TABLE
with the most common electrical output levels

and current loads

Output kW	Operating voltage 230 V 1 ph A	230 V 3ph / Δ A / ph	400 V 3ph / Y A / ph
0,50	2,17	1,26	0,72
0,75	3,26	1,88	1,08
1,00	4,35	2,51	1,44
1,50	6,52	3,77	2,17
2	8,70	5,02	2,89
3	13,04	7,53	4,33
4	17,39	10,04	5,77
5	21,74	12,55	7,22
6	26,09	15,06	8,66
7,50	32,61	18,83	10,83
9	39,13	22,59	12,99
10	43,47	25,10	14,45
12	52,17	30,12	17,32
15	65,22	37,65	21,65
16	69,57	40,16	23,09
18	78,26	45,18	25,98
20	86,96	50,20	28,87
24	-	60,25	34,64
30	-	75,31	43,30
40	-	100,41	57,74
50	-	-	72,17
60	-	-	86,60

The ohmic law

Voltage (V) $U = I \cdot R = \frac{P}{I} = \sqrt{P \cdot R}$

Current (A) $I = \frac{U}{R} = \frac{P}{U} = \sqrt{\frac{P}{R}}$

Resistance (Ω) $R = \frac{U}{I} = \frac{P}{I^2} = \frac{U^2}{P}$

Output (W) $P = U \cdot I = I^2 \cdot R = \frac{U^2}{R}$

Electrical heating cores are specified according to the above values. The values apply for DC and AC.

U = voltage in volts
I = current in amperes
R = resistance in ohms
P = output (power) in watts

A purely ohmic load can be assumed for all heating grids and air heaters. With larger outputs connected to rotary current, the current

$$I = \frac{P}{U \cdot 1{,}73}$$

The following applies to calculating the heating of air and non-combustible, non-aggressive and non-explosive gasses:

$\dot{Q}$ = heat flow in J/s = W
$= \dot{V} \cdot \varrho \cdot cp \cdot \Delta T$

$\dot{V}$ = volume flow in m³/s
ϱ = density in kg/m³
cp = spec. heat capacity in J/kg K
ΔT = temperature difference in K

Output of an electric air heater:

$$P = \frac{\dot{V} \cdot \Delta T}{2777}$$ in kW and $\dot{V}$ in m³ / h

Conversion to SI units:
1 kcal = 4.187 = approx. 4.2 kJ or 1000 kcal / h = 4187 kJ/h
1 kW = 3600 kJ (860 kcal)
1 mm Ws = 1 kp/m² = 9.81 N/m² = approx. 10 Pa = 0.1 mbar
0°C = 273 Kelvin

Carrier material - glass silk thread
We use textile fibre glass as carrier material for the heating grids in many areas of application.
E-glass silk is an alkali-free silicate glass and is manufactured as a practically continuous fibre length by a nozzle-drawing technique. We use only filaments of diameter > 9μ, hence not hazardous to health.

Fibre sizes do not present an increased health risk according to the state of the art, as well as the most up-to-date scientific findings, since fibres > 3 μ in thickness cannot penetrate the pulmonary border.
There is no basis for a restriction in use or use ban in accordance with TRGS 905/906

E-glass silk is non-combustible. The softening point is at approx. 1093 K. Temperature-resistant between approx. 193 K - 800 K.
Superb characteristics include:
high specific resistance
high disruptive strength
The required stability is made possible by impregnating the heating grids with an inorganic, non-combustible high temperature insulation compound (acc. to DIN 4102) - a water- based silicate mixture containing no solvents.
For special applications in temperature ranges up to approx. +110°C we also use polyester fibres for carrier material, impregnated with water glass.
Other information on glass thread with data on chemical composition and its reliability is available on request.

Temperature-resistant Connecting Lines

Depending on the application, we use the following leads for internal wiring:

Type	Constant temperature-resistance	perm. nominal voltage
Teflon copper strands	473 K (200 °C)	500 volts
Glass silk copper strands	453 K (180 °C)	380 volts
Silicon copper strands	473 K (200 °C)	500 volts
Silicon glass silk copper strands	473 K (200 °C)	660 volts
Teflon/PTFE nickelled copper strands	533 K (260 °C)	600 volts
Special silicon copper strands	473 K (200 °C)	1000 volts

Load table

Basic temperature 363-423 K (+ 90 °C to + 150 °C)

Cross-section	Current load
0.50 mm^2	10 A
0.75 mm^2	15 A
1.00 mm^2	19 A
1.50 mm^2	21 A
2.50 mm^2	29 A

Note

At higher temperatures or composition of several leads, the current-carrying capacity decreases very rapidly. At the max. temperatures not mentioned, it is only approx. 38% of the nominal value for nearly all types.

For use in systems or units with high humidity, you should insist on elements or heat exchangers with silicon or silicon glass silk copper strands.

When making structural connection, be sure to make the correct material selection for the connecting cables, noting the planned air outlet temperature or ambient temperature.

Tabular Survey on the Most Commonly Used Resistance and Heating Conductor Alloys, DIN 17471

Alloy	Material no.	Main component Cu	Ni	Mn	Cr	FE	Spec. electr. resistance at 20°C $\frac{Ohm \cdot mm^2}{m}$	max. perm. constant temp °C	Kelvin K
CuNi 2	2.0802	98	02				0.05	300	573
CuNi 6	2.0807	94	06				0.10	300	573
CuNi 10	2.0811	90	10				0.15	400	673
CuNi 23 Mn	2.0881	75.5	23	1.5			0.30	500	773
CuNi 30 Mn	2.0890	67	30	3			0.40	500	773
CuNi 44	2.0842	55	44	1			0.49	600	873
CuNi 25 20	1.4843		20		25	rest	0.95	1050	1323
NiCr 30 20	1.4860		30		20	rest	1.04	1100	1373
NiCr 60 15	2.4867		60		15	rest	1.13	1150	1423
NiCr 80 20	2.4869		80		20		1.12	1200	1473

The first four alloys mention are not standardized. They are manufactured based on DIN 17471 or DIN 46461/62 and are approved for use in heating grids acc. to VDE 0253 10/73. The alloy CuNi 44 (also known as constantan or isotan) that we prefer to use is also stable at temperature increases according to its specific resistance (which also applies to the first four alloys mentioned).

The last four mentioned alloys are austenitic in structure, so that the specific resistance changes according to the temperature.

All alloys can be processed as wires or bands, either painted or braided.

Bare wires are butt-welded for continuous processing.

On request, we will gladly provide you with further information on the individual alloys.