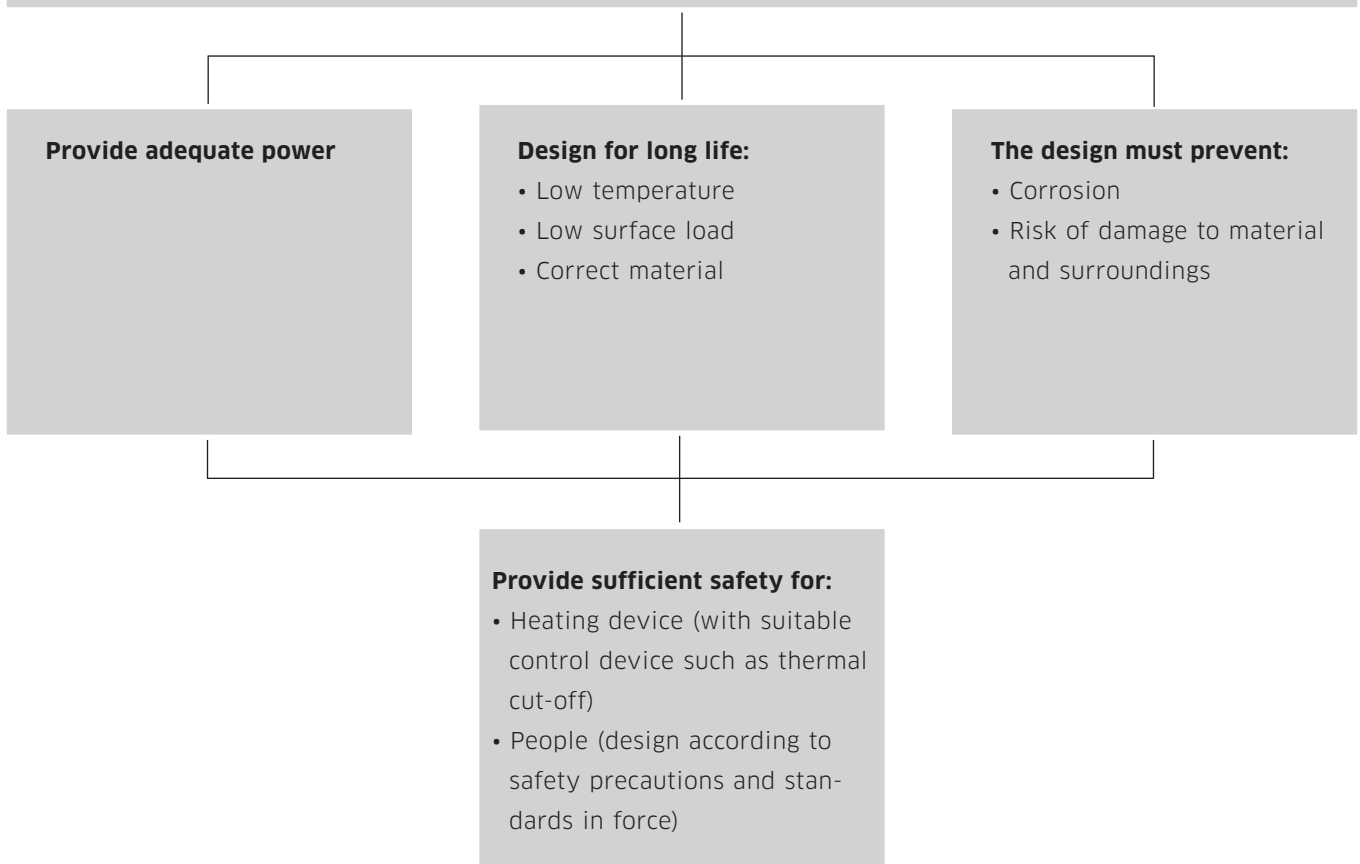
TO DETERMINE THE POWER DEMAND USE ONE OF THE FOLLOWING FORMULAS:



## For highest efficiency and quickest heating-up time, use heaters immersed into the medium or process.



## CRITERIAS AND CONSIDERATIONS AT DIMENSIONING



# THERMINOLOGY

## Thermology

In nature, energy is found in many different forms that can be transformed between each other. One of these is mechanical work. Heat is another, which can come up from chemical energy at combustion, from mechanical work or from electrical energy. The transformation from electrical energy to heat is the objective of electroheat technology. In other segments of electro technology, when electrical energy is transformed into mechanical work, heat is normally produced in a greater or smaller extent. This heat dissipates to the surroundings and is mostly regarded as an energy loss. All forms of energy is normally measured in J or Ws, which is the unit for energy.

## Thermal parameters.

Specific heat:  $c_p$ . The  $c_p$  for a body is the number of J per kilogram of the body that is required to raise its temperature 1K.

$$\Delta\vartheta = \text{temperature rise}$$

$$Q = m \times c_p \times \Delta\vartheta$$

Melting heat: The melting heat of a substance is the energy required to transform it from solid to liquid state. The unit for melting heat is J/kg.

Vaporization heat: The vaporization heat of a liquid is the energy required to transform it from liquid to vapour state at constant pressure and temperature. The unit for vaporization heat is J/kg.

## Heat transfer

Heat can be transferred mainly in three different ways: by convection, conduction or radiation.

*Convection* most commonly applies where liquids are in circulation or gases are flowing, transferring heat from one place to another.

The heat flow P (W) transferred by convection to a liquid or a gas from a heat source such as a radiator can be calculated by

$$P = \alpha \times A \times (\vartheta_1 - \vartheta_2)$$

where

$\alpha$  = heat transfer coefficient in W/m<sup>2</sup>K

A = area of the heat dissipating surface in m<sup>2</sup>

$\vartheta_1$  = temperature of the heat emitting medium in °C

$\vartheta_2$  = temperature of the heat absorbing medium in °C

The heat transfer coefficient depends on whether the gas or the liquid is flowing freely, i.e. it flows as a result of the difference in temperature between different places in the medium, or as a result of applied mechanical force such as a pump or a fan.

The flow of gases or liquids by force is found mainly in pipe or duct systems. The heat transfer coefficient can be calculated from empiric formulae. Flowing air that is heated by heating elements obtains this heat by forced convection. The sheath temperature of the element can be determined using the graphs 1 and 2 for this kind of heat transfer.

For the elements closest to the duct walls, heat radiation from these elements should also be considered. This radiated heat can raise the wall temperature quite a lot and must always be taken into consideration when dimensioning the insulation etc. The inner elements only "see" other elements with the same temperature and therefore the net radiation is zero.

The power required to heat a flow of air can be calculated by

$$P = \frac{\rho \times c_p \times q_v \times (\vartheta_2 - \vartheta_1)}{3600}$$

where

$\rho$  = air density in kg/m<sup>3</sup>

$c_p$  = isobaric specific heat for air in J/kgK

$q_v$  = air flow in m<sup>3</sup>/h

$\vartheta_1$  = initial temperature of the air in °C

$\vartheta_2$  = final temperature of the air in °C

The values for  $\rho$  and  $q_v$  are at same temperature. The value for  $c_p$  is at mean temperature  $\frac{(\vartheta_1 + \vartheta_2)}{2}$

As a general rule,  $\rho \times c_p$  can be put equal to 1200 to which must be added heat losses. This general rule applies at 20°C. At higher temperatures  $\rho \times c_p > 1200$ .

## CONT. THERMINOLOGY

Heat is *conducted* in a solid medium by the vibration of molecules. These vibrations are transferred from molecule to molecule. The heat flow P transferred by conduction from one side of a hotplate to another can be calculated by

$$P = \frac{\lambda \times A \times (\vartheta_1 - \vartheta_2)}{\delta}$$

where

$\lambda$  = thermal conductivity in W/mK

A = area of the hotplate in m<sup>2</sup>

$\delta$  = thickness of the hotplate in m

$\vartheta_1$  and  $\vartheta_2$  = temperature of the hotplate on each side in °C

Heat *radiation* is a heat transfer process between bodies without the aid of heat transfer by a surrounding medium. According to Stefan Boltzmann's law of radiation the following expression for heat transfer between two absolutely black parallell surfaces of equal size apply:

$$Q_{12} = C_s \times A \times (\Theta_1^4 - \Theta_2^4)$$

where

$C_s$  = black body radiation constant:  $5,77 \times 10^{-8}$  W/m<sup>2</sup>K<sup>4</sup>

A = area of the surfaces absorbing or emitting the heat in m<sup>2</sup>

$\Theta_1$  and  $\Theta_2$  = absolute temperatures of the bodies in K, i.e. temperatures in °C + 273°C

Bodies that are not totally black emit and absorb less radiated energy than black bodies, at the same temperature. For such bodies with parallell surfaces of equal size and at short distance from each other, the  $C_s$  value must be replaced by

$$C_{12} = \frac{C_s}{\frac{1}{\varepsilon_1} + \frac{1}{\varepsilon_2} - 1}$$

When a larger surface  $A_2$  completely surrounds a surface  $A_1$ , e.g. a heating element in a room,  $C_s$  is replaced by

$$C_{12} = \frac{C_s}{\frac{1}{\varepsilon_1} + \left[ \frac{1}{\varepsilon_2} - 1 \right] \frac{A_1}{A_2}}$$

For element in free air, heat is transferred both by free convection and by radiation.

The element temperature can be determined from graph 3 for elements at different ambient temperatures.

$\varepsilon$  = absorption/emission coefficient.

### Calculation of required electrical power

The amount of heat that must be transferred to a medium which is to be heated can be calculated by

$$Q = m \times c_p \times (\vartheta_1 - \vartheta_2)$$

where

m = weight of the medium in kg

$c_p$  = specific heat for the medium in J/kgK

$\vartheta_1$  = initial temperature in °C

$\vartheta_2$  = final temperature in °C

If h = desired heating time in hours, the required power is

$$P = \frac{m \times c_p \times (\vartheta_2 - \vartheta_1)}{h \times 3600}$$

To this must be added 5–20 % to compensate for heat losses which depend on the heat insulation of the appliance.

