

FORGU

Styling Copper

FORGU GmbH

Rudolf-Diesel Str. 3
58730 Fröndenberg
Germany

Phone : +49 2373 398888

Fax : +49 2373 398889



FORGU provides you with solutions in Copper... :

- E-Copper
- CuCrZr
- CuNiCrSi
- CuCoBe
- CuBe2
- Brass

..... In any styling process :

- casting
- cold forming
- heat treatment
- CNC machining
- welding
- soldering

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Forgu – Facts :

- ✓ founded 1969 -> 50 years of experience with copper alloys
- ✓ machining of our copper castings since 1985
- ✓ cold forming of copper bars and pipes since 1995
- ✓ specialized in hardenable copper alloys
- ✓ all parts leak tested
- ✓ all manufacturing inhouse
- ✓ highly flexible, quick deliveries
- ✓ Optimisation of cost and application to benefit the customer, as we offer different processes

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Process Overview

	E-Copper	CuCr	CuNiCrSi	CuCoBe	CuBe2	Brass
Casting		✓	✓	✓	✓	✓
Cold forming	✓	✓	✓	✓		✓
Heat Treatment		✓	✓	✓	✓	
CNC-machining	✓	✓	✓	✓	✓	✓
Welding	✓	✓	✓	✓		✓
Soldering	✓	✓	✓	✓	✓	✓

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Process Overview

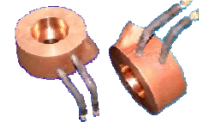
Casting

No styling limits

Composite casting possible
(Cooling tubes, heat elements, etc.)



Hollow Design



Patterns according Drawing, CAD Model or
Master piece

Saving material and resources

Bionic design



Process Overview

Cold Forming

Up to 60 mm dia.

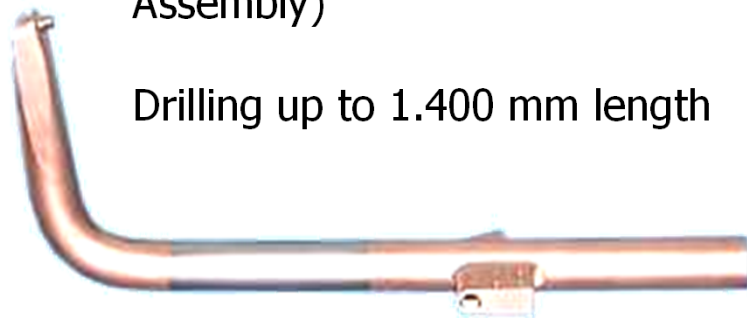
Also high strength alloys (e.g. CuCoBe)

Small parts or up to 1.400 mm length

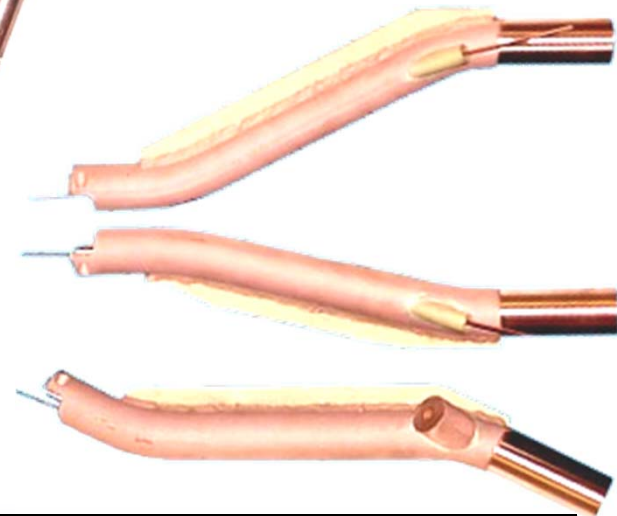
Bars or Tubes

Including following operations (welding, soldering, Assembly)

Drilling up to 1.400 mm length



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Process Overview

Heat Treatment

Definite material properties

Cold forming of high strength alloys

40 years of Know-How



Process Overview

CNC Machining

Modern machines

All machining technologies available inhouse

> 10 CNC machines

All machining inhouse -> optimized wip and total Delivery times



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FORGU invests in CNC machining

Styling Copper



FORGU GmbH widens machining capacity by adding another highlight to the modern CNC machine shop. Fully equipped with all possibilities of modern CNC 5 side machining the brandnew MTE K-20 brings more machining capacity as well as the possibility to process bigger parts.

