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Passion

Innovation

Tradition

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INDUSTRIAL FURNACE CONSTRUCTION

HEAT RESISTANT CENTRIFUGAL CASTINGS

SUPERIOR WHEN THINGS GET HOT

by Axel Korb

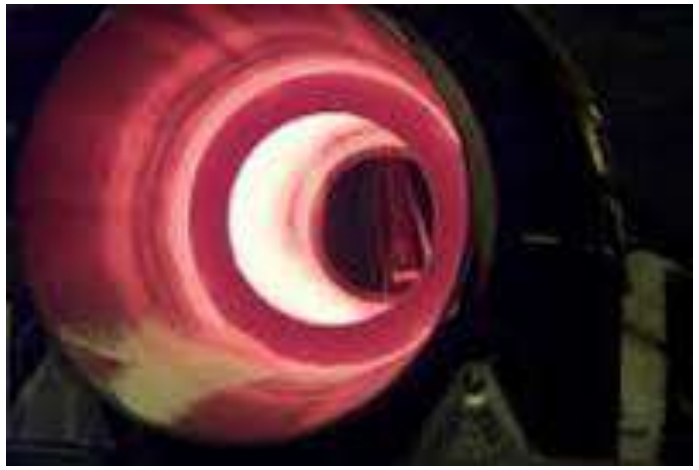
INDUSTRIAL FURNACE CONSTRUCTION - CONTENTS

INDUSTRIAL FURNACE CONSTRUCTION

Industrial furnaces are used for a very wide variety of purposes.

TYPICAL INDUSTRIES

- Steel rolling mills
- Continuous heat treatment plants
- Manufacturers of metal alloys
- Manufacturers of colour pigments
- Manufacturers of high-purity alumina
- and others



02 INDUSTRIAL FURNACE CONSTRUCTION - ROLLERS

ROLLERS

In the thermal processing industry various types of rollers are used.

TYPICAL APPLICATIONS

- Furnaces for steel slab temperature equalization
- Furnaces for heat treatment plants
- Current rollers

FURNACE ROLLERS

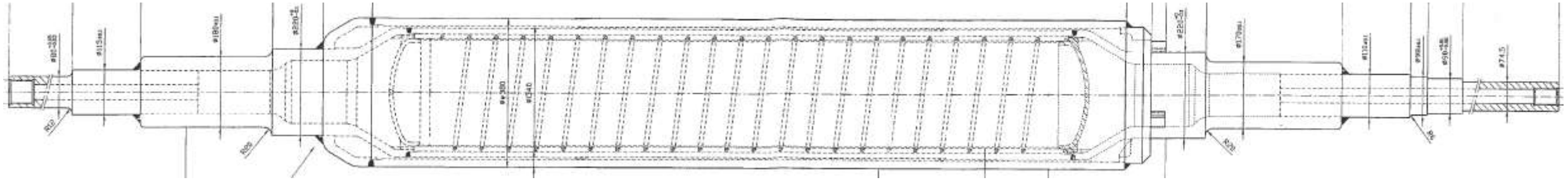
FOR HIGH TEMPERATURES ≥1150°C

There are generally two types of furnace rollers:

1. Water cooled rollers (not recommended by S+C)

- Complex furnace construction necessary
- Relatively low alloyed materials used (low cost)
- Inside water circulating component necessary
- Maximum working temperature: 1180°C
- Service life about 2 years*

