

## PRODUCT SPECIFICATIONS

### SPECIFICATIONS FOR CONTINUOUS CAST PRODUCTS

#### 1. CONTINUOUS CAST ROUNDS FOR SEAMLESS PIPE APPLICATION

Sl. No.	Grade	Range	%C	%Mn	%S	%P	%Si	%Al	%Ni	%Cr	%Mo	%V
1	BS3059 Pt-II Gr243	Min	0.13	0.6	-	-	0.15	-	-	-	0.25	-
		Max	0.18	0.75	0.02	0.02	0.35	0.012	-	0.2	0.35	0.05
2	BS3059 Pt-II Gr440	Min	0.13	1.05	-	-	0.15	0.015	-	-	-	-
		Max	0.17	1.2	0.015	0.02	0.3	0.05	-	0.2	0.05	0.08
3	DIN 1629 ST52	Min	0.17	1.35	-	-	0.2	0.015	-	0.15	-	-
		Max	0.21	1.5	0.02	0.02	0.4	0.05	-	0.2	0.05	0.05
4	DIN 1629 ST52 (Spl)	Min	0.18	1.45	-	-	0.3	0.015	-	0.2	0.08	-
		Max	0.22	1.6	0.02	0.02	0.45	0.05	-	0.3	0.13	0.05
5	SAE 1518	Min	0.17	1.25	-	-	0.1	0.015	-	0.1	-	-
		Max	0.21	1.4	0.02	0.02	0.35	0.05	-	-	0.05	0.05
6	SAE 1040	Min	0.39	0.75	-	-	0.25	0.015	-	-	-	-
		Max	0.44	0.9	0.02	0.02	0.4	0.05	-	0.2	0.1	0.05
7	SAE 1035	Min	0.33	0.65	-	-	0.2	0.015	-	-	-	-
		Max	0.37	0.85	0.02	0.02	0.35	0.05	-	0.2	0.1	0.05
8	ASTM A105	Min	0.18	0.7	-	-	-	-	-	-	-	-
		Max	0.24	1.0	0.05	0.04	0.35	-	-	0.3	0.12	0.03
9	SAE 4130	Min	0.28	0.45	-	-	0.2	0.015	-	0.85	0.15	-
		Max	0.33	0.6	0.02	0.02	0.3	0.05	-	1.05	0.25	0.05
10	API 5L X-42	Min	0.11	1.05	-	-	0.3	0.015	-	0.13	-	-
		Max	0.15	1.2	0.015	0.015	0.45	0.05	-	0.17	-	0.05
11	API 5L X-60	Min	0.17	1.35	-	-	0.35	0.015	-	0.25	-	0.12
		Max	0.21	1.45	0.015	0.02	0.45	0.05	-	0.35	-	0.15
12	N-80	Min	0.4	1.6	-	-	0.3	0.015	-	-	-	-
		Max	0.45	1.7	0.02	0.02	0.45	0.05	-	-	-	-
13	BS-3059 (IBR GRADE) (Equivalent to- BS-3059)	Min	0.13	1.05	-	-	0.1	0.02	-	-	-	-
		Max	0.18	1.2	0.025	0.025	0.35	0.05	0.2	0.2	0.05	0.05
14	SAE-1518 (Eq to SAE-1518)	Min	0.18	1.2	-	-	0.1	0.02	-	-	-	-
		Max	0.21	1.3	0.01	0.015	0.35	0.05	0.2	0.2	0.05	0.05
15	SAE-1541 (Eq. To SAE-1541)	Min	0.4	1.5	-	-	0.1	0.02	-	-	-	-
		Max	0.44	1.65	0.015	0.025	0.25	0.05	0.2	0.2	0.05	0.05
16	ST-52 (Eq-DIN 1.0580)	Min	0.18	1.4	-	-	0.3	0.02	-	-	-	-
		Max	0.22	1.6	0.015	0.02	0.55	0.05	0.2	0.2	0.05	0.05
17	SAE-1537V (EQ. To SAW-17)	Min	0.25	1.5	-	-	0.15	0.015	-	-	-	0.12
		Max	0.3	1.6	0.02	0.02	0.3	0.035	0.2	0.2	0.05	0.15
18	SAE-1527 (Eq. To SAW-15)	Min	0.25	1.5	-	-	0.15	0.02	-	-	-	-
		Max	0.29	1.6	0.02	0.02	0.35	0.05	0.2	0.2	0.05	0.05

