Kaoroll

KAOROLL HEAT TREATMENT IND. CO., LTD

Kaoroll

Professional·High Standard

ABOUT US

Kaoroll Heat Treatment Ind. Co., Ltd. is the first and largest heat treatment factory in Taiwan. It has been manufacturing Sendzimir rolls since 1970. Forty- year of heat treatment experience encompasses material science, casting production, machining process, welding forging brazing, soldering, plastic deformation and powder metallurgy treatment technology.

We understand the characteristic and application of materials. Therefore, we not only provide heat treatment service, material application and improvement technology for our clients, but also develop high quality accessory and material to satisfy our clients. Sendzimir rolls are the typical examples. We have also reached ISO9001: 2008 certificate to manage our quality.

Kaoroll has successfully developed low cost but high performance rollers through the material research and the special treatment technology. Our roller's average life span is 25-30% longer than other manufacturers' under the same condition.

For each order, we find suitable, 100% ESR grade steel, Salt Bath Furnace for heat treatment and control intensive mechanical characteristic. Every process is strictly inspected step by step. Each roller must be inspected and reports must be submitted, including material composition, hardness and dimensional certification. Kaoroll has 90% market share of rollers in Taiwan. Furthermore, our export has worldwide extended more than 20 countries including South East Asia, South North Asia, North America, and Europe.

Special Feature

- High standard, rigid steel grade, and manufacture by customer's demand - less cracks and spalling.
- Experienced technical support group to solve problems quickly.
- Salt Bath Furnace for heat treatment - resulting in a refined and more stable micro-structure and strengthened mechanical properties.
- High standard thermal shock resistant, anti-wear test ,compression resistant and hardening test.
- Strict quality control - accurate steel grade, heat treatment process, hardness and dimensional inspection.
- Quality assurance - Certificate of ISO 9001: 2008
- Fast manufacturing and delivery.
- High quality and fair price strengthen client's competitive ability.
- 90% market share in Taiwan and export worldwide more than 20 countries.

Quality Control

Reasons to choose Kaoroll

High Qualified Steel Grade Selected and Manufacture technology :

100% ESR material is our first priority. It provides high cleanliness and low non-metallic inclusions. Composing refined structure (grain size), results in higher rigidity and strong toughness to accommodate different situations while rolling, avoid cracks and spalling.

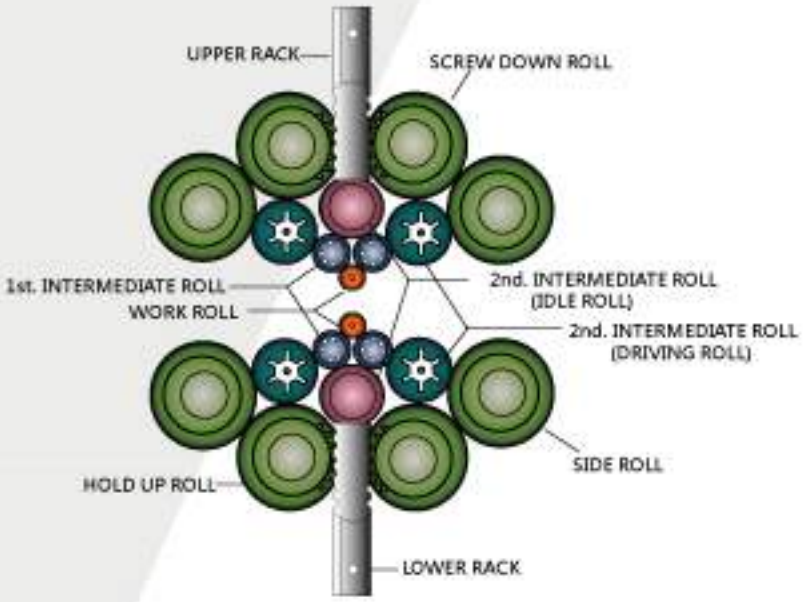
Salt Bath Furnace rather than Vacuum Furnace :

1. Fast heating, Heated evenly, and even hardness by Salt Bath Furnace.
2. To eliminate the amount of residual Austenitic and stress, a repeating tempering process is employed. The tempering heat treatment can stabilize fine-grain, micro structure inside the material, avoid cracks and phase transformation induced on the roll's surface when the rolling process is in employment.

Strict Quality Control and Inspection Report :

All of the raw materials are inspected by Nondestructive Macro analyses and microanalyses, such as X-ray Defectoscopy, magnetic power test, Ultrasonic inspection and EDS composition analysis. Mechanical and physical properties, including strength, toughness, thermal shock resistance, and wear resistance, will be strictly checked by Quality Control Department before rolls are delivered to customers.