*Depending on used material and service conditions



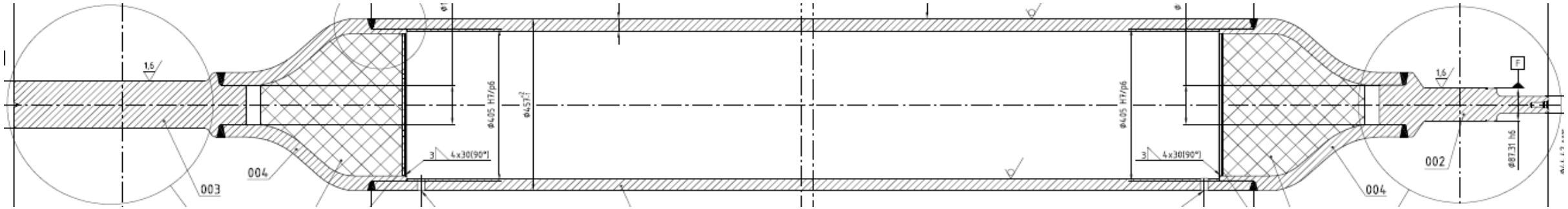
FURNACE ROLLERS WITH BUILT-IN ADVANTAGES

FOR HIGH TEMPERATURES ≥1150°C

2. Dry rollers

- Easy design and solid construction of furnace and rollers
- High alloyed heat and creep resistant materials necessary
- Without any inside cooling = crucial economic advantage
- Maximum working temperature identical or higher (max. 1250°C) compared to water cooled rollers
- Service life about 4 – 4 ½ years, partly up to 9 years*

*Depending on used material and service conditions



DRY ROLLERS VS. WATER COOLED ROLLERS

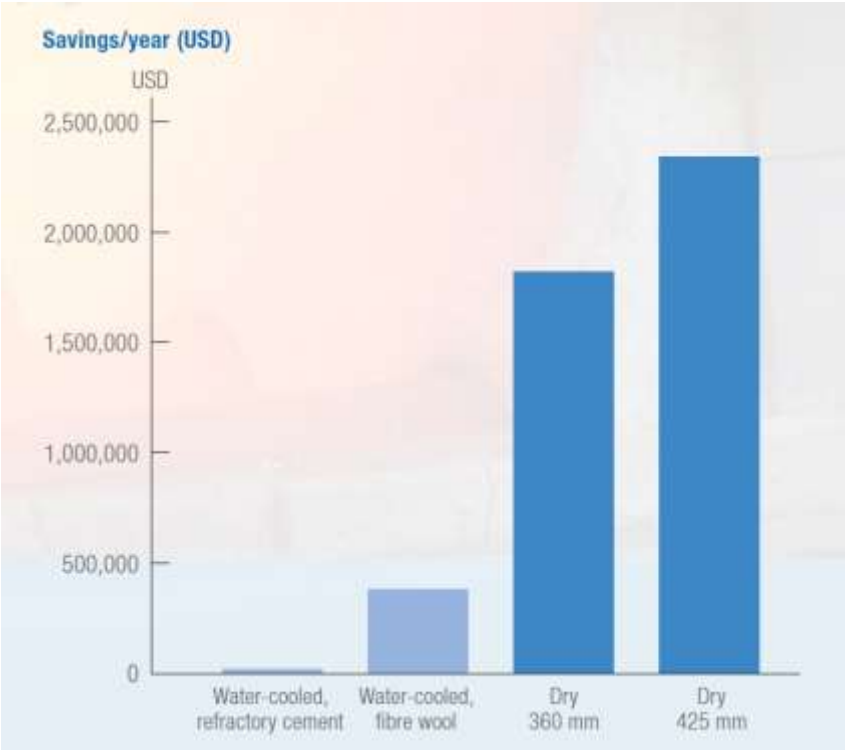
COST SAVINGS

Example calculation of rollers in a tunnel furnace for temperature equalisation

	Water-cooled, refractory cement	Water-cooled, fibre wool	Dry 360 mm	Dry 425 mm
Energy consumption (GJ/tonne)	0.7	0.6	0.45	0.45
Energy costs (million USD/year)	7.200	6.200	4.700	4.700

Changing over to dry rollers results in average 95%* less heat losses and up to 35%* lower annual energy costs

*Depending on type of furnace



Total costs taking investment, energy costs, water supply, maintenance costs and service life into consideration