The travel range of 2.000 x 1.000 x 1.000 mm gives 2 m³ machining volume. At the same time the machine has a round table as 4th axis and a swivel SK50 milling head with A- and B Axis. This leads into cost improvements also for bigger parts, as parts can be machined in less clamping setups.

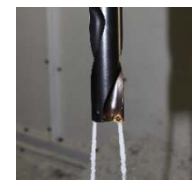
The 34 tool changer and the 5 side machining possibility allows us to not only machine single and mini series, but also medium size series on competitive cost levels.

Due to the high X travel and the high pressure coolant through spindle we can drill > 1.200 mm (blind hole) and > 2.000 mm (open hole).

As an addition to the existing CNC machining shop the K-20 is meant to be an extension in capacity, but also a milestone in process development. FORGU will continue to invest in order to make sure that all core processes can be kept inhouse in order to secure high quality product with short leadtimes.



The K-20 is also used for very big Aluminium Gun Arms for resistance welding applications. For more information please visit www.forgu.de



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FORGU invests in CNC machining

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FORGU GmbH, based in Fröndenberg adds another highlight to their CNC machining shop. Starting spring 2011 the new Hedelius RS605 is fully in production. Fully equipped with all the must haves of modern machining this is both an addition in capacity and complexity to the existing possibilities.

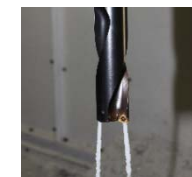


Function : 6 Sides Machining in two areas
Swivel-Turn Table Dia. 520 mm
Fixed Table 760 x 600 mm



Mainly small and medium sized series are produced on the RS605; such as Chill Vent Inserts for HPDC, but also bus bars and other parts for resistance welding industries. For more information please visit :

www.forgu.de



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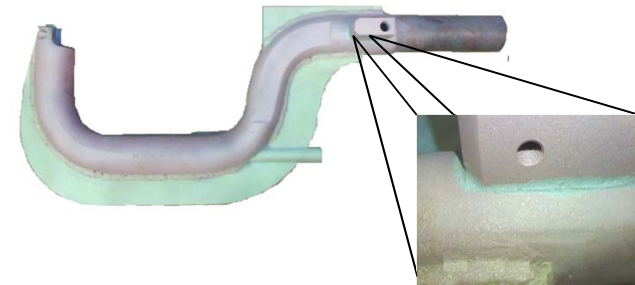


Process Overview

Joint processes : Welding and Soldering

Welding of Copper Materials :

- Guiding ribs
- Reinforcements
- Connecting elements



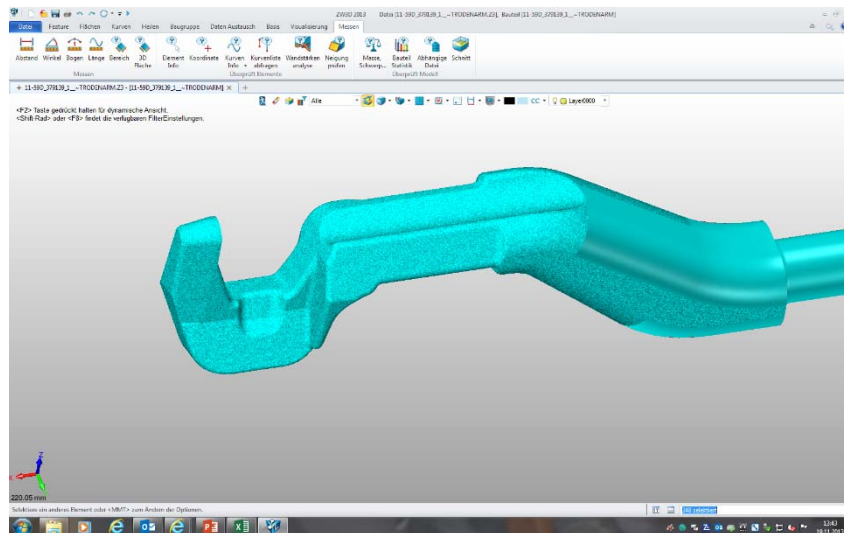
Soldering of Copper Materials :

- silver solder
- highly conductive joints



FORGU provides you solutions in copper :

