

Clean Steel

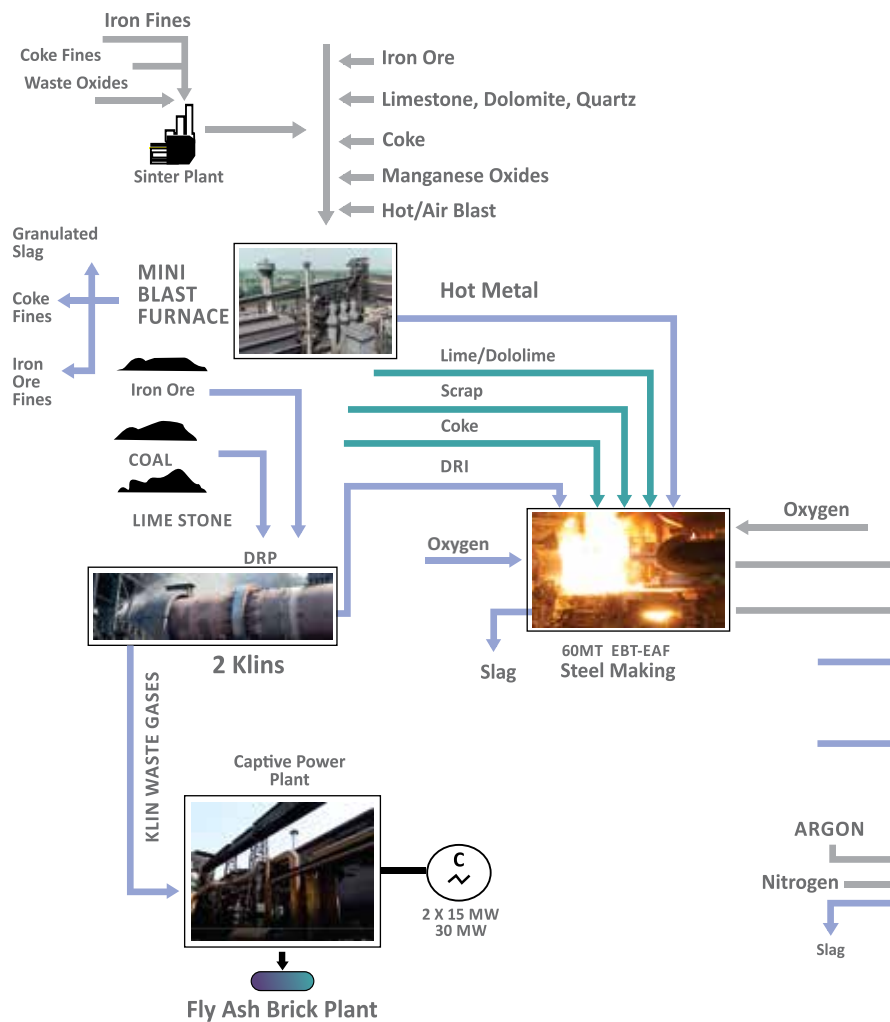
State of the Art Process Technology





Clean Steel

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SUNFLAG IRON & STEEL CO. LTD.

SUNFLAG IRON & STEEL CO. LTD. belongs to the Sunflag Group which has diversified business interests in Steel, Synthetic Yarns, Fabrics and non-woven textiles, spanning across the globe.

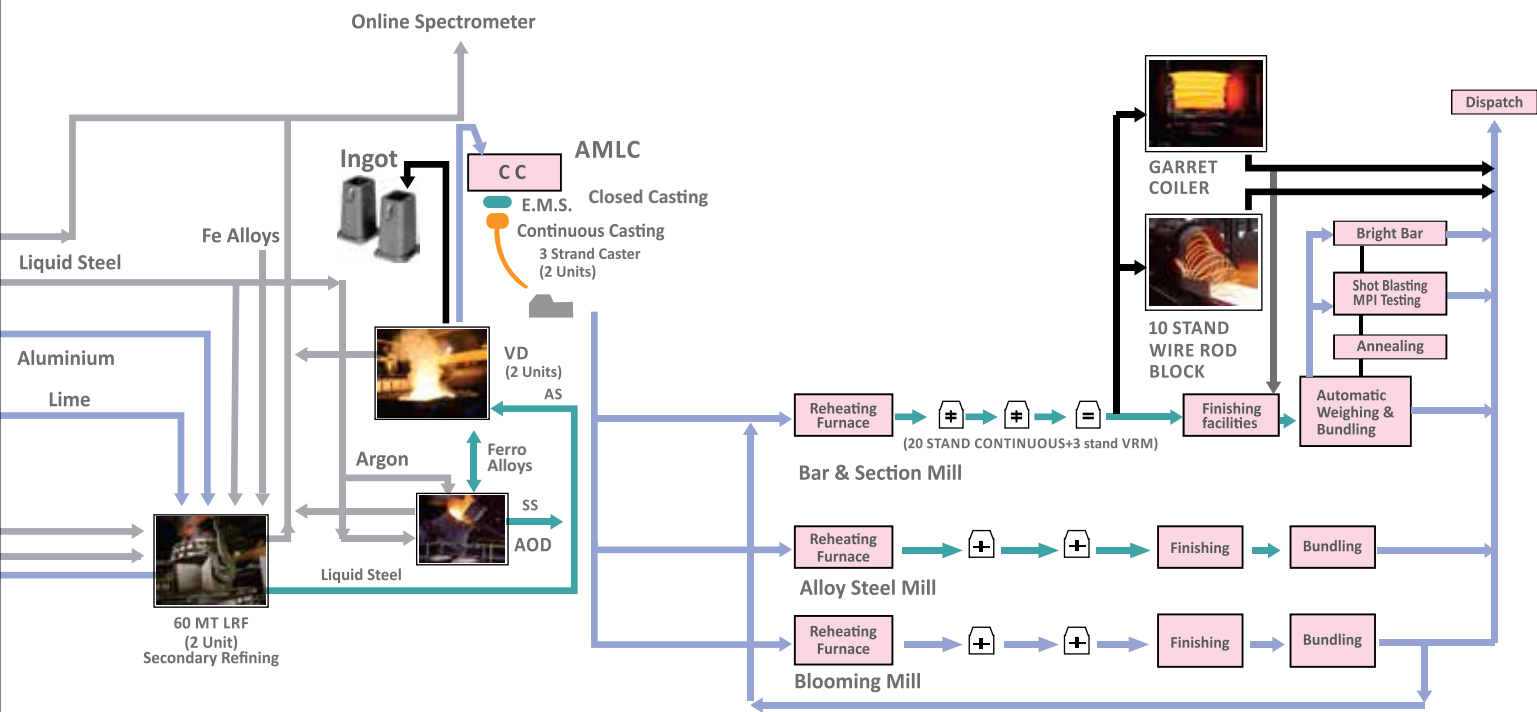
Steel being one of the core products for industrial development, Sunflag ventured into steel sector in 1989 with setting up of an integrated steel plant at Bhandara, near Nagpur using state of art technology in steel making. Today Sunflag operates a 0.5 million tones per annum capacity plant manufacturing high quality steel products including a wide range of special, alloy and stainless steels.

With a constant endeavour to enhance its technology and to be best in the industry, Sunflag has successfully embraced "Clean Steel Technology" transferred by Daido Steel, Japan and has developed steel with high cleanliness, low gas and low inclusion content that are used in critical applications.

With a vision on future, Sunflag has recently made investment in ESR / VAR / VIM and ventured in production of high-performance material & super alloys for aviation, space, defence, power sector and medical implants.

The guiding philosophy of SUNFLAG STEEL is to ever evolve while ensuring customer satisfaction at all the times. We have achieved success through sheer dint of hard work, support of our valued customers and with a passion to be the best!!

COMPUTERIZED PROCESS CONTROL
AT ALL STAGES OF MANUFACTURING



- DRP : Direct Reduction Plant

DRI : Direct Reduced Iron

EAF : Electric Arc Furnace

EBT : Eccentric Bottom Tapping
- VD : Vacuum Degassing

LRF : Ladle Refining Furnace

AOD : Argon Oxygen Decarburisation

EMS : Electro Magnetic Stirrer
- AMLC : Auto Mould Level Controller

VRM : Variable Reduction Mill

AS : Alloy Steel

SS : Stainless Steel

For downstream processing of hot rolled bars/coils, the following facilities are available

- Pickling / Phosphating

• Normalising

• Bell type SA furnace

• Hardening Tempering

• Spheroidize Annealing
- Solution Annealing

• Bright Bar manufacturing by peeling, drawing & centreless grinding

• Wire drawing

SUNFLAG PRODUCT RANGE

Ingot Size & WT	Billet/Bloom Size	Rolled Product		Bright Bar	
		Shape	Size range	Type	Size range
810x610x1970mm 7.2MT	130 x 130mm	Straight length round	15-350mm dia	Peeled & ground bars	5 - 100mm dia
637x480x1700mm 4.2MT	160 x 160mm	Straight length Hexagons	15.5-42mm A/F		
500x402x1700mm 2.7MT	210 x 232mm	Wire rod rounds	5.5-38mm	Drawn & ground bars	6 - 34mm dia
412x323x1700mm 1.8 MT	240 x 280mm	Wire rod hexagon	13.5-25.5 A/F		
	150 x 320mm	Round corner squares	40-350mm	Drawn & SAPPD wires	5 -30mm
	280 x 320mm	Flat (Width/Thickness)	50-150/5-34mm		
Forged Products	Forged Rounds : 160 to 500mm dia.				
	Forged Blocks : 350 (T) X 600(W) X 5460 (L)				

OEM APPROVALS



MAJOR TIER-1 CUSTOMERS



COMPETITIVE ADVANTAGE OF SUNFLAG PRODUCT

S.No.	FACILITIES	PRODUCT STRENGTH
1	Inhouse manufacturing facility for DRI and Pig Iron	Reliable and dependable supplier Consistency in input material quality
2	100% virgin material in charge mix	Products with very low tramp elements and free from radioactive contamination
3.	Steel making through process control computers	Close chemistry range with high repeatability
4.	Vacuum Degassing	Reduction in gas level & improved cleanliness of steel
5.	Continuous caster equipped with Mould Electromagnetic stirrer (EMS)	Improved cleanliness Free from central segregation, piping, central porosity and minimum columnar structure, enhanced mechanical properties, Controlled Hardenability band
6.	100% close casting facility from ladle to tundish and tundish to Mould	Cleaner steel due to absence of re-oxidation
7.	Automatic mould level controller	Ensure high integrity of chill zone in the cast billet / bloom assuring high degree of surface and subsurface soundness
8.	Auto mould powder feeder	Improved surface quality of billet
9.	Foot EMS	Reduction in carbide segregation in bearing steel
10.	Automatic Slag Detector	Improved cleanliness of steel
11.	Ingot Casting Facility	To produce high alloy steel & rolled product with high reduction ratio
12.	Duplex / Triplex process for stainless steel	Very low residual gas levels in stainless steel
13.	Computer control heating and furnace oxygen atmosphere in walking beam reheating furnace	Uniform temperature in billet, minimum decarburization in rolled product
14.	Sophisticated PLC controlled 20 stand continuous mill with water quenching facility	Good size control for defect free rolling by controlling inter stand tension
15.	Danielli make 3 stand VRM	VRM ensures close dimensional tolerance of 1/4th of standard DIN 1013 or 60% of IS3739. Assurance of minimum size variation along the length of bar. As per customer's urgency, size changing flexibility helps in minimising changeover time.
16.	Danielli 10 stand block mill facility	Good size control and effective temperature control in finish product and uniform control cooling.
17.	Cooling bed fully covered for controlled cooling of rolled product	Controlled "as rolled hardness" and controlled grain size of rolled products
18.	Rake type cooling bed	Assured straightness of rolled products
19.	Cold shear equipped with mechanical guage control	Fixed length product
20.	Cut length optimization through cooling bed computers	Minimization of short length generation
21.	Marketing offices & stock yard are connected with plant SAP	Effective monitoring of progress on order execution
22.	Sunflag online posting order on website and app	Customer can track order status at any time on app.

QMS CERTIFICATION AND APPROVALS

The guiding Philosophy in Sunflag Steel is enhancing customer satisfaction through continual improvement. To continuously achieve higher level of performance in these areas Sunflag had adopted and effectively implemented various Quality Management system.

QMS Standards Certified	Standard Scope	Certification Body
ISO 9001	Quality Management System	UL DQS, Germany
IATF 16949	Global Automotive Quality Management Systems	UL DQS, Germany
ISO 14001	Environment Management Systems	TUV Nord, Germany
ISO 45001	Occupational Health & Safety Management Systems	TUV Nord, Germany
AD 2000 - Merkblatt WO / PED	QA System for Material Manufacturer as per Pressure Equipment Directives 97/23/EC & AD 2000 - Merkblatt WO	TUV Nord, Germany
NABL (National Accreditation Board for testing & Calibration Laboratoies)	Sunflag Chemical & Mechanical Laboratories certified by NABL.	NABL India

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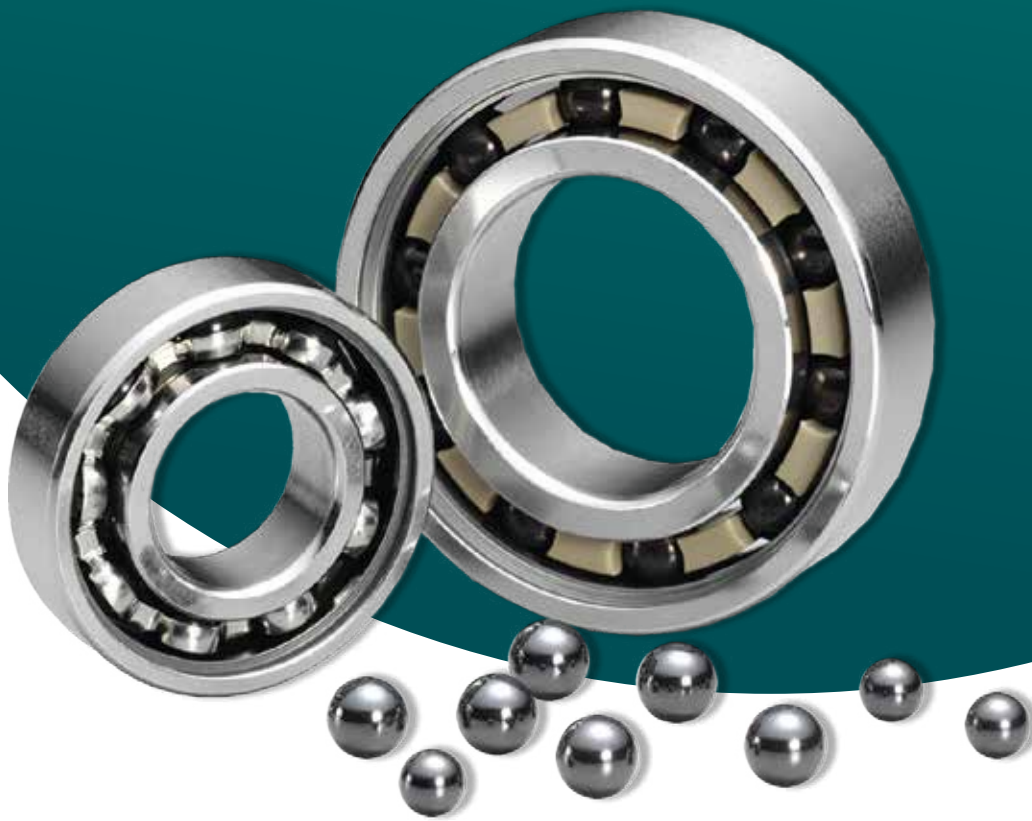
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BEARING STEELS



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Bearing Steels are special class of low alloy steels, typically with 1% Carbon and 1.4% Chromium. In special cases, Manganese and Molybdenum are also added. These steels find applications in automobiles, railways, earth moving, defence, aircraft, power generations, compressor and other moving machinery parts. In view of the continuous fatigue strain during service, this steel and its components demands high level of process discipline during manufacturing.

