

U- and W-shaped radiant tubes

Tube design for efficient furnace production

Sandvik offers a broad range of radiant tube alternatives for trouble-free and uninterrupted furnace operation in the heat treatment, steel and aluminum industries. Depending on factors such as temperature, furnace atmospheres and geometries, we can offer cost-efficient solutions for trouble-free use and maximized customer productivity.

Sandvik's radiant tube products are developed to contribute to higher furnace productivity by offering longer service life and allowing higher power output.

Kanthal APM™

Kanthal APM is an advanced powder metallurgical, dispersion strengthened, ferritic iron-chromium-aluminum alloy, which is used at tube temperatures up to 1250°C (2280°F). Tubes made from Kanthal APM have good form stability at high temperatures. Kanthal APM forms a non-scaling surface oxide, which gives good protection in most furnace environments, such as oxidizing, sulphurous and carbonaceous gases, as well as against deposits like carbon and ash. The combination of excellent oxidation properties and form stability makes the alloy unique.

Kanthal APMT™

Kanthal APMT is a further development of Kanthal APM, designed for especially demanding applications. The alloy has the same excellent high temperature corrosion resistance as Kanthal APM, but with even higher strength. Kanthal APMT is designed for applications where a higher mechanical strength is required.

Sandvik® 253 MA®

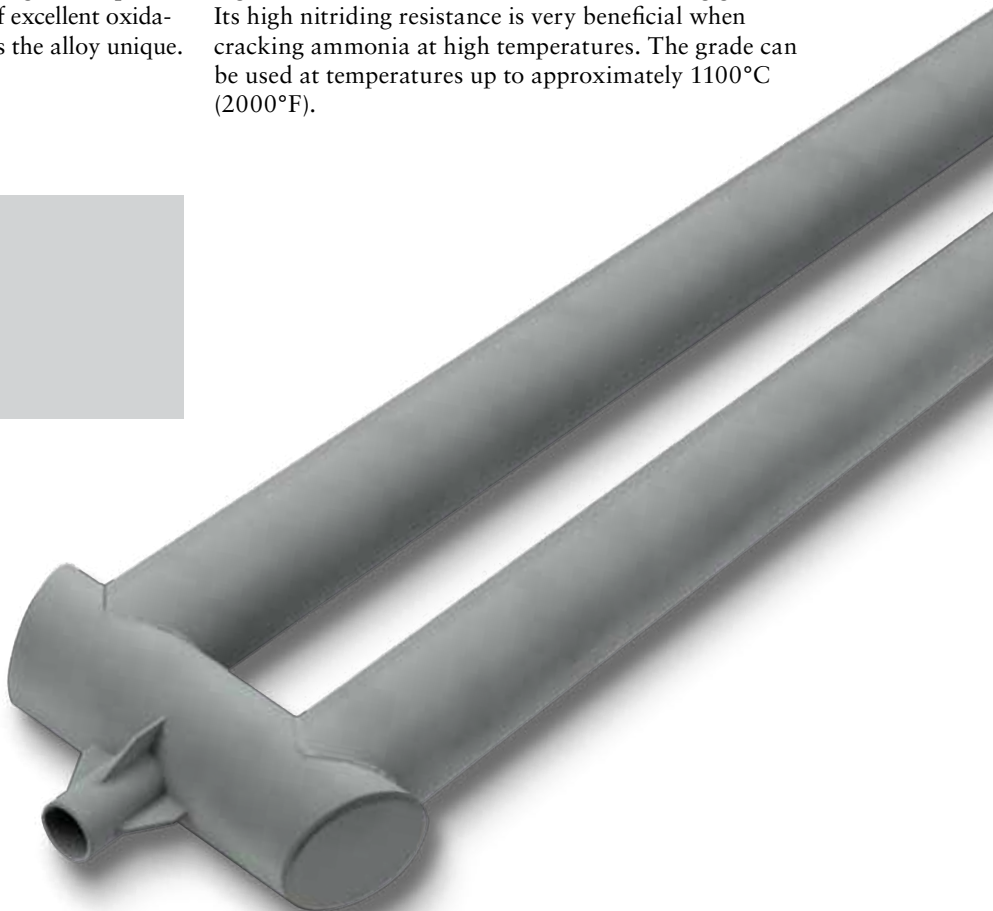
Sandvik 253 MA is an austenitic chromium-nickel steel alloyed with nitrogen and rare earth metals. The grade is characterized by high creep strength, very good resistance to isothermal and, particularly, cyclic oxidation, good structural stability at high temperatures and good weldability. The grade can be used at temperatures up to about 1075°C (1950°F).