Werkstoffauswahl



Design Consulting

Manufacturing according Drawing, CAD Modell or master piece

Properties our low alloyed Copper Materials

Name	CuCrZr	CuNiCrSi	CuCo2Be	CuBe2
Material #	2.1293	--	2.1285	2.1247
Chemical Composition	0,4-1,2% Cr 0,003-0,1%Zr Others max.0,2% other Cu	2,0-2,5% Ni 0,3-1,0% Cr 0,5-0,8% Si Others max.0,5% other Cu	0,4-0,8% Be 2,0-2,7% Co Others max. 0,5% other Cu	1,8-2,4% Be 0,4-0,7% Co Others max.0,5% other Cu
$\rho \frac{\text{kg}}{\text{dm}^3}$	8,9	8,8	8,75	8,26
$R_m \frac{\text{N}}{\text{mm}^2}$	350-450	650-900	650-900	1000-1400
$R_{p0,2} \frac{\text{N}}{\text{mm}^2}$	350-450	500-850	500-850	1000-1300
Hardness HV	100-140	190-260	190-260	360-420
Biegewechselfestigkeit bei $n = 10^8$ $\pm \frac{\text{N}}{\text{mm}^2}$	--	--	>240	>275

Name	CuCrZr	CuNiCrSi	CuCo2Be	CuBe2
Material #	2.1293	--	2.1285	2.1247
E - Modul $\frac{\text{N}}{\text{mm}^2}$	127000	125000	131000	127500
fracture elongation $A_5\%$	Aug 20	Mai 15	Aug 15	01. Okt
Thermal Growth $\alpha \frac{10^{-6}}{\text{K}}$	17	16	17,6	17
elec. Conductivity $\frac{\text{m}}{\Omega^* \text{m}^2}$	42 - 44	28 - 30	25 - 26	Dez 13
them. Conductivity $\lambda \frac{\text{W}}{\text{m}^* \text{K}}$	320	170	210 (20 °C) 320 (300 °C)	115 (20 °C) 210 (300 °C)
Softening Point °C	ca. 500	ca. 475	ca. 475	ca. 300

The given values show the indicated varity, depend on the level of hardening. Beside elongation all mechanical and electrical characteristics show increased values with increased hardening.