**CONTINUOUS CAST ROUNDS FOR SEAMLESS PIPE APPLICATION / CONTD-**

Sl. No.	Grade	Range	%C	%Mn	%S	%P	%Si	%Al	%Ni	%Cr	%Mo	%V
19	P-110 (Eq. To SAW-16)	Min	0.24	1.45	-	-	0.15	-	-	0.5	-	-
		Max	0.29	1.55	0.015	0.02	0.35	0.02	0.2	0.6	0.05	0.05
20	SAE-4140 (Eq. To En-19)	Min	0.38	0.75	-	-	0.1	0.02	-	0.8	0.15	-
		Max	0.43	1.0	0.015	0.025	0.25	0.05	0.2	1.1	0.25	0.05
21	SAE-4130	Min	0.28	0.4	-	-	0.1	0.02	-	0.8	0.15	-
		Max	0.33	0.6	0.015	0.025	0.25	0.05	0.2	1.1	0.25	0.05
22	SAE-1035	Min	0.32	0.6	-	-	0.1	0.02	-	-	-	-
		Max	0.38	0.9	0.015	0.025	0.25	0.05	0.2	0.2	0.05	0.05
23	SAE-5120H	Min	0.17	0.6	-	-	0.15	0.02	-	0.6	-	-
		Max	0.23	1.0	0.015	0.025	0.25	0.05	0.2	1.0	0.05	0.05

**2. ALLOY GRADE FOR FORGING APPLICATIONS (BLOOMS & BILLETS)**

Sl. No.	Grade	C	Mn	S	P	Si	Al	Cr	Ni	Mo	V	CE
1	16MnCr5	0.14/0.19	1.00/1.30	0.035 max	0.035 max	0.15/0.40	0.020/0.040	0.80/1.10	-	-	-	-
2	EN1A	0.07/0.15	.80/1.20	0.20/0.30	0.040 max	0.10 max	-	-	-	-	-	-
3	EN43BCR	0.35/0.45	0.70/1.00	0.035 max	0.035 max	0.15/0.35	0.020 min	0.45/0.55	-	-	-	-
4	EN43D	0.60/0.65	0.40/0.60	0.025/0.040	0.045 max	0.15/0.35	0.020 min	-	-	-	-	-
5	SAE8620	0.18/0.23	0.70/0.90	0.020/0.050	0.035 max	0.15/0.30	0.020/0.050	0.40/0.60	0.40/0.70	0.15/0.25	-	-
6	SCM420	0.18/0.23	0.60/0.85	0.015/0.030	0.030 max	0.15/0.35	0.020/0.035	0.90/1.20	-	0.15/0.30	-	-
7	EN31	0.98/1.10	0.25/0.45	0.025 max	0.025 max	0.15/0.35	-	1.45/1.60	-	-	-	-
8	SAE4140	0.38/0.43	0.75/1.00	0.035 MAX	0.035 MAX	0.15/0.30	0.020/0.050	0.80/1.10	-	0.15/0.25	-	-
9	20MnCr5	0.17/0.22	1.10/1.40	0.035 MAX	0.035 MAX	0.15/0.40	0.020/0.050	1.00/1.30	-	-	-	-
10	A-105	0.18/0.25	0.70/1.05	0.040 max	0.035 max	0.10/0.35	0.020/0.040	-	-	-	-	-
11	EN9	0.50/0.60	0.50/0.80	0.030 max	0.030 max	0.20/0.30	0.015/0.025	-	-	-	-	-
12	EN8D	0.40/0.45	0.70/0.90	0.030 max	0.030 max	0.20/0.30	0.015/0.025	-	-	-	-	-
13	SAE1552	0.47/0.55	1.20/1.50	0.025 max	0.025 max	0.15/0.35	0.015/0.025	0.25 MAX	-	-	-	-
14	SAE4130	0.29/0.32	0.48/0.58	0.010/0.020	0.025 max	0.20/0.30	0.020/0.040	0.95/1.05	0.25 max	0.18/0.22	-	-
15	SAE1040	0.37/0.44	0.60/0.90	0.020/0.035	0.035 MAX	0.10/0.35	0.020/0.040	-	-	-	-	-
16	EN15A	0.33/0.40	1.30/1.70	0.010/0.035	0.040 MAX	0.15/0.35	0.020/0.035	-	-	-	-	-
17	EN18	0.35/0.45	0.60/0.95	0.035 MAX	0.035MAX	0.15/0.35	0.020/0.035	0.85/1.15	-	-	-	-
18	CK 45	0.42/0.50	0.50/0.80	0.035 MAX	0.035 MAX	0.10/0.35	0.020/0.040	-	-	-	-	-
19	EN 353	0.14/0.20	0.50/1.00	0.020/0.035	0.035 MAX	0.10/0.35	0.020/0.040	0.75/1.25	1.00/1.50	0.08/0.15	-	-

