

## KANTHAL® AF TUBE

### TECHNICAL SPECIFICATION

**Kanthal® AF is a ferritic iron-chromium-aluminium alloy (FeCrAl alloy) for use at tube temperatures up to 1200°C (2280°F).**

The alloy is characterized by excellent oxidation resistance and forms an excellent, non-scaling surface oxide, which gives good protection in most furnace environments, i.e. oxidizing, sulphurizing and carburizing, as well as against deposits of carbon, ash, etc.

A typical application for Kanthal® AF tubes are as vertically positioned radiant tubes in electrically fired furnaces such as sealed quench furnaces used for carburizing and/or carbonitriding. Or for use in other furnace applications where the tube is exposed to moderate mechanical stress levels.

#### STANDARD STOCK SIZES

OD <sup>1)</sup> MM	WALL THICKNESS MM	WEIGHT KG/M	MAX LENGTH MM
83 <sup>2)</sup>	2	3.6	5
89	2	3.9	5
94	2	4.1	5
100	2	4.4	5
108	2	4.8	5
128	2	5.7	5
138	2	6.1	5

<sup>1)</sup> OD = Outer diameter

<sup>2)</sup> Note: Tubes in other diameters and lengths can be made on request. Please contact your local Kanthal representative.

#### CHEMICAL COMPOSITION

	C %	SI %	MN %	CR %	AL %	FE %
<b>NOMINAL COMPOSITION<sup>3)</sup></b>					5.3	Bal.
<b>MIN</b>	-	-	-	20.5	-	
<b>MAX</b>	0.08	0.7	0.4	23.5	-	

#### MECHANICAL PROPERTIES

YIELD STRENGTH	TENSILE STRENGTH	ELONGATION	HARDNESS
Rp0.2	Rm	A	
MPa	MPa	%	Hv
420-600	620-750	10-24	200-240

#### MECHANICAL PROPERTIES AT ELEVATED TEMPERATURE

TEMPERATURE °C	900	1000	1100	1200	1300
<b>MPa</b>	37	20	12	6	4

Ultimate tensile strength - deformation rate  $6.2 \times 10^{-2} \text{ min}^{-1}$

#### CREEP STRENGTH - 1% ELONGATION IN 1000 H

TEMPERATURE °C	1100	1200
<b>MPa</b>	0.7	0.3

#### YOUNG'S MODULUS

TEMPERATURE °C	20	100	200	400	600	800	1000
<b>GPa</b>	220	210	205	190	170	150	130

#### CREEP STRENGTH - 1% ELONGATION IN 1000 H

TEMPERATURE °C	1100	1200
<b>GPa</b>	220	210

<sup>3)</sup> Note: All mechanical property data is valid for 2 mm thick Kanthal® AF strip



## PHYSICAL PROPERTIES

DENSITY G/CM <sup>3</sup>	7.15
ELECTRICAL RESISTIVITY AT 20°C Ω MM <sup>2</sup> /M	1.39
POISSON'S RATIO	0.30

## COEFFICIENT OF THERMAL EXPANSION

TEMPERATURE °C	THERMAL EXPANSION X 10 <sup>-6</sup> /K
20 - 250	11
20 - 500	12
20 - 750	14
20 - 1000	15

## THERMAL CONDUCTIVITY

TEMPERATURE °C	50	600	800	1000	1200
W M <sup>-1</sup> K <sup>-1</sup>	11	20	22	26	27

## SPECIFIC HEAT CAPACITY

TEMPERATURE °C	20	200	400	600	800	1000	1200
KJ KG <sup>-1</sup> K <sup>-1</sup>	0.46	0.56	0.63	0.75	0.71	0.72	0.74

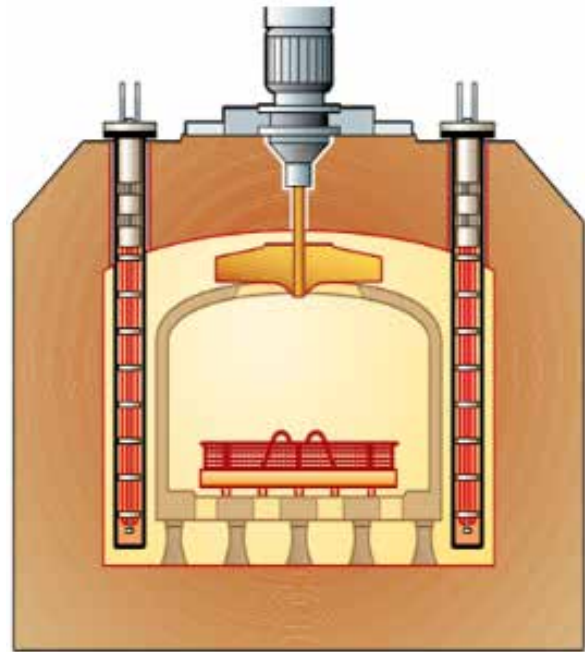
MELTING POINT °C	1500
MAX CONTINUOUS OPERATING TEMPERATURE IN AIR °C	1300
MAGNETIC PROPERTIES	The material is magnetic up to approximately 600°C (Curie point).
EMISSIVITY - FULLY OXIDIZED MATERIAL	0.70

## WELDING

### WELDING OF KANTHAL® AF TO (FE)NICR MATERIALS

- Pre-heat the tube to approximately 200–300°C.
- Use TIG welding.
- Use 25Cr/20Ni low carbon, low silicon material as filler material. (As an alternative Nikrothal 40B – low silicon material can be used).
- Stress relieve the welded component at approximately 700°C for one (1) hour, followed by slow cooling in the furnace to obtain a minimum of stresses in the welded goods.

Remark: Stress relieving is not absolutely necessary to perform if the handling and installation is done with care.



### WELDING OF KANTHAL® AF TUBE TO KANTHAL® APM BOTTOM

- Heat up the tube and the bottom plate to 300–500°C using a gas torch or in a furnace.
- Carry out the welding while the tube and the bottom plate are still hot. Finish off the welding before the temperature has fallen below approximately 200°C.
- Spot weld the bottom plate to the tube.
- Weld the bottom plate to the tube until the gap is completely filled up with material (3–4 passes). Use TIG welding equipment and Kanthal® A-1 wire, Ø 1–3 mm, as filler material.
- Put the welded tube into a furnace for stress relieving. This must be done before the temperature of the material has fallen below approximately 150°C. Raise the temperature to 900–1000°C and maintain this temperature for two (2) hours.

### WELDING OF KANTHAL® AF TUBE TO MILD STEELS

- Use TIG welding
- Use the same type of filler material, i.e. type of mild steel.
- Stress relieve the welded component at approximately 700°C for one (1) hour, followed by slow cooling in the furnace to obtain a minimum of stresses in the welded goods.

Remark: Stress relieving is not absolutely necessary to perform if the handling and installation is done with care.

Disclaimer: Recommendations are for guidance only, and the suitability of a material for a specific application can be confirmed only when we know the actual service conditions. Continuous development may necessitate changes in technical data without notice. This datasheet is only valid for Kanthal materials.