Sandvik® 353 MA®

Sandvik 353 MA is an austenitic chromium-nickel steel alloyed with nitrogen and rare earth metals. It shares many of the properties of Sandvik 253 MA, but has a higher resistance to carburization and nitriding gases. Its high nitriding resistance is very beneficial when cracking ammonia at high temperatures. The grade can be used at temperatures up to approximately 1100°C (2000°F).

SPECIAL FEATURES

- Longer service life
- Trouble-free production
- Increased productivity



Technical information

The four alloys available for the U- and W-shaped radiant tubes are Kanthal APMT™, Kanthal APM™, Sandvik® 353 MA® and Sandvik® 253 MA®. In the tables below the chemical composition and the standard product range is

indicated. The diagram shows the difference in surface loading between Kanthal APMT or Kanthal APM and conventional NiCr (nickel-chromium) alloys.

Standard product range

Kanthal APM™						Kanthal APMT™						Sandvik® 253 MA®						Sandvik® 353 MA®*	
OD		Wall thickness		Weight		OD		Wall thickness		Weight		OD		Wall thickness		Weight			
mm	in	mm	in	kg/m	lb/ft	mm	in	mm	in	kg/m	lb/ft	mm	in	mm	in	kg/m	lb/ft		
100	3.94	5	0.20	10.6	7.13	100	3.94	5	0.20	10.8	7.24								
109	4.29	5	0.20	11.6	7.81														
												114.3	4.50	6.02	0.24	16.0	10.7		
115	4.53	5.5	0.22	13.4	9.04	115	4.53	5.5	0.22	13.6	9.19								
128	5.04	5.5	0.22	15.0	10.1														
146	5.75	6	0.24	18.7	12.6							148	5.83	7	0.28	24.2	16.3		
154	6.06	6	0.24	19.8	13.3	154	6.06	6	0.24	20.1	13.54								
164	6.46	6	0.24	21.1	14.2														
												168	6.61	7	0.28	27.6	18.6		
178	7.01	8	0.31	30.3	20.4														
198	7.80	9	0.35	37.9	25.5							198	7.80	9	0.35	41.7	28.0		

Sandvik 253 MA (UNS S30815) and Sandvik 353 MA (UNS S35315), ASTM A312 (pipe)

*Contact your local Sandvik sales office for more information

Chemical composition (nominal) %

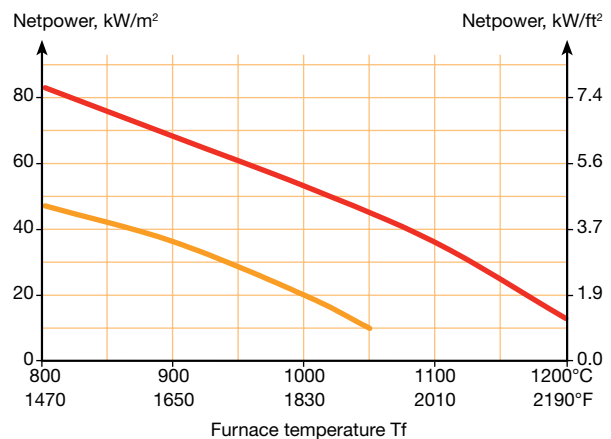
	Sandvik® 253 MA®	Sandvik® 353 MA®	Kanthal APM™	Kanthal APMT™
C	0.08	0.05	≤0.05	≤0.05
Si	1.6	1.6	≤0.7	≤0.7
Mn	≤0.8	1.5	≤0.4	≤0.4
Cr	21	25	22	22
Ni	11	35	-	-
Mo	-	-	-	3.0
Al	-	-	5.8	5.0
N	0.17	0.16		
Others	Ce=0.05*	Ce=0.05*	REM	REM

*To cerium should be added the quantity of other rare earth metals, since the additive takes the form of misch metal containing about 0.05% Ce.

Tolerances

	Outside diameter	Wall thickness
Ø114.3 mm (4.5 in) Sandvik® 253 MA®	±0.8%	+22.5/-12.5%
All other grades	±1%	+22.5/-12.5%

