



TRUST ON ROLLING



Roll supplier for steel plants globally



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A Member of Turkish Steel Exporters Assc.

MELTING





GAMMA ROLLS

Gamma Rolls Çelik Sanayi, an industrial engineering and steel casting company located in Istanbul Turkey, is Rolling Mill Roll and Crusher Mill Components supplier for the mills and project companies. Providing entire technical requirements in respect to performance and life-term criteria, trust and satisfaction are our priority. We share responsibility of most involved technical staff in roll shop of the steel mills, crusher unite of cement mills and mining area and also such heavy duty industrial applications. Every single part produced in accordance with ISO standard is controlled by certified and experienced technical staff. Starting from simulation stages of the parts, chemical composition, ultrasonic tests, dimensional, physical controls are applied thru well-installed and well-practiced standards. The entire production period is strictly scheduled by planning engineers according to dates of delivery, covering shipment period till arrival of the goods to the plants. Gamma Roll guarantees period cover the up to scrap diameter usage for free charge of re-placement. Gamma Rolls product range covers sphero cast iron, steel, adamite qualities ranging between 300 kg and 14 tones finished weight rolls, rings and sleeves. Based on Static Casting Method, our rolls produced maximum 1,400mm diameter and 4,500 mm overall length. With 2x6,5 tons and 2x2,5 tons' induction furnaces, max 18 tons cast weight rolls can be produced. Archived a sample cut off thru barrel extension for microstructure for each roll. This information is recorded for each roll by its serial number in case future issues about the rolling mill to be sure on what we have produced, which quality and hardness point we have started to improve and such technical questions.

TECHNICAL CONSULTING

Gamma Rolls offers service consisting of roll supply finished grooving and all rolling mill conditions. Our technical department advise and assist on the choice of roll quality for any specific application and also to help with general rolling problems. We also give our technical service prior to the selection of a quality.

The roll quality is indicated after very careful consideration of all mill conditions in conjunction with the performance history of roll qualities currently in use along with those in similar Mills.

MOULDING



SG-PC NODULAR CAST IRON PEARLITIC ROLLS

These type cast iron rolls are used mainly in the Roughing Stands due to stabilized structure against high thermal stress. Enriched with Cr, Ni and Molybdenum alloys, the chemical content of pearlitic rolls result to a homogen structure with globular grahite nodules on barrel surface. The barrel gains flexibility and spreading skill to high temperature

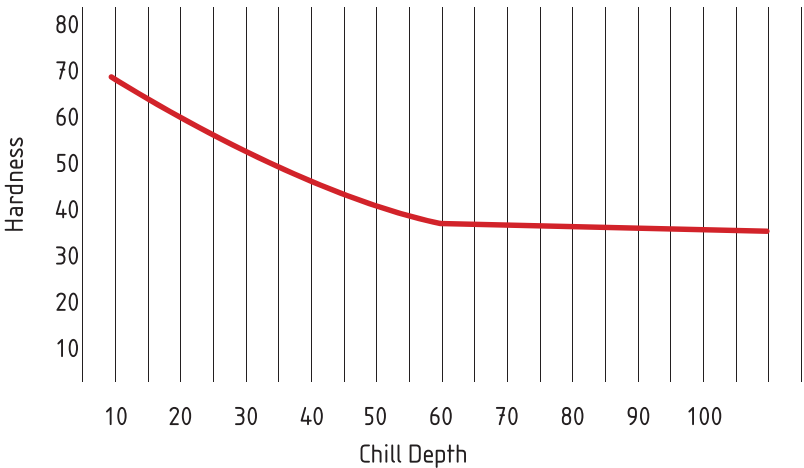
conditions during rolling process. Therefore SG-PC rolls generally have higher resistance against fire-cracking, thermal shocks and related tempeture problems. The rolls mostly preferred roughing stands for rebar and wire mills, light and medium section mills which are not applied deeply grooves.

MICROSTRUCTURE



Pearlitic structure with nodular graphite, carbides and pearlite noduls

SG - PC PEARLITIC SPHERO ROLLS HARDNESS TREND



PEARLITIC ROLLS

QUALITY	HARDNESS ShC	METALLURGICAL COMPONENT					
		C%	Si%	Mn%	Cr%	Ni%	Mo%
SG - PC	51 - 60	3.0-3,5	1,4-2,2	0,4-0,9	0,2-0,8	1,1-2,0	0,2-0,6
SG - PC	61 - 69	3.2-3,6	1,2-2,0	0,4-0,9	0,2-0,8	1,1-2,0	0,2-0,6
SG - PC	70 -76	3.2-3,6	1,0-1,8	0,4-0,9	0,6-1,2	1,8-3,2	0,2-0,6

TYPICAL MECHANICAL BEHAVIOR

ROLL MATERIAL	HARDNESS ShC	Tensile Strength N/mm²	Bending Strength N/mm²	Microstructure
SG - PC	51 - 55	500-650	850 -1050	pearlite + carbide
SG - PC	56 - 65	450-650	850 -1050	pearlite + carbide
SG - PC	66 -76	450-650	850 -1000	pearlite + carbide