The components for these applications are manufactured either through hot forging route or through Spheroidized annealing followed by cold forging route. At Sunflag, all the necessary facilities for manufacturing and testing of bearing steel grades have been established. Various controls are exercised during manufacturing, right from selection of raw materials and ferro alloys required to meet the stringent quality parameter of various customer.

- **Fatigue Life**
- **Uninform heat treatment response**
- **Compact Structure with uniform grain flow and fine grain size imparting high impact toughness**

Inspection activities before dispatch are designed to address the verification of all the quality requirements of bearing steels. Any deviation observed during production process and quality testing is recorded and analysed for taking suitable corrective and preventive actions to meet the quality requirements of this critical steel grade.



SIZES AND CONDITION OF SUPPLY

No.	SIZE (mm)	SHAPE	SUPPLY CONDITION
1	15 to 160 dia.	Straight Length Round	Hot Rolled, Annealed
2	12 to 60 dia.	Straight Length Round	Stress Relief / Spherodised Annealed
3	10 to 56 dia.	Straight Length Round	Spherodised Annealed, Peeled and Ground
4	5.5 to 38 dia.	Wire Rod Rounds	Spherodised Annealed

More shapes, sizes with combination of different supply condition can be developed as per specific requirement by customers

INTERNATIONAL SPECIFICATIONS OF BALL BEARING STEELS

No.	Country	Grade	Chemistry						
			C	Mn	Si	P	S	Cr	
1	U.S.A.	SAE 52100	Min Max	0.98 1.10	0.25 0.45	0.15 0.30	- 0.025	- 0.025	1.30 1.60
2	Germany	100Cr6	Min Max	0.95 1.10	0.25 0.45	0.15 0.30	- 0.030	- 0.030	1.30 1.60
3	India	103Cr2	Min Max	0.95 1.10	0.25 0.45	0.15 0.35	- 0.025	- 0.025	1.40 1.60
4	Japan	SUJ 2	Min Max	0.95 1.10	0.50 Max	0.15 0.35	- 0.025	- 0.025	1.30 1.60
5	Britain	EN31	Min Max	0.90 1.20	0.30 0.75	0.10 0.35	- 0.050	- 0.050	1.00 1.60

CERTIFICATION OF QUALITY

Following important quality features are tested and certified on all Bearing heats made at Sunflag.

• Chemistry	As per international standards with low tramp levels (low titanium)
• Gases	O2, N2 and H2
• Internal Soundness	As per ASTM E-381
• Dimensional Tolerances	As per IS3739: Grade 1
• Decarburization Level	Less than 1% of diameter
• Surface quality	100% surface of bar inspected through automatic MFLT / MPI
• Non – Metallic Inclusions	As per ASTM E45 A and B: 1.0 (max), C: 0.0, D: 0.5 (max)
• Microstructure (Banding)	As per SEP-1520 DIN Standard Chart

Any other special testing requirement found desirable by the customer can be satisfied



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***COLD FORGING
QUALITY STEELS***



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Material quality requirements for cold heading steels.

- Excellent surface quality ensuring zero defect situation so that forged components have no defects
- Good control over ovality to ensure smooth forging process.
- Good control over mechanical properties such as tensile strength and reduction are to ensure proper cold forgeability and productivity
- Completely descaled surface to avoid forging defects such as scale pits and resultant surface roughness.
- Suitable metallurgical structure to ensure proper machinability level.
- Good and uniform response to heat treatment since the components are always treated in bulk.

Category	SAE/AISI	DIN	IS	EN
Low Carbon & Medium Carbon Grades	1006	-	-	-
	1008	-	-	-
	1010	CK-10	C10	-
	1012	CK-10	C10	EN2A
	1015	CK-15	-	EN32B
	1018	-	C-15Mn75	EN2C
	1020	C-20	C-25Mn75	EN3A
	1025	-	-	-
	1040	-	-	-
	1045	-	-	-
Carbon Manganese	1541	36Mn7	37C15	EN15
Boron Grades	10B21	-	21C10BT	-
	15B25	-	26C10BT	-
	15B41	-	-	-
Crome-Moly	4135	-	-	-
	4140	-	40CR ₄ MO ₃	EN-19

Dimensional Specifications (As rolled)*

Diameter Range	Ovality	Permissible Tolerance
5.5-9.0 mm	0.2 mm max	± 0.15 mm
10-25 mm	0.3 mm max	± 0.20 mm
26-36 mm	0.4 mm max	± 0.30 mm

* In specific cases stricter specifications can be met.

Particulars	Block Route (5.5 mm to 11 mm dia)	Garret Route (12 mm to 36 mm dia)
Coil Weight	1500 kgs max	1500 kgs max
Coil Inner Diameter	800 mm	800 mm
Coil Outer Diameter	1200 mm	1500 mm
Coil Height	900 mm	1100 mm
Coiling Direction	Clockwise	Clockwise
Binding	Strap	Strap

Wire Rods Rolled Sizes :

Sizes (mm)
5.5, 6.0, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10, 11, 12, 13, 14, 15, 16, 16.3, 17.3, 18.5, 20, 21, 22, 23, 24, 25.4, 26, 27.5, 28, 30, 32, 33, 34, 36, 38 mm dia.



CHEMICAL COMPOSITIONS OF TYPICAL COLD FORGING QUALITY GRADES :

CARBON STEELS

Sr.	Grade	C%	Si%	Mn%	S% Max	P% Max	Cr%	B%	Mo%	Pb%	Ni%	Others
1	AISI 1006	0.06 Max	0.10 max	0.25- 0.40	0.050	0.040						
2	AISI 1008	0.10 max	0.10 max	0.30- 0.50	0.050	0.040						
3	AISI 1010	0.08- 0.13	0.10 max	0.30 0.60	0.050	0.040						
4	VS 14250	0.10- 0.14	0.13 max	0.21- 0.45	0.040	0.030						
5	VS 13111	0.07- 0.11	0.07 max	0.20- 0.40	0.040	0.030						
6	AISI 1015	0.13- 0.18	0.15 max	0.30- 0.60	0.050	0.040						
7	AISI 1018	0.15- 0.20	0.05- 0.10	0.60- 0.90	0.050	0.040						
8	EN1APb	0.08- 0.15	0.10 max	0.85- 1.15	0.26- 0.35	0.040 0.090				0.15- 0.35		
9	EN1A	0.07- 0.15	0.10 max	0.80- 1.20	0.20- 0.30	0.060 max						

BORON STEELS

Sr.	Grade	C%	Si%	Mn%	S% Max	P% Max	Cr%	B%	Mo%	Pb%	Ni%	Others
1	SAE/AISI 10B21	0.18- 0.23	0.30 max	0.80- 1.10	0.030	0.030	0.10- 0.20	0.0005- 0.003				
2	AISI 15B25	0.23- 0.28	0.30 max	0.90- 1.30	0.030	0.030	0.10- 0.20	0.0005- 0.003				
3	19MnB4M	0.20- 0.25	0.15- 0.30	0.80- 1.10	0.030	0.030	0.30- 0.40	0.0008- 0.003				
4	SAE/AISI 15B41	0.36- 0.44	0.15- 0.30	1.35- 1.65	0.030	0.030	0.10- 0.20	0.0005- 0.003				
5	AISI 10B36M	0.34- 0.39	0.15- 0.30	0.80- 1.10	0.030	0.030	0.20- 0.40	0.0006- 0.003				
6	DIN 36CrB4	0.34- 0.38	0.10 max	0.60- 0.90	0.015	0.015	0.90- 1.20	0.0015- 0.005				
7	51B37	0.35- 0.40	0.20- 0.35	0.35- 0.45	0.025	0.025	0.95- 1.15	0.0005- 0.003	0.040 max		0.10 max	

ALLOY STEELS

Sr.	Grade	C%	Si%	Mn%	S% Max	P% Max	Cr%	B%	Mo%	Pb%	Ni%	Others
1	SCM 415 H	0.12- 0.18	0.15- 0.35	0.55- 0.90	0.03	0.03	0.85- 1.25		0.15- 0.35		0.25 max	
2	SCM 435	0.32- 0.39	0.15- 0.30	0.55- 0.90	0.03	0.03	0.80- 1.25		0.15- 0.35		0.25 max	
3	AISI 4135	0.33- 0.38	0.15- 0.30	0.70- 0.90	0.04	0.035	0.80- 1.10		0.15- 0.25		0.25 max	
4	AISI 4140	0.38- 0.43	0.15- 0.30	0.75- 1.00	0.04	0.035	0.80- 1.10		0.15- 0.25			
5	AISI 5140	0.38- 0.43	0.15- 0.30	0.70- 0.90	0.04	0.035	0.70- 0.90					
6	AISI 1541	0.36- 0.44	0.15- 0.30	1.35- 1.65	0.05	0.04						



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ENGINE VALVE STEELS

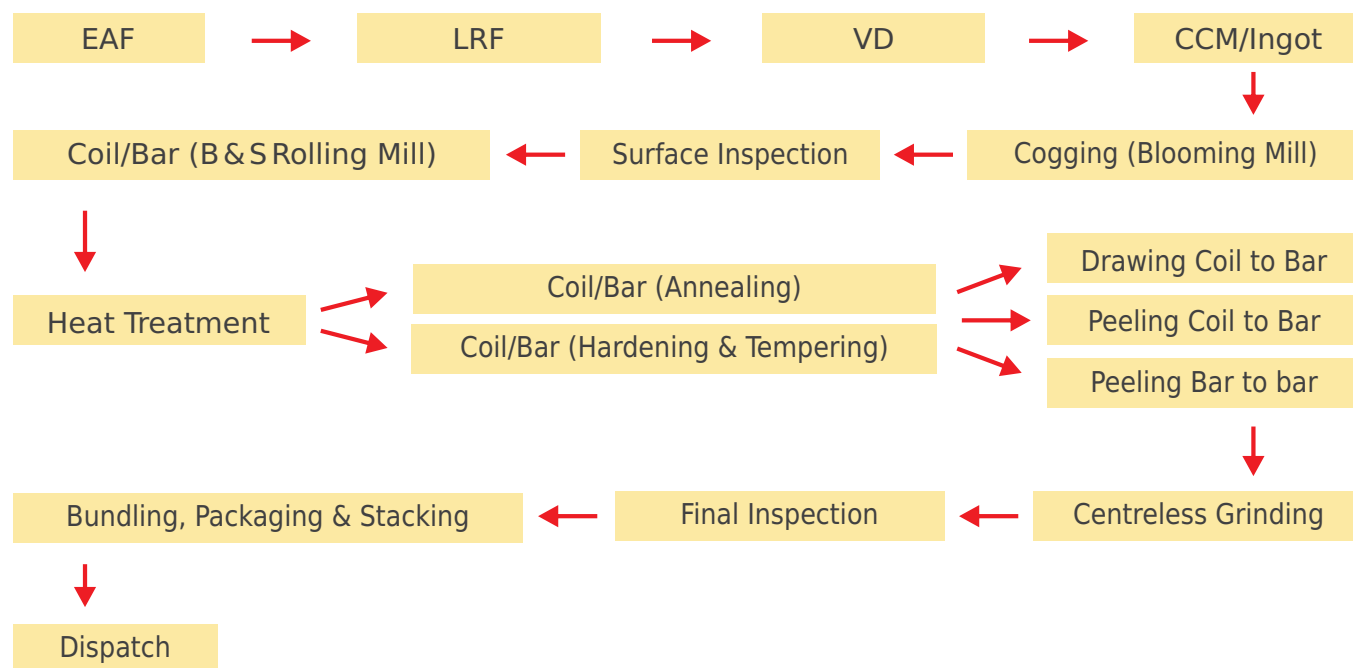
FOR INLET & EXHAUST VALVE OF I. C. ENGINE



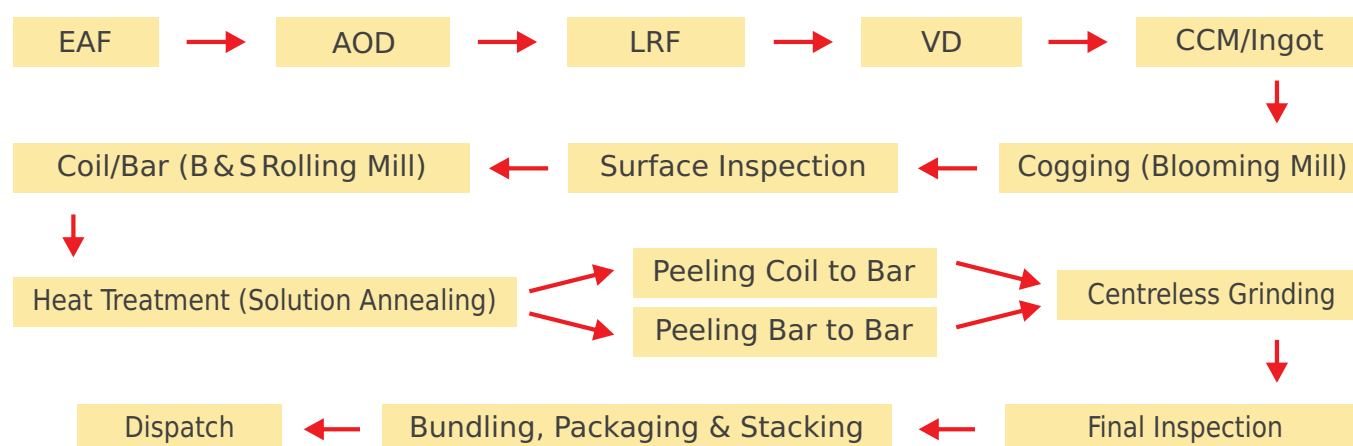
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MANUFACTURING ROUTE OF ENGINE VALVE STEELS

Martensitic Grades



Austenitic Grades



INSPECTION AND TESTING

- Surface Quality by M.P.I/ Zygo/ECT
- Internal Soundness by Ultrasonic Testing • Dimension & Length Controls
- Metallurgical Testing (Hardness, Microstructure, Inclusion, Grain Size etc.)

