



BARS, RODS & REBARS



Bars, Rods & Rebars

Rationalised sizes of Bars, Rods & Rebars

Plain Rounds		SAIL TMT/ SAIL TMT HCR			Mill
Size mm	Weight kg/m	Size mm	Weight kg/m	Length m	
		8	0.395	available	BWRM
		10	0.617	in	
		12	0.89	coils	
16	1.58	16	1.58	5.5 to 13	DMM/IMM
18	2.00	18	2.00	for all other	DMM
20	2.47	20	2.47	sizes	DMM/IMM
22	2.98	22	2.99		DMM/IMM
25	3.85	25	3.86		DMM/IMM
28	4.83	28	4.83		DMM/BMM/ IMM
32	6.31	32	6.31		BMM/IMM
33.5*	6.92				BMM
36	7.99	36	7.99		BMM/IMM
40	9.85	40	9.85		BMM/IMM
45	12.50				BMM
50	15.41				BMM/IMM
53*	17.32				BMM/IMM
56	19.34				BMM/IMM
60*	22.0				BMM
63	24.47				BMM/IMM
67*	27.68				BMM/IMM
80	39.50				BMM/IMM

*Bright Bar Sizes

Abbreviations used :

BWRM : Bhilai Wire Rod Mill

BMM : Bhilai Merchant Mill

DMM : Durgapur Merchant Mill

IMM : IISCO Merchant Mill

Common grades : IS 2062/2006, IS 1786.2006 GRD (SAIL TMT and SAIL TMT HCR). Also available in the following foreign specifications :

ASTM-A 615 Grade 40 (for TMT Wire Rods) and **ASTM-A 615 Grade 40/Grade 60** (for TMT Bars), if sufficient orders are available.

Packaging

Signode strapping in bundles of 5 tonnes

Plain Rounds/TMT rebars/TMT-HCR rebars in sizes 8, 10 and 12 mm are available in coils. The other sizes of Plain Rounds/TMT rebars/TMT-HCR rebars are available in straight lengths.

Applications

Specification	Application	Special Qualities
SAIL TMT	General concrete reinforcements in high rise buildings, bridges and other concrete structures	Excellent bendability, good weldability and high fatigue resistance on dynamic loading
SAIL TMT HCR	Construction exposed to coastal, marine or underground environment	
SAIL TMT Roof Bolts	Underground mine and tunnel roof support and slope stabilisation in hills	In addition to above this has high corrosion resistance properties Better bond properties with excellent strength Better UTS/YS ratio
SAIL TMT EQR	Construction in earthquake prone zone	

Tolerances on Lengths and Nominal Mass as per IS: 1786 - 1985

Specified Lengths

If bars are specified to be cut to certain lengths, each bar shall be cut within the deviations of + 75 mm, - 25 mm on the specified length, but if minimum lengths are specified, the deviations shall be + 50 mm, - 0 mm.

Tolerance on Nominal Mass

Nominal Size	Tolerance on the Nominal Mass, percent		
	Batch	Individual Sample*	Individual Sample for Coils only**
< 10	± 7	- 8	± 8
> 10 to 16	± 5	- 6	± 6
> 16	± 3	- 4	± 4

* For individual sample plus tolerance is not specified.

** For coils batch tolerance is not applicable

Chemical Composition IS : 2062:2011

Grade Designation	Quality	Ladle Analysis, Percent, Max					Carbon Equivalent (CE)	Max Method of Deoxidation
		C	Mn	S	P	Si		
E 250	A	0.23	1.50	0.045	0.045	0.40	0.42	Semi killed/killed
	BR	0.22	1.50	0.045	0.045	0.40	0.41	Killed
	BO							
	C	0.20	1.50	0.040	0.040	0.40	0.39	Killed
E 300	A							Semi Killed/Killed
	BR							Killed
	BO	0.20	1.30	0.045	0.045	0.45	0.40	
	C							
E 350	A							Semi Killed/Killed
	BR							Killed
	BO	0.20	1.50	0.045	0.045	0.45	0.42	
	C							
E 410	A							Semi Killed/Killed
	BR							Killed
	BO	0.20	1.60	0.045	0.045	0.45	0.46	
	C							
E 450	A							Semi Killed/Killed
	BR	0.22	1.60	0.045	0.045	0.45	0.48	Killed
E 550	A							Semi Killed/Killed
	BR	0.22	1.65	0.020	0.025	0.50	0.50	Killed
E 600	A							Semi Killed/Killed
	BR	0.22	1.70	0.020	0.025	0.50	0.50	Killed
E 650	A							Semi Killed/Killed
	BR	0.22	1.70	0.015	0.025	0.50	0.52	Killed

