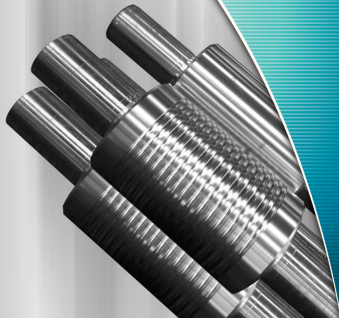


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PARKOLIN CORPORATION





Casting

Mill Rolls	ADM, DCI, ICDP, HSS
Pinch Rolls	SKD61, SKD11, Resistar
Guide Rollers	SKD61, SKD11, Resistar
Slitting Rollers	SKD61, SKD11, Resistar
Cantilever type Roll	DCI, Resistar
Looper Roll	Resistar
Static Guide	
Guide Box	

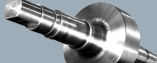
Powder Metallurgy

Mill Roll rings	FT-9, FT-23
Pinch Rolls	FT-9, FT-10
Guide Rollers	FT-1, FT-9, FT-23
Crimp Roll	FT-2
Looper Roll	FT-9
Seaming Roll	FT-1, FT-2
Drawing Die	FT-1

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Adamite & Steel Base Rolls



SG Iron Rolls (Ductile Cast Iron Rolls)



Generally it is classified into low carbon base and high carbon base is further divided into adamite and graphite steel, in which graphite crystallized. Since high carbon base one has very hard toughness and good thermal shock resistance, it can be applied to almost every type of mills.

These ductile irons are structurally characterized by spheroidal graphite in matrix. Spheroidal graphite gives these rolls great tensile strength, enabling them withstand heavy loads. Application from large blooming and rolls to small finishing stands rolls of wire rod mills.

Steel Base Rolls

Characteristics	Application
- Very hard toughness - Good thermal shock resistance	Break down for large section mill

ADAMITE

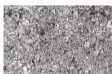
Characteristics	Application
- Carbon content - 1.2-2.6% - Peasite and contains a little carbide in the structure - Good wear resistance and hardness gradient to depth - Excellent thermal shock resistance & breakage - Adamite with a good bilting are applied	- Blooming & Slabbing - Hot strip mill (Roughing) - Medium, Small Section (Roughing) - Large Section (Intermediate, Finishing) - Wire Rod, Bar (Roughing)

Mechanical Properties

Symbol	Hardness (HRC)	Tensile Strength (kg/mm ²)	Bending Strength (kg/mm ²)	Elongation (%)	Impact Value (kg mm/cm ²)
ADM	40-45	45-70	80-120	0.2-1.0	0.2-1.2

Chemical Composition

Symbol	C	Si	Mn	Ni	Cr	Mo
ADM	1.2-2.5	0.4-2.0	0.6-1.5	0.6-2.5	0.6-2.5	0.2-0.0



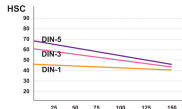
SG Iron Roll(Spheroidal Graphitic Iron)

Mechanical Properties

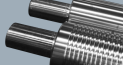
Symbol	Hardness (HRC)	Tensile Strength (kg/mm ²)	Bending Strength (kg/mm ²)	Elongation (%)	Impact Value (kg mm/cm ²)
DIN-1	35-45	60-80	80-100	0.5-1.0	0.1-0.6
DIN-3	45-60	50-70	60-120	0.3-1.0	0.1-0.4
DIN-5	60-70	40-55	60-80	0.1-1.0	0.1-0.3

Chemical Composition

Symbol	C	Si	Mn	Ni	Cr	Mo
DIN-1	3.00-3.60	1.50-2.20	0.30-0.60	0.90-2.50	0.25-0.60	0.2-1.0
DIN-3	3.00-3.60	1.50-2.20	0.40-0.70	1.00-3.00	0.25-0.80	0.3-1.0
DIN-5	3.00-3.60	1.40-2.10	0.40-0.70	1.50-4.00	0.25-1.00	0.3-1.0



Indefinite Chilled Iron Rolls (Ni-Grain Rolls)



Description

In this type of roll, the graphite is distributed in the matrix unlike definite chilled material.