ENGINE VALVE STEELS



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International Standards of Valve Steels

DIN	W.Nr	BS	JIS	SAE	IS
X45CrSi9-3	1.4718	EN-52	SUH-1	HNV-3	X45Cr9Si3
-	-	-	SUH-11	-	X50Cr9Si2
X40CrSiMo10-2	1.4731	-	SUH-3	HNV-1	X40Cr11Si2Mo1
X85CrMoV18-2	1.4748	-	-	-	-
X55CrMnNiN20-8	1.4875	21-2N	-	EV-12	X55Cr21Mn8Ni2N
X53CrMnNiN21-9	1.4871	21-4N	SUH-35	EV-8	X53Cr22Mn9Ni4N
-	-	21-12N	SUH-37	EV-4	X20Cr21Ni12N
X50CrMnNiNbN21-9	1.4882	21-43N	-	-	-
X33CrNiMnN23-8	1.4866	23-8N	-	EV-16	X33Cr23Ni8Mn3N
NiCr16Fe7TiAl Inconel 751	2.4694	-	SUH-751	J-775	-

Chemical Composition

Grades	C	Mn	Si	S max	P max	Cr	Mo	Ni	W	N	Nb+Ta	Cu	Ti	Al	Fe	V
X45CrSi9-3/(EN-52)	0.40-0.50	0.60 max	2.70-3.30	0.030	0.040	8.00-10.00	-	0.50 max	-	-	-	-	-	-	-	-
SUH-11	0.45-0.55	0.60 max	1.00-2.00	0.030	0.030	7.50-9.50	-	0.60 max	-	-	-	-	-	-	-	-
SUH-3	0.35-0.45	0.60 max	1.80-2.50	0.030	0.030	10.00-12.00	0.70-1.30	0.60 max	-	-	-	0.30 max	-	-	-	-
X85CrMoV18-2	0.80-0.90	1.50 max	1.00 max	0.030	0.040	16.50-18.50	2.00-2.50	-	-	-	-	-	-	-	-	0.30-0.60
21-2N	0.50-0.60	7.00-10.00	0.25 max	0.030	0.045	19.50-21.50	-	1.50-2.75	-	0.20-0.40	-	-	-	-	-	-
21-4N	0.48-0.58	8.00-10.00	0.25 max	0.030	0.045	20.00-22.00	-	3.25-4.50	-	0.35-0.50	-	-	-	-	-	-
21-12N	0.15-0.25	1.50 max	0.70-1.25	0.030	0.050	20.00-22.00	-	10.50-12.50	-	0.15-0.25	-	-	-	-	-	-
21-43N	0.45-0.55	8.00-10.00	0.45 max	0.030	0.045	20.00-22.00	-	3.50-5.50	0.80-1.50	0.40-0.60	1.80-2.50	-	-	-	-	-
23-8N	0.28-0.38	1.50-3.50	0.50-1.00	0.030	0.045	22.00-24.00	0.50 max	7.00-9.00	0.50 max	0.25-0.35	-	-	-	-	-	-
Inconel 751	0.03-0.10	0.50 max	0.50 max	0.015	0.015	14.0-17.0	0.05 max	Base	-	-	0.70-1.20	0.50 max	2.00-2.60	1.10-1.35	5.00-9.00	-

PRODUCT DETAILS

Size Range :	
Bright Bars	Dia 5.00 mm to 100 mm
Hot Rolled Annealed Wire Rod	Dia 5.50 mm to 38 mm
Hot Rolled Annealed Bars	Dia 15 mm to 160 mm
Standard Length	4000 +50/-00 mm or as per Customer Specified Length
Supply Conditions :	
Dimensional Tolerance: ISO h9, h11, + 0.05/-0.00, +0.05/-0.05, + 0.10 & Black Bar as per IS-3739	
Martensitic Grades	Hot Rolled, Annealed or Hardened & Tempered
	Drawn & Ground, Peeled & Ground and Black bar
Austenitic Grades	Hot Rolled, Solution Annealed, Peeled & Ground and Black Bar

MECHANICAL PROPERTIES

Grade	Condition	Yield Strength N/mm ²	Tensile Strength N/mm ²	% Elongation min	% Reduction in Area min	HRC
EN-52/X45CrSi9-3	H & T	700	900-1100	14	40	25-35
SUH-11	H & T	700	900-1100	14	40	25-35
SUH-3	H & T	700	900-1100	14	40	25-35
X85CrMoV18-2	H & T	800	1000-1200	7	12	25 min
21-2N	Solution Annealed	550	900-1150	8	10	30-40
21-4N	Solution Annealed	580	950-1200	8	10	30-40
21-12N	Solution Annealed	400	800	35	45	23-25
21-43N	Solution Annealed	580	950-1150	10	12	30 min
23-8N	Solution Annealed	550	850-1100	25	30	25 min
Inconel 751	Solution Annealed	630-850	1100-1300	12	20	32-40



FORGING QUALITY INGOTS



Steel
State of the Art Process Technology



FORGING QUALITY INGOTS

SALIENT FEATURES OF INGOTS

With Modern facilities already existing for refining, degassing and continuous casting of steel, Sunflag considered it is important to widen the current product mix to cater the needs of specific application segments where ingots are preferred over continuous cast blooms. Accordingly, Sunflag has commissioned new setup for casting Wide End Up – Bottom Poured Ingots. Our ingot casting facility is capable of producing steel for critical applications like Tool & Die, Railways, Defence and Aerospace sector.

INGOT DIMENSION - PHASE 1

Ingot Size (mm)	Ingot Weight, MT
810x610x1970mm	7.2MT
637x480x1700mm	4.2MT
500x402x1700mm	2.7MT
412x323x1700mm	1.8 MT



GRADES

- Regularly Carbon, Cr, Cr-MO & Cr-Ni-Mo grades, as per popular standards like AISI, BS, EN, DIN, GOST, JIS, etc.
- Also against specific TDSs of Customers.

STAINLESS STEEL GRADES

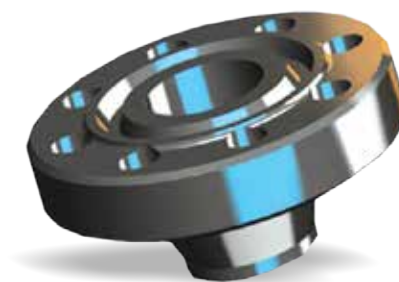
- AISI 410, 420 - Majority for export market (indirect).
- X22, X20, X5, X18, X19 - Energy (Turbine Blades)
- AISI 304, 316, 304L - Defence, Aerospace

OTHER VALUE ADDED STEEL GRADES

- En36C, En39B, AMS 6418 - Mining / Boring Tools
- En52, 21-4N, SUH 11 - Valve stems
- Din 1.2174, H11, H13 - Die Blocks
- En41B - Screw / Barrels for injection Moulding M/c.

Rolled Products from Ingots			
Straight Length Rounds		Round Corner Squares	
Single Rolling	200 to 250mm dia.	Single Rolling	160 to 340mm RCS
Double Rolling	50 to 180mm dia.	Double Rolling	50 to 150mm RCS

- Slow cooling pits are available for control cooling of rolled product.
- Sufficient Top (8%) & bottom (2%) discards are given on rolled bars.
- We guarantee a Minimum Reduction ration of 6:1 for Round products.



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UNIQUE ADVANTAGES OF SUNFLAG INGOTS

- Homogenized chemistry within narrow ranges
- Treatment of liquid steel through Vacuum Degassed (VD) / Argon Oxygen Decarburization (AOD)
- Mould powder bags are hung in ingots for better surface finish of ingots (1.5Kg powder / MT of liquid metal)
- Argon flushing of trumpet before cast start
- Argon shrouding of metal flow from ladle to trumpet
- Bricks & Hot Tops preheated for 24hrs at 200°C
- Uphill teaming with central trumpet, with high alumina runner bricks
- Specially designed moulds for ingots to control micro-segregation
- Dressing of ingots before reheating
- Reheating furnace with soaking capacity of 16 ingots



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***FORGING
QUALITY STEELS***

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Forging Quality Steels are widely used in automobile, defence, railways and various manufacturing industries. Automobile industry is the single largest user of forgings. Components produced through forging are generally used in the transmission systems of an automobile where large forces get transferred between different parts, hence they are of vital importance.

FORGING QUALITY STEELS

Quality requirements for Forging Quality Steels

- Close control on chemistry
- Freedom from harmful internal & surface defects
- Dimensional tolerance IS 3739 grade 1
- High degree of cleanliness
- Fine and Uniform Grain Size

These steels are widely used in automobile, defence, railways and various manufacturing industries.

Gears | Axles | Crankshaft | Camshaft
Connecting Rod | Pinions | Crown Wheels

SIZES AND CONDITION OF SUPPLY

Supply Condition	Shapes	Sizes
Hot rolled, Hot rolled annealed, Peeled & ground, Peeled & reeled, Drawn	Round Bars	15 to 350mm
	Round Corner Square Bars	50 to 350mm

Dimensional Tolerance as per IS 3739 specification

CERTIFICATION

Standard Fetures

- Chemistry
- Internal Soundness (Macro Quality)
- Cleanliness Levels (Inclusion)
- Grain Size
- Hardness
- Magna-flux
- Microstructure
- Anti Mix-up Test

In Addition to the standard features, following additional tests can be performed and certified as per customer's requirement

- Ultrasonic Test
- Step Down Test
- Blue fracture Test
- Jominy Hardenability
- Mechanical Properties - Tensile, Elongation, Reduction in Area, Hardness (on heat treated samples.)
- Impact Test (at desired temperatures -80°C to Room Temperature)
- Any other special test as per end application of the product



Clean Steel
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TYPICAL FORGING QUALITY STEEL GRADES

Classification	IS	EN	DIN	AISI / SAE	JIS
Plain Carbon	15C8, 35C8 45C8	EN-8, EN-9 EN-32 B	CK-15, CK-30 CK-45, C35 Pb K C15 Pb K, CK-35 CK-60	1015, 1026 1030, 1135, 1040 1045, 1050 1055, 1060, 1080	S43C, S45C S48C, S55C, S35C, S53C
Carbon Manganese	47Mn6, 37Mn6, 37Mn2, 37C15, 20Mn2	EN-14A, EN-14B EN-15, EN-15B	40Mn4, 28Mn6, 27Mn2	1524, 1526, 1541, 1041F	SMn420H, SMn430H SMn433H, SMn435H SMn 443H
Plain Chrome	40CrI, 50Cr4	EN-18 EN-207	34Cr4, 37Cr4 41Cr4	5120, 5140 5145, 5150 5160	SCr 420H, SCr415
Chrome Manganese	16Mn5Cr4 20Mn5Cr5	-	16MnCr5, 20Mn5Cr5	-	-
Chrome Moly	40Cr1Mo28	EN-19	42CrMo4	4118, 4130, 4135, 4140, 4145, 4150 A182 F12 C1 II	SCM 415, SCM 420H SCM 435H, SCM 440H
Chrome Nickel	40CrNi6 16Ni3Cr2	EN-36A EN-36B	15CrNi6, 16CrNi4 18CrNi8, 20CrNi4	- -	-
Chrome Nickel Moly	20NiCr2Mo2	EN-353, EN-354, EN-355, EN-36C EN-24, 845H17, 822H17	17CrNiMo6 30CrNiMo3 34CrNiMo6	4340, 8620 8640, 8627 8615, 8617	SNCM220H SNCM420H
Moly-Manganese	35Mn6Mo3 35Mn6Mo4	EN-16 EN-17	-	4027H 4037H	-
Ball Bearing	103Cr2	EN-31	100Cr6	SAE52100	SUJ2
Micro Alloyed	38MnSiVS5	-	-	-	-



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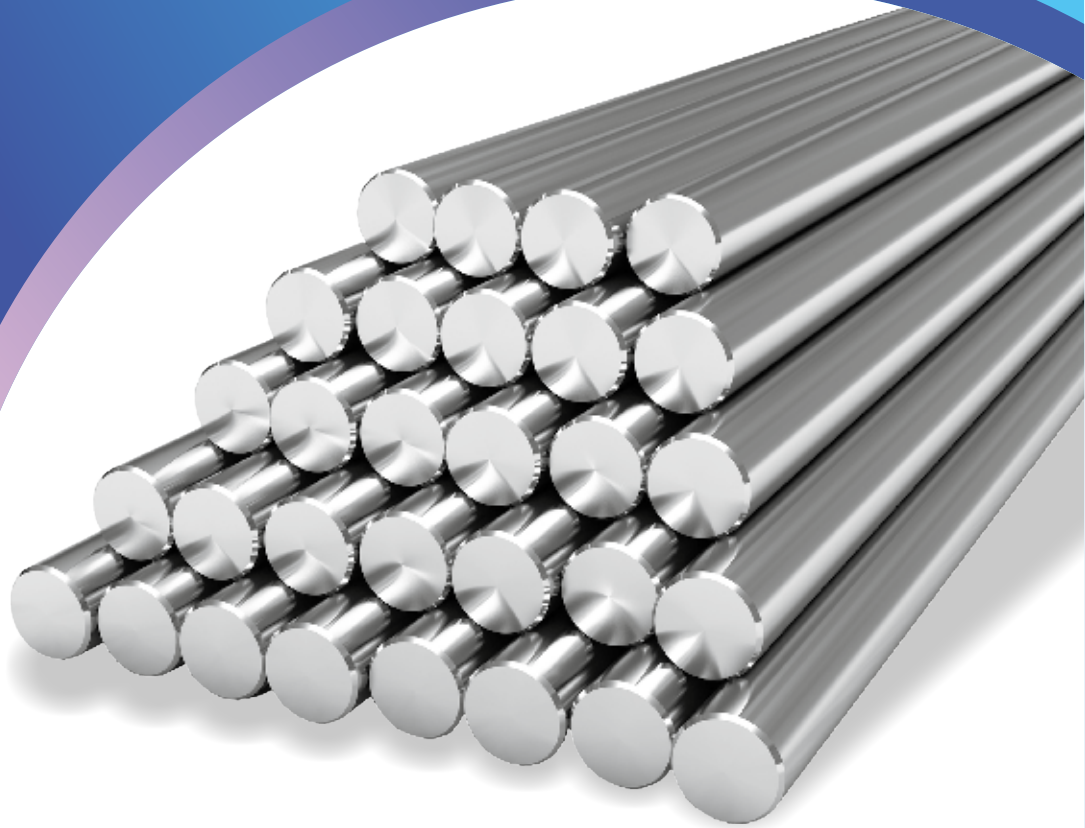
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FREE CUTTING STEELS