NORMALIZING



SG-FE NODULAR CAST IRON FERRITIC ROLLS

This type of cast iron structure has more toughness. Ferrite zones and perlite surround the nodular graphites. In Ferritic Perlitic quality, ferrite zones cover more area than ferrit noduls in comparison to perlitic structures. Therefore the flexibility lower but the toughness is higher than pearlitic structures. To decide for better performance on roughing stands,

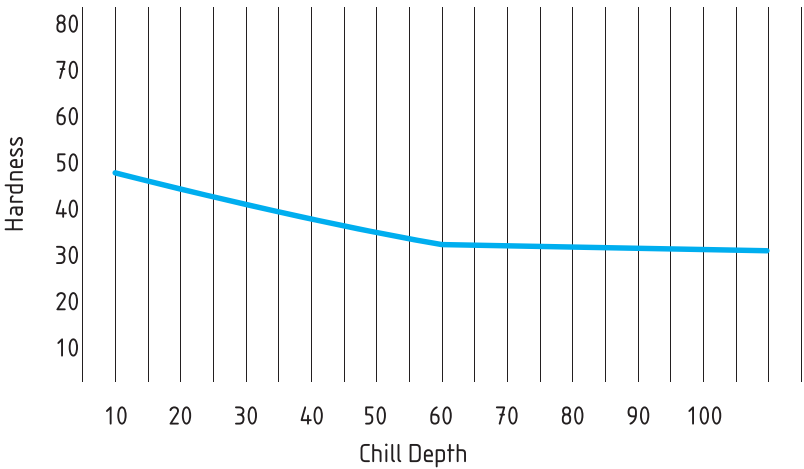
cooling systems, thermal stresses, arrival speed of billet for rolling should be evaluated well. Increasing toughness on roughing stands may give better performance but brings new risks since flexibility disappear.
The roughing stand of Round Bar mills is convenient to use the rolls.

SG-FE Ferritic Nodular Cast Iron Rolls



Nodular graphite surrounded by ferrite.

SG - FE FERRITIC ROLLS HARDNESS TREND



FERRITIC ROLLS

QUALITY	HARDNESS ShC	METALLURGICAL COMPONENT					
		C%	Si%	Mn%	Cr%	Ni%	Mo%
SG - FE	46 - 53	3.2-3,5	1,2-2,0	0,4-0,9	0,5-0,8	1,1-2,0	0,2-0,6
SG - FE	54 - 61	3.2-3,5	1,4-2,2	0,4-0,9	0,5-0,8	1,1-2,0	0,2-0,6

TYPICAL MECHANICAL BEHAVIOR

ROLL MATERIAL	HARDNESS ShC	Tensile Strength N/mm²	Bending Strength N/mm²	Microstructure
SG - FE	46-53 48 Cr	550-700	1000-1300	pearlite+graphite
SG - FE	54-61 58 Ni	550-700	1000-1300	pearlite+graphite

ROUGH MACHINING



SG-PX-Mo 46 HIGH MOLYBDENUM NODULAR CAST ROLLS

SG-PX-Mo 46 Nodular Graphite iron has a special behavior due to its unique matrix. Composition of roll shows high ferrite nodules. The material provides properties associated with both traditional acicular and pearlitic qualities. Oval Graphite noduls are surrounded with ferrite, named as the “bull’s eyes” is the most important characteristic of the SG-PX-Mo 46 rolls.

This quality is convenient for high temperature heat treated, high Mo alloyed, pearlitic or acicular nodular iron.

The microstructure ranges from pearlite in the lower alloyed grades to acicular phase in the higher alloyed

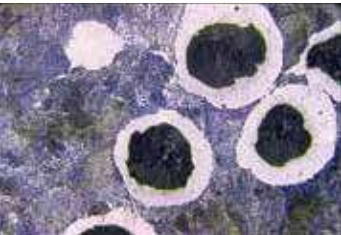
and heat treated grades

The presence of bull’s eyes (spheroidized graphite surrounded by a layer of ferrite) provides strength, toughness and fire-cracking resistance. The high strength and thermal resistance of SG-P-Mo make it an suitable roll material for use in roughing applications where thermal duty is severe.