### Electrical parameters

U = voltage in V

R = resistance in  $\Omega$

I = current in A

P = power in W

Q = energy in J

A heating appliance with a resistance R  $\Omega$  at a current I A requires an amount of energy per s defined as the rated power of the appliance:

$$P = R \times I^2 = \frac{U^2}{R}$$

During the time t (in sec) the energy consumption of the appliance is

$$Q = P \times t$$

The resistance of a conductor wire is calculated by

$$R = \rho \times \frac{4 \times L}{\pi \times D^2}$$

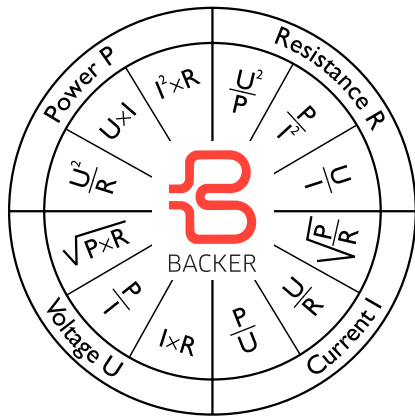
where

L = wire length in m

D = wire diameter in mm

$\rho$  = specific resistance, resistivity, for the wire in  $\Omega\text{mm}^2/\text{m}$

# CONT. THERMINOLOGY



| Designation | Parameter  | Symbol | Name   |
|-------------|------------|--------|--------|
| P           | Power      | W      | Watt   |
| U           | Voltage    | V      | Volt   |
| I           | Current    | A      | Ampere |
| R           | Resistance |        | Ohm    |

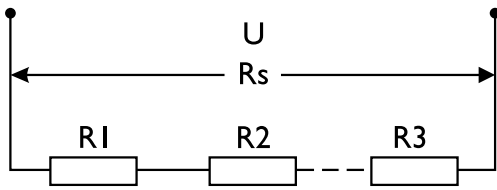
In a 3-phase system  
 U = Main voltage  
 I = Main ampere

U<sub>v</sub> = Phase voltage  
 I<sub>v</sub> = Current in phase

$$P = \sqrt{3}UI = 3U_v I_v$$

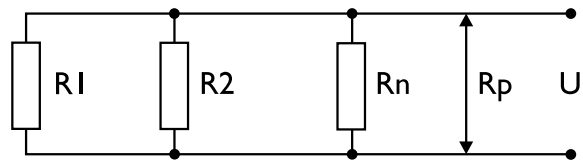
(cos φ of resistance = 1)

Connection in series



$$R_s = R_1 + R_2 + \dots + R_n$$

Connection in parallel



$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_n} \quad R_p = \frac{R_1 \times R_2}{R_1 + R_2} \text{ (2 elements)}$$

| Connection of equal resistances |                                   |                           |   |   |
|---------------------------------|-----------------------------------|---------------------------|---|---|
|                                 | Connection in series              | Connection in parallel    | Example of 2 resistances 52.9 U=230 V               |   |
|                                 |                                   |                           | Connection in series                                | Connection in parallel                              |
| Resistance                      | $R_s = n R_1$                     | $R_p = \frac{R_1}{n}$     | $R_s = 2 \times 52.9 = 105.8$                       | $R_p = \frac{52.9}{2} = 26.45$                      |
| Power                           | $P_s = \frac{U^2}{n R_1}$         | $P_p = \frac{U^2 n}{R_1}$ | $P_s = \frac{230^2}{2 \times 52.9} = 500 \text{ W}$ | $P_p = \frac{230^2 \times 2}{52.9} = 500 \text{ W}$ |
| Relationship                    | $\frac{P_s}{P_p} = \frac{1}{n^2}$ | $P_r = n^2 P_s$           | 250 W resistance      1000 W resistance             |   |
|                                 |                                   |                           | $P_p = 2^2 \times P_s = 4 \times P_s$               |   |

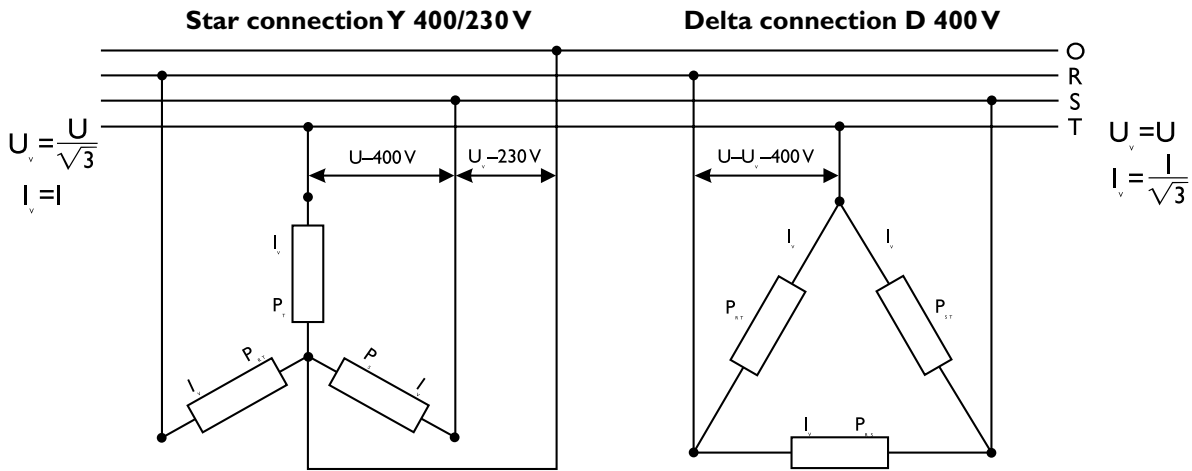
Power at different voltages

E.g. 400 V instead of 230 V

$$P_1 = \frac{U_1^2}{R_1} \quad P_2 = \frac{U_2^2}{R_1} ; \frac{P_1}{P_2} = \frac{U_1^2}{U_2^2} \quad P_2 = \frac{U_2^2}{U_1^2} \times P_1 \quad P_2 = \frac{400^2}{230^2} \times P_1 = 3 \times P_1$$

# CONT. THERMINOLOGY

## Star and delta connections with 3-phase systems. Phases equally loaded



$$P_R = P_S = P_T = \frac{U_V^2}{R}$$

$$P_Y = P_R + P_S + P_T$$

$$P_Y = \frac{3U_V^2}{R} = \frac{U^2}{R}$$

$$P_Y = U_V I = \sqrt{3} UI (\cos \varphi = 1)$$

$$I_V = \frac{1}{3U_V} P_Y$$

$$I_V (\text{A}) = 1,52 \times P_Y (\text{kW})$$

$$P_{RS} = P_{ST} = P_{TR} = \frac{U^2}{R}$$

$$P_D = P_{RS} + P_{ST} + P_{TR}$$

$$P_D = \frac{3U^2}{R}$$

$$P_D = 3U I_V = \sqrt{3} UI (\cos \varphi = 1)$$

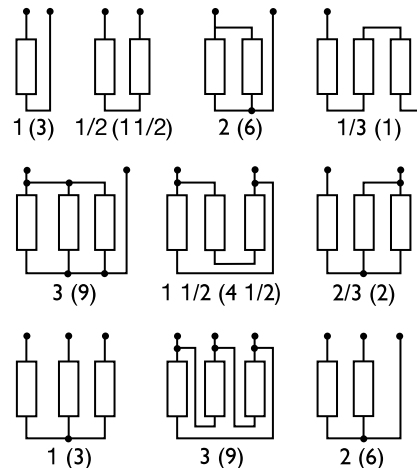
$$I_V = \frac{1}{3U} P_D$$

$$I_V (\text{A}) = 0,88 \times P_D (\text{kW})$$

| Effekt | Motstånd Ω |        |        |
|--------|------------|--------|--------|
|        | 230 V      | 400 V  | 500 V  |
| 100    | 529,0      | 1600,0 | 2500,0 |
| 133    | 397,7      | 1203,0 | 1879,7 |
| 167    | 316,8      | 958,1  | 1497,0 |
| 200    | 264,5      | 800,0  | 1250,0 |
| 250    | 211,6      | 640,0  | 1000,0 |
| 333    | 158,9      | 480,5  | 750,8  |
| 350    | 151,1      | 457,1  | 714,3  |
| 500    | 105,8      | 320,0  | 500,0  |
| 667    | 79,3       | 239,9  | 374,8  |
| 750    | 70,5       | 213,3  | 333,3  |
| 1000   | 52,9       | 160,0  | 250,0  |
| 1250   | 42,3       | 128,0  | 200,0  |
| 1330   | 39,8       | 120,3  | 187,5  |
| 1500   | 35,3       | 106,7  | 166,7  |
| 1667   | 31,7       | 96,0   | 150,0  |
| 2000   | 26,5       | 80,0   | 125,0  |
| 2500   | 21,2       | 64,0   | 100,0  |
| 3000   | 17,6       | 53,3   | 83,3   |
| 3333   | 15,9       | 48,0   | 75,0   |
| 4000   | 13,2       | 40,0   | 62,5   |
| 4500   | 11,8       | 35,6   | 55,6   |
| 5000   | 10,6       | 32,0   | 50,0   |

Power with different connections of two or three identical resistances. The power for one resistance at 230 equals 1. The figure in brackets is the corresponding effect connected to 400 V.

**Important!** Check to ensure that none of the resistances is overloaded when making these different connections.



# CHARTS

## Air Heating

**Example:**

Calculate the surface temperature of the element for air input at 100°C and air output at 300°C.

The rate of air flow is 10 m/s.

The surface load of the tubular element is 2.6 W/cm<sup>2</sup>.