Manufacturing Process



SENDZIMIR ROLL

Product Description

Suitable steel grade and heat treatment technologies are key points to produce high quality Sendzimir Rolls.

WORK ROLL

We focus on wear, toughness and strong compression resistance when selecting the proper steel grade. ESR manufacturing process produces high cleanliness and low nonmetallic inclusion to ensure the higher rigidity and toughness. Unique heat treatment technology improves wear resistant, toughness, compression and thermal shock resistance. Practical in-production data reveal that our roller's life performance is 25% greater than others.

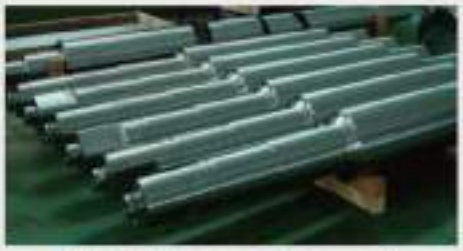
Steel grade selection for Work Roll :

Application	Size	Hardness	Characteristic
Work Roll	Φ10mm~300mm	Customized	● Brighter and thicker steel sheets ● Stronger thermal shock and wear resistance

Product Description

Thermal-shock resistant and heat compression are the most important factor for intermediate roll's steel grade choice.

INTERMEDIATE ROLL



First intermediate roll

Second intermediate roll
-Idle roll-

Second intermediate roll
-Driver Roll-

Intermediate rolls' surface hardness will be increased through high thermal shock and heat compression. Cracks and spalls occur and reduce rollers' life performance. This is the most frequent problem during the rolling operation period. Kaoroll concentrates on a solution for this problem from beginning, material selection, follow by manufacturing process and unique heat treatment. Every single step is designed to prevent cracks and spalls due to thermal shock and compression resistance. Unique heat treatment technology refines and stabilizes the structure to further strengthen the roll for thermal shock and compression resistance and toughness.

In addition, we have developed modified steel grade which has better thermal shock resistant and heat compression, also greatly lower the possibility of cracks and spalls happening. According to the data, modified steel grade has double life performance than other intermediate rolls.

Steel grade selection for Intermediate roll :

Application	Size	Hardness	Characteristic
Intermediate roll (Idle roll, Drive roll)	Φ15mm~ 1000mm	Customized	● Great toughness and wear resistant ● Strong Thermal shock and compression resistant

ROLLS FOR COLD ROLLING

Characteristics for cold rolling

- High Toughness
- High Wearing Resistance
- Proper Hardness
- Bright Surface

Two kinds of rolls for cold rolling by hardness depth.

Through hardened roller for cold rolling:

The diameter ranges from 12mm to 400mm, with a maximum length of 3000mm.

The main purpose of developing through hardened rolls is to replace surface hardened type. The characteristics for cold rolling have strong toughness, wear resistance, proper hardness and brighter surface, and the grinding amount is just 25-30% of surface hardened roller for cold rolling during the operation period. The life performance is much longer than surface hardened type. Although the manufacture cost is higher, overall the result is benefit more than surface hardened type.

Surface hardened roller for cold rolling:

The diameter ranges from 12mm to 850mm, with a maximum length of 5000mm.

The hardness depth ranges from 2mm to 35mm .

Steel grade selection not only satisfies all cold rolling requirements by itself, but ESR manufacturing process must be completed to make sure no cracks and spalls occur under normal situation. High, medium, or low frequency will be done after discuss with clients. Sub-zero treatment comes after to make rollers more toughness, and the life performance increases 30%.

Product Description

BACK UP ROLLS

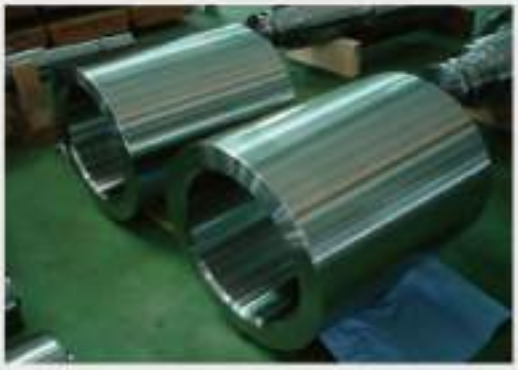
Description	Diameter	Length	Hardness
Backup roll	Φ20~550mm	~4m	Customized

SIDE SUPPORT ROLL

Description	Diameter	Length	Hardness
Side support roll	Φ20~550mm	~4m	Customized

SLEEVE

- Customized
- High Quality、Endurance
- Forging/Heat Resistance



LARGE SIZE MILL ROLLS

Application	Material applied (ESR)	Diameter	Weight	Hardness
Work Roll Intermediate Roll Back Up Roll Leveler Roll Side Support Roll	KRMC3 KRMC5	Max.2000mm	Max.150MT	~HSC 75