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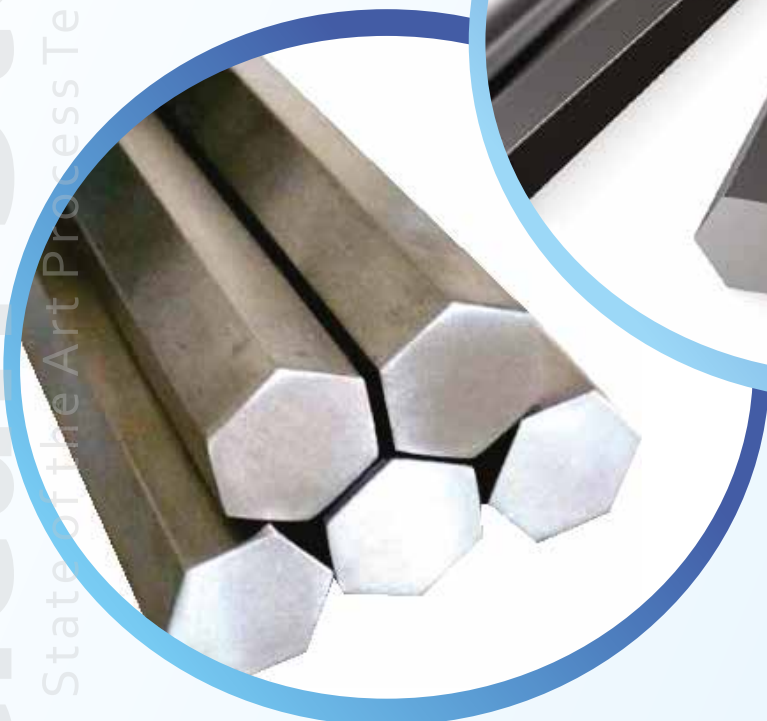
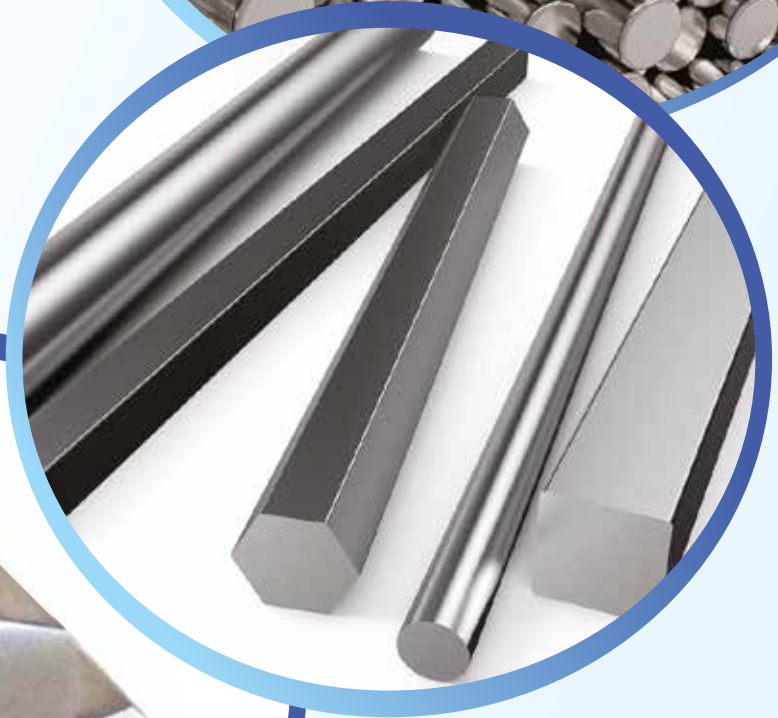
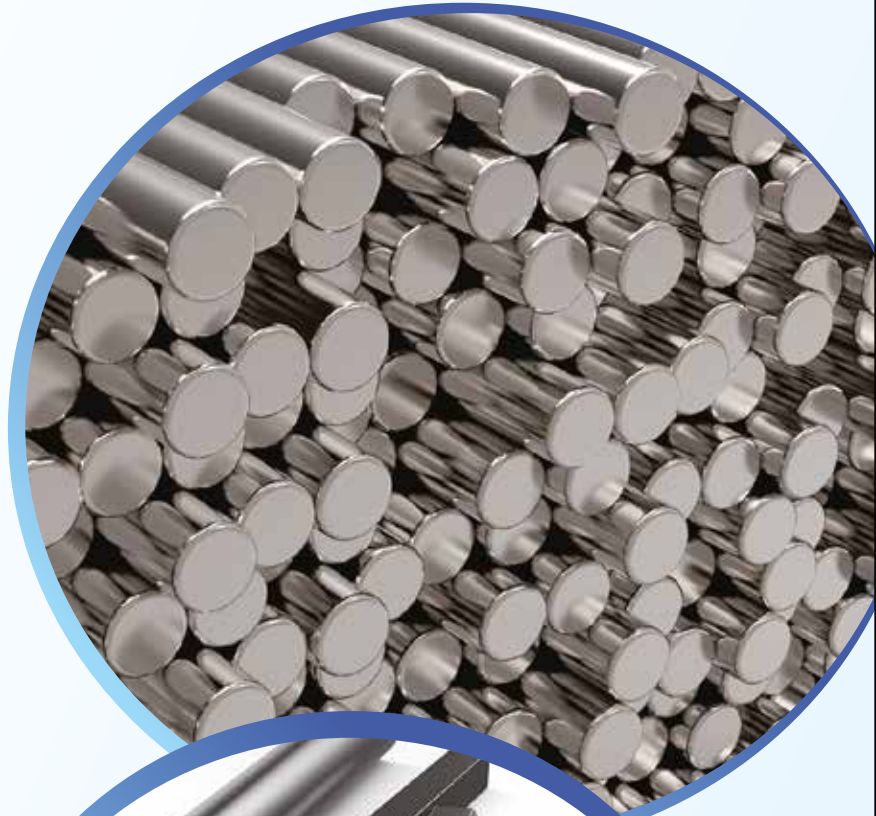
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FREE CUTTING STEELS



QUALITY REQUIREMENT FOR FREE CUTTING STEELS

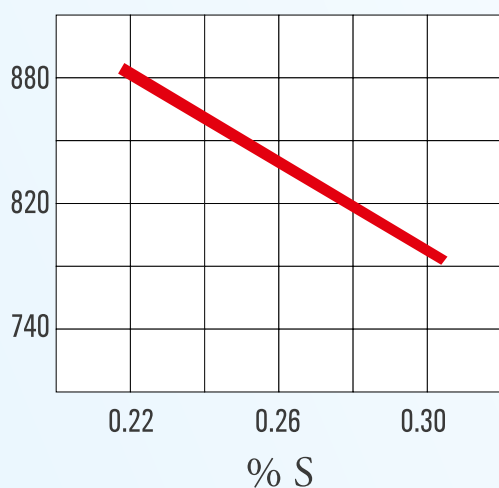
- Uniform distribution of MnS
- Hardness
- Microstructure
- Dimensional quality
- Straightness



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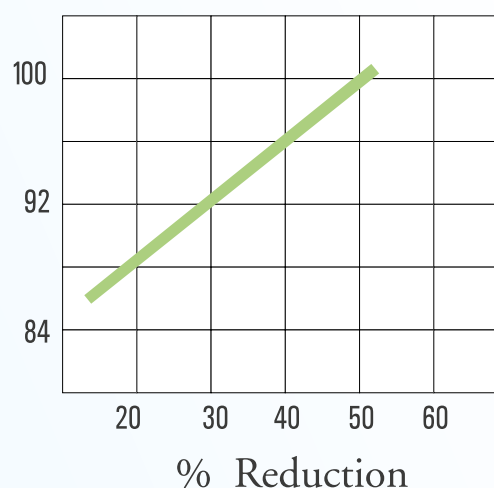
TYPICAL CO-RELATION OF MACHINING PARAMETERS WITH ELEMENTAL LEVELS

Machining (Force) Torque



Effect of 'S' content on the machining torque.

Surface Hardness HB



Free machining steels are generally used after cold processing such as drawing, peeling, grinding etc. The extent of cold work employed in converting black bar of free machining steel into bright bar, decides its surface hardness, which in turn is responsible for its machining performance.

CERTIFICATION OF QUALITY

- Surface condition : Free from defects
- Macro etch test (ASTM: E-381)
- Spark/Spectral test - 100% bars
- As rolled hardness - Free Cutting Steels \leq 150 BHN
- Inclusion rating - (ASTM - E-45) 2.5 max each - B, C,D
- Micro structure - Sulphide morphology (Aspect Ratio)

INTERNATIONAL SPECIFICATIONS OF FREE CUTTING STEELS

Country	Grade	Chemistry	C	Mn	Si	P	S	Pb
IS (Indian)	11C10S25	Min Max	0.08 0.15	0.80 1.20	- 0.10	- 0.06	0.20 0.30	- -
BS (British)	220M07	Min Max	- 0.15	0.90 1.30	- -	- 0.07	0.20 0.30	- -
EN (British)	E1-Pb	Min Max	0.07 0.15	0.80 1.20	- 0.10	0.040 0.090	0.26 0.35	0.15 0.35
AISI (American)	12L14	Min Max	- 0.15	0.85 1.15	- 0.10	0.04 0.09	0.26 0.35	0.15 0.35
JIS (Japanese)	SUM24L	Min Max	- 0.15	0.85 1.15	- 0.10	0.04 0.09	0.26 0.35	0.10 0.35
DIN (German)	9SMn28K	Min Max	- 0.16	0.86 1.35	- 0.06	- 0.11	0.24 0.36	0.15 0.35
ASTM (American)	1215	Min Max	- 0.09	0.75 1.05	- -	0.040 0.090	0.260 0.350	- -

INTERNATIONAL SPECIFICATIONS OF SEMI FREE CUTTING STEELS

Country	Grade	C	Mn	Si	P	S	A1
DIN (German)	SU1A28	-/0.18	0.70/1.05	-/0.45	-/0.060	0.08/0.15	0.020/0.050
	R10S10U	-/0.18	0.70/1.05	-/0.45	-/0.060	0.08/0.15	0.020/0.050
	45S20U	0.39/0.53	0.66/1.15	0.07/0.33	-/0.065	0.15/0.28	-
SAE (American)	SAE1117	0.14/0.20	1.00/1.30	-	0.040 Max	0.080/0.130	-
	SAE1118	0.14/0.20	1.30/1.60	-	0.040 Max	0.080/0.130	-
	SAE1137	0.32/0.39	1.35/1.65	-	0.040 Max	0.080/0.130	-
	SAE1141	0.37/0.45	1.35/1.65	-	0.040 Max	0.080/0.130	-
	SAE1144	0.40/0.48	1.35/1.65	-	0.040 Max	0.240/0.33	-
EN (British)	EN8M	0.35/0.45	1.00/1.30	0.25 Max	0.060 Max	0.120/0.200	-

SIZES AND CONDITIONS OF SUPPLY

Condition of Supply	Shapes	Sizes
1. Black	Hex Round WRD	15.5 mm - 38 mm A/F 5.5 mm - 100 mm dia 5.5 mm - 38 mm dia
2. Drawn	Hex Round	14 mm - 36 mm A/F 10mm - 50 mm dia
3. Peeled & Ground	Round	10 mm - 90 mm dia



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MICROALLOYED STEELS

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MICROALLOYED STEELS

INTRODUCTION

The use of MICRO ALLOYED STEELS (MAS) originally developed for high strength low alloy steel sheets (HSLA) for automobile bodies has shown steady and significant growth in Long products also for manufacture of forged components. The Indian steel manufacturers as well as forged component manufacturers have adapted themselves to manufacture and use MAS components for AUTO sector.

MAS grades not only helps in avoiding use of costly alloying elements but also eliminates the need for heat treatment of forged components. Plain carbon steels having closely controlled chemistry (to maintain carbon equivalent) alongwith small additions of microalloying elements such as V, Nb and Ti (to promote precipitation strengthening) can achieve the desired strength levels after forging without heat treatment. Optimum sulphur levels and maintained to promote machinability.

These steels are covered by EN spec10267 as general spec, which can be fine tuned to meet specific customer requirements.

Sunflag melting and refining process has capability to meet close range chemistry with help of controlled addition of Microalloying Elements like V, Nb, Ti and special wire injection facilities for sulphur and aluminium addition.

Nitrogen can also be closely maintained in the range of 100 to 200ppm as specified by customer.

MICROALLOYED GRADES BEING PRODUCED

Sr.no.	Grades	End Application
1	C70S6	Fracture splittable connecting rod
2	38MnSiVS5	Crank shaft, Outer ball joint, Inner insert
3	30MnVS6	Housing shaft and socket
4	SAE 11V41	Yoke
5	SAE 1137V	Transmission components
6	MT-15	Link application
7	S48CS1V	Crank shaft
8	S45CS1V	Rack bar
9	38MnVS5	Crank shaft
10	40MnSiVS6	Tubular and spherical rails
11	36MnVS4	Connecting Rod
12	SCr420HV-SG	Transmission Shaft



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***RESEARCH AND DEVELOPMENT CENTRE
&
AUTOMATIC INSPECTION FACILITIES***



Steel
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Clean

RESEARCH AND DEVELOPMENT

R & D division of Sunflag Iron Steel Co. Ltd. lays a pivotal role in retaining and consolidating Sunflags' leadership position in automobile industry.

R & D focus on development of new steel grades, process improvement, continuous up-gradation of Quality, Customer Satisfaction through customized products matching with their specific requirement.

Sunflag R&D lab is equipped with following state of the art equipment :

- Scanning Electron Microscope with Energy Dispersive X-Ray Spectroscopy (SEM-EDS) of Make – JOEL
- Immersion Ultrasonic Testing Facility of Make – Olympus / Blue Star
- Optical Microscope with Automatic Multiaxis stage Movement and Image Analysis software
- Micro-hardness tester • Ferritometer

- **NABL Certified Testing Lab**

- **R&D Centre Recognised by DSIR (Government of India)**

SCANNING ELECTRON MICROSCOPE WITH EDS

- Key Function
 - Microstructure analysis
 - Quantitative & Qualitative Analysis of Inclusions
- Failure Analysis
- Fractography
- Inclusion with quantitative elemental analysis

Salient Features

- Fully automatic system comprising of turbo molecular rotary pump
- Automatic stage movement



IMMERSION ULTRASONIC TESTING MACHINE

- Key Function : Inspection of cleanliness levels (macro inclusions) in steel

Salient Features

- Dimension of samples that can be tested :
- Round Bars :
 - Size 15-120 mm dia.
 - Length 800mm
- Round Corner Square Bars :
 - Size 60-120 mm
 - Length 800 mm

UST Prob : 10 MHz - 6mm as per Sep 1927

- Automatic data saving & reporting
- A scan & C scan analysis with real time display

Quality Highlights

Inclusion Mapping with 100% volume as Sep 1927 Class 1 to 5



UPRIGHT METALLURGICAL MICROSCOPE WITH CLEMEX SOFTWARE

- Automatic Motorised Stage & Auto Focus
- Clemex Automated Inclusion Rating Analysis As per
 - ASTM E 45 Method A, C, D, E
 - Din 50602 Method K, M,
 - JIS G 0555,
 - ISO 4967 compliant (DS)
 - EN 10247 Complete analysis by all above methods simultaneously
- Automated Grain Size measurement
- Phase analysis



AUTOMATIC MAGNETIC FLUX LEAKAGE TESTING (MFLT)

- Highly sensitive test method for detection of longitudinal defects on steel bars
- No Coupling Liquid
- Reliable and reproducible test results
- Automatic marking and sorting of defective bars during testing
- High production speed
- Real time display of inspection results

MFLT SALIENT FEATURES

Diameter range	5 to 140 mm
Channels	8
Probes	up to 16
Channel width	5.0 mm
AC Frequency	7 kHz
Rotation	max. 1.800 rpm
Test Speed	up to 2 m/s for 100% material Scanning



AUTOMATIC EDDY CURRENT TESTING (ECT) FOR BAR & WIRE RODS

ECT is a non-destructive testing technique making use of electromagnetic induction to detect and characterize surface & subsurface flaws for bright bars.

SALIENT FEATURES

ECT For Bars

- Automatic bar feeding system
- Automatic marking and sorting of defective bars during testing
- Size range: 6 to 60 mm
- Inspection of Longitudinal / Circular Surface defects
- Detectability of ECT: 0.05mm depth flaw with length 5mm
- Reliable and reproducible test results
- High production speed

ECT For Wire Rod Coils

- Online Eddy Current Testing facility
- Automatic marking of defects during testing
- Size range: 5.5 to 26 mm
- Inspection of Longitudinal / Circular Surface defects
- Detectability of ECT: 0.05mm depth flaw with length 5mm
- Reliable and reproducible test results
- High production speed



Eddy Current Testing for Bar



Eddy Current Testing for Wire Rod

PHASED ARRAY AUTO ULTRASONIC TESTING

SALIENT FEATURES

Phased Array Technology

Phased Array testing is a specialized type of ultrasonic testing that uses sophisticated multi-element array transducers and powerful instrumentation/software to steer ultrasonic beams through the test piece and map returning echoes.

No rotating movement, only electronic scanning is done

Depth focalization for bar volume inspection (LW)

Electronic steering for bar surface inspection (SW)

Quality Highlights :

Capacity - 15 to 120 mm dia. Full bar volume inspection

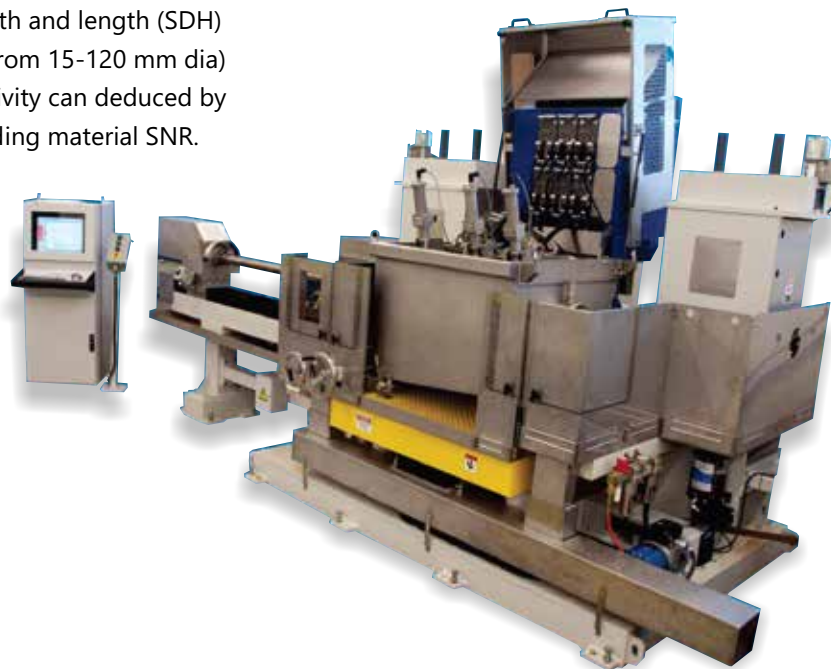
Acceptance Criteria -

Minimum defect depth and length (FBH)

- 0.7 mm FBH from 15-60 mm dia
- 1.2 mm FBH above 60 dia

Minimum defect depth and length (SDH)

- 0.5 mm x 10 mm (from 15-120 mm dia)
- 0.3 mm SDH sensitivity can deduced by extrapolation depending material SNR.