The mean temperature will be  $\frac{300 + 100}{2} = 200^\circ\text{C}$ .

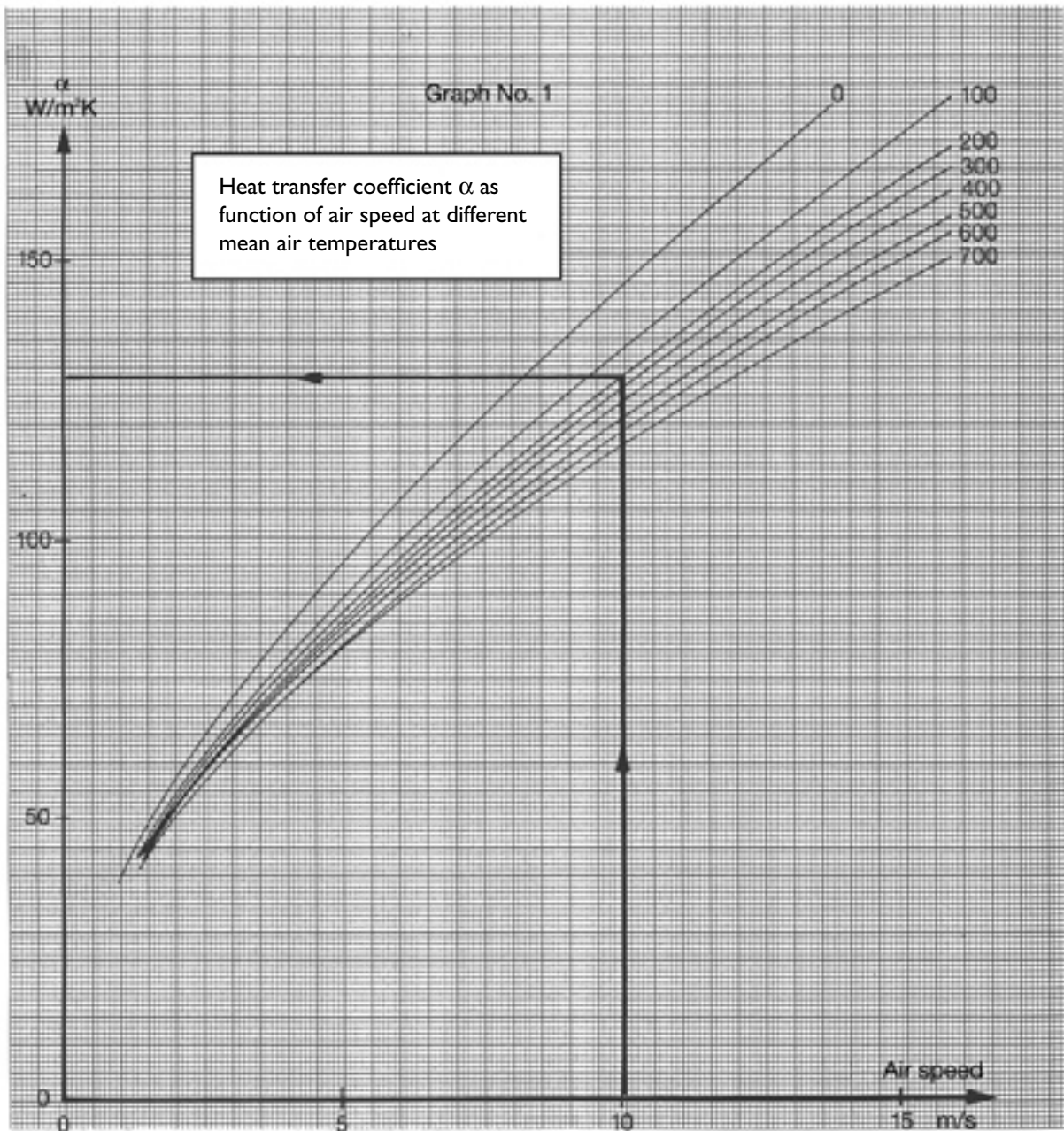
From graph no. 1 we obtain  $\alpha = 129 \text{ W/m}^2 \text{ K}$  for a mean temperature of 200°C and a rate of air flow of 10 m/s.

Then turn to the axis for surface load on graph no. 2. The

surface load was 2.6 W/cm<sup>2</sup>. Trace the graph upwards to  $\alpha = 129 \text{ W/m}^2 \text{ K}$ . Then go horizontally towards the graph for the increase in air temperature 200°C.

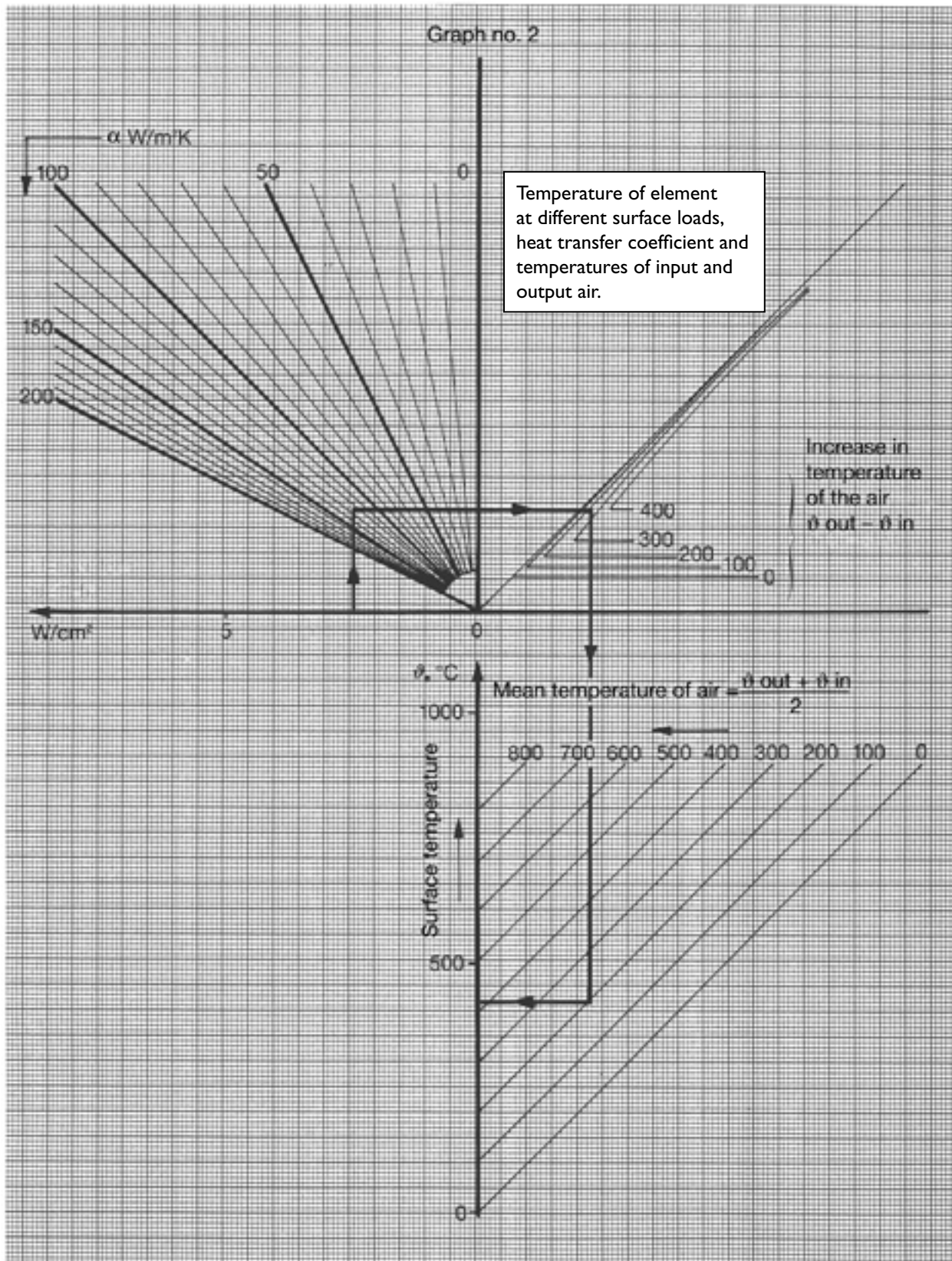
Now go to the graph for a mean air temperature of 200°C and then horizontally to the axis for element temperature.