Chemical Composition

IS 1786 – SAIL TMT Fe 415 grade

	% C max	% S max	% P max	% S + P max	Carbon Equivalent
Normal	0.25	0.050	0.050	0.085	As per IS: 1786
Grade D	0.25	0.045	0.045		
EQR	0.25	0.045	0.045		
HCR	0.25	0.050	0.050		
HCR EQR	0.25	0.045	0.045		

Note: Micro alloy, if added, will not be exceed 0.030%

SAIL TMT Rock Bolt (IS:1786 grade)

	% C max	% S max	% P max	Alloying/Micro alloying	Carbon Equivalent
Fe 500	0.25	0.050	0.050	Nb+V 0.045% max	As per IS: 1786
Fe 550	0.25	0.050	0.050	Nb+V 0.050% max	
Fe 600	0.25	0.050	0.050	Nb+V 0.055% max	

IS: 1786 – SAIL TMT Fe-500 grade

	% C max	% S max	% P max	% S + P max	Carbon Equivalent
Normal	0.25	0.050	0.050	0.075	As per IS: 1786
Grade D	0.25	0.040	0.040		
EQR	0.25	0.040	0.040		
HCR	0.25	0.050	0.050		
HCR EQR	0.25	0.050	0.050		

Note: Micro alloy, if added, will not be exceed 0.030%

IS: 1786 – SAIL TMT Fe-550 grade

	% C max	% S max	% P max	% S + P max	Carbon Equivalent
Normal	0.25	0.050	0.050	0.075	As per IS: 1786
Grade D	0.25	0.040	0.040		
HCR	0.25	0.050	0.050		

Note: SAIL, TMT-HCRA: (Cu+P) > 0.40% • SAIL TMT-HCRM: (Cu+Cr) > 0.75%

Savings in steel* when using SAIL TMT or SAIL TMT-HCR

Grade	Fe 415	Fe 500	Fe 550
Saving in steel compared to IS-2062 plain bar	40%	44%	47%
Saving in steel compared to IS-1786/Fe 415 CTD		14%	19%

* In case of doubly reinforced beams using M15 and M20 grades of concrete.

Mechanical Properties IS : 2062:2011

Grade Designation	Quality	Tensile Strength Rm Min Mpa	Yield Stress Min Mpa			Percentage Elongation A, at Gauge Length, L=5.65 √S Min	Internal Bend Diameter Min (See Note 2)		Charpy Impact Test (See Note 3 & 4)	
			<20	20-40	>40		<25	>25	Temp °C	Min
E-250	A	410	250	240	230	23	2t	3t	—	—
	BR								RT	27
	BO								0	27
	C								(-) 20	27
E-300	A	440	300	290	280	22	2t	—	—	—
	BR								RT	27
	BO								0	27
	C								(-) 20	27
E-350	A	490	350	330	320	22	2t	—	—	—
	BR								RT	27
	BO								0	27
	C								(-) 20	27
E-410	A	540	410	390	380	20	2t	—	—	—
	BR								RT	25
	BO								0	25
	C								(-) 20	25
E-450	A	570	450	430	420	20	2.5t	—	—	—
	BR								RT	20
	BO								0	20
	C								(-) 20	20
E-550	A	650	550	530	520	12	3.0t	—	—	—
	BR	650	550	530	520	12	3.0t	—	RT	15
E-600	A	730	600	580	570	12	3.5t	—	—	—
	BR								RT	15
E-650	A	780	650	630	620	12	4.0t	—	—	—
	BR								RT	15

Mechanical Properties: IS 1786 SAIL TMT Fe 415, 500 & 550

Grade	Yield Strength MPa min	YS MPa Max	Ultimate Tensile Strength MPa min	UTS/YS Min	% Elongation min	% Uniform Elongation* min
Fe 415	415		485		14.5	–
Fe 415 D	415		500		18	5
Fe 415 HCR	415		485		14.5	–
Fe 415 EQR	415	540		1.25	20.0	10
Fe 415 HCR EQR	415	540		1.25	20.0	10
Fe 500	500		545		12.0	–
Fe 500 D	500	565		1.1	16	5
Fe 500 HCR	500		545			
SAIL TMT EQR 500	500	625		1.18	18	8
SAIL TMT EQR-HCR 500	500	625		1.18	18	8
Fe 550	550		585		10	–
Fe 550 D	550		600	1.1	14.5	5
Fe 550 HCR	550		585			
Fe 600	600		660		10	
Fe 600 HCR	600		660		10.0	

Note: 1. Mechanical properties will meet the requirement of IS: 1786.