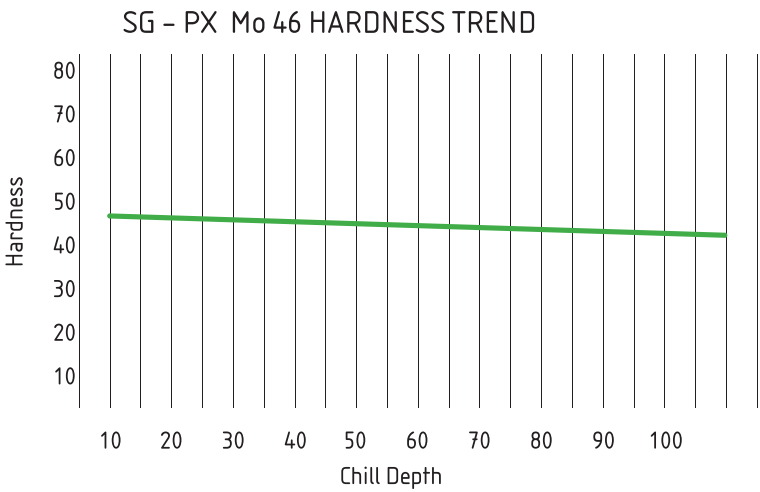
These rolls have high strength and excellent resistance against fire-cracking, therefore making them very suitable for heavy duty applications and especially in slow rolling Roughing stands.

MICROSTRUCTURE

SG-PX Mo 46 – For High Thermal Stress



Bulls’ Eye Structure



SG-PX Mo46

QUALITY	HARDNESS ShC	METALLURGICAL COMPONENT					
		C%	Si%	Mn%	Cr%	Ni%	Mo%
SG - PX Mo 46	46	3.0-3,5	1,2-2,0	0,4-0,9	0,2-0,8	1,1-2,0	0,2-0,6

TYPICAL MECHANICAL BEHAVIOR

ROLL MATERIAL	HARDNESS ShC	Tensile Strength N/mm²	Bending Strength N/mm²	Microstructure
SG - PX Mo 46	46	600-700	900 -1200	pearlite + carbide

MACHINING



SG-AC ACICULAR SPHERO ROLLS

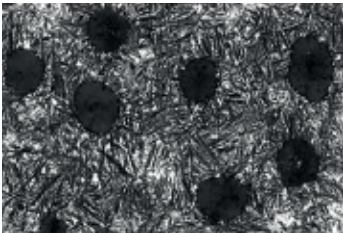
Acicular Rolls are mostly convenient for intermediate and finishing stands due to its tougher structure. While rolling speed getting increase towards finishing stands, the surface of rolled material gains its final shape on prefinishing and finishing stands. Today, rebar and especially wire mills are using Acicular Roll qualities to give better surface to rolled material unless they use composite tougher rolls.

Acicular ferrite is also characterised by high angle boundaries between the ferrite grains. This further re-

duces the chance of cleavage, because these boundaries impede crack propagation. It is reported that nucleation of various ferrite morphologies is aided by nonmetallic inclusion; in particular oxygen-rich inclusions of a certain type and size are associated with the intragranular formation of acicular ferrite. Acicular ferrite is a fine Widmanstätten constituent, which is nucleated by an optimum intragranular dispersion of oxide/sulfide/silicate particles.

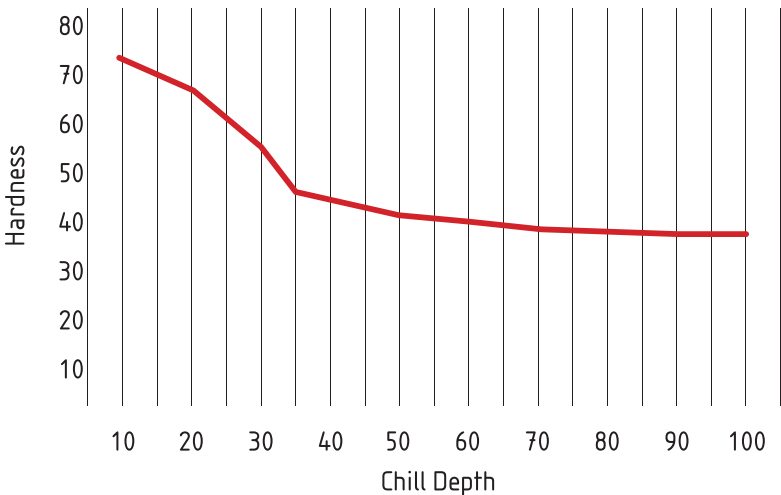
MICROSTRUCTURE

SG-AC Acicular Sphero Rolls



Bainitic-martensitic and pearlite matrix with nodular graphite and carbides.

SG-AC ACICULAR SPHERO ROLLS HARDNESS TREND



ACICULAR ROLLS

QUALITY	HARDNESS ShC	METALLURGICAL COMPONENT					
		C%	Si%	Mn%	Cr%	Ni%	Mo%
SG - AC	55-65	3,1-3,7	1,1-2,0	0,4-0,9	0,2-0,8	2,8-4,0	0,4-1,2
SG - AC	66-75	3,1-3,7	1,1-2,0	0,4-0,9	0,2-0,8	2,9-4,1	0,4-1,2
SG - AC	76-80	3,1-3,7	1,1-2,0	0,4-0,9	0,4-1,0	3,0-4,2	0,4-1,2