Maximum surface loading



■ Kanthal APM™/Kanthal APMT™ ■ NiCr/FeNiCr

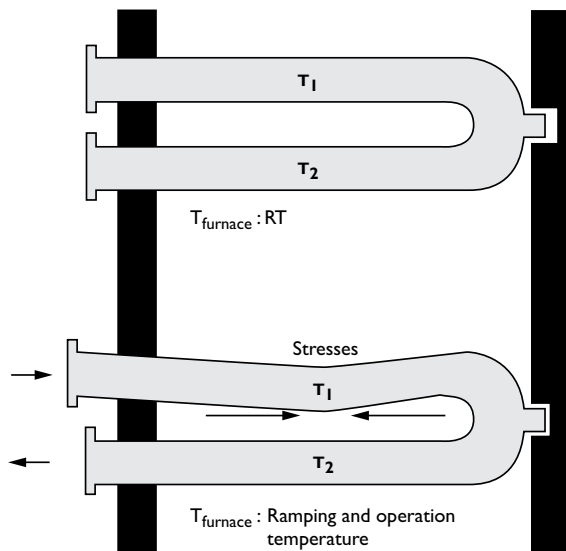
Kanthal APM and Kanthal APMT radiant tubes are capable of far higher operating temperatures than tubes made from NiCr. This gives the opportunity to use fewer tubes but keeping the same total power input in the furnace, to increase the temperature or to increase the life of the radiant tubes.

Recommendation for installations

Sandvik recommends the use of an expansion joint. A frequent cause to premature replacement of tubes in gas tight furnaces is cracks. One reason to the cracks is

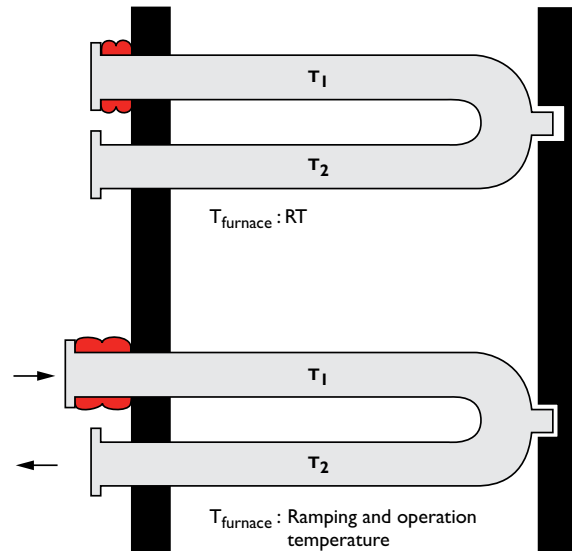
stresses of the tubes caused by the thermal elongation. Many operators use today one or two expansion joints to prevent cracks on their existing NiCr radiant tubes.

Without expansion joint



Cracks caused by the relative movement of the legs may occur in the welds but also in the tubes themselves. When the burner is on, the temperature in the burner leg becomes higher than in the exhaust leg. The temperature differences cause a difference in thermal elongation.

With expansion joint



In the cases when a specific atmosphere is used, the furnace needs to be gas tight. To keep the atmosphere in the furnace an expansion joint is recommended. It will compensate for the difference in elongation between the burner and the exhaust leg and prevent leakages.

Extended life of burner leg in continuous annealing furnace

When using Kanthal APMT tubes as burner legs in a continuous annealing furnace deformation is no longer an issue.



After 1.5 years of service in the hottest zone of a furnace, the W-tube with the burner leg made of Kanthal APMT showed a sagging of 0–2 mm (0–0.1 in).



The reference tubes, made of conventional cast material (iron-nickel-chromium), had sagged 55–65 mm (2.2–2.6 in). Two of the reference tubes were replaced already after 1.5 years.

Sandvik Group

The Sandvik Group is a global high technology enterprise with 47,000 employees in 130 countries. Sandvik's operations are concentrated on three core businesses: Sandvik Tooling, Sandvik Mining and Construction and Sandvik Materials Technology – areas in which the group holds leading global positions in selected niches.

Sandvik Materials Technology

Sandvik Materials Technology is a world-leading manufacturer of high value-added products in advanced stainless steels and special alloys, and of medical implants, steel belt-based systems and industrial heating solutions.

Kanthal is a Sandvik owned brand, under which world class heating technology products and solutions are offered. Sandvik, Kanthal, Kanthal APM and Kanthal APMT are trademarks owned by Sandvik Intellectual Property AB. 253 MA and 353 MA are trademarks owned by Outokumpu OY.

Quality management

Sandvik Materials Technology has quality management systems approved by internationally recognized organizations. We hold, for example, the ASME Quality Systems Certificate as a materials organization, approval to ISO 9001, ISO/TS 16949, ISO 17025, and PED 97/23/EC, as well as product approvals from TÜV, JIS and Lloyd's Register.

Environment, health and safety

Environmental awareness, health and safety are integral parts of our business and are at the forefront of all activities within our operation. We hold ISO 14001 and OHSAS 18001 approvals.

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.

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