2. For EQR, EQRHCR grades, apart from % EI, UTS/YS will be 1.25 min for Fe 415 grade and 1.18 min for Fe 500 grade

*With mutual consent

Rock Bolt

Grade	Yield Strength MPa min	Ultimate Tensile Strength MPa min	% Elongation min
ROCKBOLT Fe 500	500	545	12.0
ROCKBOLT Fe 550	550	585	10.0
ROCKBOLT Fe 600	600	720	8.0
ROCKBOLT Fe 640	640	710	8.0

Note: Transverse Rib Angle not less than 70 Deg.

High Temperature Strength

SAIL TMT-HCR-A, SAIL TMT-HCR-M, SAIL TMT-HCR-P reinforcement bars exhibit higher thermal resistance even at temperatures up to 600°C. The retention of significant strength or, in other words, resistance to softening, is attributed to design of steel chemistry, presence of tempered martensite layer on the rebar surface and absence of any cold worked structural zone. Thus the thermally hardened SAIL TMT-HCR-A, SAIL TMT-HCR-M, SAIL TMT-HCR-P rebars are ideal for use in places prone to fire hazards.

Wire Rods

Size in mm	Weight kg/m	Mill
5.5	0.186	BWRM
6	0.222	BWRM
7	0.302	BWRM
8	0.395	BWRM
10	0.617	BWRM

Abbreviation used : **BWRM** : Bhilai Wire Rod Mill

Coil Weight : 850 kg per coil

Coil Dimension : Outer diameter -1240/1380 mm; Inner diameter 830/956 mm; Height 512/620 mm

Packaging : Each coil is strapped with metallic straps.

Common grades : IS 2062/2006, IS 2879/1998, SWR-14, SWR-10, SAE 1008*, SAE 1010* (*CHQ under development)

Materials are also available in the following foreign specifications :

JIS-G-3505-SWRM-10, JIS-G-3112-1991-SR-235, ASTM-A 510

M-93, SAE-1015, if sufficient orders are available.

Chemical Composition

Specification	Grade	C %	Mn %	S % max	P % max
IS: 2062	Grade A	0.23 max	1.50 max	0.05	0.05
IS: 2879	Rimming	0.1 max	0.38-0.62	0.03	0.03
SWR-14		0.14 max	0.70 max	0.05	0.05
SWR-10		0.1 max	0.60 max	0.04	0.04
SAE 1008		0.1 max	0.30-0.50	0.05	0.04
SAE 1010		0.08-0.13	0.30-0.60	0.05	0.04
High Carbon	EN-8	0.35-0.45	0.60-1.0	0.030	0.035
	EN-9	0.50-0.60	0.50-0.80	0.030	0.035

Note : For EN-8 & EN-9, Si 0.1 to 0.35

Tolerance : As per IS: 1852

Size	Diameter	Ovality (max)
5.5, 6 & 7 mm	± 0.50 mm	0.65 mm
8 & 10 mm	± 0.50 mm	0.65 mm

Applications

Specification	Application
IS : 2062/2011	Structural applications
IS : 2879/1998	Arc welding electrodes, welding machine wires
SWR-14, SAE-1010	Bolts, nuts, rivets, machine screw, wire nail, fencing wire, wire netting, bright bar and other general engineering applications
SWR-10, SAE-1008	Cable armouring, wire mesh and other low carbon applications

Mechanical Properties

Specification	Grade	Yield Strength MPa	Tensile Strength MPa	Elongation %
IS: 2062/2011	Grade A	250 min	410 min	23 min
IS: 2879/1998*	Rimming			
SWR-14*				
SWR-10*				
SAE 1008*				
SAE 1010*				
High Carbon	EN-8, EN-9			

* Mechanical properties not mandatory