TYPICAL MECHANICAL BEHAVIOR

ROLL MATERIAL	HARDNESS ShC	Tensile Strength N/mm²	Bending Strength N/mm²	Microstructure
SG - AC	55-60	600-700	900-1000	Bainitic + Martensitic
SG - AC	60-67	500-650	850-1000	Bainitic + Martensitic
SG - AC	68-74	400-600	850-1000	Bainitic + Martensitic
SG - AC	75-80	350-500	750-900	Bainitic + Martensitic

DIMENSIONAL TESTING

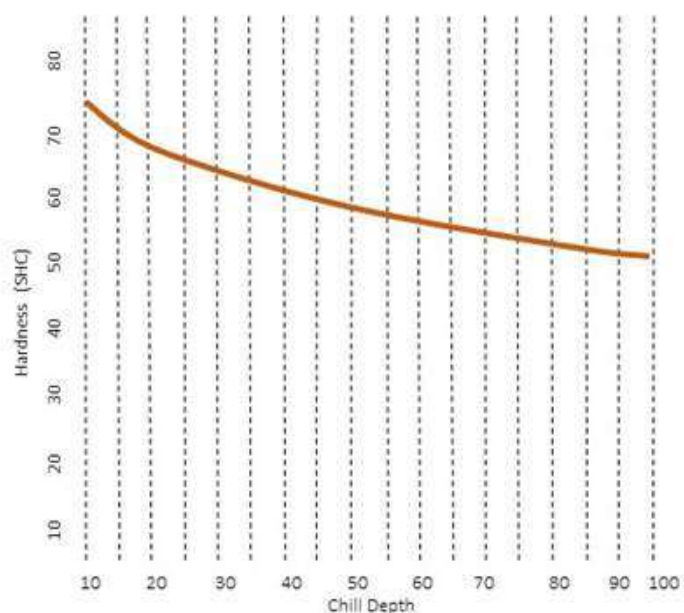


SG-MX HIGH ALLOYED NODULAR ROLLS

SG-MX Rolls have been developed for finishing stands of reinforcing bar, round bar and wire rod mills. The rolls chemically consist higher Nickel and Molybdenum than regular sphero rolls. The MX quality advised for flat bar, round bar, T bar and special steel production for lighth, medium section finishings due to high flexibility ratio.

The rolls receive a multi-stage, high temperature heat treatment to obtain a combination of hardness, toughness and wear resistance necessary for their particular application.