This characteristic gives high heat conductivity and thermal shock rigidity as well as easiness in choosing the degree of hardness according to the alloy forming technology.

This roll plays an important role in hot strip mill thanks to its high quality of product surface due to graphite and good resistance to accidents by centrifugal double cast.

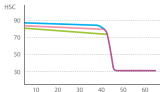


Characteristics

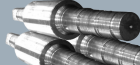
- High alloy centrifugal indefinite chilled roll.
- Homogenizes and fine shell structure and low degradation in hardness penetration the centrifugal cast.
- Improved resistance to heat fatigue.
- Maintaining the high quality of product surface

Application

- Hot strip Mill(Rear finishing stand)
- Medium, small section mill(Finishing stand)
- Bar and wire rod mill(Intermediate & finishing stand)



High Speed Steel Rolls



Description

High Speed Steel Rolls are composed of outer shell layer containing high carbon and high alloy and core layer of SG iron. They are characterized by the presence of primary carbides (MC type) with high hardness and tempered martensite matrix with high temperature.

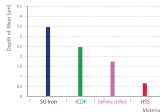
Compared with the ordinary DCI rolls, its performance is 2~3 times more, dressing amount decreases 10~50%. The total productivity increases minimum 3 times.

Characteristics

- High hardness, high resistance to abrasion
- High resistance to adhesiveness by surface oxide layer
- High resistance to heat cracks and thermal fatigue
- Good surface quality
- Fine and uniform structure until deep inside

Application

- Reinforcing Bar mill(Intermediate, Finish Stand)
- Bar, wire-rod mill(Intermediate, Finishing Stand)



HSS Roll Classification

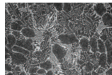
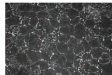
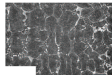
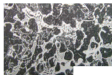
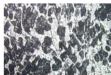
Materials	Characteristics	Hardness	Structure Characteristics
HSS	High resistance to abrasion and small coefficient of friction	70-85	Tempered Martensite + Carbides -mainly MC or MC+M ₂ C ₆

Mechanical Properties

Symbol	Hardness (HRC)	Tensile Strength (kg/mm ²)	Bending Strength (kg/mm ²)	Elongation (%)	Impact Value (kg·m/cm ²)
ICDP	70-85	30-45	50-70	0.5-0.6	0.1-0.4

Chemical Composition

Symbol	C	Si	Mn	Ni	Cr	Mo
ICDP	3.0-3.6	0.6-1.2	0.3-1.0	4.0-6.0	1.8-2.8	0.2-0.6

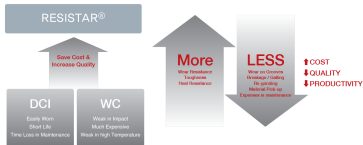


Advantages of RESISTAR® Composite Mill Roller Rings

- Superior properties due to centrifugal cast over traditional high speed steel
- Less wear on roller grooves, hence high output of the mill
- Less breakage / galling / chipping of rollers
- Less stock removal per re-grind, hence longer life
- Uniformity and stability of the finished products
- Less material pick-up on surface
- Less expenses in maintenance than high speed steel shelled double cladding roller

The performance of RESISTAR® Mill Roller has been proved by several rod mills and it shows the clear superiority of Centrifugally Casted High Speed Steel to traditional materials.

RESISTAR® Composite Mill Roller Rings are optionally supplied with grooves on its ground surface as shown in the picture below.