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SPRING STEELS



Clean Steel

State of the Art Process Technology

SIZES AND CONDITIONS OF SUPPLY

Condition of Supply	Shapes	Sizes
Hot Rolled	Flat (WxT)	50x5 mm – 125x34 mm
Hot Rolled	Round	5.5 to 250 mm
Drawn	Round	5 – 50 mm
Peeled and Ground	Round	5 – 100 mm

Edge Radius

Flats can be supplied with an edge radius "R" which is equal to either "T" or "T/2", where "T" is equal to thickness.

General Length

We cater to orders in standard and specific length.

- a) Standard length 4 to 6 mtrs with 10% shorts down to 1 mtr.
- b) Customer's specific lengths with tolerance + 50/-0mm.

Straightness

Bars hot rolled 3 mm/mtr (max) & hot rolled & machine straightened 1 mm/mtr (max)

Quality

Surface Condition: On visual inspection, surface is free from harmful defects, eg. Crack, lap, fold, scratch, roll/pass marks, pits etc.

Decarburization

	Full	Partial	Total
Flats (upto 80 x 13)	Nil	0.15	0.15 mm (max)
Flats (above 80 x 13)	0.03	0.25	0.25 mm (max)
Hot Rolled Round		0.8% of the size (max)	

Grain size

5.8 (As per ASTM E-112)

As Rolled Hardness

310 BHN (max)

Inclusion Rating

As per IS-4163/ASTM E-45 : THIN : 2.5 A, B, C, D max
: HEAVY : 1.5 A, B, C, D Max
As per JIS G-0555 : % dA - 0.15 max
: % dB + dC - 0.10 max
: % d Tot - 0.20 max



Delivery Conditions

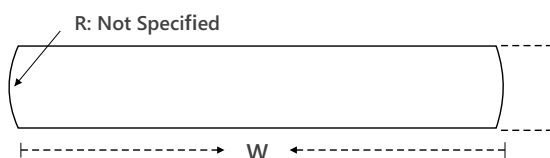
All bundles tied with wire/strapping at 3/4 places.

Approx. bundle weight : 2 MT. max

Grade/HT. No. identification : By painted colour code and Heat Number written on each bundle / bar

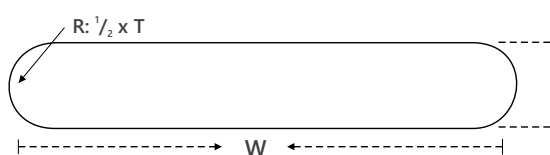
Standard shapes and sizes of Spring Steel Flat Bars

1. RE Type



The conventional type is of Round Edge (RE) type, having edge radius approximately equivalent to thickness but not specified.

2. FL Type



Feather leaf type Spring Steel flats have edge radius of half of thickness and also have many advantages over RE type in terms of economical and technical aspects. Size - wise edge radius is be mutually agreed.

DIMENSIONAL TOLERANCES

Flats :

Width Range (mm)	Tolerance (mm) (+/-)			Tolerance (mm)	
	Width (W)	Thickness (T)		Concavity (+max) for	
		< = 10	> 10	T < = 10	T > 10
40-50	0.30	0.15	-	0.15	0.15
51-75	0.50	0.15	0.20	0.15	0.20
76-100	0.70	0.20	0.25	0.20	0.20
101-125	0.90	0.25	0.40	0.30	0.40

ROUNDS (HOT ROLLED)

Size (mm Dia)		Tolerance (mm)	
Over	Upto & Including	Tolerance (Dia)	Tolerance (Out of Round)
-	12	± 0.18	0.25
12	15	± 0.18	0.25
15	22	± 0.20	0.30
22	25	± 0.24	0.35
25	28	± 0.25	0.40
28	31	± 0.28	0.45
31	34	± 0.30	0.50
34	38	± 0.36	0.60
38	50	± 0.40	0.60
50	64	+ 0.8/-0	0.80
64	80	+ 1.20/-0	0.80
80	89	+ 1.20/-0	0.80
89	100	+ 1.60/-0	1.20

ROUNDS (BRIGHT BARS):

Size (mm Dia)		Tolerance on Dia (mm)		
Over	Upto & Including	Cold Drawn	Peeled / Turned	Centreless Ground
-	10	+ 0/- 0.09	—	+ 0/- 0.036
10	18	+ 0/- 0.11	+0/- 0.11	+ 0/- 0.043
18	30	+ 0/- 0.13	+ 0/- 0.13	+ 0/- 0.052
30	50	+ 0/- 0.16	+0/- 0.16	+ 0/- 0.062

FATIGUE GUARANTEED SPRING STEELS

Sunflag Steel, a pioneer in making Spring Steel, has come up with products in this category, which ensure the required fatigue life to springs used in vehicles, in the most demanding situations.

THE SALIENT FEATURES OF THESE PRODUCTS ARE :

- Use of virgin inputs in steel making such as DRI, Pig Iron which are free from undesirable tramp elements
- Carefully planned, steel making refining vacuum degassing and casting processes.
- Well controlled reheating and rolling process.
- Closely monitored cooling parameters of rolled products.
- Thorough inspection and testing.
- Proper packing, stacking and storage for despatch.
- Wide size range.



CHEMICAL COMPOSITION OF TYPICAL SPRING STEEL OF VARIOUS INTERNATIONAL STANDARDS

Grade	C H E M I S T R Y												
	C	Mn	P	S	Si	Cu	Cr	Ni	Mo	V	Al	B	Nb
DIN													
50CrV4	0.47-0.55	0.70-1.10	0.035 Max	0.035 Max	0.15-0.40	0.25 Max	0.90-1.20	-	-	0.10-0.20	0.040 Max	-	-
51CrMoV4	0.48-0.56	0.70-1.10	0.030 Max	0.030 Max	0.15-0.40	0.25 Max	0.90-1.20	-	0.15-0.25	0.07-0.12	0.040 Max	-	-
51CrV4	0.48-0.55	0.85-1.10	0.020 Max	0.020 Max	0.25-0.40	0.25 Max	0.95-1.20	0.20 Max	0.06 Max	0.10-0.20	0.015-0.040	-	-
51CrV4-Nb	0.50-0.55	0.90-1.10	0.015 Max	0.015 Max	0.15-0.40	0.25 Max	0.95-1.20	0.40 Max	0.06 Max	0.07-0.14	0.015-0.025	-	0.0600
5 Cr4Mo2V	0.48-0.56	0.70-1.10	0.025 Max	0.025 Max	0.15-0.40	-	0.90-1.20	-	0.15-0.25	0.07-0.12	-	-	-
52CrMoV4	0.48-0.56	0.70-1.10	0.015 Max	0.015 Max	0.15-0.40	-	0.90-1.20	-	0.15-0.25	0.07-0.12	-	-	-
55Cr3	0.50-0.60	0.60-0.80	0.035 Max	0.035 Max	0.10-0.35	0.25 Max	0.60-0.80	-	-	-	0.040 Max	-	-
55Si7	0.50-0.60	0.80-1.00	0.025 Max	0.025 Max	1.50-2.00	0.25 Max	0.25 Max	-	-	-	-	-	-
60Si7	0.55-0.65	0.80-1.00	0.025 Max	0.025 Max	1.50-2.00	0.25 Max	0.25 Max	-	-	-	-	-	-
60SiCr7	0.55-0.65	0.70-1.00	0.045 Max	0.045 Max	1.50-1.80	0.25 Max	0.20-0.40	-	-	-	0.40 Max	-	-
65Si7	0.60-0.70	0.80-1.00	0.025 Max	0.025 Max	1.50-2.00	-	0.25 Max	-	-	-	-	-	-
54SiCr6	0.50-0.59	0.50-0.80	0.03 Max	0.030 Max	1.20-1.60		0.50-0.80	-	-				0.1000
BS													
EN45A	0.55-0.65	0.70-1.00	0.050 Max	0.050 Max	1.70-2.00		0.25 Max	-	-			-	-
ASTM						0.25 Max				-	0.040 Max	-	-
SAE5160	0.56-0.64	0.75-1.00	0.035 Max	0.040 Max	0.15-0.30		0.70-0.90	-	-	-		-	-
SAE5160H	0.55-0.65	0.65-1.10	0.035 Max	0.035 Max	0.15-0.30	0.25 Max	0.60-1.00	-	-	-	0.040 Max	-	-
SAE51B60H	0.55-0.65	0.65-1.10	0.035 Max	0.040 Max	0.15-0.30	0.25 Max	0.60-1.00	-	-	-	0.040 Max	0.0005 Min	-
SAE9254	0.51-0.59	0.60-0.80	0.035 Max	0.040 Max	1.20-1.60	0.25 Max	0.60-0.80	-	-	-	0.040 Max	-	-
SAE9261B(M)	0.55-0.65	0.70-1.00	0.050 Max	0.050 Max	1.80-2.20	0.25 Max	0.10-0.25	0.35 Max	0.10 Max	-	0.040 Max	-	-
JIS						0.35 Max			-	0.10 Max	-		
SUP6	0.56-0.64	0.70-1.00	0.035 Max	0.035 Max	1.50-1.80	0.25 Max	0.25 Max	-	-	-	0.040 Max	-	-
SUP7	0.55-0.65	0.70-1.10	0.035 Max	0.035 Max	1.80-2.20	0.25 Max	0.25 Max	-	-	-	0.040 Max	-	-
SUP7C	0.58-0.64	0.80-1.00	0.030 Max	0.030 Max	1.90-2.20	0.25 Max	0.10-0.20	-	-	-	0.040 Max	-	-
SUP7N	0.58-0.63	0.80-1.00	0.035 Max	0.035 Max	1.90-2.20	-	0.10-0.20	-	-	-	-	-	-
SUP9	0.52-0.60	0.65-0.95	0.035Max	0.035Max	0.15-0.35	0.15 Max	0.65-0.95	-	-	-	-	-	-
SUP9A	0.56-0.64	0.65-0.95	0.035 Max	0.035 Max	0.15-0.35	0.25 Max	0.70-1.00	-	-	-	0.040 Max	-	-
SUP9H	0.52-0.60	0.65-0.95	0.035 Max	0.035 Max	0.15-0.35	0.25 Max	0.65-0.95	-	-	-	0.040 Max	-	-
SUP9M	0.55-0.60	0.75-0.90	0.030 Max	0.030 Max	0.15-0.35	0.30 Max	0.75-0.90	-	-	-	0.020 Min	-	-
SUP9N	0.56-0.60	0.80-1.00	0.030 Max	0.030 Max	0.15-0.35	0.25 Max	0.80-1.00	-	-	-	0.040 Max	-	-
SUP11A	0.56-0.64	0.70-1.00	0.035 Max	0.035 Max	0.15-0.35		0.70-1.00	-	-	-		0.0005 Min	-
SUP12	0.51-0.59	0.60-0.90	0.030 Max	0.030 Max	1.20-1.60	0.25 Max	0.60-0.90	-	-	-	0.040 Min	-	-



SUPER ALLOYS




**SUNFLAG
STEEL**

SUPER ALLOYS

India is fast developing economy with population over 120 million with vast border. To meet the growing demand of our population and protect our border, growth of technology is inevitable. The growth of technology is relevant to sectors like Biomedical, Aerospace, Petrochemical, Thermal and Nuclear Plants, Defense, Armament, Transport etc. To attain high level of perfection in this sectors depends, on availability of stringent quality of rawmaterial. As on date most of raw material is imported.

Government of India has embarked upon ambitious program of self reliance through make in India program. Sunflag widely accepted as marque company in supplying high quality material to automobile and general Engg Industries wish to enter this high tech area. The fast developing electrical vehicle technology may also require these advanced high tech material in high volume.

These hi tech material are used in making Aircraft Parts, Bio Medical Implants, Industrial and Vehicle Gas Turbines, Super Critical Power Plants Parts, Space Vehicles and Rocket Engines, Submarine Parts, Nuclear Reactor, Missiles and Arnaments etc.

The high performance high tech alloys required by these industries are required to be operated at a load and temperature above 500 degree centigrade with resistance to oxidation and environmental attack, that are usually prevalent at this temp. Hence the raw material used for this high sectors requires low level of impurities and meeting with stringent spec.

In nature, we rarely come across very pure material and it contains metallic impurities like lead, bismuth, etc , non metallic impurities like sulphur. phosphorous etc, residual gases like oxygen, hydrogen and nitrogen and nonmetallic impurities like oxides, nitrides. Sulphide etc.

The above impurities considerably reduced in conventional technology of arc furnace, AOD, LRF and VOD and the low level of impurities required by these hi-tech industries can be achieved only by melting at Vacuum Induction Melting [VIM], Electro Slag Refining [ESR] and Vaccum Arc Re-melting furnace [VAR] etc apart from other specialised melting.

Sunflag has put up VIM, ESR, VAR facility at Bhandara Plant near Nagpur. These equipment have latest technology and supplied by the World Leaders in this field, Sunflag also have tie up with DAIDO Japan, who are well known have equity participation with Sunflag. DAIDO also provide inputs for improvement in the technology.

Sunflag other facilities include Concast, Blooming Mill, specialised Rolling Mill, Heat Treatment facilities and Bright Bar and Centerless Grinding Facility.

To test these high tech material, most modern lab equiped with good analytical instruments, metallographic equipments, mechanical testing equipment for testing RT, LT and HT specimens. Online Phase Arrey Machines for testing UT, eddy current, MPI and FPT tests also available to test the product to various national and international standards.

Sunflag has trained manpower who have specialised skill to operate these most modern equipments & control.