From this you will be able to read the surface temperature of the element, 420°C

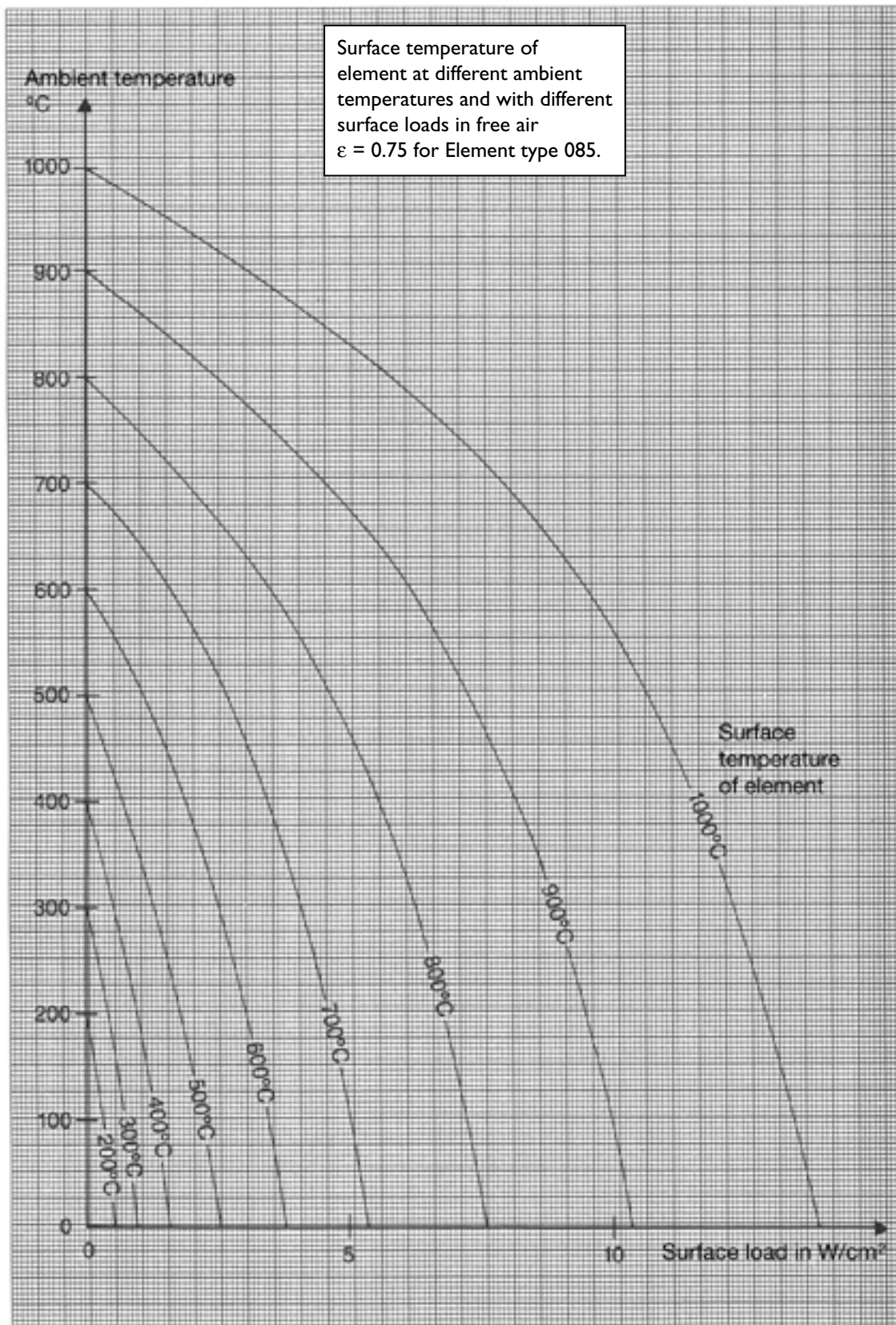




CONT. CHARTS

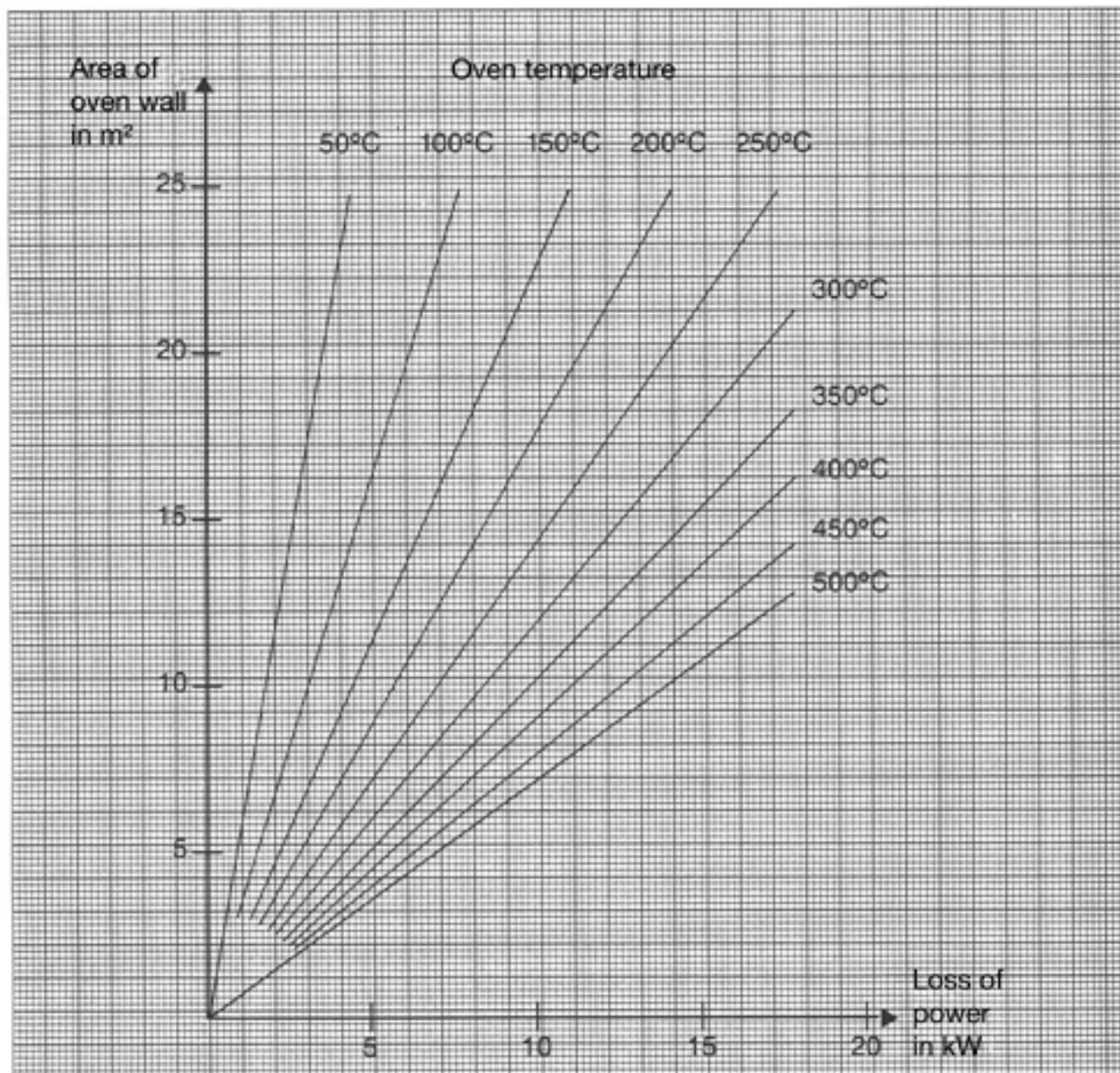


CONT. CHARTS



# CONT. CHARTS

**Loss of power from oven wall in an ambient temperature of 20°C.**



## CONT. BASE FOR CALCULATION

### Heating water in a tank

An open tank filled with water is to be heated to a temperature of 70°C in one hour and after that be kept at this temperature.  
The tank is made of 5 mm stainless steel and the dimensions

are (L x B x H) 2 m x 1 m x 1 m. The tank is insulated with 50 mm mineral wool.  
The tank is not fitted with a lid. The ambient temperature is 20°C and the relative humidity is 40 %.

#### A. Power required for heating

Density of steel:  $\rho = 7840 \text{ kg/m}^3$

Weight of tank:  $(3 \cdot 2 \cdot 1 + 2 \cdot 1 \cdot 1) \cdot 5 \cdot 10^{-3} \cdot 7840 = 314 \text{ kg}$

Weight of water:  $2 \cdot 10^3 \text{ kg}$

Specific heat of steel:  $c_{p, st} = 0.46 \text{ kJ/kg K}$

Specific heat of water:  $c_{p, W} = 4.18 \text{ kJ/kg K}$

$$P_A = \frac{(314 \cdot 0.46 + 2 \cdot 10^3 \cdot 4.18) \cdot (70 - 20)}{3600} = 118.1 \text{ kW}$$

#### B. Heat losses from vertical wall of tank

$$A = 2(2 \cdot 1 + 1 \cdot 1) = 6 \text{ m}^2$$

$$P_B = 1 \text{ kW}$$

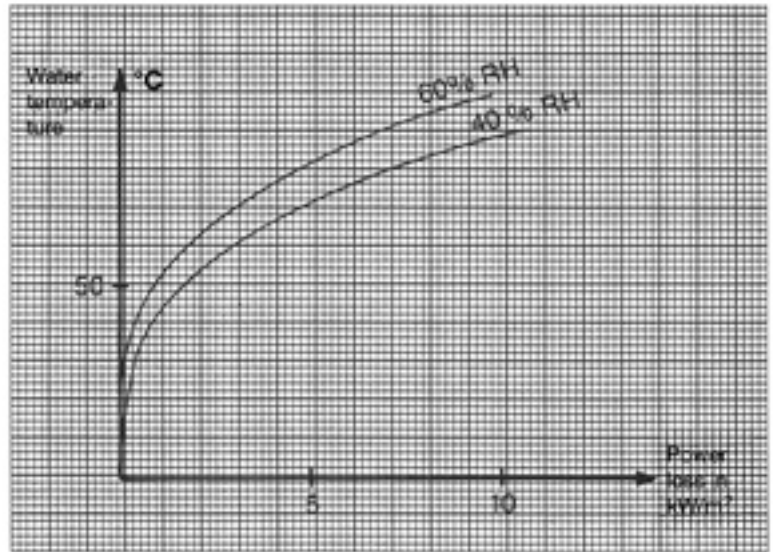
(see diagram page 10:28)

#### C. Heat loss from surface of water

$$A = 1 \cdot 2 = 2 \text{ m}^2$$

$$F = 4.5 \text{ kW/m}^2$$

$$P_C = 2 \cdot 4.5 = 9 \text{ kW}$$



During heating one should allow for a loss of 2/3 of the losses of B and C above, i.e.  $2/3 \times 10 = 6.7 \text{ kW}$ .