RESISTAR® DH4 : Technical Data

Chemical Composition

	C	Mn	Si	Cr	Mo	V	W	Co	Ti	Ni	Fe
MIN	1.5	-	-	5.5	4.5	1.8	9.0	8.1	0.1	-	BAL
MAX	2.0	8.0	0.8	6.5	5.5	3.8	12.0	1.0	1.8	1.0	BAL

Technical Data

Characteristics	RESISTAR®	DCI (DC)
Matrix	High Speed Steel	Ductile Cast Iron
Hardness	HRC	
	Hs	
Density (g/cc)	8.15 - 8.28	7.3 - 8.0
TYS (kgf/cm ²)	100 - 130	80 - 100
Elongation (%)	0.3 - 0.5	0.2 - 0.4
Compressive strength (kgf/cm ²)	320 - 360	230 - 270
Tensile strength (kgf/cm ²)	80 - 100	40 - 60
Toughness	70 - 80	60 - 80
Performance	2 - 4	1



[Hardness Variation of RESISTAR® at high temperature]



[Wear Resistance of Materials]

RESISTAR® Applications



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HIP Hot Isostatic Press



Powder Metallurgy Alloy Steel



Hot Isostatic Pressing is a method by which a workpiece is processed under the simultaneous application of high-pressure gas and high temperature. HIP can solve many technical problems which were impossible to solve by conventional processes. One example is the elimination of casting defects.

Specification

Press Paper Type	Press frame type Multiple steel plate joint type
Maximum working pressure	118MPa(1,250kgf/cm ²)
Loading style	Bottom loading
Furnace Type	Gas-fired, three zone
Maximum working Temperature	1200°C
Process gas	Argon
Furnace size	Φ900mm × 1,300mm
Product / Product basket (Crucible) size	Φ950mm × 1,300mm

Application

Sintering



Co Alloy Powder



Injection Molding Cylinder



Mold

Pore Removing



Turbine Blade



Ceramic

Diffusion Bonding



Copper Glass



Stainless/Al Alloy



Ti Alloy Hollow



Neutron Detector Equipment



Cooling plate

Strengths

- Superior wear-resistance: 3~5times vs DCI, 2~3times vs HSS, 4~6times vs Tool Steel
- Materials without porosity by HIP (Hot Isostatic Press)
- Possible to produce (Mild steel+FT-9) and economical and easy for assembly. Applicable to the part of use.
- Minute compound Carbides are distributed equally. Improvements to Toughness, Wear-resistance, Yield hardness, and Anti-corrosion.
- Keeping Wear-resistance, Toughness, and Hardness up to 500°C, Minimize crack
- Sintering manufacture with Alloyed Powder atomized: Protection for one side wear of rolls and roll marking (Good shape of wear).
- Similar Hardness to Casting HSS with almost same condition of Heat Treatment. But Heat Treatment transform and low thermal expansion coefficient.
- Excellent effect versus cost (Reduction effect of repair time and cost)
- Easy reprocessing and remachining versus DCI and HSS. (Approx. more than 15%)
- Lathe and CNC Machining with ceramic, CBN bite(0.5~2mm remachining)

Chemical Composition(wt%)

Materials	C	Cr	Mo	V	W	Fe
FT-9	1.85	5.55	1.50	9.00	-	Bal
FT-10	2.45	5.30	1.50	9.50	-	Bal
FT-23	1.30	4.20	5.00	2.10	6.30	Bal

Mechanical Properties

Classification	FT-9	FT-10	FT-23
Density (g/cm ³)	7.45	7.45	8.60
Hardness(HC)	Anneals d	25~29	25~29
	Hardens d	54~58	60~64
Transverse Rapture Strength (Kg/mm ²)	600~620	615~630	570~600
Modulus of Elasticity (Gpa.)	221	221	207
Tensile Strength (Kg/mm ²)	95~110	95~110	

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Powder Metallurgy Alloy Steel



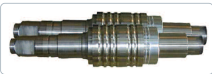
Powder Metallurgy Alloy Steel



Application

FT-9

- Guide Roller and Work Roll for wire rod, round bars & reinforcing bars
- Pinch Roll, Looper Rolls, Wear Parts, composite mill roll
- Hot Work Tooling, Knives
- Plastic injection mold, Nozzle, Screw, Barrel
- Compacting dies