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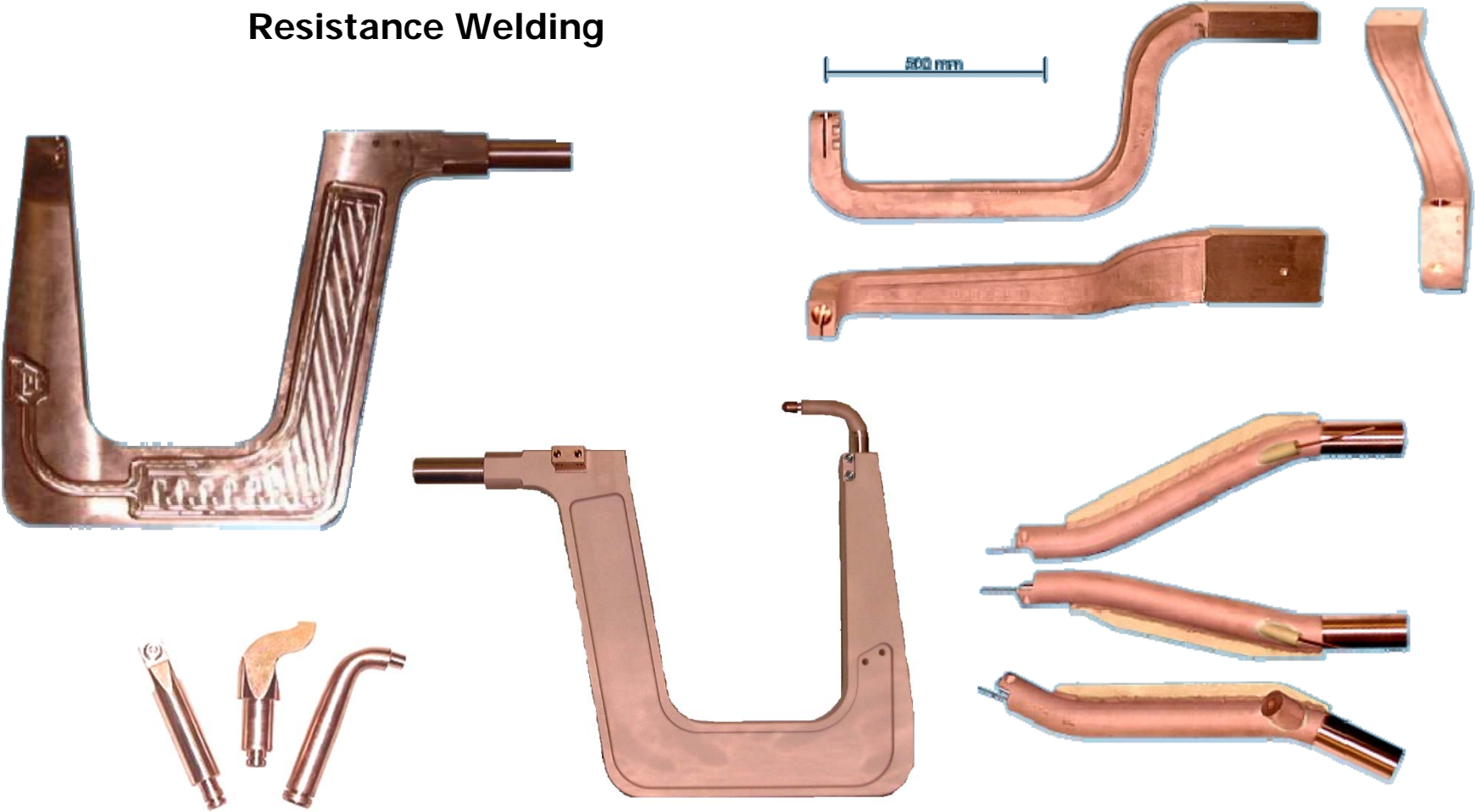
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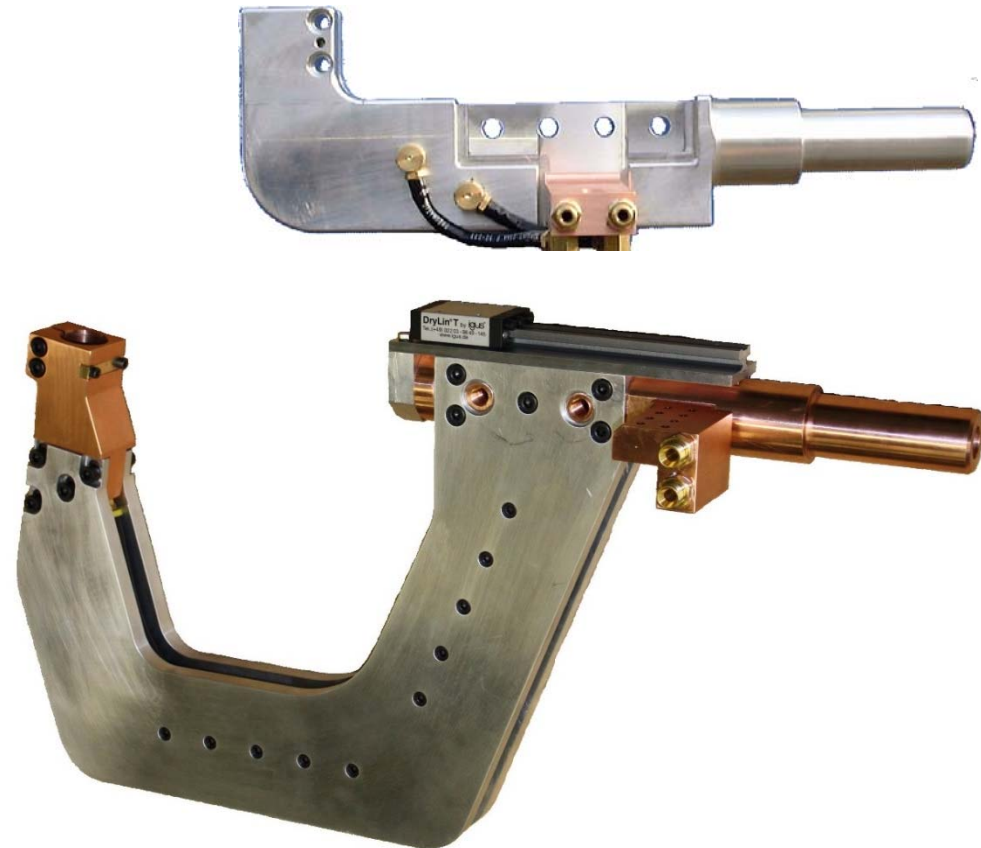
Applications

Resistance Welding



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Applications Resistance Welding