Product Description

LEVELER ROLLS

- Leveler Rolls
- Wiper Rolls

Description	Diameter	Length	Hardness
· Leveler Rolls · Wiper Rolls	Φ20~550mm	~4m	Customized

CUTTERS

- Slitter Cutters
- Side Trimmer

OTHER PRODUCT

- Shearing Blade
- Pipe Cutters

STEEL
MATERIAL SELL

JIS	ASTM/AISI	DIN
S45C	1045	1.1191
尺寸：Φ50~900 (mm)		

JIS	ASTM/AISI	DIN
SUJ2	52100	1.3505
尺寸：Φ50~900 (mm)		

JIS	ASTM/AISI	DIN
SCM420	4118	1.7264
尺寸：Φ50~900 (mm)		

JIS	ASTM/AISI	DIN
SCM440	4140	1.7225
尺寸：Φ50~1250 (mm)		

JIS	ASTM/AISI	DIN
SNCM220	8620	1.6523
尺寸：Φ50~900 (mm)		

JIS	ASTM/AISI	DIN
SNCM439	4340	1.6582
尺寸：Φ50~1250 (mm)		

硬度換算表 Hardness Conversion Table

Vickers	Brinell (HB)		Rockwell (HR)			Rockwell Superficial			Shore	抗拉強度 TS
HV	標準球	硬質球	A	C	D	15N	30N	45N	HS	Mpa
940	-	-	85.6	68.0	76.9	93.2	84.4	75.4	97	
920	-	-	85.3	67.5	76.5	93.0	84.0	74.8	96	
900	-	-	85.0	67.0	76.1	92.9	83.6	74.2	95	
880	-	(767)	84.7	66.4	75.7	92.7	83.1	73.6	93	
860	-	(757)	84.4	65.9	75.3	92.5	82.7	73.1	92	
840	-	(745)	84.1	65.3	74.8	92.3	82.2	72.2	91	
820	-	(733)	83.8	64.7	74.3	92.1	81.7	71.8	90	
800	-	(722)	83.4	64.0	73.8	91.8	81.1	71.0	88	
780	-	(710)	83.0	63.3	73.3	91.5	80.4	70.2	87	
760	-	(698)	82.6	62.5	72.6	91.2	79.7	69.4	86	
740	-	(684)	82.2	61.8	72.1	91.0	79.1	68.6	84	
720	-	(670)	81.8	61.0	71.5	90.7	78.4	67.7	83	
700	-	(656)	81.3	60.1	70.8	90.3	77.6	66.7	81	
690	-	(647)	81.1	59.7	70.5	90.1	77.2	66.2	-	
680	-	(638)	80.8	59.2	70.1	89.8	76.8	65.7	80	
670	-	630	80.6	58.8	69.8	89.7	76.4	65.3	-	
660	-	620	80.3	58.3	69.4	89.5	75.9	64.7	79	
650	-	611	80.0	57.8	69.0	89.2	75.5	64.1	-	
640	-	601	79.8	57.3	68.7	89.0	75.1	63.5	77	
630	-	591	79.5	56.8	68.3	88.8	74.6	63.0	-	
620	-	582	79.2	56.3	67.9	88.5	74.2	62.4	75	
610	-	573	78.9	55.7	67.5	88.2	73.6	61.7	-	
600	-	564	78.6	55.2	67.0	88.0	73.2	61.2	74	
590	-	554	78.4	54.7	66.7	87.8	72.7	60.5	-	2055
580	-	545	78.0	54.1	66.2	87.5	72.1	59.9	72	2020
570	-	535	77.8	53.6	65.8	87.2	71.7	59.3	-	1985
560	-	525	77.4	53.0	65.4	86.9	71.2	58.6	71	1950
550	(505)	517	77.0	52.3	64.8	86.6	70.5	57.8	-	1905
540	(496)	507	76.7	51.7	64.4	86.3	70.0	57.0	69	1860
530	(488)	497	76.4	51.1	63.9	86.0	69.5	56.2	-	1825
520	(480)	488	76.1	50.5	63.5	85.7	69.0	55.6	67	1795
510	(473)	479	75.7	49.8	62.9	85.4	68.3	54.7	-	1750
500	(465)	471	75.3	49.1	62.2	85.0	67.7	53.9	66	1705
490	(456)	460	74.9	48.4	61.6	84.7	67.1	53.1	-	1660
480	448	452	74.5	47.7	61.3	84.3	66.4	52.2	64	1620
470	441	442	74.1	46.9	60.7	83.9	65.7	51.3	-	1570
460	433	433	73.6	46.1	60.1	83.6	64.9	50.4	62	1530
450	425	425	73.3	45.3	59.4	83.2	64.3	49.4	-	1495
440	415	415	72.8	44.5	58.8	82.8	63.5	48.4	59	1460
430	405	405	72.3	43.6	58.2	82.3	62.7	47.4	-	1410

