

Heater with middle- / tip-swaging

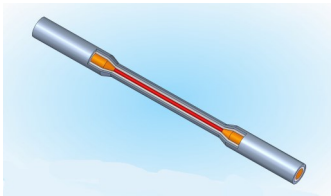
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|-----------------|----------------|---------------|---------------|---------------|----------------|--------------|--------------|---------------|
| Core material | K = Constantan | Ni=Nickel | NC= NiCr80/20 | BA=NiFe70/30 | | | | |
| Sheath material | VA=AISI 304L | VA2=AISI 304 | VA3=AISI 316L | VA4=AISI 321 | VA5=AISI 316TI | VA6=AISI 314 | VA7=AISI 309 | VA8=AISI 310S |
| | I=Inconel600 | I2=Inconel601 | I3=Inconel625 | I4=Inconel800 | I5=Inconel825 | | | |

Encoding scheme for requests and orders:

1 - C - H - I - 0,35 - 6,0 - 1000 - // - 3,0 - 6000 - // - 6,0 - 1000

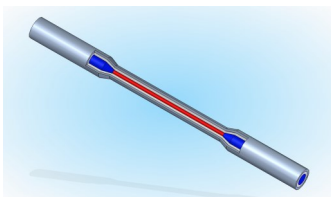
Example:

Customized single core heater, sheath: „I“ (Inconel600), medium swaging ratio 2:1, cold end 1: d=6,0mm, R=0,35Ohm/m, l=1000mm, swaged to 3mm , R=1,4Ohm/m, l=6000mm, Cold end 2: same as cold part 1



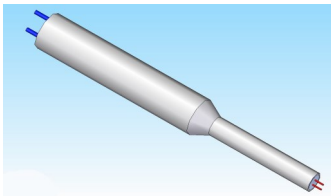
Heater with cold ends by medium swaging.

Beside heaters with welded or real cold ends without change of diameter, cold end heater can be manufactured by partial swaging of the heater.



Heater with real cold ends and medium swaging.

You get a continuous sheath “made of one piece” without welded components even in the inner gain but different diameter for cold (higher diameter) and hot (lower diameter) parts and therefore less flexible cold ends.



2-core heater with tip swaging.

The swaging process can be used also in combination with real or welded cold end heaters. Tip Swaging can be used for 2-core or grounded single core heaters.

Common **swaging** ratios are up to **ratio 2:1**, what means, the **power dissipation** in the swaged area is **4 times** higher than in the unswaged part. The **density of power** on the sheath is **8 times** higher there.

Example:

Swaging of a heater from d=6mm to d= 3mm means, in the 3mm swaged area the line resistance will be 4 times higher than in the 6mm area. The electrical power dissipation will be 4 times higher there and the power density in relation to the surface will be 8 times higher.

If the swaged part of the cable runs with ~ 925°C at calm air at room temperature (what is about 10W/cm² power density on sheath) the unswaged part will have only ~ 400°C surface temperature, what is “cold” in relation to the swaged part.

ThermSys manufactures heaters in standard and customized designs with dedicated properties in line resistance and sheath materials

Technical data's / Handling:

- Resistance tolerance: +/-10% (standard)
- Sheath-Ø-tolerance: +/-0,05mm
- Core material: NiCr80/20 (standard)
- Sheath material: VA4 or I (standard)
- Bending radius: 2 - 3 x sheath-Ø
- Do not bend heater to often - depending from bending ratio and accumulated plastic deformations of the heater materials !
- Hot part length tolerance: swaged part < 4m: +/-50mm, 4 - 12m: +/-100mm , >12 - 18m: +/-200mm, above on request
- Cold part length: customized
- Max. voltage / power over sheath depending on sheath diameter, temperature gradient heater to heated parts / thermodynamic max. possible flow energy from heater to heated part and heating up cycles. Please refer to our technical sheet “Handling and operation of ThermSys mineral insulated heaters and applications” we send on request or you can download on our website.
- Mineral insulation: Magnesium Oxide (MgO), other insulation on request
- Recommended use:
Stainless steel sheath up to 600°C,
Inconel600 sheath up to 1000°C

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