The total power required, inclusive of an additional 10 % as a safety margin, will be:

$$P = 1.1 \cdot (118.1 + 6.7) = 137.3 = 140 \text{ kW}$$

## CONT. BASE FOR CALCULATION

**Pressure** Pascal, Pa 1 Pa = 1 N/m

| Pa                      | kp/cm                   | lbf/in <sup>2</sup>     | mmHg                    | mmvp        |
|-------------------------|-------------------------|-------------------------|-------------------------|-------------|
| 1                       | 10.2 · 10 <sup>-6</sup> | 0.145 · 10 <sup>3</sup> | 7.5 · 10 <sup>-3</sup>  | 1.0120 · 10 |
| 98.07 · 10 <sup>3</sup> | 1                       | 14.22                   | 735.6                   | 1.10        |
| 6.89 · 10 <sup>3</sup>  | 70.3 · 10 <sup>3</sup>  | 1                       | 51.7                    | 697.3       |
| 133                     | 1.36 · 10 <sup>-3</sup> | 19.3 · 10 <sup>-3</sup> | 1                       | 13.46       |
| 9.807                   | 1 · 10 <sup>-2</sup>    | 1.43 · 10 <sup>-3</sup> | 74.3 · 10 <sup>-3</sup> | 1           |

**Power** Watt, W

| W, Nm/s | kpm/s | kcal/h | hk                      | ft · lbf/s |
|---------|-------|--------|-------------------------|------------|
| 1       | 0.102 | 0.86   | 1.36 · 10 <sup>-3</sup> | 0.738      |
| 9.81    | 1     | 8.43   | 13.3 · 10 <sup>-3</sup> | 7.233      |
| 1.16    | 0.119 | 1      | 1.58 · 10 <sup>-3</sup> | 0.858      |
| 735.5   | 75    | 632    | 1                       | 542.5      |
| 1.356   | 0.138 | 1.166  | 1.84 · 10 <sup>-3</sup> | 1          |

**Energy** Joule, J

| J, Ws, Nm              | Wh                       | cal   | ft · lbf                |
|------------------------|--------------------------|-------|-------------------------|
| 1                      | 0.278 · 10 <sup>-3</sup> | 0.239 | 0.738                   |
| 3.6 · 10 <sup>-3</sup> | 1                        | 860   | 2.66 · 10 <sup>-3</sup> |
| 4.19                   | 1.16 · 10 <sup>-3</sup>  | 1     | 3.088                   |
| 1.356                  | 0.377 · 10 <sup>-3</sup> | 0.324 | 1                       |

**Temperature** Kelvin, K

| Magnitude                       | Kelvin scale K  | Centigrade scale C | Fahrenheit scale F |
|---------------------------------|-----------------|--------------------|--------------------|
| Related temperatures            | 0               | -273.15            | -459.67            |
|                                 | 255.37          | -17.78             | 0                  |
|                                 | 273.15          | 0                  | 32                 |
|                                 | 373.15          | 100                | 212                |
| Related temperature-differences | 1               | 1                  | 1.8                |
|                                 | 0.55556<br>=5/9 | 0.5556<br>=5/9     | 1                  |

Conversion  
°C ↔ °F  
t<sub>C</sub> = 5/9 (t<sub>F</sub>-32)  
t<sub>F</sub> = 9/5 t<sub>C</sub>+32

### The electrochemical chain of potential

The electrochemical chain of potential shown in the table gives the electrochemical potentials of the principle metals with their relevant chemical symbols and also according to the magnitude of their normal potentials which arise when each of the metals is immersed in a normal aqueous solution (1n) of its salt.

The valency of the metal ions of each solution is indicated by a corresponding number of dots after the chemical symbol. The metals listed above hydrogen (H) in the table are termed electropositive, those listed below H are termed electronegative.

If two metals are placed together in a galvanic element the further the two metals are from each other in the chain of potential the greater will be their electromotive force. Electromotive forces can be calculated using the formula e.g. Cu/Ni gives + 0.34 - (-0.23) = 0.57V.

| Metals    | Process that determines potential (oxidation) | Normal potential |
|-----------|---|------------------|
| Magnesium | Mg → Mg <sup>··</sup>                         | -2.34            |
| Aluminium | Al → Al <sup>···</sup>                        | -1.70            |
| Beryllium | Be → Be <sup>··</sup>                         | -1.69            |
| Manganese | Mn → Mn <sup>··</sup>                         | -1.10            |
| Zinc      | Zn → Zn <sup>··</sup>                         | -0.76            |
| Chrome    | Cr → Cr <sup>··</sup>                         | -0.60            |
| Iron      | Fe → Fe <sup>··</sup>                         | -0.44            |
| Cadmium   | Cd → Cd <sup>··</sup>                         | -0.44            |
| Nickel    | Ni → Ni <sup>··</sup>                         | -0.23            |
| Tin       | Sn → Sn <sup>··</sup>                         | -0.14            |
| Lead      | Pb → Pb <sup>··</sup>                         | -0.13            |
| Hydrogen  | H → H <sup>·</sup>                            | 0                |
| Copper    | Cu → Cu <sup>··</sup>                         | +0.34            |
| Silver    | Ag → Ag <sup>·</sup>                          | +0.80            |
| Mercury   | Hg <sub>2</sub> → 2Hg <sup>··</sup>           | +0.80            |
| Gold      | Au → Au <sup>·</sup>                          | +1.5             |

# TABLES

## Physical properties

|                               | Temperature<br>°C | Density<br>kg/m <sup>3</sup> | Specific heat<br>kJ/kg K | Thermal conductivity<br>W/m K | Melting point<br>°C |
|-------------------------------|-------------------|------------------------------|--------------------------|-------------------------------|---------------------|
| <b>Gases</b>                  |                   |                              |                          |                               |                     |
| Ammonia                       | 0/100             | 0.771                        | 2.056/2.219              | 0.022/0.033                   |                     |
| Carbon dioxide                | 0/200             | 1.951                        | 0.816/1.001              | 0.015/0.030                   |                     |
| Carbon monoxide               | 0/200             | 1.234                        | 1.038/1.055              | 0.023/0.037                   |                     |
| Nitrogen                      | 0/200             | 1.234                        | 1.038/1.047              | 0.024/0.037                   |                     |
| Air                           | 0/200             | 1.276                        | 1.005/1.022              | 0.024/0.039                   |                     |
| Oxygen                        | 0/200             | 1.410                        | 0.909/0.963              | 0.024/0.039                   |                     |
| Sulphur dioxide               | 0/200             | 2.888                        | 0.586/0.712              | 0.0086/0.019                  |                     |
| Hydrogen                      | 0/200             | 0.089                        | 14.05/14.41              | 0.171/0.249                   |                     |
| <b>Liquids</b>                |                   |                              |                          |                               |                     |
| Ethanol                       | 18                | 791                          | 2.39                     | 0.17                          | -115                |
| Fuel oil class I              | 15                | 860                          | 2.36                     | 0.285                         |                     |
| Paraffin                      | 20                | 800                          | 0.50                     | 0.145                         |                     |
| Glycerine                     | 20                | 1260                         | 2.36                     | 0.285                         | -18                 |
| Glycol                        | 20                | 1120                         | 2.4                      |                               |                     |
| Hydraulic oil                 | XX                | XX                           | XX                       |                               |                     |
| Methanol                      | 20                | 790                          | 2.50                     | 0.21                          |                     |
| Olive oil                     | 20                | 920                          | 1.65                     | 0.17                          |                     |
| Paraffin                      | 20                | 710                          | 0.71                     | 0.242                         |                     |
| Lubricating oil               | 30                | 900-930                      | 2.09                     | 0.13-0.14                     |                     |
| Coal tar                      | 15-90             | 1100-1260                    | 1.42                     |                               |                     |
| Turpentine                    | 18                | 840                          | 1.75                     | 0.15                          | 10                  |
| Trichlorethylene              | 20                | 1480                         | 0.96                     | 0.15                          |                     |
| Water                         | 18                | 999                          | 4.18                     | 0.60                          |                     |
| <b>Metals</b>                 |                   |                              |                          |                               |                     |
| Babits                        | 20                | 10000                        | 0.16                     |                               |                     |
| Lead                          | 20                | 11340                        | 0.13                     | 34.6                          | 327                 |
| Bronze                        | 20                | 8670                         | 0.34                     | 26.0                          | 1000                |
| Cast iron                     | 20                | 7000-7800                    | 0.54                     | 55-64                         | 1200                |
| Incoloy 800                   | 20                | 8030                         | 0.50                     | 14.0                          | 1357                |
| Copper                        | 20                | 8950                         | 0.42                     | 388.0                         | 1083                |
| Brass                         | 20                | 8100-8600                    | 0.38                     | 110-150                       | 925                 |
| Stainless steel               | 20                | 7840                         | 0.46                     | 15.0                          | 1440                |
| Silumin                       | 20                | 2700                         | 0.90                     | 160.0                         | 570                 |
| Steel                         | 20                | 7850                         | 0.50                     | 65.8                          | 1516                |
| <b>Other solid substances</b> |                   |                              |                          |                               |                     |
| ABS                           | 20                | 1100-1220                    | 1.46                     | 0.19                          |                     |
| Acrylic                       | 20                | 1100-1180                    | 1.42                     | 0.14                          |                     |
| Asbestos                      | 0                 | 470-700                      | 0.81                     | 0.15-0.23                     |                     |
| Asphalt                       | 20                | 1100-1500                    | 2.09                     | 0.7                           | 120                 |
| Bakelite                      | 20                | 1400                         | 1.60                     | 0.23                          |                     |
| Cement/concrete               | 20                | 1800-2500                    | 0.88                     | 0.8-1.4                       |                     |
| Beeswax                       | 20                | 965                          | 65                       |                               |                     |
| Oak (air dried)               | 20                | 690-1030                     | 2.38                     | 0.1-0.46                      |                     |
| Fat                           | 20                | 920-940                      | 2.09                     |                               |                     |
| Glass                         | 20                | 2400-2900                    | 0.71-0.83                | 0.9                           |                     |
| Graphite (pure)               | 20                | 1800-2350                    | 0.75-1.25                | 1.46                          | 3000                |
| Pine (air dried)              | 20                | 350-600                      | 2.72                     | 0.1-0.46                      |                     |
| Gravel (dry)                  | 20                | 1800-2100                    | 3.34                     | 0.34                          |                     |
| Rubber (pure)                 | 20                | 900-1000                     | 1.42-2.1                 | 0.23                          | 125                 |
| Resin                         | 20                | 1030-1340                    |                          |                               | 70200               |
| Ice                           | 0                 | 920                          | 1.92                     | 2.25                          | 0                   |
| Marble                        | 20                | 2500-2800                    | 0.83                     | 2.1-3.5                       |                     |
| Nylon                         | 20                | 1070-1150                    | 1.26-2.09                | 0.24                          |                     |
| Paper                         | 20                | 700-1200                     | 1.88                     | 0.19 (0.13)                   |                     |
| Paraffin wax                  | 20                | 900                          | 2.88                     | 0.28 (0.24)                   | 54                  |
| Polyethylene                  | 20                | 910-960                      | 2.26                     | 0.33                          |                     |
| Polyimide                     | 20                | 1440                         | 1.31-1.30                | 0.36-0.98                     |                     |
| Polycarbonate                 | 20                | 1180-1250                    | 1.26                     | 0.20                          |                     |
| Polypropylene                 | 20                | 880-910                      | 1.93                     | 0.25                          |                     |
| Polystyrene                   | 20                | 1060                         | 1.34                     | 0.05-0.14                     |                     |
| Polyester                     | 20                | 1060-1470                    | 0.84-1.46                | 0.57-0.72                     |                     |
| Porcelain                     | 20                | 2150-2360                    | 1.09                     | 1.05 (1.52)                   | 1550                |
| Sand (dry)                    | 20                | 1410-1600                    | 0.80                     | 0.32                          |                     |
| Steatit                       | 20                | 2590                         | 0.84                     | 2.94                          |                     |
| Brick                         | 20                | 1400-2000                    | 0.83-1.09                | 0.41                          | 1580-2200           |