**3. STRUCTURAL GRADES (BILLETS AND BLOOMS)**

Sl. No.	Grade	C	Mn	S	P	Si	V	CE	YS(Mpa)	UTS(Mpa)	%E(min)
1	JSP 355	0.14/0.20	1.20/1.45	0.030 max	0.030 max	0.10/0.35	0.030/0.050	0.37/0.42	355 min	490 - 630	22
2	JSP 540	0.17/0.24	1.25/1.50	0.030 max	0.030 max	0.10/0.35	0.030/0.060	0.48 max	400 min	540 min	16

NOTE: Above grades are approved by PGCIL.

4. CARBON STEEL GRADES FOR RE-ROLLING FOR GENERAL STRUCTURAL PURPOSE (Billets / Blooms / Slabs / Ingots) : IS 2830-1992

IS 2830 - 1992	Carbon %	Manganese%
C-15	0.12-0.18	0.30-0.60
C-18	0.15-0.21	0.30-0.60
C-20	0.17-0.23	0.30-0.60
C-15MMn	0.12-0.18	0.60-1.00
C-18MMn	0.15-0.21	0.60-1.00
C-20MMn	0.17-0.23	0.60-1.00
C-15HMn	0.12-0.18	1.00-1.50
C-18HMn	0.15-0.21	1.00-1.50
C-20HMn	0.17-0.23	1.00-1.50

**SPECIFICATION FOR ROLLED PRODUCTS**

1. IS 2062-2006: HOT ROLLED LOW, MEDIUM, AND HIGH TENSILE STRUCTURAL STEEL

a) Chemical Composition (Ladle Analysis)

Grade	% Element (max)						UTS (Mpa) Min	YS(Mpa)Min			%E, GL 5.65 So	Bend Test Mandrel Dia (mm)		CVN-Impact Energy (J) Min.	
	C	Mn	S	P	Si	CE		Thickness(mm) of flange				Min	<25	>25	RT
								<20	20-40	>40					
E 250 A (Fe 410W A)	0.23	1.50	0.045	0.045	0.4	0.42	410	250	240	230	23	3t	3t	-	-
E 250 B (Fe 410W B)	0.22	1.50	0.045	0.045	0.4	0.41	410	250	240	230	23	2t	3t	-	27
E 300 (Fe 440)	0.20	1.50	0.045	0.045	0.45	0.4	440	300	290	280	22	2t	3t	50	30
E 350 (Fe 490)	0.20	1.50	0.045	0.045	0.45	0.42	490	350	330	320	22	2t	3t	50	25
E410 (Fe540)	0.20	1.60	0.045	0.045	0.45	0.44	540	410	390	380	20	2t	3t	50	25

2. EN 10025-2004: HOT ROLLED PRODUCTS OF NON-ALLOY STRUCTURAL STEEL

(For Parallel Flange Beams & Columns, and Channels)

Grades	Chemical Composition, % Max. (Ladle Analysis)									Mechanical Properties					%EL(min)		Impact min		
	Carbon for t(mm)			Mn	Si	S	P	N	CE for t(mm)			YS Mpa Min for t mm			UTS MPa	t >3 <40	t >40 <63	At °C	Joules
	<16	>16 <40	>40						<30	>30£40	>40 £150	<16	>16 £40	>40 £63					
S 235JR	0.17	0.17	0.2	1.4	-	0.035	0.035	0.012	0.35	0.35	0.38	235	225	215	360-510	26	25	-	-
S 275JR	0.21	0.21	0.22	1.50	-	0.035	0.035	0.012	0.40	0.40	0.42	275	265	255	410-560	23	22	20	27
S 275JO	0.18	0.18	0.18	1.50	-	0.030	0.030	0.012	0.40	0.40	0.42	275	265	255	410-560	23	22	0	27
S 275J2	0.18	0.18	0.18	1.50	-	0.025	0.025	-	0.40	0.40	0.42	275	265	255	410-560	23	22	-20	27
S 355JR	0.24	0.24	0.24	1.60	0.55	0.035	0.035	0.012	0.45	0.47	0.47	355	345	335	470-630	22	21	20	27
S 355JO	0.20	0.20	0.22	1.60	0.55	0.030	0.030	0.012	0.45	0.47	0.47	355	345	335	470-630	22	21	0	27
S 355J2	0.20	0.20	0.22	1.60	0.55	0.025	0.025	-	0.45	0.47	0.47	355	345	335	470-630	22	21	-20	27
S 355K2	0.20	0.20	0.22	1.60	0.55	0.025	0.025	-	0.45	0.47	0.47	355	345	335	470-630	22	21	-20	40
S 450JO	0.20	0.20	0.22	1.70	0.55	0.030	0.030	0.025	0.47	0.49	0.49	450	430	410	550-720	17	17	0	27