TYPICAL COMPETITION OF SUNFLAG HI TECH GRADES

S.No.			Fe	Ni	Cr	Mo	Co	Cu	Ti	C	Mn	Al	Others
SPECIAL STEEL													
1	SUN V250	Maraging 250		18		4.8	8.5		0.4			4.2	
2	SUN V174	17-4PH	0.07	4	16.5			4					
3	SUN V155	15-5PH	0.07	5	15			4					
4	SUN V11-10	11-10PH	0.03	10	11	2							
5	SUN V904L	AVESTA 904L	0.02	25	19.5	4.5							
6	SUN V138	13-8Mo		8	12.5	2.3				0.05		1.1	
HEATING ELEMENT ALLOYS													
1	SUN HEAT80	NICROME 5		80	20								
2	SUN HEAT60	NICROME 3		60	40								
SOFT MAGNETIC IRON													
1	SUN MAG36B	PERM ALLOY D	Bal.	36									
2	SUN MAG48B	PERM ALLOY B	Bal.	48									
	SUN MAG78	MUMETAL	Bal.	78									
CONTROLLED EXPANSION ALLOYS													
1	SUN CE36	INVAR	Bal.	36									
2	SUN CE42	N42	Bal.	42									

TYPICAL COMPETITION OF SUNFLAG HI TECH GRADES

S.No.	SUPER ALLOYS	EQU. GRADE	Fe	Ni	Cr	Mo	Co	Cu	Ti	C	Mn	Al	Others
IRON BASED													
1	SUN R MDS	INCOLLOY DS	Bal.	38	18			0.5	0.2	0.1			Si 2.1
2	SUN R 800/800H	INCOLLOY 800/800H	46	32	21				0.38	0.1			
3	SUN RA286	A 286	53	26	15	1.24			2.15			1.4	V 0.3
NICKLE BASED													
1	SUN P600	INCONEL 600	8		15.5								
2	SUN P76	NIMONIC 76	4	75	19.5			0.4					
3	SUN P80A	NIMONIC 80A		75	21		2.45						
4	SUN P90	NIMONIC 90		59	19.5		19		2.5				
5	SUN P690M	INCONEL 690M	7-11	58 Min	27-31			0.5	0.6	0	0.5		B 0.006, S 0.015
6	SUN P740	INCONEL 740	0.7	bal	25	0.5	20		1.8	0.03	0.3	0.9	Nb2
7	SUN P825	INCOLLOY825	30	42	21.5	3	2.25		0.9	0.03	0.5	0.1	
8	SUN P750	INCONEL 750X	7	73	15.5			0.25	2.5	0.04	0.5	0.7	Nb 0.95
9	SUN P625	INCONEL 625	2.5	61	21.5	9	10						Nb 3.15-4.15
10	SUN P718	INCONEL 718	18.5	52.5	19	3.05		0.15	0.9	0.04	0.18	0.5	Cb+Ta 5.13
11	SUN P82	INCONEL 82	3	bal	20				0.55		3		Nb 2.5
12	SUN PC276	HASTE ALLOY C276	5	62	15	16				0.02	1		V 0.3
13	SUN P617	INCONEL 617		44.5	23	9	13					1	B 0.006
14	SUN P706M	INCONEL 706		41.6	16	0.5	0.5		1.75				
	SUPER ALLOYS	EQU. GRADE	Fe	Ni	Cr	Mo	Co	Cu	Ti	C	Mn	Al	Others
COBALT BASED													
	SUN B605	INCONEL 605		10	20		BAL				1.5		W 15

TYPICAL PROPERTIES OF SOME GRADES

SUPER ALLOYS				
GRADE	NOMINAL COMPOSITION (in%)	MECHANICAL PROPERTIES		
		0.2%PS (kg/mm ²)	UTS (kg/mm ²)	%EI
SUN R MDS	Ni 37, Cr 18, Cu 0.5, Ti 0.2, Si 2.1, C 0.1, Fe Bal	36.0	68.0	37
SUN R 800/800H	Ni 32, Cr 21, Al 0.3, Mn 1.5max, Ti 0.3, Si 1max, C 0.1max, Fe Bal	32.6	70.0	40
SUN P 600	Fe 10max, Ni Bal, Cr 15.5, Mn 0.5	24.6	56.0	30
SUN P 76	Fe 18.5, Ni Bal, Cr 21.0, Co 2.5max, Cu 0.2, Mo 9.0, Mn 1.0, C 0.1 Others W-0.5	27.5	80.0	30
SUN P 80A	Fe 1max, Ni Bal, Cr 19, Co 2.0max, Al 1.5 Ti 2.5, C 0.07	70.5	105.0	20
SUN P 90	Fe 1max, Ni Bal, Cr 19, Co 19, Al 1.5 Ti 2.5, C 0.08	68.0	108.0	20
SUN P 718	Fe 18.5, Ni Bal, Cr 19.0, Cu 0.15, Al 0.50, Mo 3.05, Mn 0.18, Ti 0.90, Si 0.18, C 0.04, Others Cb+Ta-5.13	83.0	103.0	12
SUN P 750	Fe 7.0, Ni Bal, Cr 15.5, Cu 0.25, Al 0.70, Mn 0.50, Ti 2.50, Si 0.25, C 0.04, Others Cb+Ta-0.95	63.0	98.0	8
SUN P 825	Fe 30.0, Ni 42.0, Cr 21.5, Cu 0.25, Al 0.10, Mo 3.0, Mn 0.50, Ti 0.90, Si 0.25, C 0.03			
SUN P 82	Fe 3.0, Ni Bal, Cr 20.0, Mn 3.0, Ti 0.55, Others Nb-2.5	95.0	42.0	
SUN P C276	Fe 6.0, Ni Bal, Cr 15.0, Mo 16.0, Mn 1.0, Si 0.08, C 0.02, Others W-35			
SUN P 690M	Ni 58 min, Cr 27-31, Fe 7 to 11, C 0.05, S 0.015, Mn 0.5, Si 0.5, Cu 0.5, Ti 0.6, B 0.006	24.0	58.0	30
SUN P 617	Ni 44.5 min, Cr 20-24, Co 10-15, Mo 8-10, Al 0.8-1.5, B 0.006, C 0.05-0.15, Fe 3.0, Mn 1.0, Si 1.0, S 0.015, Ti 0.6, Cu 0.5	32.0	73.0	62
SUN P 625	Ni 58, Cr 20-23, Fe 5, Mo 8-10, Nb + Ta 3.15-4.15, Co 1.00	27.0	60.0	30
SUN P 740	C 0.03, Cr 25, Mo 0.5, Co 20, Al 0.9, Ti 1.8, Nb 2.0, Mn 0.30, Fe 0.7, Si 0.5, Ni bal	72.0	115.0	50
SUN P 706M	Ni + Co 39.0-44.0, Cr 14.5-17.5, Nb+Ta 2.5-3.3, Ti 1.5-2.0, Al 0.40, C 0.06, Cu 0.30, Mn 0.35, Si 0.35, S 0.015, P 0.020, B 0.006, Co 1.00	99.0	128.0	18





SPECIAL STEELS

GRADE	NOMINAL COMPOSITION (in%)	MECHANICAL PROPERTIES		
		0.2%P.S (kg/mm ²)	UTS (kg/mm ²)	%EI
SUN V 174	C 0.07, Ni 4.0, Cu 4.00, Cr 16.5, Fe Bal, Others Nb-0.3, Condition H1100.	72	93	16.50 ft lb(cvm)
SUN V 250	C 0.01, Ni 18.5, Co 8.5, Fe Bal, Condition 480°C, Others Mo-4.8, Ti-0.4, Ak-4.17 Condition Aged	178	185	100 MPaVm
SUN V 904L	C 0.02, Ni 25.0, Cu 1.5, Cr 19.5, Fe Bal, Others Mo-4.5	22	50	36
SUN V 15-5PH	C 0.07, Mn 1.0, P 0.040, S 0.030, Si 1.0, Cr 14.0-15.0, Ni 3.50-5.50, Cu 2.50-4.50, Cb + ta 0.15-0.45, Ti 0.6-1.0, Al 0.2, Nb 0.15, Cu 0.3 Fe-bal	795	965	14
SUN V 11-10PH	C 0.03, Si 0.15, Mn 0.1, P 0.01, S 0.01, Cr 10.0-11.0, Ni 9.0-10.3, Mo 1.8-2.3	1270	1370	8

CONTROLLED EXPANSION ALLOYS

GRADE	NOMINAL COMPOSITION (in%)	MEAN COEFFICIENT OF THERMAIL EXPANSION (10-7)	
		0-100°C	0-200°C
SUN CE 36	Ni 36, Fe Bal	12	23
SUN CE 42	Ni 42, Fe Bal	47	45

RESISTANCE ALLOYS

GRADE	NOMINAL COMPOSITION (in%)	PHYSICAL PROPERTIES	
		Resistivity at 20°C	Max working temp
SUN HEAT 80	Ni 80, Cr 20, R	109	1200
SUN HEAT 60	Ni 60, Cr 15, Fe Bal	112	1150
SUN HEAT 45	Ni 45, Cr 25, Fe Bal	112	1150
SUN HEAT 30	Ni 30, Cr 20, Fe Bal	104	1100

SOFT MAGNETIC ALLOYS

GRADE	NOMINAL COMPOSITION (in%)	TYPICAL MAGNETIC PROPERTIES				
		Strip Thick	Bs Tesia	μ_{\max}	$\mu_{2\max}$	Coercive force
SUN MAG 36B	Ni 36, Fe Bal	0.3	1.3	20000	17000	0.15
SUN MAG 48B	Ni 48, Fe Bal	0.3	1.3	55000	35000	0.08
SUN MAG 78B	Ni 78, Cr 0.05, Cu 5, Mo 4, Fe Bal	0.1	0.7	160000	140000	0.012
SUN MAG 78D	Cr -do-	0.1	0.7	390000	250000	0.006
SUN MAG 78E	Cr -do-	0.1	0.7	560000	280000	-0.004

SUPER ALLOYS DIVISION

Infrastructure for Manufacture of Super Alloys

Equipment	Make	Capacity (MT)
Vacuum Induction Melting (VIM)	CONSARC (USA)	6.5 MT
Vacuum Arc Re-melting (VAR)	CONSARC (USA) ALD (Germany)	2.2 MT 16 MT
Electro Slag Re-melting (ESR)	CONSARC (USA) ALD (Germany)	1.8 MT 22 MT

ELECTRO SLAG REMELTING (ESR)

Product Range: 1.8MT to 22MT

Salient Features :

- Automatic Electrode Feed Control System
- Real Time Automatic melt Control System through pre-defined recipe
 - ✓ Full automatic operation
 - ✓ Automatic start phase of the furnace by a defined power/time profile
 - ✓ Realtime Melting rate control through maintaining melting rate or melting power profile with respect to the consumed weight of electrode
 - ✓ Automatic hot topping as per recipe defined power/time profile
- Pre-defined profiles for various stages of processing e.g. slag resistance set point profile or swing set point profiles.
- Digital Operator Interface and data acquisition system
- Furnace head provided with x-y angular corrections of electrode and total sealed system for argon shielded melting
- Fume exhaust and environment protection hood
- Fully coaxial high current feedings system



Vacuum Arc Remelting (VAR)

Product Range: 2 MT to 16 MT

Salient Features :

- Fully computerized automatic melt control system based on dynamic electrode feed control system with arc voltage control/drip short pulse rate control
- Real Time Automatic melt Control System through pre-defined recipe
 - ✓ Full automatic operation
 - ✓ Automatic start phase of the furnace by a defined power/time profile
 - ✓ Realtime Melting rate control through maintaining melting rate or melting power profile with respect to the consumed weight of electrode
 - ✓ Automatic hot topping as per recipe defined power/time profile
 - ✓ Recipe defined profiles for electrode control feed systems for start-melt-hot topping phase.
- Digital Operator Interface and data acquisition system
- Furnace head provided with x-y angular corrections of electrode and total sealed system
- Fume exhaust and environment protection hood
- Fully coaxial high current feedings system
- Ultimate vacuum level of 1×10^{-3} mbar

Vacuum Induction Melting (VIM)

Product Range: 1 MT to 6 MT

Salient Features :

1. Furnace equipped with mould height 4000 MM
2. Facility for Rapid exchange of crucible
3. Multiple mould pouring
4. Facility for bulk and additional charging of mix under vacuum
5. Sampling and temperature measurements under vacuum
6. Fully Rollaway head for facilitating cleaning of melt chamber
7. Ultimate vacuum level of 1×10^{-4} mbar

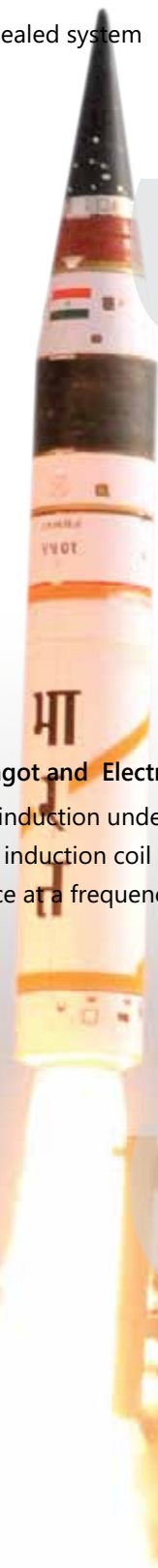
Vacuum Induction Melting Furnace

6.5 Ton x 4000 mm (Tall Vacuum Induction Melting & Casting Furnace for Ingot and Electrode Production)

Vacuum Induction Melting (VIM) is the melting of metal via electromagnetic induction under vacuum.

An induction furnace containing a refractory lined crucible surrounded by an induction coil is located inside a vacuum chamber. The induction furnace is connected to an AC Power source at a frequency precisely correlating to the furnace size and material being melted.

VIM is a process used to make super alloys, stainless steels, magnetic alloys, electronic alloys, and other demanding high value alloys.



Product Range for Super Alloys, Other Hi Tech Grades

Type	Size Range (mm)	Supply Condition
Hot Forged		
Bars	150 to 500 (OD)*	<ul style="list-style-type: none">• Forged and Machined• Annealed• Hardened & Tempered
Rings	400 to 2000 (OD)*	
Discs	Upto 800 dia*	
Cylinder	1000 (OD)* - 4500 (Length)	
Hot Rolled		
Bars	15 to 350 dia	<ul style="list-style-type: none">• Solution Annealed• Aged <p>* High strength alloys</p>
Flats	50 to 150 (W) & 5 to 34 (T)	
Wire Rod Coils	5 to 38 dia	
Round Corner Squares	40 to 350	
Hexagons	15 to 25 A/F	

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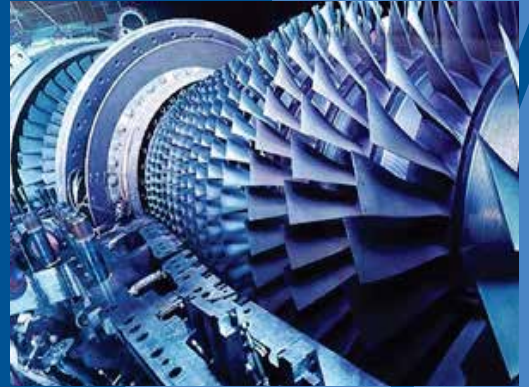
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Tool Steels




**SUN FLAG
STEEL**

Tool steels are high quality steels made to controlled chemical composition and processed to develop properties useful for working and shaping of other materials. The carbon content in tool steel may range from as low as 0.1% to as high as more than 1.6%. They are alloyed with elements such as Chromium, Molybdenum, Vanadium Tungsten etc.

At Sunflag Tool Steels are produced through specially designed steel making process via Electric Arc Furnace followed by Ladle Refining and Vacuum Degassing and processed through ESR / VAR for ensuring homogeneous properties & Ultra clean material. Stringent control is practiced during designing of chemical composition and other process parameters during casting, rolling / forging and heat treatment.