CONT. TABLES

**Corrosion guide**

The effects of corrosion have been graded in the table as follows:

- 0: Rate of corrosion <0.1 mm per year  
Material used is resistant to corrosion.
- 1: Rate of corrosion 0.1–1.0 mm per year.  
Material not resistant to corrosion but usable in certain cases.
- 2: Rate of corrosion >1.0 mm per year.  
Excessive corrosion. Material not usable.

P: Risk for pitting and crevice corrosion.

S: Risk for stress corrosion.

Please note that the figures in the corrosion table can change considerably in if concentrations and temperatures are increased. The mixing of different substances can result in the resistance to corrosion being reduced. This applies above all to solutions containing chlorides.

| Substance                                | Conc.%             | Temp.°C | SS2337             | SS2348             | SS2562             | I 800              |
|--|--------------------|---------|--------------------|--------------------|--------------------|--------------------|
| 1 Acetone .....                          |                    | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 2 Aluminium chloride.....                | 5                  | 50      | P2 <sup>S</sup>    | P2 <sup>S</sup>    | P0 <sup>S</sup>    | P0 <sup>S</sup>    |
| 3 Aluminium sulphate neutr. low Fe ..... | 10                 | 20-K    | 0 2                | 0 1                | 0                  | 0                  |
| 4 Ammonium hydrate solution.....         |                    | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 5 Ammonium bicarbonate .....             |                    | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 6 Ammonium chloride.....                 | 5                  | 20-K    | P0 <sup>S</sup>    | P0 <sup>S</sup>    | P0 <sup>S</sup>    | P0                 |
| 7 Ammonium nitrate.....                  | saturated          | 20-K    | 1                  | 0                  | 0                  | 0                  |
| 8 Ammonium persulphate .....             | 10                 | 20      | 0                  | 0                  | 0                  | 0                  |
| 9 Ammonium sulphate.....                 | all concentrations | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 10 Benzene .....                         |                    | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 11 Blood (meat juices).....              |                    | 20      | 0                  | 0                  | 0                  | 0                  |
| 12 Lead acetate.....                     | 20                 | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 13 Borax.....                            | saturated          | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 14 Boric acid .....                      | saturated          | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 15 Citric acid.....                      | 5                  | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 16 Ether.....                            |                    | 20      | 0                  | 0                  | 0                  | 0                  |
| 17 Ethyl alcohol .....                   | all concentrations | 20      | 0                  | 0                  | 0                  | 0                  |
| 18 Carboic acid.....                     | all concentrations | 20-K    | 0 1                | 0                  | 0                  | 0                  |
| 19 Formaldehyde.....                     | all concentrations | 20      | 0                  | 0                  | 0                  | 0                  |
| 20 Phosphoric acid.....                  | <35, 50            | 80, K   | 0 2                | 0 2                | —                  | 0                  |
| 21 Photographic developer .....          |                    | 20      | 0                  | 0                  | 0                  | 0                  |
| 22 Fruit juices.....                     |                    | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 23 Furfurol, vapour .....                |                    | vapour  | 0                  | 0                  | 0                  | 0                  |
| 24 Gallic acid .....                     | saturated          | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 25 Tannic acid.....                      | 50                 | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 26 Glycerine .....                       | all concentrations | 20      | 0                  | 0                  | 0                  | 0                  |
| 27 Iron chloride (III).....              | 5                  | 20      | P2 <sup>S</sup>    | P2 <sup>S</sup>    | P2 <sup>S</sup>    | P2 <sup>S</sup>    |
| 28 Iron nitrate (III).....               | 5                  | 20      | 0                  | 0                  | 0                  | 0                  |
| 29 Iron sulphate (II, III) .....         | 5                  | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 30 Coffee.....                           |                    | K       | 0                  | 0                  | 0                  | 0                  |
| 31 Calcium chloride.....                 | 5                  | 20-K    | P0 <sup>S</sup>    | P0 <sup>S</sup>    | P0 <sup>S</sup>    | P0 <sup>S</sup>    |
| 32 Potassium chromate .....              | 25                 | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 33 Potassium cyanide .....               |                    | 20      | 0                  | 0                  | 0                  | 0                  |
| 34 Potassium chloride.....               | saturated          | 20-K    | P0 P1              | P0                 | P0                 | P0                 |
| 35 Potassium nitrate.....                | saturated          | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 36 Potassium permanganate .....          | 5                  | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 37 Potassium sulphate.....               | 5                  | 20-K    | 0                  | 0                  | 0                  | 0                  |
| 38 Chlorine (hydrous).....               |                    | 20      | P2                 | P2                 | P1                 | P2                 |
| 39 Chloroform.....                       |                    | 20-K    | P0 P0 <sup>S</sup> | P0 P0 <sup>S</sup> | P0 P0 <sup>S</sup> | P0 P0 <sup>S</sup> |



# CONT. TABLES

| Substance                      | Conc. %            | Temp. °C | SS2337             | SS2348             | SS2562             | I 800              |
|--------------------------------|--------------------|----------|--------------------|--------------------|--------------------|--------------------|
| 40 Carbene tetrachloride ..... | 100                | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 41 Copper cyanide.....         | saturated          | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 42 Copper nitrate.....         | 10                 | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 43 Copper sulphate.....        | 10                 | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 44 Chromic acid.....           | 10                 | 20-K     | 0 2                | 0 2                | 0 2                | 0 2                |
| 45 Magnesium chloride.....     | 2.5                | 20       | P0                 | P0                 | P0                 | P0                 |
| 46 Magnesium sulphate.....     | saturated          | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 47 Manganese chloride.....     | 10                 | 20-K     | P0 <sup>S</sup>    | P0 <sup>S</sup>    | P0 <sup>S</sup>    | P0 <sup>S</sup>    |
| 48 Lactic acid.....            | 5                  | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 49 Formic acid.....            | 5                  | 20       | 0                  | 0                  | 0                  | 0                  |
| 50 Sodium bisulphate.....      | 10                 | 20-50    | 0                  | 0                  | 0                  | 0                  |
| 51 Sodium bisulphate.....      | 10                 | 20-K     | 0 1                | 0                  | 0                  | 0                  |
| 52 Sodium citrate.....         | saturated          | 20       | 0                  | 0                  | 0                  | 0                  |
| 53 Sodium hydroxide.....       | 20                 | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 54 Sodium carbonate.....       | 25                 | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 56 Sodium nitrate.....         | saturated          | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 57 Sodium nitrite.....         | saturated          | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 58 Sodium peroxide.....        | 10                 | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 59 Sodium sulphate.....        | saturated          | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 60 Sodium sulphite.....        | 5                  | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 61 Sodium thiosulphate.....    | 25                 | 20-K     | 0                  | 0                  | 0                  | 0                  |
| In presence of Cl.....         | 25                 | 20-K     | P0 <sup>S</sup>    | P0 <sup>S</sup>    | P0 <sup>S</sup>    | P0 <sup>S</sup>    |
| 62 Nickel chloride.....        | saturated          | 20       | P0                 | P0                 | P0                 | P0                 |
| 63 Nickel sulphate.....        | saturated          | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 64 Oxalic acid.....            | 5                  | 20-K     | 0 2                | 0 1                | 0 1                | 0 1                |
| 65 Pyrogalllic acid.....       | all concentrations | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 66 Nitric acid.....            | <40                | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 67 Hydrochloric acid.....      | 1                  | 60       | 2                  | 2                  | P1                 | 2                  |
| 68 Silvernitrate.....          | 5                  | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 69 Butyric acid.....           |                    | 20-K     | 0 1                | 0                  | 0                  | 0                  |
| 70 Stearic acid.....           |                    | 130      | 0                  | 0                  | 0                  | 0                  |
| 71 Sulphuric acid.....         | 1                  | 20-100   | 0 2                | 0 1                | 0 1                | 0 1                |
| .....                          | 20                 | 20-100   | 2                  | 0 2                | 0 2                | 0 2                |
| .....                          | 60                 | 20-70    | 2                  | 2                  | 0 2                | 0 2                |
| 72 Stannic chloride.....       | 5                  | 20       | P2                 | P1                 | P1                 | P1                 |
| 73 Trichlorethylene.....       |                    | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 74 Tartaric acid.....          | 10                 | 20-K     | 0                  | 0                  | 0                  | 0                  |
| 75 Hydrogen peroxide.....      | 30                 | 20       | 0                  | 0                  | 0                  | 0                  |
| 76 Zinc chloride.....          | 5-20               | 20-K     | P0 P1 <sup>S</sup> | P0 P0 <sup>S</sup> | P0 P0 <sup>S</sup> | P0 P0 <sup>S</sup> |
| 77 Zinc sulphate.....          | saturated          | 20-K     | 0 1                | 0                  | 0                  | 0                  |
| 78 Acetic acid.....            | 80                 | 20-K     | 0 1                | 0                  | 0                  | 0                  |
| 79 Malic acid.....             | 10                 |          | 0                  | 0                  | 0                  | 0                  |