HARDNESS GRAPH



MICROSTRUCTURE

SG-MX ALLOYED ROLL

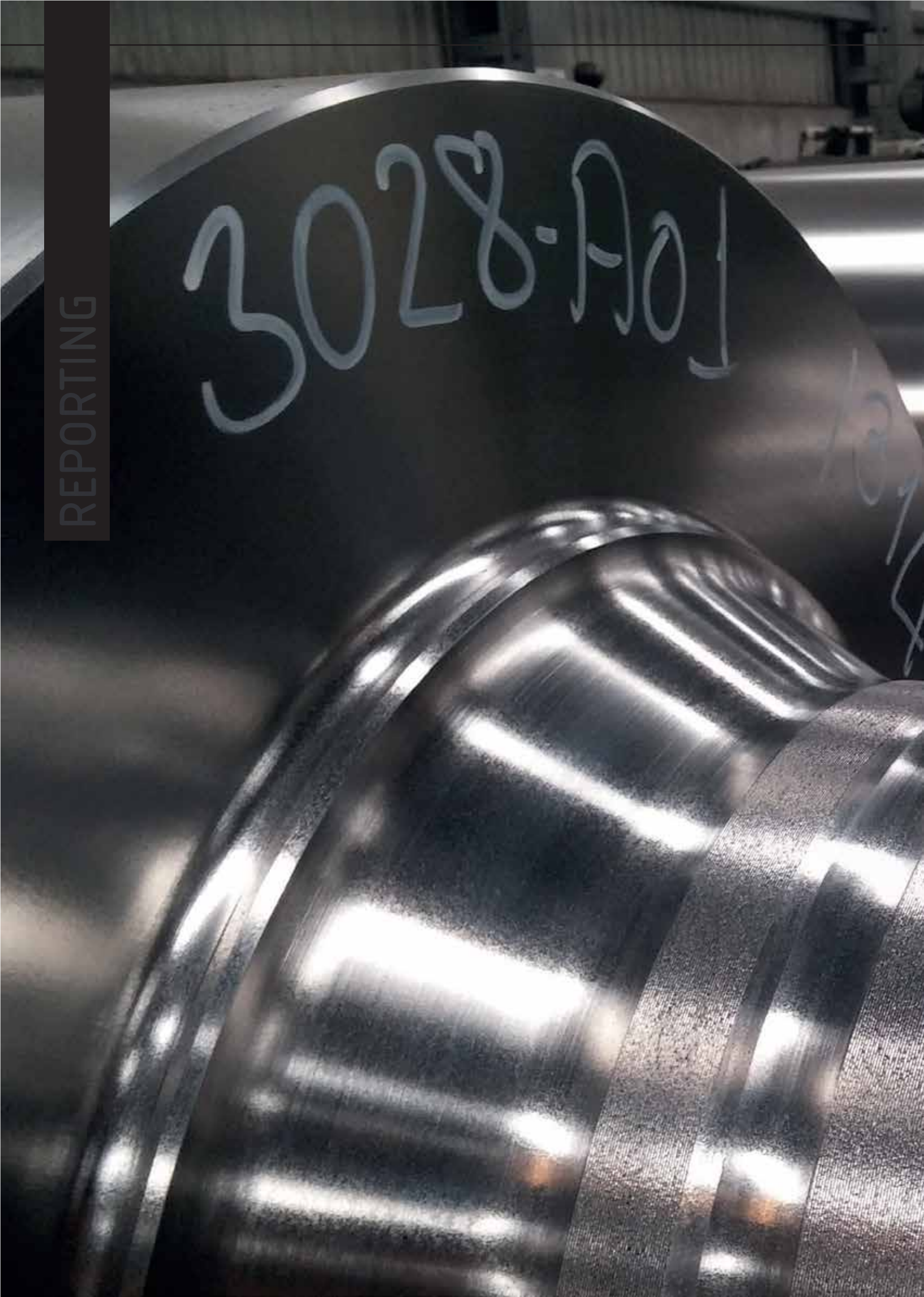


QUALITY	HARDNESS SHC	METALLURGICAL COMPONENT					
		C%	Si%	Mn%	Cr%	Ni%	Mo%
SG - MX	63 - 68 A	3,3 - 3,6	1,8-2,2	0,3-07	0,3 - 1,1	3,6 - 4,4	0,6-1,2
SG - MX	69 - 74 R	3,3 - 3,6	1,8-2,2	0,3-07	0,2 - 0,8	4,2 - 4,8	0,8-1,4
SG - MX	75 - 80 H	3,3 - 3,6	1,8-2,2	0,3-07	0,1 - 0,6	4,4 - 5,0	1,0-1,6

ROLL MATERIAL	HARDNESS SHC	Tensile Strength N/mm ²	Bending Strength N/mm ²	Microstructure
SG - MX	63 - 68 A	550 - 750	750 - 1000	Pearlite-Bainite-Carburised
SG - MX	69 - 74 R	550 - 750	750 - 1000	Pearlite-Bainite-Carburised
SG - MX	75 - 80 H	550 - 750	750 - 1000	Pearlite-Bainite-Carburised

REPORTING

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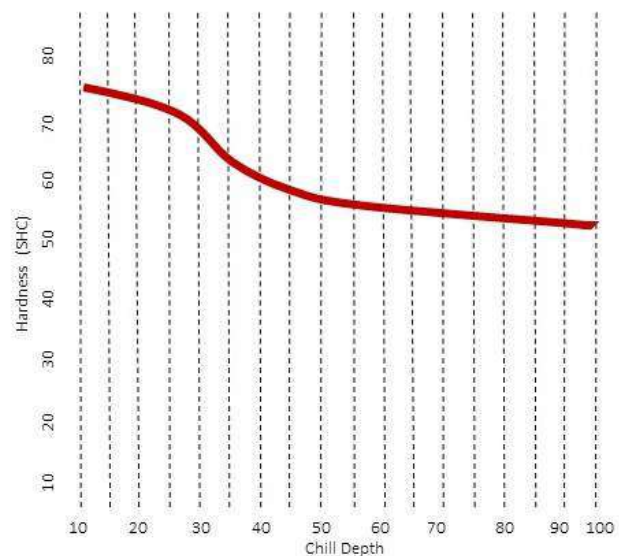
NIKRA - High Alloyed Nodular Rolls

Unlike MX Rolls, the micro-structure of NIKRA is based on carbided martensitic and bainitic. Similarly NIKRA is applicable for late intermediate and finishing stands widely. Due to its hard surface, preferred to improve of surface quality of rolled bar, round bar, and such a long round products at finishing stands. The rolls chemically consist higher Nickel and Molybdenum than regular sphero rolls.

The rolls receive a multi-stage, high temperature heat treatment to obtain a combination of hardness, toughness and wear resistance necessary for their particular application.

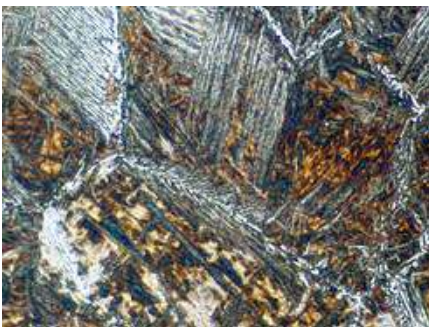
In comparison to MX, the surface stability longer and flexibility is less than MX.