SPECIAL FURNACE ROLLERS

For prevention of scratches on the strip

Furnace rollers made in Centralloy® 60 HT R prepared for brush surface

PROBLEM: FURNACE ROLLERS WITH PICK-UP

Causes of surface damages on production material:

- Contact area of the of a full metal surface is large
- Smooth cylindrical rollers tends to formation of pimple-like pick-up on the surface
- This pick-up is gradually built up in layers and damages the production material
- Scale particles or other foreign materials causes this pick-up

Furnace Roller with pick-up

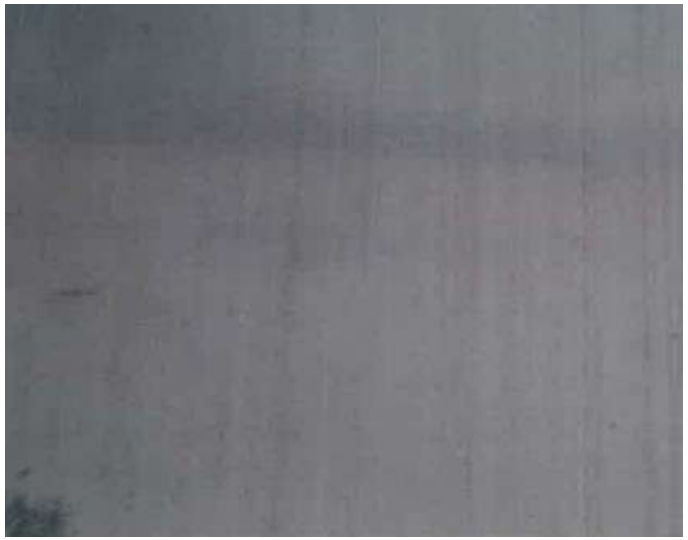
Damaged strip material

SURFACE CONSERVING FURNACE ROLLERS

Rollers with reduced contact area

- The contact ratio with significantly reduced surface is required to avoid pick-up (no full metal surface)
- The contact area must be large enough to avoid any damage on the strip material
- Solution: Extremely dense wire brush cover in a selection of special high-temperature resistant alloys
- Temperature resistant up to 1200°C