Electro Slag Re-melting (ESR)



Vacuum Arc Re-melting (VAR)



Type & application of tool steels:

- Water hardening tool steel (e.g. cold heading, cutting tools, knives, reamers and cutlery etc)
- Shock resisting tool steel (e.g. chisel for hot and cold cutting, chuck jaws, gripper, cold shear, hot shear etc.)
- Cold work tool steel [3 types]
 - ✓ Oil hardening cold work tool steel (thread cutting, die blanking, cold-forming, cold trimming, gauges etc.)
 - ✓ Medium alloy air hardening cold work tool steel (blanking, coining, cold forming, cold swaging, cold trimming tools, gauges etc.)
 - ✓ High carbon, high chromium cold work tool steel (die inserts, cold-forming, cold shaping, thread roll, cold trimming, wire drawing etc.)
- Low alloy special purpose tool steel (forging dies, die casing, file cutting, paper cutter, die bending, blanking and coining etc.)
- Mold tool steel (plastic mold)
- Hot work tool steel (die casting dies, hot extrusion dies, hot forging dies, hot swaging, hot trimming, hot shear, hot gripper etc.)
- High Speed Steels (Single point cutting tools, broach insert, tap, drill, reamers, milling cutters, saws)



Aluminum extrusion dies



Hot forging punch/die



Supply Conditions

From Bloom, Ingot or ESR Remelted Ingot

Supply Condition
Forged, Annealed & Proof Machined
Forged & Annealed
Rolled & Annealed
Rolled, Annealed, Peeled & Ground
As Forged
As Rolled

Sizes

Hot Rolled Rounds	15 to 250mm
Forged Rounds	160 to 500mm
Flats / Plates	150mm (T) x 450mm (W)
Peeled & Ground	5 to 100mm
Drawn & Ground	5 to 34mm
Forged Blocks	350(T) x 600 (W) x 5460(L)

Flats / Plates can also be supplied in following Thickness:

12, 14, 16, 28, 32, 35, 40, 42, 48, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 110, 120, 130, 140, 150

Grades of Tool Steels

Water-hardening tool steels

AISI	UNS	C	Mn	Si	Cr	Ni	Mo	W	V	Co
W1	T72301	0.70-1.50	0.10-0.40	0.10-0.40	0.15 max	0.20 max	0.10 max	0.15 max	0.10 max	-
W2	T72302	0.85-1.50	0.10-0.40	0.10-0.40	0.15 max	0.20 max	0.10 max	0.15 max	0.15-0.35	-
W3	T72305	1.05-1.15	0.10-0.40	0.10-0.40	0.40-0.60	0.20 max	0.10 max	0.15 max	0.10 max	-

Shock-resisting steels

AISI	UNS	C	Mn	Si	Cr	Ni	Mo	W	V	Co
S1	T41901	0.40-0.55	0.10-0.40	0.15-1.20	1.00-1.80	0.30 max	0.50 max	1.50-3.00	0.15-0.30	-
S2	T41902	0.40-0.55	0.30-0.50	0.90-1.20	-	0.30 max	0.30-0.60	-	0.50 max	-
S5	T41905	0.50-0.65	0.60-1.00	1.75-2.25	0.50 max	-	0.20-1.35	-	0.35 max	-
S6	T41906	0.40-0.50	1.20-1.50	2.00-2.50	1.20-1.50	-	0.30-0.50	-	0.20-0.40	-
S7	T41907	0.45-0.55	0.20-0.90	0.20-1.00	3.00-3.50	-	1.30-1.80	-	0.20-0.30	-

Oil-hardening cold-work steels

AISI	UNS	C	Mn	Si	Cr	Ni	Mo	W	V	Co
O1	T31501	0.85-1.00	1.00-1.40	0.50 max	0.40-0.60	0.30 max	-	0.40-0.60	0.30 max	-
O2	T31502	0.85-0.95	1.40-1.80	0.50 max	0.50 max	0.30 max	0.30 max	-	0.30 max	-
O6	T31506	1.25-1.55	0.30-1.10	0.55-1.50	0.30 max	0.30 max	0.20-0.30	-	-	-
O7	T31507	1.10-1.30	1.00 max	0.60 max	0.35-0.85	0.30 max	0.30 max	1.00-2.00	0.40 max	-

Air-hardening, medium-alloy, cold-work steels

AISI	UNS	C	Mn	Si	Cr	Ni	Mo	W	V	Co
A2	T30102	0.95-1.05	1.00 max	0.50 max	4.75-5.50	0.30 max	0.90-1.40	-	0.15-0.50	-
A3	T30103	1.20-1.30	0.40-0.60	0.50 max	4.75-5.50	0.30 max	0.90-1.40	-	0.80- 1.40	-
A4	T30104	0.95-1.05	1.80-2.20	0.50 max	0.90-2.20	0.30 max	0.90-1.40	-	-	-
A6	T30106	0.65-0.75	1.80-2.50	0.50 max	0.90-1.20	0.30 max	0.90-1.40	-	-	-
A7	T30107	2.00-2.85	0.80 max	0.50 max	5.00-5.75	0.30 max	0.90-1.40	0.50- 1.50	3.90-5.15	-
A8	T30108	0.50-0.60	0.50 max	0.75-1.10	4.75-5.50	0.30 max	1.15-1.65	1.00- 1.50	-	-
A9	T30109	0.45-0.55	0.50 max	0.95-1.15	4.75-5.50	1.25-1.75	1.30-1.80	-	0.80- 1.40	-
A10	T30110	1.25-1.50	1.60-2.10	1.00-1.50	-	1.55-2.05	1.25-1.75	-	-	-

High-carbon, high-chromium, cold-work steels

AISI	UNS	C	Mn	Si	Cr	Ni	Mo	W	V	Co
D2	T30402	1.40-1.60	0.60 max	0.60 max	11.00-13.00	0.30 max	0.70-1.20	-	1.10 max	-
D3	T30403	2.00-2.35	0.60 max	0.60 max	11.00-13.50	0.30 max	-	1.00 max	1.00 max	-
D4	T30404	2.05-2.40	0.60 max	0.60 max	11.00-13.00	0.30 max	0.70-1.20	-	1.00 max	-
D5	T30405	1.40-1.60	0.60 max	0.60 max	11.00-13.00	0.30 max	0.70-1.20	-	1.00 max	2.50-3.50
D7	T30407	2.15-2.50	0.60 max	0.60 max	11.50-13.50	0.30 max	0.70-1.20	-	3.80-4.40	-

Low-alloy special-purpose tool steels

AISI	UNS	C	Mn	Si	Cr	Ni	Mo	W	V	Co
L2	T61202	0.45-1.00	0.10-0.90	0.50 max	0.70-1.20	-	0.25 max	-	0.10-0.30	-
L6	T61206	0.65-0.75	0.25-0.80	0.50 max	0.60-1.20	1.25-2.00	0.50 max	-	0.20-0.30	-

Low-carbon mold steels

AISI	UNS	C	Mn	Si	Cr	Ni	Mo	W	V	Co
P2	T51602	0.10 max	0.10-0.40	0.10-0.40	0.75-1.25	0.10-0.50	0.15-0.40	-	-	-
P3	T51603	0.10 max	0.20-0.60	0.40 max	0.40-0.75	1.00-1.50	-	-	-	-
P4	T51604	0.12 max	0.20-0.60	0.10-0.40	4.00-5.25	-	0.40-1.00	-	-	-
P5	T51605	0.10 max	0.20-0.60	0.40 max	2.00-2.50	0.35 max	-	-	-	-
P6	T51606	0.05-0.15	0.35-0.70	0.10-0.40	1.25-1.75	3.25-3.75	-	-	-	-
P20	T51620	0.28-0.40	0.60-1.00	0.20-0.80	0.40-2.00	-	0.30-0.55	-	-	-
P21	T51621	0.18-0.22	0.20-0.40	0.20-0.40	0.50 max	3.90-4.25	-	-	0.15-0.25	1.05-1.25

Chromium hot-work steels

AISI	UNS	C	Mn	Si	Cr	Ni	Mo	W	V	Co
H10	T20810	0.35-0.45	0.25-0.70	0.80-1.20	3.00-3.75	0.30 max	2.00-3.00	-	0.25-0.75	-
H11	T20811	0.33-0.43	0.20-0.50	0.80-1.20	4.75-5.50	0.30 max	1.10-1.60	-	0.30- 0.60	-
H12	T20812	0.30-0.40	0.20-0.50	0.80-1.20	4.75-5.50	0.30 max	1.25-1.75	1.00- 1.70	0.50 max	-
H13	T20813	0.32-0.45	0.20-0.50	0.80-1.20	4.75-5.50	0.30 max	1.10-1.75	-	0.80- 1.20	-
H14	T20814	0.35-0.45	0.20-0.50	0.80-1.20	4.75-5.50	0.30 max	-	4.00- 5.25	-	-
H19	T20819	0.32-0.45	0.20-0.50	0.20-0.50	4.00-4.75	0.30 max	0.30-0.55	3.75- 4.50	1.75-2.20	4.00-4.50

Tungsten hot-work steels

AISI	UNS	C	Mn	Si	Cr	Ni	Mo	W	V	Co
H21	T20821	0.28-0.36	0.15-0.40	0.15-0.50	3.00-3.75	0.30 max	-	8.50-10.00	0.30-0.60	-
H22	T20822	0.30-0.40	0.15-0.40	0.15-0.40	1.75-3.75	0.30 max	-	10.00-11.75	0.25-0.50	-
H23	T20823	0.25-0.35	0.15-0.40	0.15-0.60	11.00-12.75	0.30 max	-	11.00-12.75	0.75-1.25	-
H24	T20824	0.42-0.53	0.15-0.40	0.15-0.40	2.50-3.50	0.30 max	-	14.00-16.00	0.40-0.60	-
H25	T20825	0.22-0.32	0.15-0.40	0.15-0.40	3.75-4.50	0.30 max	-	14.00-16.00	0.40-0.60	-
H26	T20826	0.45-0.55	0.15-0.40	0.15-0.40	3.75-4.50	0.30 max	-	17.25-19.00	0.75-1.25	-

Molybdenum hot-work steels

AISI	UNS	C	Mn	Si	Cr	Ni	Mo	W	V	Co
H42	T20842	0.55-0.70	0.15-0.40	-	3.75-4.50	0.30 max	4.50-5.50	5.50-6.75	1.75-2.20	-

Molybdenum high-speed steels

AISI	UNS	C	Mn	Si	Cr	Ni	Mo	W	V	Co
M1	T11301	0.78-0.88	0.15-0.40	0.20-0.50	3.50-4.00	0.30 max	8.20-9.20	1.40-2.10	1.00-1.35	-
M2	T11302	0.78-0.88; 0.95-1.05	0.15-0.40	0.20-0.45	3.75-4.50	0.30 max	4.50-5.50	5.50-6.75	1.75-2.20	-
M3, class 1	T11313	1.00-1.10	0.15-0.40	0.20-0.45	3.75-4.50	0.30 max	4.75-6.50	5.00-6.75	2.25-2.75	-
M3, class 2	T11323	1.15-1.25	0.15-0.40	0.20-0.45	3.75-4.50	0.30 max	4.75-6.50	5.00-6.75	2.75-3.75	-
M4	T11304	1.25-1.40	0.15-0.40	0.20-0.45	3.75-4.75	0.30 max	4.25-5.50	5.25-6.50	3.75-4.50	-
M7	T11307	0.97-1.05	0.15-0.40	0.20-0.55	3.50-4.00	0.30 max	8.20-9.20	1.40-2.10	1.75-2.25	-
M10	T11310	0.84-0.94; 0.95-1.05	0.10-0.40	0.20-0.45	3.75-4.50	0.30 max	7.75-8.50	-	1.80-2.20	-
M30	T11330	0.75-0.85	0.15-0.40	0.20-0.45	3.50-4.25	0.30 max	7.75-9.00	1.30-2.30	1.00-1.40	4.50-5.50
M33	T11333	0.85-0.92	0.15-0.40	0.15-0.50	3.50-4.00	0.30 max	9.00-10.00	1.30-2.10	1.00-1.35	7.75-8.75
M34	T11334	0.85-0.92	0.15-0.40	0.20-0.45	3.50-4.00	0.30 max	7.75-9.20	1.40-2.10	1.90-2.30	7.75-8.75
M35	T11335	0.82-0.88	0.15-0.40	0.20-0.45	3.75-4.50	0.30 max	4.50-5.50	5.50-6.75	1.75-2.20	4.50-5.50
M36	T11336	0.80-0.90	0.15-0.40	0.20-0.45	3.75-4.50	0.30 max	4.58-5.50	5.50-6.50	1.75-2.25	7.75-8.75
M41	T11341	1.05-1.15	0.20-0.60	0.15-0.50	3.75-4.50	0.30 max	3.25-4.25	6.25-7.00	1.75-2.25	4.75-5.75
M42	T11342	1.05-1.15	0.15-0.40	0.15-0.65	3.50-4.25	0.30 max	9.00-10.00	1.15-1.85	0.95-1.35	7.75-8.75
M43	T11343	1.15-1.25	0.20-0.40	0.15-0.65	3.50-4.25	0.30 max	7.50-8.50	2.25-3.00	1.50-1.75	7.75-8.75
M44	T11344	1.10-1.20	0.20-0.40	0.30-0.55	4.00-4.75	0.30 max	6.00-7.00	5.00-5.75	1.85-2.20	11.00-12.25
M46	T11346	1.22-1.30	0.20-0.40	0.40-0.65	3.70-4.20	0.30 max	8.00-8.50	1.90-2.20	3.00-3.30	7.80-8.80
M47	T11347	1.05-1.15	0.15-0.40	0.20-0.45	3.50-4.00	0.30 max	9.25-10.00	1.30-1.80	1.15-1.35	4.75-5.25
M47	T11348	1.42-1.52	0.15-0.40	0.15-0.40	3.50-4.00	0.30 max	4.75-5.50	9.50-10.50	2.75-3.25	8.00-10.00
M62	T11362	1.25-1.35	0.15-0.40	0.15-0.40	3.50-4.00	0.30 max	10.00-11.00	5.75-6.50	1.80-2.10	-

Tungsten high-speed steels

AISI	UNS	C	Mn	Si	Cr	Ni	Mo	W	V	Co
T1	T12001	0.65-0.80	0.10-0.40	0.20-0.40	3.75-4.50	0.30 max	-	17.25-18.75	0.90-1.30	-
T2	T12002	0.80-0.90	0.20-0.40	0.20-0.40	3.75-4.50	0.30 max	1.0 max	17.50-19.00	1.80-2.40	-
T4	T12004	0.70-0.80	0.10-0.40	0.20-0.40	3.75-4.50	0.30 max	0.40-1.00	17.50- 19.00	0.80-1.20	4.25-5.75
T5	T12005	0.75-0.85	0.20-0.40	0.20-0.40	3.75-5.00	0.30 max	0.50-1.25	17.50-19.00	1.80- 2.40	7.00-9.50
T6	T12006	0.75-0.85	0.20-0.40	0.20-0.40	4.00-4.75	0.30 max	0.40-1.00	18.50-21.00	1.50- 2.10	11.00-13.00
T8	T12008	0.75-0.85	0.20-0.40	0.20-0.40	3.75-4.50	0.30 max	0.40-1.00	13.25-14.75	1.80- 2.40	4.25-5.75
T15	T12015	1.50-1.60	0.15-0.40	0.15-0.40	3.75-5.00	0.30 max	1.00 max	11.75- 13.00	4.50-5.25	4.75-5.25

Intermediate high - speed steels

AISI	UNS	C	Mn	Si	Cr	Ni	Mo	W	V	Co
M50	T11350	0.78-0.88	0.15-0.45	0.20-0.60	3.75-4.50	0.30 max	3.90-4.75	-	0.80- 1.25	-
M52	T11352	0.85-0.95	0.15-0.45	0.20-0.60	3.50-4.30	0.30 max	4.00-4.90	0.75-1.50	1.65- 2.25	-

Testing Facilities at Sunflag Steel

Unique Facilities at Sunflag



Immersion Ultrasonic Testing Machine



Scanning Electron Microscope with EDS



Upright Metallurgical Microscope with CLEMEX software



Phase Array Auto Ultrasonic Testing Machine



Magnetic Flux Leakage Testing (MFLT)



Eddy Current Testing for Bar



Eddy Current Testing for Wire Rod



XRF Spectrometer- Anti-mix up Test.