HARDNESS GRAPH



MICROSTRUCTURE

NIKRA



QUALITY	HARDNESS SHC	METALLURGICAL COMPONENT					
		C%	Si%	Mn%	Cr%	Ni%	Mo%
NIKRA 65	63 - 68	3,3 - 3,6	1,8-2,2	0,3-07	0,3 - 1,1	3,2 - 3,8	0,6-1,2
NIKRA 73	69 - 74	3,3 - 3,6	1,8-2,2	0,3-07	0,2 - 0,8	3,6 - 4,2	0,8-1,4
NIKRA 80	75 - 80	3,3 - 3,6	1,8-2,2	0,3-07	0,1 - 0,6	4,0 - 4,8	1,0-1,6

ROLL MATERIAL	HARDNESS SHC	Tensile Strength N/mm ²	Bending Strength N/mm ²	Microstructure
NIKRA 65	63 - 68	550 - 750	750 - 1000	Martensitic-Bainitic-Carbided
NIKRA 73	69 - 74	550 - 750	750 - 1000	Martensitic-Bainitic-Carbided
NIKRA 80	75 - 80	550 - 750	750 - 1000	Martensitic-Bainitic-Carbided

A SAMPLE INSPECTION CERTIFICATE



BUREAU
VERITAS

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INSPECTION PHOTOS



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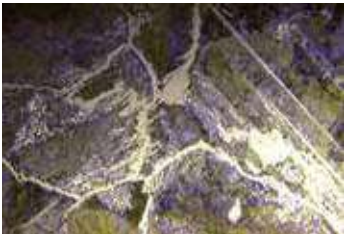
ALLOY STEEL BASE ROLLS ACS

Unlike cast iron rolls, these rolls have heat treatment application during its production. Due to their tough behavior, the rolls are very suitable for light section mills and medium section mills where the deep grooves are applied for roll pass design.

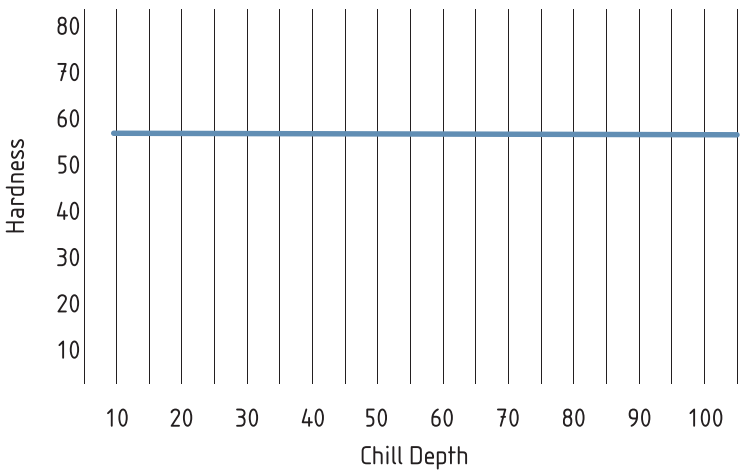
The rolls receive a multi-stage, high temperature heat treatment to obtain a combination of hardness, toughness and wear resistance necessary for their particular application.

MICROSTRUCTURE

ACS – ALLOY STEEL BASE ROLL



ACS ALLOY STEEL BASE ROLLS HARDNESS TREND



ALLOY STEEL BASE ROLLS

QUALITY	HARDNESS ShC	METALLURGICAL COMPONENT					
		C%	Si%	Mn%	Cr%	Ni%	Mo%
ACS	40-45	0,4-1,4	0,4-1,0	0,4-1,2	0,5-1,4	Max 0,6	0,1-0,6
ACS	45-50	0,4-1,4	0,4-1,0	0,4-1,2	0,5-1,4	Max 0,6	0,1-0,6
ACS	50-55	0,4-1,4	0,4-1,0	0,4-1,2	0,5-1,4	Max 0,6	0,1-0,6

TYPICAL MECHANICAL BEHAVIOR

ROLL MATERIAL	HARDNESS ShC	Tensile Strength N/mm²	Bending Strength N/mm²	Microstructure
ACS	40-45	650-800	1100-1400	pearlitic + carbide
ACS	45-50	650-800	1100-1400	pearlitic + carbide
ACS	50-55	650-800	1100-1400	pearlitic + carbide

QUALITY CONTROL

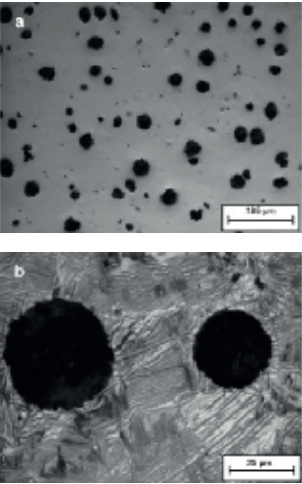


GRAPHITICSTEEL BASE ROLLS (GST)

This graphite nodules are to increase the thermal conductivity of the roll and is therefore more resistant to fire cracking.