Furnace Roller with brush surface*

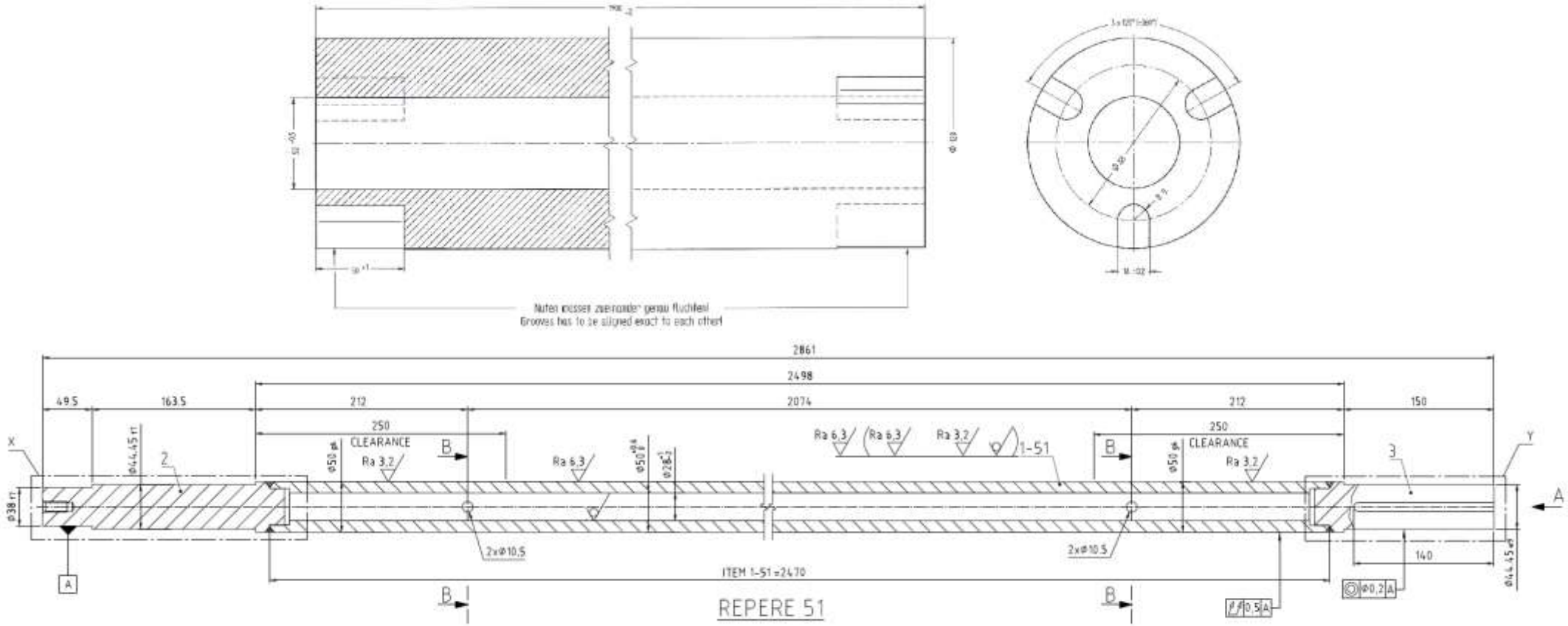


Undamaged strip material

*Brush to be manufactured and welded by specialized companies

SHAFTS FOR GRAPHITE FURNACE ROLLER SLEEVES

Centrifugally cast high strength material G4859 Micro



SHAFTS FOR GRAPHITE FURNACE ROLLER SLEEVES

Centrifugally cast high strength material G4859 Micro

Centrifugally cast shafts before finish machining / welding

Forged stub ends welded to the castings

Precision machined shafts ready for installation

SHAFTS FOR GRAPHITE FURNACE ROLLER

Centrifugally cast high strength material G4859 Micro

Centrifugally cast shafts substitutes solid shafts made in forged AISI 310 steel, W. Nr. 1.4841

Advantages of centrifugally cast furnace roller shafts:

- No bending
- No deformation
- Easy replacement of graphite sleeve
- Longer service life

FURNACE ROLLERS

For heat treatment of stainless steel tubes (T max. 1250°C)

Furnace rollers made in Centralloy® 60 HT R with forged journals

USED MATERIALS

- Heat-resistant stainless steel spun castings (CrNi steels)
- Heat-resistant Nickel-based spun cast alloys

We can draw on many years of experience in the field in industrial furnaces which resulted in an extensive range of materials. This enables us to offer at least one optimum solution for your actual requirement.

MOST COMMON MATERIALS*

Centralloy®	Material No.	Abbreviation	Analysis / reference values in %									
			C	Si	Mn	Cr	Ni	Co	W	Nb	others	max. Temperture
G4848	1.4848	GX40CrNiSi25-20	0,40	2,00	1,50	25,00	20,00	-	-		-	1100°C
G4852	1.4852	GX40NiCrSiNb35-26	0,40	1,50	1,50	25,00	35,00	-	-	1,50	-	1100°C
G4855	1.4855	GX30CrNiSiNb24-24	0,30	2,00	1,50	24,00	24,00	-	-	1,50	-	1050°C
G4879	2.4879	G-NiCr28W	0,50	2,00	1,50	28,00	48,00	-	5,00		-	1150°C
G4879 Co	-	G-NiCr28WCo	0,50	1,50	1,50	28,00	48,00	3,00	5,00		-	1150°C
G4879 W16	-	Special Grade	0,25	0,30	0,30	32,00	50,00	-	16,00		-	1200°C
60 HT R	-	Special Grade	0,50	-	-	27,00	60,00	-	5,00	0,70	Al 4,00	1250°C

*This is just a little selection of S+C's standard range of materials. Additional grades are available.