3. ASTM- A 36 M CARBON STRUCTURAL STEEL  
(For Parallel Flange Beams & Columns, and Channels)

Grade	Chemical composition % (max) (Ladle Analysis)						Mechanical Properties			
	C	Mn	P	S	Si	Cu (Min)	UTS (Mpa)	YS (Mpa)	% Elongation on GL	
									200mm	50mm
A 36	0.26	-	0.04	0.05	0.40	0.20	400-550	250(Min)	20	21

4. GRADES OF RAILWAY RAILS  
IRS T-12-96, UIC 860(O), IRS T-43-92, & Electrical Conductivity Rails.

Grades	Chemical composition % (Ladle Analysis)							Mechanical Properties				
	C	Mn	Si	S(max)	P(max)	Al (max)	H(ppm) max	UTS (MPa)	%EL(min) GL 5.65 $\sqrt{So}$	Hardness BHN	FWT	Sulphur
												Print
IRS-T-12-96Gr 880	0.60-0.80	0.80-1.30	0.10-0.50	0.030	0.030	0.02	1.6	880 min	10	265	Satisfactory	Satisfactory
UIC-860 (O) Gr 900A	0.60-0.80	0.80-1.30	0.10-0.50	0.040	0.040	-	-	880-1030	10	-	Satisfactory	Satisfactory
IRS T-43-92 Grade II	0.60-0.85	0.80-1.40	0.10-0.55	0.055	0.065	-	-	880 Min	10	265	Satisfactory	Satisfactory
ECR	0.11 max.	0.30-0.50	0.10 max	0.050	0.050	-	-	-	-	-	-	-

5. CRANE RAIL SECTIONS (IS-3443:1980)

Grades	Chemical composition % (Ladle Analysis)			Mechanical Properties				
	C	Mn	Si	S (max)	P (max)	UTS MPa (Min)	%EL GL 5.65 $\sqrt{So}$	Hardness BHN Min
55 C11	0.50-0.60	0.95-1.25	0.05-0.30	0.06	0.06	710	14	200
50 C12	0.40-0.60	0.90-1.45	0.03-0.30	0.06	0.06	710	14	200

6. JSP-HT 350HI & 410HI  
Micro Alloyed High Strength steel

Grade	Chemical composition % max (Ladle Analysis)					Mechanical properties							
	C	Mn	S	P	Nb+V+Ti	YS			UTS	%Elongation	Bend at M.D.	Impact joule (min.)	
						t<16mm	16-40mm	41-63 mm				at 0°C	at -20°C
JSPHT 350HI	0.20	1.50	0.040	0.040	0.20	350	330	320	490-610	22	3T	40	30
JSPHT 410HI	0.20	1.50	0.040	0.040	0.20	410	390	380	540-660	20	3T	35	25

7. ASTM A 572: HIGH STRENGTH LOW ALLOY COLUMBIUM-VANADIUM STRUCTURAL STEEL  
(For Parallel Flange Beams & Columns, and Channels)

Grade	Chemical Composition*(max)						Mechanical Properties				
	C	Mn	S	P	Si	Micro Alloy	UTS (Min) Mpa	Yield Point (Min) Mpa	SpecI		
									200mm	50mm	
50 (345)	0.23	1.35	0.05	0.04	0.4	*a	450	345	18	21	

Note:

\*a : Nb=0.005 to 0.05 or V=0.01 to 0.015 or Nb=0.005 to 0.015 with Nb+V = 0.02 to 0.15