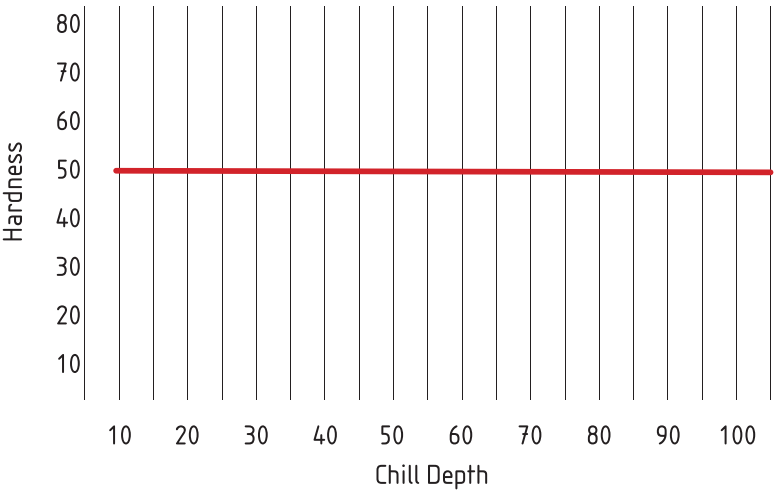
The rolls are suitable quality for Roughing rolls, especially those with deep grooves and high thermal stress.

MICROSTRUCTURE



Pearlitic matrix with nodular and flake graphite

GST-GRAPHITIC STEEL ROLLS HARDNESS TREND



GRAPHITIC STEEL BASE ROLLS							
QUALITY	HARDNESS ShC	METALLURGICAL COMPONENT					
		C%	Si%	Mn%	Cr%	Ni%	Mo%
GST	35-42	1,2-1,6	0,9-2,0	0,5-0,9	0,5-1,2	0,4-1,0	0,6 max
GST	42-47	1,2-1,6	0,9-2,0	0,5-0,9	0,5-1,2	0,4-1,0	0,6 max
GST	48-55	1,2-1,6	0,9-2,0	0,5-0,9	0,5-1,2	0,4-1,0	0,6 max

TYPICAL MECHANICAL BEHAVIOR				
ROLL MATERIAL	HARDNESS ShC	Tensile Strength N/mm²	Bending Strength N/mm²	Microstructure
GST	35-42	400-650	550-1000	spheroidal carbide
GST	42-47	400-650	550-1000	spheroidal carbide
GST	48-55	400-650	550-1000	spheroidal carbide

PACKAGING



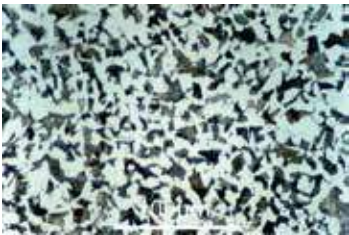
ALLOY STEEL ADAMITE ROLLS (ASB)

ASB highly alloyed with Ni, Mo and the carbon content is between 0.45% and 1.50%. Alloyed with nickel and molybdenum, these rolls show high strength and wear resistance than lower alloy steels. Also the higher carbon grades in provides capability of good surface finish. The rolls are produced a multi-stage, high temperature heat treatment to obtain a combi-

nation of hardness, toughness and wear resistance necessary for their particular application. Alloy cast steel can be used in heavy duty applications in heavy section mills but the improved wear resistance of the higher grades makes it also suitable for use in medium section mills as well as roughing rolls for flat products.

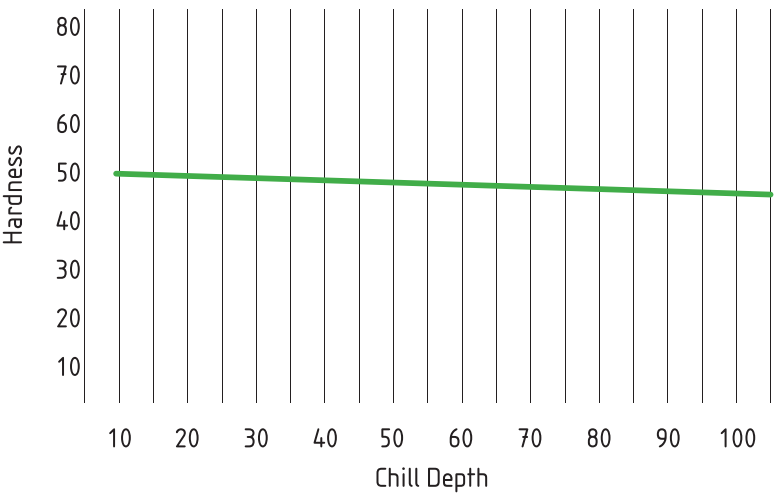
MICROSTRUCTURE

ASB - ALLOY STEEL BASE ADAMITE ROLLS



Carburized in a matrix of Pearlite.