SPECIAL HEAT RESISTANT MATERIAL

Features

High furnace temperatures of up to 1250 °C result into extremely corrosive atmospheres. S+C developed the optimum material to meet this exceptional challenge:

Centralloy® 60 HT R

- Nickel-aluminium alloy
- Formation of α-aluminium protective layer
- Extremely temperature resistant
- Dimensional stable
- Very high corrosion resistant
- Designed for longest service life

CONDUCTOR ROLLERS

Electrolytic Strip Coating Lines

Conductor rollers generally have the task to conduct the electricity passing from the coating anodes to the strip back to a transformer-rectifier. The outer shell of the rollers is made of an acid-proof and current-conducting metal.

Required features:

- Extra durable corrosion resistance
- Fault free material (without casting defects)

- Special Cr/Ni/Mo alloyed materials:
  - Euzonit® G60 (W. Nr. 2.4697)
  - Märker® Alloy 59 (~W. Nr. 2.4605)

Complete conductor rollers (finish machined)

Conductor roller mantles (pre-machined)

PUSHER TUBES

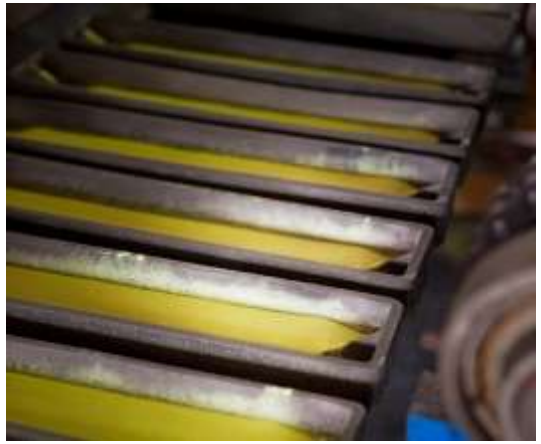
PUSHER TYPE REDUCTION FURNACE

The pusher method is used in the calcination of saline materials and powder metals. With the reducing gas hydrogen oxides of tungsten, molybdenum, rhenium and cobalt are deoxidized into pure metals.

Multiple tube pusher furnaces can be configured with automatic boat charging, pushing and unloading.

Multiple tube pusher furnace

Pusher tube with boat



Boats filled with oxide powder

Centrifugally cast pusher tubes (typical length up to 10 m)

ROTARY KILNS

There are generally two types of rotary kilns:

1. Direct-fired kilns

- Pipe with refractory lining (not suitable for S+C)

2. Indirect-fired kilns

- Tube (drum) made in heat resistant steels or special alloys
- Heat resistant up to 1250°C
- Diameters from Ø50 up to ~Ø1350 mm (or bigger on request)
- Length up to 20 meters (depending on diameter)

INDIRECT-FIRED ROTARY KILNS

APPLICATIONS

Examples for the usage of indirectly fired rotary kilns*:

- Calcination of inorganic colour pigments
- Production of high-purity aluminas (e.g. for catalysts manufacture)
- Production of powder metals
- Production of high-tech graphite and carbon products

*Applications for rotary kilns are growing to meet new processing needs

Centrifugally cast rotary kiln drum 913Ø x 17.600 mm made in G4879 + 60 HT R with forged flanges

Pre-heated rotary kiln (1150°C)

REPAIR OF ROTARY KILN PIPES

The following Service can be offered:

- Examination of the used pipe
- Evaluation of results and decision about part(s) for re-utilisation
- Cutting of damaged from good parts
- Shot blasting of pre-cleaned pipe
- Centrifugal casting of new pipe segments
- Machining, preparation and welding of new pipe section to the existing part
- Manufacture and welding of flanges
- Inspection of weld seams

INDUSTRIAL FURNACE CONSTRUCTION

When it becomes hot, use extra durable components of

Schmidt + Clemens

CONTACT

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