Vickers	Brinell (HB)		Rockwell (HR)				Rockwell Superficial			Shore	抗拉強度 TS
HV	標準球	硬質球	A	B	C	D	15N	30N	45N	HS	Mpa
420	397	397	71.8		42.7	57.5	81.8	61.9	46.4	57	1370
410	388	388	71.4		41.8	56.8	81.4	61.1	45.3	-	1330
400	379	379	70.8		40.8	56.0	81.0	60.2	44.1	55	1290
390	369	369	70.3		39.8	55.2	80.5	59.3	42.9	-	1240
380	360	360	69.8	(110.0)	38.8	54.4	79.8	58.4	41.7	52	1205
370	350	350	69.2	-	37.7	53.6	79.2	57.4	40.4	-	1170
360	341	341	68.7	(109.0)	36.6	52.8	78.6	56.4	39.1	50	1130
350	331	331	68.1	-	35.5	51.9	78.0	55.4	37.8	-	1095
340	322	322	67.6	(108.0)	34.4	51.1	77.4	54.4	36.5	47	1070
330	313	313	67.0	-	33.3	50.2	76.8	53.6	35.2	-	1035
320	303	303	66.4	(107.0)	32.2	49.4	76.2	52.3	33.9	45	1005
310	294	294	65.8	-	31.0	48.4	75.6	51.3	32.5	-	980
300	284	284	65.2	(105.5)	29.8	47.5	74.9	50.2	31.1	42	950
295	280	280	64.8	-	29.2	47.1	74.6	49.7	30.4	-	935
290	275	275	64.5	(104.5)	28.5	46.5	74.2	49.0	29.5	41	915
285	270	270	64.2	-	27.8	46.0	73.8	48.4	28.7	-	905
280	265	265	63.8	(103.5)	27.1	45.3	73.4	47.8	27.9	40	890
275	261	261	63.5	-	26.4	44.9	73.0	47.2	27.1	-	875
270	256	256	63.1	(102.0)	25.6	44.3	72.6	46.4	26.2	38	855
265	252	252	62.7	-	24.8	43.7	72.1	45.7	25.2	-	840
260	247	247	62.4	(101.0)	24.0	43.1	71.6	45.0	24.3	37	825
255	243	243	62.0	-	23.1	42.2	71.1	44.2	23.2	-	805
250	238	238	61.6	99.5	22.2	41.7	70.6	43.4	22.2	36-	795
245	233	233	61.2	-	21.3	41.1	70.1	42.5	21.1	-	780
240	228	228	60.7	98.1	20.3	40.3	69.6	41.7	19.9	34	765
230	219	219	-	96.7	(18.0)	-	-	-	-	33	730
220	209	209	-	96.0	(15.7)	-	-	-	-	32	695
210	200	200	-	93.4	(13.4)	-	-	-	-	30	670
200	190	190	-	91.5	(11.0)	-	-	-	-	29	635
190	181	181	-	89.5	(8.5)	-	-	-	-	28	605
180	171	171	-	87.1	(6.0)	-	-	-	-	26	580
170	162	162	-	85.0	(3.0)	-	-	-	-	25	545
160	152	152	-	81.7	(0.0)	-	-	-	-	24	515
150	143	143	-	78.7	-	-	-	-	-	22	490
140	133	133	-	75.0	-	-	-	-	-	21	455
130	124	124	-	71.2	-	-	-	-	-	20	425
120	114	114	-	66.7	-	-	-	-	-	-	390
110	105	105	-	62.3	-	-	-	-	-	-	-
100	95	95	-	56.2	-	-	-	-	-	-	-
95	90	90	-	52.0	-	-	-	-	-	-	-
90	86	86	-	48.0	-	-	-	-	-	-	-
85	81	81	-	41.0	-	-	-	-	-	-	-

1. 換算表依據 SAE J 417 編輯，粗體字同 ASTM E 140，為 SAE-ASM-ASTM 共同調整結果。
2. 表中括弧( )數值為通常不太可能使用的範圍，僅提供參考用。
3. 抗拉強度（Tensile Strength）近似值，依據 JIS Z 8413 與 JIS Z 8438（已廢止）換算，使用上需注意質量效果，鋼材成份與熱處理方法 等影響。

單位換算： 1 MPa = 1 N/mm^2 · 1kgf/mm^2 = 9.8 MPa = 9.8 N/mm^2

1 Ksi = 1000 psi = 0.7037 kgf/mm^2 = 6.89626 Mpa

KR

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