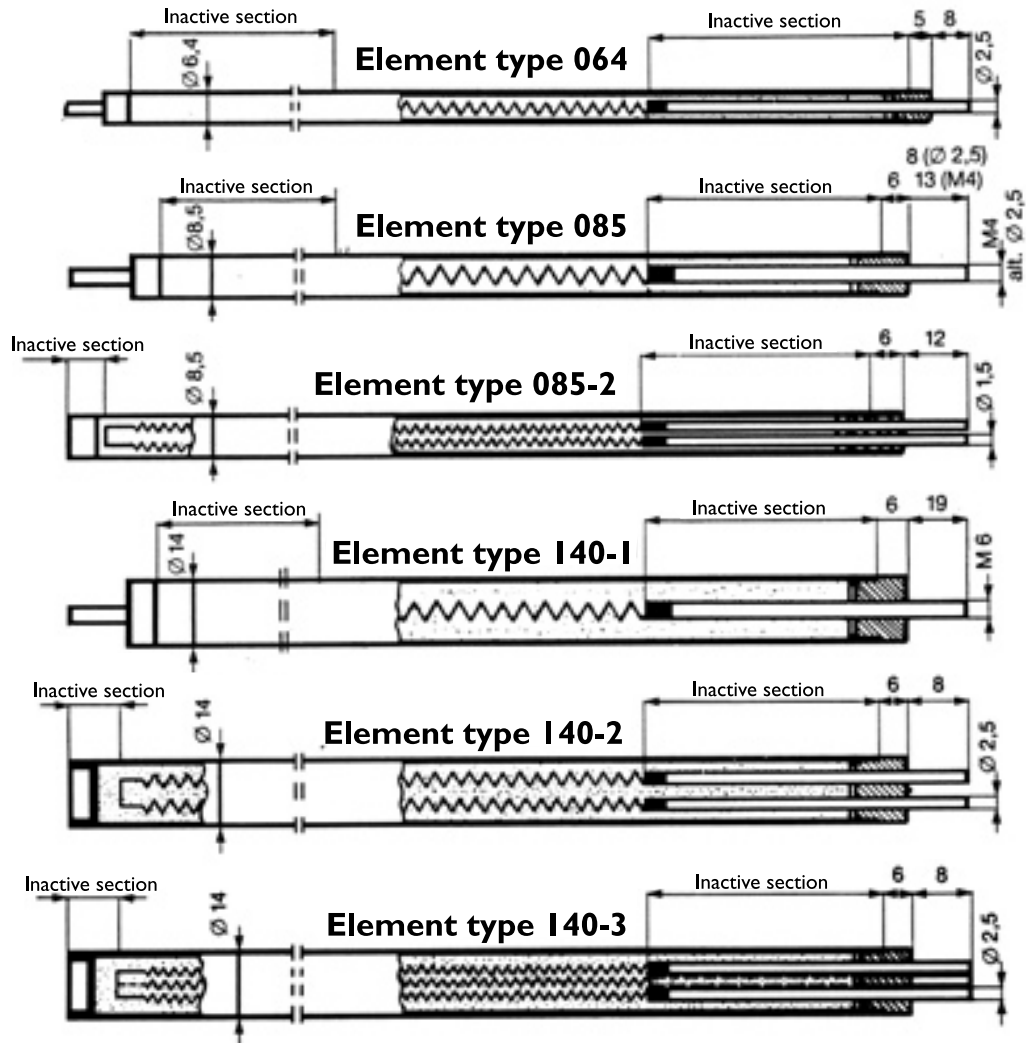
# DESIGN CHECK LIST

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Maximum recommended surface loads when heating different substances and media

| Substance                                    | Surface effect in W/cm <sup>2</sup> |       |                 |        |
|--|-------------------------------------|-------|-----------------|--------|
|  | Temp °C                             | Steel | Stainless steel | Copper |
| Still air .....                              | 50                                  | 1.7   | 6               |        |
| Still air .....                              | 450                                 |       | 4               |        |
| air 3 m/s.....                               | 200                                 | 1.5   | 5               |        |
| air 6 m/s.....                               | 260                                 | 2.5   | 7               |        |
| air 10 m/s.....                              | 200                                 | 3.5   | 10              |        |
| air 10 m/s.....                              | 300                                 | 1.5   | 8               |        |
| air 10 m/s.....                              | 450                                 |       | 4               |        |
| Alkaline solutions .....                     | 100                                 |       | 6               |        |
| Thin oil.....                                | 50                                  |       | 6               |        |
| Thin oil solutions.....                      | 200                                 |       | 4               |        |
| Thin oil solutions.....                      | 350                                 |       | 2               |        |
| Vegetable oil.....                           | 200                                 |       | 4               |        |
| Heat transfer oil .....                      | 200                                 |       | 5               |        |
| Heat transfer oil .....                      | 300                                 |       | 2               |        |
| Tar .....                                    | 150                                 |       | 1               |        |
| Still water .....                            | 100                                 |       | 10              | 10     |
| Flowing water.....                           | 80                                  |       | 15              | 15     |
| Metallic surfaces for contact heating ...400 | 2                                   |       |                 |        |
| Metallic surfaces for contact heating ...600 |                                     | 5     |                 |        |
| Solid castings in aluminium.....             | 300                                 | 12    | 12              |        |

The following types of tubular elements are produced



We can supply these different types of elements in the following sheath materials:

| Material               | Swedish standard | AISI       | WERK-stoff | Max. temp* | 064 | 085 | I40 |
|------------------------|------------------|------------|------------|------------|-----|-----|-----|
| Steel.....             |                  | -          | -          | 400        | X   | X   | X   |
| Stainless steel .....  | SS2333           | 304        | 1.4301     | 750        | X   |     |     |
| Stainless steel .....  | SS2337           | 321        | 1.4541     | 750        |     |     | X   |
| Acid proof steel ..... | SS2348           | 316L       | 1.4404     | 700        | X   | X   | X   |
| Copper.....            | SS5015           | C12200     | -          | 250        |     | X   | X   |
| Nickel/bronze.....     | SS5667           | C70600     | -          | 275        |     | X   |     |
| SMO254.....            | SS2378           | UNS S31254 | -          | 400        | X   | X   | X   |
| Incoloy 800 .....      |                  | -          | 1.4876     | 800        | X   | X   | X   |
| Incoloy 825 .....      |                  | -          | 2.4858     | 450        | X   | X   | X   |
| R323 .....             |                  | (302B)     | 1.4828S    | 900        | X   | X   |     |
| Titan .....            |                  | -          | -          |            |     |     | X   |

\* Max. temp refers to the sheath temperature of the element.

## Standard cold part - and max/min element lengths other cold part lengths on request

All tubular elements must be produced with an inactive part in both ends.

| Tubular Element<br>Type                         | Cold part length in mm |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     | Element length |     |     |     |      |      |
|---|------------------------|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------------|-----|-----|-----|------|------|
|   | 30                     | 35 | 45 | 60 | 70 | 85 | 100 | 110 | 130 | 145 | 175 | 190 | 200 | 205 | 235 | 245 | 275 | 325            | 375 | 425 | 475 | Min. | Max. |
| 064<br>Terminal pin Ø 2,5 mm<br>Qual. SS 1914   |                        | •  | •  | •  | •  | •  | •   | •   | •   | •   | •   |     | •   |     |     |     | •   | •              | •   |     |     | 250  | 3400 |
| 085<br>Terminal pin Ø 2,5 mm<br>Qual. SS 1914   |                        | •  | •  | •  | •  | •  | •   | •   | •   | •   | •   |     | •   |     |     |     | •   | •              | •   | •   | •   | 210  | 6400 |
| Alt. M 4<br>Qual. SS 1914                       | •                      |    | •  | •  | •  |    | •   |     |     | •   | •   | •   |     | •   | •   |     | •   | •              | •   |     | •   | 210  | 6400 |
| 085-2<br>Terminal pin Ø 1,5 mm<br>Qual. SS 1914 |                        | •  | •  | •  |    |    | •   |     | •   | •   | •   |     | •   |     |     |     |     |                |     |     |     | 350  | 3600 |
| 140-1<br>Terminal pin M 6<br>Qual. SS 1914      |                        |    | •  |    |    | •  |     |     | •   |     |     | •   |     |     |     |     |     | •              |     |     | •   | 160  | 6400 |
| 140-2<br>Terminal pin Ø 2,5 mm<br>Kval. SS 1914 |                        | •  | •  | •  | •  | •  | •   | •   | •   | •   | •   |     | •   |     |     |     | •   | •              | •   | •   | •   | 160  | 4200 |
| 140-3<br>Terminal pin Ø 2,5 mm<br>Qual. SS 1914 |                        | •  | •  | •  | •  | •  | •   | •   | •   | •   | •   |     | •   |     |     |     | •   |                |     |     |     | 220  | 4200 |

Through other companies within the Backer group we can offer a wide range of other dimensions. Please contact us for more info!