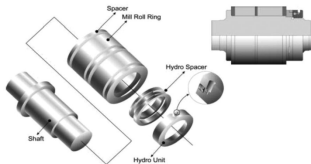
FT-10

- Punches, Dies for blanking, Piercing dies, Notching dies
- Cold heading, Steel mill rolls, extrusion die & barrels, Nozzles, screw
- Plastic injection mold, Compacting tools, Pelletizer blades, Screw
- Compacting dies, Slitter knives, Shears, Woodworking tools
- Semiconductor Mold Part : Chase, Center Block, Pot & Plunger, Cavity Bar Automold Chase, Mold Die



FT-23

- Milling Cutters, Punches, Thread Roll Dies, Form Tools, Taps, End Mills
- Broaches, Drills, Rolls, Slitter knives, General Cold Work Tooling
- Semiconductor Mold Part : Chase, Center Block, Pot & Plunger, Cavity Bar, Automold Chase
- Press Punch, Die, Compacting Punch, Die



Assembly Process



Fixing Shaft and Inserting Spacer



Inserting Rings



Rings Inserting completed and Inserting O-ring



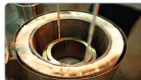
Hydro ring, unit setup and tightening



Oil pressure supply (2,000 bar)



Fixing Shaft and Protection-Application key-Inserting



Heating for Shrink Fit of rings and Pulling it out of the furnace



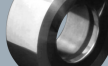
Ring Shrink Fit



Rings cooling And Tightening with a Jig

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Advantages

- Finest rounded grains for better lubrication and local friction mode.
- Less wear on roller grooves, hence high output of the mill.
- No breakage / galling / chipping of rollers during rolling.
- Less stoke removal per re-grind, hence longer life.
- Uniformity and stability of the finished products.
- High resistance to oxidation and less material pick-up on surface.
- Reduced risk of bearing breakage and failure due to low density.

Properties of Alloy-TiC®

Grade	Hardness(HRC) Ann Hard	Density (g/cm³)	Transverse Rupture Strength(KSI)	Compressive Strength(KSI)	Impact Strength (in lb/in²)
FT-1	45 68	6.5	252	510	211
FT-2	49 68	6.5	165	483	140
FT-3	33 68	6.6	230	385	420
FT-4	44 70	6.6	220	525	323
FT-5	45 53	6.8	158	390	306
FT-128	48 62	6.6	175	398	-
FT-143	49 62	6.7	211	349	-

Chemical Composition of Alloy-TiC®

Grade	TiC (vol%)	Binder phase (wt%)					
		Cr	Mo	Al	Ni	Ti	Fe
FT-1	45	9.7	3	-	-	-	Bal
FT-2	45	10	0.5	-	-	-	Bal
FT-3	35	5.2	4.1	-	0.6	-	Bal
FT-4	45	3.1	3.1	-	-	-	Bal
FT-5	43	12.8	-	0.7	Bal	0.7	5.7
FT-128	44	13.5	5	Co(8)	4	-	Bal
FT-143	44	-	5	Co(9)	15	-	Bal

Advantages

The performance of Alloy-TiC® Guide Rollers on several rod mills has proved the clear superiority of titanium-carbides over traditional materials. Alloy-TiC® Guide Rollers are supplied 'grooved' with lapped surface.

Technical Data

Material	Alloy-TiC®	TiC	Tool STEEL
Matrix	Alloy Steel	Co-Ni	Fe
Hard phase	TiC	WC	Fe ₃ C
Manufacturing process	Powder metallurgy	Powder metallurgy	Casting
Hardness (HRC)	Tempered	68-72	55-62
	Annealed	45-48	20-30
Density (g/cc)	6.45-6.50	14.0-15.0	7.8-8.5
TRS (Kg/mm²)	180-190	200-230	60-100
Compressive strength (N/mm²)	3,500-3,800	3,200-4,200	2,000-2,700
Machinability	good	impossible	excellent
Life (Times)	20-30	20-30	1

Application