ASB - Alloy Steel Base Adamite Rolls HARDNESS TREND



ADAMITE STEEL BASE ROLLS

QUALITY	HARDNESS ShC	METALLURGICAL COMPONENT					
		C%	Si%	Mn%	Cr%	Ni%	Mo%
ASB	38-45	1,0 - 1,6	0,4-1,0	0,4-0,9	0,5-1,4	0,4-1,2	Max 0,6
ASB	45-53	1,4 - 2,0	0,4-1,0	0,4-0,9	0,5-1,4	0,4-1,2	Max 0,6
ASB	53-58	2,2 - 2,6	0,4-1,0	0,4-0,9	0,5-1,4	0,4-1,2	Max 0,6

TYPICAL MECHANICAL BEHAVIOR

ROLL MATERIAL	HARDNESS ShC	Tensile Strength N/mm²	Bending Strength N/mm²	Microstructure
ASB	38-45	400 - 650	550 - 950	pearlite + carbide
ASB	45-53	400 - 650	550 - 950	pearlite + carbide
ASB	53-58	400 - 650	550 - 950	pearlite + carbide



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PREFERABLE ROLL QUALITIES FOR APPLICATIONS

Cast Iron Rolls	Mill Type	Group	Stand No
SG - P /FE 40-45	Bar Mill, Rod Mill, Light-Medium Section	Roughing Stands	Stand 1-2
SG - P /FE 45-50	Bar Mill, Rod Mill, Light-Medium Section	Roughing Stands	Stand 1-2-3
SG - P /FE 50-55	Bar Mill, Rod Mill, Light-Medium Section	Roughing Stands, preintermediate	Stand 2-3
SG - P 55-60	Bar Mill, Rod Mill, Light-Medium Section	Preintermediate, intermediate	Stand 3-4-5-6
SG - P 60-65	Bar Mill, Rod Mill, Light-Medium Section	Intermediate	Stand 6-7-8-9-10
SG - P 65-70	Bar Mill, Rod Mill, Light-Medium Section	Intermediate	Stand 9-10-11-12
SG-PX-Mo 46	Bar Mill, Rod Mill, Light-Medium Section	Roughing	Stand 1-2
SG - AC 50-55	Bar Mill, Rod Mill, Light-Medium Section	Preintermediate,	Stand 4-5
SG - AC 55-60	Bar Mill, Rod Mill, Light-Medium Section	Preintermediate, intermediate	Stand 6-7-8
SG - AC 60-65	Bar Mill, Rod Mill, Light-Medium Section	Intermediate, prefinishing	Stand 9-10-11-12
SG - AC 65-70	Bar Mill, Rod Mill, Light-Medium Section	Intermediate, prefinishing, finishing	Stand 11-12-13-14
SG - AC 70-75	Bar Mill, Rod Mill, Light-Medium Section	Finishing	Stand 14-15-16-17-18

Steel Rolls	Mill Type	Group	Stand No
ASB 38-45	Round -Flat Bar Mill, Light -Medium Section	Roughing Stands	Stand 1-2
ASB 45-53	Round -Flat Bar Mill, Light -Medium Section	Blooming, 2 High Reversing	Stand 1-2-3
ASB 53-58	Round -Flat Bar Mill, Light -Medium Section	Roughing Stands, preintermediate	Stand 2-3-4
GSB 40-45	Round -Flat Bar Mill, Light -Medium Section	2 High, 3 High Reversing, Blooming Mill	Stand 1-2
GSB 45-50	Round -Flat Bar Mill, Light -Medium Section	2 High, 3 High Reversing, Blooming Mill	Stand 1-2-3
ACS 40-45	Round -Flat Bar Mill, Light -Medium Section	Roughing Stands	Stand 1-2
ACS 45-50	Round -Flat Bar Mill, Light -Medium Section	Roughing Stands	Stand 1-2-3
ACS 50-55	Round -Flat Bar Mill, Light -Medium Section	Roughing Stands	Stand 3-4-5



- Thermal Stress, Fire Cracks, Heavy Duty
- Alternatives for acicular with its flexibility
- Help better finish surface and increase performance
- Heavy Duty Applications, MSM mills and Blooming

The Principles of Cooling

Cooling water pressure should be about 4 to 6 Bar for Long product mills.

A too high thermal gradient increases the risk of roll breakage (thermal stress).

Heat should not penetrate the roll and therefore, the roll surface should be cooled as soon as possible at the exit side of the rolling gap. The cooling water must never rebound of the roll surface. If the flow of cooling water is interrupted, there is chance of roll breakage due to thermal stress. Insufficient water used increases the roll temperature until it exceeds 100° C on the surface, when the heating up process accelerates resulting in unstable rolling conditions. Too much water should not be a problem. High volume and low pressure is essential. Over cooling may result in roll surface material becoming

more brittle and have a negative influence on the maximum bite angle possible.

More water must be supplied to the earlier passes than to the finishing passes.

In case of flat products, more cooling water concentrated in the centre part of the rolls than on the edges.

More water is applied to the grooves and anti collars of section mill rolls than to the rest portion of the roll.

When rolling non-symmetrical sections there are high axial forces which have to be compensated by the rolls. The collars which take these axial forces are highly loaded and stressed and show significant wear. The friction areas between the roll is should be lubricated, not by oil but by some grease of low viscosity (like graphite)





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