### Surface load

Among other factors the functional life of an element depends on the surface load of the element. You will find recommendations for surface loads for different kind of heating purposes on page 107.

Surface load is calculated as follows:

$$Y = \frac{P}{LXM} \quad L = \frac{P}{MXY}$$

Y = Surface load in W/cm<sup>2</sup>

L = Active length of the element in cm

P = Output in W

M = Element type 064: 2.01 cm<sup>2</sup>/cm

Element type 085: 2.67 cm<sup>2</sup>/cm

Element type 140: 4.40 cm<sup>2</sup>/cm

### Total length of element

The total length of the element is obtained by adding L to the total length of the inactive section.

### Ohms/metre

In certain cases ohms/metre can be a limiting factor. The following limits apply:

| Type of element | 064 | Min. 6 Ω/ mL | Max. 6 Ω/ mL |
|-----------------|-----|--------------|--------------|
| 085             |     | 3            | 1300         |
| 085-2           |     | 14           | 700          |
| 140-1           |     | 3            | 1300         |
| 140-2           |     | 8            | 1200         |
| 140-3           |     | 8            | 1000         |

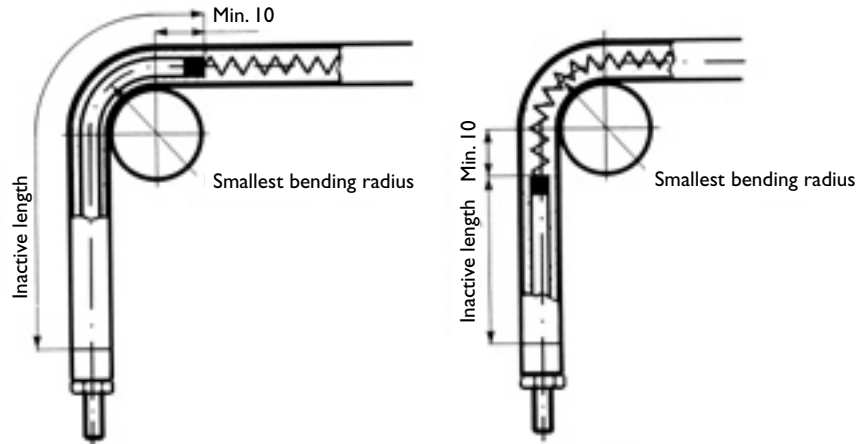
P = Power in W

U = Voltage in V

L = Active length of element in m

$$\text{Ohms/metre} = \frac{U^2}{P \times L}$$

## Bending instructions



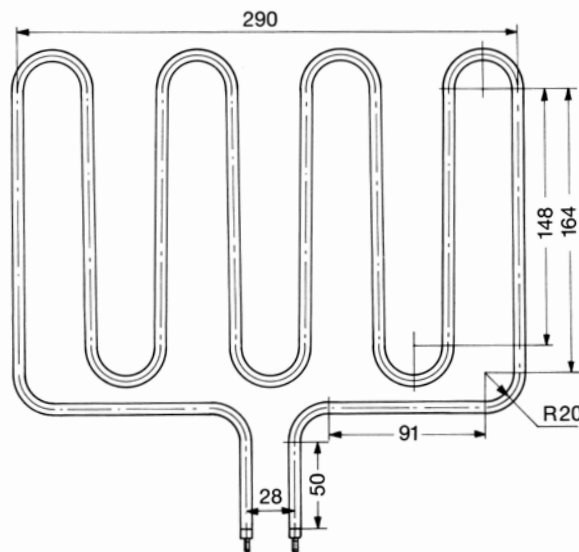
In cold state Backer's elements can easily be bent to a small radius. This simplifies the work of design. The requirement for space in different electrical appliances can be reduced

to a minimum. Terminal pins must always be least 10 mm from the extremity of a bend (see diagram).

Smallest bending radius of different sheath materials.

| Type of tubular element | Copper C12200 | Steel Grade D | Stainless steel EN 1.4301 | Stainless steel EN 1.4404 | Stainless steel EN 1.4828 | Stainless steel Incoloy 800 | Stainless steel Incoloy 825 | Stainless steel UNS S31254 | S/Titanium 20 |
|-------------------------|---------------|---------------|---------------------------|---------------------------|---------------------------|-----------------------------|-----------------------------|----------------------------|---------------|
| 064                     | 10            | -             | 10                        | 10                        | 10                        | 11,5                        | 17,5                        | 12,5                       | -             |
| 085                     | 12,5          | 12,5          | 12,5                      | 12,5                      | 11                        | 15                          | 18                          | 15                         | -             |
| 140                     | 25            | 25            | 25                        | 25                        | 25                        | 30                          | 30                          | 30                         | 35            |

When figuring an element drawing, c-c measures apply.



# SALES CONDITIONS

## 1. General

These conditions of sale and delivery are applicable on deliveries of products, plants and components manufactured, delivered and/or erected by Backer BHV AB (the "Supplier"). Such products, plants and components are hereinafter jointly referred to as the "Products". These conditions apply as a complement to the parties' separate contract or any other corresponding written agreement, such as for example offers and orders preceding the delivery (the "Agreement"). The applicable Orgalime General Conditions shall be stated in the Agreement. If applicable Orgalime General Conditions are not indicated in the Agreement, Orgalime SC 06 (or any subsequent conditions that replace Orgalime SC 06) shall apply between the parties. However, Appendix 1 to Orgalime SC 06 shall never apply between the parties unless otherwise specifically set forth in the Agreement. In the event the provisions of these conditions of sale and delivery, the Agreement and applicable Orgalime General Conditions should be in conflict the documents shall take precedence in the order listed below.

- 1.The Agreement
- 2.These conditions of sale and delivery
- 3.Applicable Orgalime General Conditions (including supplementary conditions)

Any deviation from the above mentioned documents shall be approved in writing by the Supplier in order to form part of the parties' agreement. This means *inter alia* that the purchaser's conditions of purchase are applicable between the parties only after the Supplier's written approval.

## 2. Prices

All prices indicated in the Agreement are exclusive of value added tax and packaging costs.

## 3. Packaging

The purchaser shall pay compensation for packaging in accordance with the Supplier's at each time valid price list. The purchaser shall at its own risk and expense return standard pallets and collars to the Supplier within two months from receipt. The purchaser shall receive compensation for such standard pallets and collars in accordance with the Supplier's at any time current price list. The Supplier does not accept any other packaging in return.

## 4. Conditions of delivery

Unless otherwise stated in the Agreement the Products are delivered Ex Works the Supplier's factory in accordance with the valid Incoterms at any time.

## 5. Payment and invoicing

Unless otherwise stated in the Agreement, the purchase price shall be paid no later than thirty (30) days from the delivery date. The Supplier has the right to request payment in advance of the purchase price or that the purchaser provides other corresponding security, such as for example documentary letter of credit, before delivery of the Products, irrespective of the reason therefor.

## 6. Retention of title

The Products shall remain the property of the Supplier until full payment of any of the Supplier's claims out of or in connection with the Agreement has been made. However, until full payment of any of the Supplier's claims out of or in connection with the Agreement has been made the purchaser shall be entitled to process and resell

the Products in the ordinary course of business in accordance with the following provisions. Any processing of the Products shall be conducted on behalf of the Supplier as manufacturer and the Supplier shall acquire the ownership in any such newly manufactured products ("Newly Manufactured Products") in whole or, if the Newly Manufactured Products comprise products of different owners; pro rata in accordance with the value of the processed products. The purchaser herewith (in advance) assigns any current and future claims against its customers resulting from or in connection with the resale of the Products or resale of Newly Manufactured Products (in case of co-ownership of the Newly Manufactured Products; pro rata) to the Supplier as security. The Supplier herewith authorizes the purchaser to collect such assigned claims on behalf of the Supplier. The Supplier may at any time revoke said authorization. The stipulations set forth above shall apply to the extent that such retention of title is valid under the applicable law.

## 7. Deviations

The following shall only apply when Orgalime SC 06 or Orgalime S 2012 (or any subsequent conditions that replace said conditions) is applicable between the parties: The purchaser must accept a deviation in the quantity of delivered Products (excess or short delivery) by maximum ten (10) per cent of the ordered quantity and must make full payment of the purchase price. In case of excess delivery the purchaser is also obligated to pay for the surplus Products.

## 8. Samples, tools and equipment

All samples and tools as well as equipment furnished by the Supplier for the manufacture of the Products remain the sole property of the Supplier.

## 9. Documentation

To the extent available, the Supplier will provide product information regarding the delivered Products. Other documentation and assembly instructions are offered separately at the Purchaser's request.

## 10. Complaints and liability for defects

The Supplier's liability for defects follows from the applicable Orgalime General Conditions, except as set out below in this clause 10. The Supplier assumes no liability for defects as regards layout and design of the Products unless expressly stated in the Agreement. Each Product is marked with a serial number indicating the date of manufacture. The Supplier's liability for defects expires after a period of 52 weeks calculated from the date of manufacture of the Product in question. The mentioned time limitation shall apply irrespective of whether the Product or parts of the Product has/have been repaired or replaced during this period. The purchaser is liable for all costs in connection with reparations or replacements of the Products or parts of the Products. All transportation of defect Products or defect parts of the Products to and from the Supplier shall be at the purchaser's risk and expense.

## 11. Third party claims

If the Supplier incurs liability towards a third party that has purchased the Products from the purchaser or from downstream distributors, the purchaser shall indemnify, defend and hold the Supplier harmless against any and all such claims.



BACKER

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