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Applications

Resistance Welding - 3D Aluminium Gun Arms



Machined off > 85 %

AW7075 – Aluminium T6

Rough Milling $F > 4.000 / \text{min}$
with $a_e = 0,5 D$

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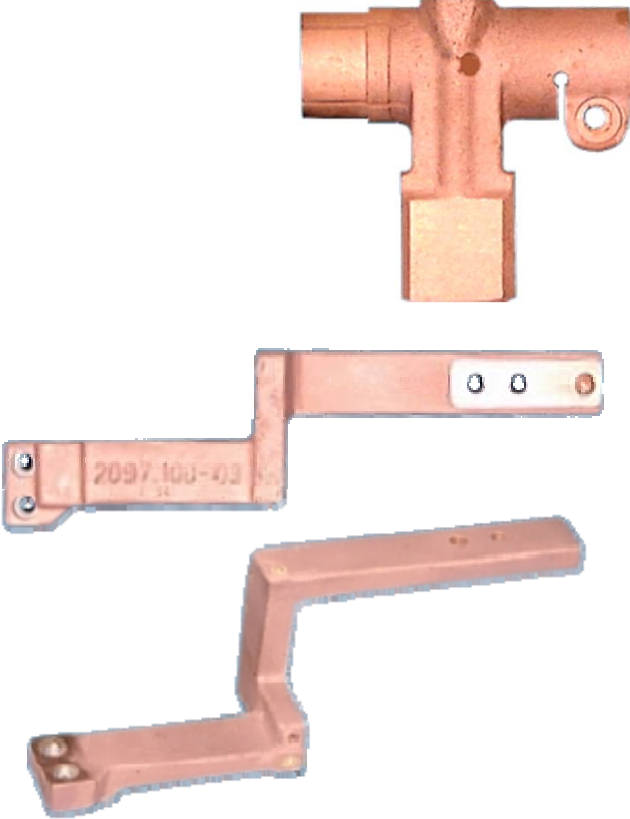
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Applications

Resistance Welding



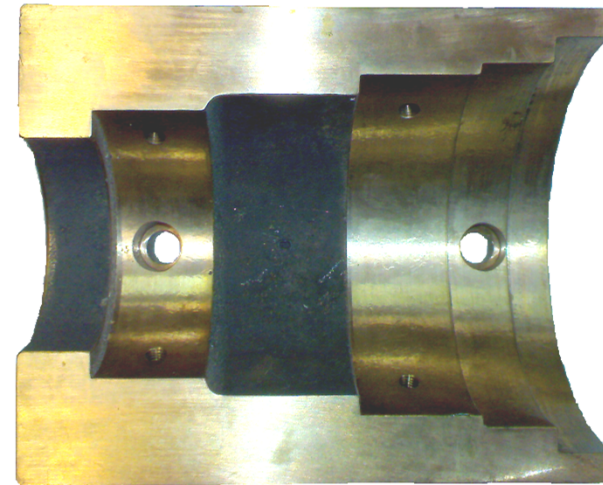
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Applications

Butt Welding



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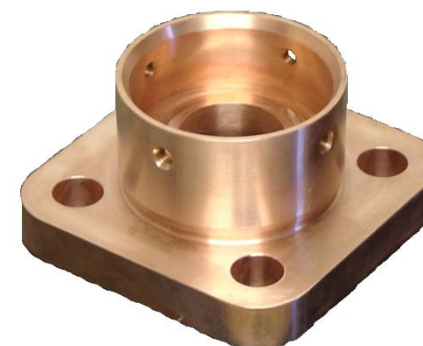
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Applications

On / Off Shore



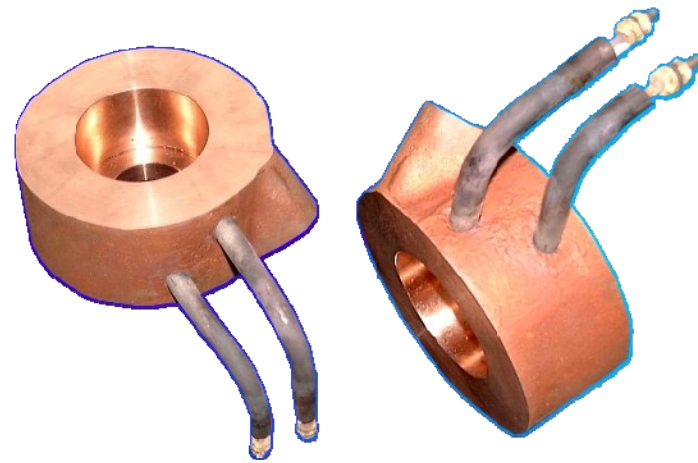
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Applications

Heating / Cooling Systems with mechanical and abrasive wear



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