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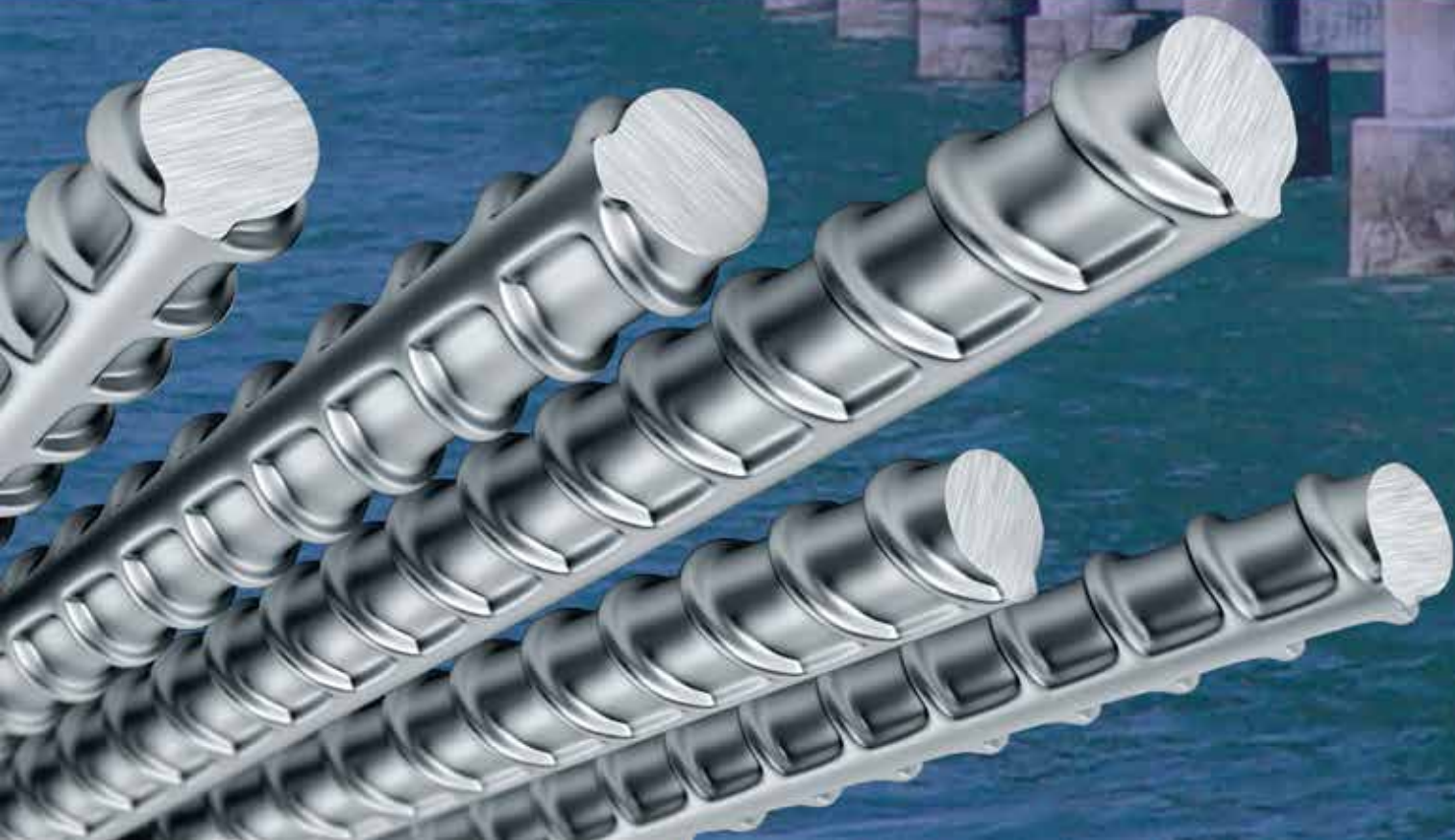


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SSR 550

**A Stainless Steel Rebar
Built to Last**



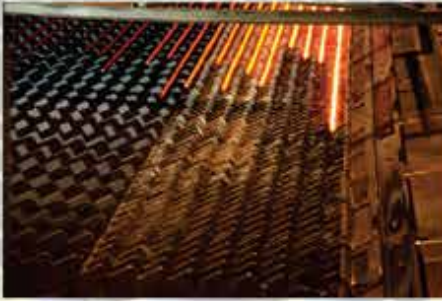


About us

Sunflag Iron & Steel Co. Ltd., INDIA is a part of the renowned Sunflag Group. The sunflag Group was founded in Kenya in 1937. It has a diversified range of activities in Kenya, Tanzania, Nigeria, Comeroon, The United Kingdom & India employing over 10,000 people.

In India Sunflag Iron & Steel Co. Ltd.. (SISCO) activity is divided into two business segment : Steel and Stainless Steel products and power sector. SISCO has set-up an integrated steel plant with technical know-how and major equipments from MANNESMANN DEMAG and KRUPP of Germany. It is most modern plant, the first integrated steel plant of its kind in India with a capacity of 0.5 million tonnes per annum of rolled products, which are comparable to the best in the world. This plant produces alloy steels, special steels and stainless steels, which are also supplied to major automobile manufacturers in India and a large part of our production is exported. SISCO has its own captive thermal power plant to meet the requirement of steel plant.

With ISO 9002 / QS 9000 organisation we provide best quality of steel to our customers.



Reinforcement Stainless Steel Rebars (Ferritic) Grade G of IS 16651:2017



What is SS Rebar Grade G?

It is a new kind of stainless steel rebar first introduced in India by Sunflag Steel. SS Rebar Grade G is a low cost stainless containing 11-13.5 % Chromium rebar that has a good corrosion resistance. SS REBAR GRADE G is a new age building material which increase the life of the building because of its better corrosion resistance properties compared to TMT, Epoxy coated or Zinc coated rebars.

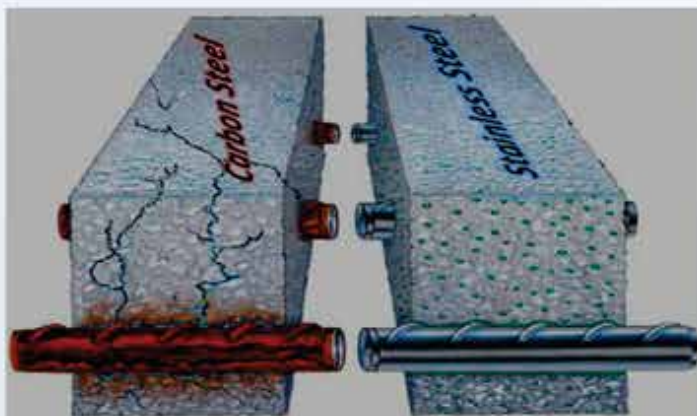
Why SS Rebar Grade G ?

Like any other rebar SS REBAR GRADE G does the job of reinforcement. The concrete inner structure of any building is made of steel. Due to formation of chromium oxide layer on the surface when exposed to atmosphere the SS REBAR GRADE G rebar does not get corroded. This protective oxide layer improves the life of rebar in concrete. In twenty first century SS REBAR GRADE G is a gift to builder, architect and consumer for corrosion free structure.

Corrosion in Concrete Structure

The corrosion of reinforcing bar can result in cost maintenance and repair of concrete structures. Corrosion may occur as a result of carbonation of the concrete, which destroys the protective passive layer surrounding the reinforcing bar. In marine environments, chemical and mineral processing plants etc., corrosion is usually caused by the ingress of highly corrosive chloride ions through the concrete to the reinforcing bar. The products of corrosion (Iron salts and oxides) of the reinforcing bar occupy a considerably greater volume than the original steel resulting in the cracking and subsequent spalling of the concrete. The corrosive attack on the reinforcement then becomes very rapid as the steel is no longer protected by the concrete cover.

The structure will soon weaken to the point where it will become unserviceable or dangerous.



Carbon Steel

Iron expansion inside due to increase in volume of rusting product from reinforced bar and thus the cracking and spalling

RSSR (F) G IS 16651:2017

Passive layer of chromium oxide prevents rusting

To protect the concrete structure from corrosion few techniques have been adopted without much success.

- Coatings on the steel bars
- Using Alloy Steel in the place of Carbon Steel
- Cathodic Protection
- Addition of inhibitors in the concrete
- Increase concrete cover thickness
- Reduced water/cement ratios

Though application of coatings to rebar is an easy route, damage of coatings during handling is the main limitation. Effect of inhibitors is temporary and short-lived. Cathodic protection is perhaps the perfect method but is difficult to implement and requires post maintenance and monitoring (Stainless steel is therefore the only solution for enhancing corrosion protection of concrete).

Low alloy steel with alloy concentration - 1% or so are also not the answer, where the concrete is exposed to both high levels of urban pollution and aggressive marine environment.

What Type of Stainless Steel Can be Used in the Reinforcement of Concrete?

A wide range of stainless steel alloy types is available for rebar selection, to meet the mechanical design aspects and the expected corrosivity of the environment. Stainless Steels are available mainly in five main groups. Austenitic, Ferritic, Duplex, Martensite and Precipitation hardened steels. Depending upon several factors such as relative corrosion, longevity, life cycle cost the SS REBAR GRADE G Stainless Steel is a desirable material. SS REBAR GRADE G is currently used by Orbit Buildcon & Reality (P) Ltd. in Mumbai for their premium housing projects. Orbit Buildcon is a famous construction company located in Mumbai.



Villa Orb

This is a 28 storey structure with exquisite ocean facing suits located at Darabsha lane in Napeansea Road, Mumbai.



Orbit Heaven

Located at apeansea Road, Orbit Haven is a 33 storey residential tower with 5 star comforts.



Orbit Arya

This is a 27 storey building located at Darabsha lane in Napeansea Road, Mumbai.

Stainless Steel Rebar SSR 550



Intrinsic Properties of SS Rebar Grade G

Carbon and Nitrogen control the mechanical properties of Stainless Steel. Higher Carbon and Nitrogen contents are harmful for reinforcement purposes, since these result in a steel with low weldability and low toughness (Control of Carbon content to 300 ppm max. and Nitrogen content to 300 ppm max). results in the formation of a fine equiaxed ferritic steel with good toughness and adequate mechanical properties. That makes SSR 550, Grade G of IS 16651:2017 the best stainless steel for reinforcement of concrete.

Chemical composition of SS Rebar Grade G

Chemical	C	Ni	Mn	Si	P	S	Cr	N
Min %		0.0					11	-
Max %	0.03	0.60	1.0	1.0	0.04	0.030	13.50	-

Properties of SS Rebar Grade G

Grade Elongation	0.2% Proof Strength/ Yield strength	Tensile Strength	
	Mpa	Mpa	%
SS REBAR GRADE G Min.	550	625	17
MS Fe415	415	485	14.5
MS Fe500	500	545	12
MS Fe 550	550	585	8

Equivalent Standards

SS REBAR GRADE G falls in IS 16651:2017 and also A;LSzO
Conforms to all requirements of equivalent grade in JIS G 4322:
2008

Physical Properties

Density	Kg/m ³	7740
Modulus of Elasticity	Tension(Gpa)	200
	Torsion(Gpa)	79
Poisson's Ratio	-	0.32
Specific Heat Capacity	J/Kg/K	478
Thermal Conductivity	100C(W/mk)	30.5
Coefficient of thermal expansion	Um/mk	11.07
Relative permeability	-	Ferromagnetic
Magnetic permeability	Oersted	700-1000

Size & Mass

Nominal Diameter (mm)	Nominal Mass/M (kg/m)	Nominal Sectional area (mm ²)	Circumference (mm)
8	0.395	50.27	25.13
10	0.617	78.54	31.42
12	0.888	113.10	37.70
16	1.578	201.10	50.27
25	2.466	490.90	78.53
32	6.313	804.20	100.50

Cutting

SS REBAR GRADE G has good cutting property and can be easily cut by a mechanical shear or abrasive disc with less tool/disc wear but it is advised not to cut by an oxy-acetylene flame.

Welding

SS REBAR GRADE G has good weldability because of its fine grained structure. Filler material such as AFRIX RSSR (F) G IS 16651:2017, or austenitic stainless steel filler materials such as R309L or 316L are preferred.

In marine environments, chemical and mineral processing plants etc., corrosion is usually caused by the ingress of highly corrosive chloride ions through the concrete to the reinforcing bar. The products of corrosion (Iron salts and oxides) of the reinforcing bar occupy a considerably greater volume than the original steel resulting in the cracking and subsequent spalling of the concrete. Immersion tests in various solutions show eligible corrosion rate (Table 1) of SS Rebar Grade G.

(Table 1).

S.No.	Test Solution (30°C)	Corrosion Rate (mmpy)		•Relative Corrosion Resistance
		16mm	10mm	
1	10% NaOH	0.0013	0.0014	Outstanding
2	10% Ca(OH)	0.00064	0.000575	Outstanding
3	Saturated CaCl	0.000663	0.00089	Outstanding
4	3.5% NaCl	0.025225	0.0268	Excellent
5	3% H ₂ SO ₄	2.05925	0.3375	Poor
6	Hot Water (65°C)	0.1855	0.21625	Good

*M.G.Fontana, Corrosion Engineering, Mc Graw Hill
Outstanding <0.02, Excellent = 0.02-0.1, Good = 0.1-0.5, Poor = 10-5.0
mmpy (millimeter penetration per year) is the most commonly used
corrosion expression

Stainless Steel Rebar SSR 550 (Grade G)



Advantages of SS Rebar Grade G

- SS REBAR GRADE G has inherently good corrosion resistance like any other stainless steel due to chromium oxide layer on the surface.
- It has good high and low temperature tensile as well as yield strength to match or exceed carbon steel.
- In RSSR (F) G IS 16651:2017, no cathodic protection is required.
- It has got good weldability due to very low percentage of carbon content (i.e 0.03 % max.)
- It has very good ductility.
- No coating is required here to have adequate corrosion resistance.
- It can be shipped, handled and bent without any problem.
- SS REBAR GRADE G has excellent earthquake resistance due to high percentage of elongation and ductility.
- Establish Examples of use of similar Stainless Steel Rebars

In South Africa



A similar product 3CR12 has been used extensively for many projects in bridges, building.....

Switzerland & Part of Europe

In the region it is produced and promoted by SWISS steel under the brand name of TOP12.

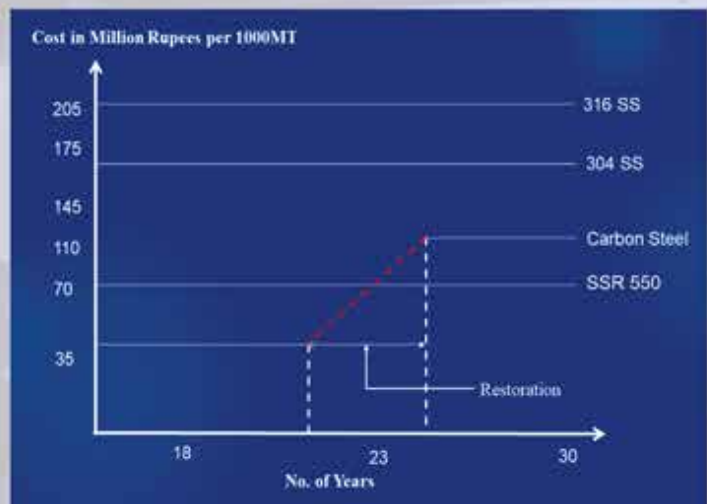


Japan

In Japan ferritic stainless steel rebar is being produced by Nippon Steel & Sumikin Stainless Steel Corporation under the brand name of NSSD410-295 External Wall of Nippon Keidanren Building of NSSD 410-295 Stainless Rebar

Life Cycle Cost

Life cycle costing estimates the total cost of product from initial outlay, through all related future costs may be incurred as a Consequence of initial investment decisions. While making any building or RCC structure the initial investment is going to be higher as there is a price gap between Carbon Steel Rebar and SS Rebar Grade G. But in the long run there will be major savings as building made by SS REBAR GRADE G does not need any maintenance/replacement. Hence, higher investment cost gets offset due to low maintenance.



Case Study : Midlands Links Viaduct



The Midland Links Viaducts carry the M5 and M6 Motorways around Birmingham, Britain

By 2010, it is estimated that further USD 305 million will be spent on repair

By 1989, USD 145 million has been spent on repair

Built in 1972 at a cost of USD 71.4 million evidence of corrosion became apparent after 2 years of operation

The cost of adequate prevention carried out during the stages of design and execution are minimal compared to the savings they make possible during the service life

SS Rebar Grade G

Rebars are Characterized by Superior Mechanical Properties, Ductility & Enhanced Life. It's Built to Last Longer



Certificates



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OUR PRODUCT RANGE

