

# Steel for Low, Medium & High Tensile Structural Applications

S. No.	Specification & Description	Grade	Chemistry (%)								Mechanical Properties					
			C	Mn	S	P	Si	Nb+V+Ti	N	C.E. Value	YS (Mpa)	UTS (Mpa)	El (%)	Impact-min	Bend	Hardness
1	IS 2062-2006 Steel for Low, Medium & High Tensile structural	E-250 Gr-A	0.23 max	1.50 max	0.050 max	0.050 max	0.40 max	-	-	0.42 max	for thk<20mm-250 for thk 20-40mm-240 for thk>40mm-230	410	23 min		for thk=<25mm-3t for thk>25mm-2t	-
		E-250 Gr-B	0.22 max	1.50 max	0.045 max	0.045 max	0.40 max	-	-	0.41 max	for thk<20mm-250 for thk 20-40mm-240 for thk>40mm-230	410	23 min	27J at 0 degC	for thk=<25mm-2t for thk>25mm-3t	-
		E-250 Gr-C	0.20 max	1.50 max	0.040 max	0.040 max	0.40 max	-	-	0.39 max	for thk<20mm-250 for thk 20-40mm-240 for thk>40mm-230	410	23 min	27J at -20degC	for thk=<25mm-2t for thk>25mm-3t	-
		E-300	0.20 max	1.30 max	0.045 max	0.045 max	0.45 max	0.25 max	-	0.40 max	for thk<20mm-300 for thk 20-40mm-290 for thk>40mm-280	440	22 min	50 J at R.T. 30J at -20degC	for thk=<25mm-2t for thk>25mm-3t	-
		E-350	0.20 max	1.50 max	0.045 max	0.045 max	0.45 max	0.25 max	-	0.42 max	for thk<20mm-350 for thk 20-40mm-330 for thk>40mm-320	490	22 min	50 J at R.T. 25J at -20degC	for thk=<25mm-2t for thk>25mm-3t	-
		E-410	0.20 max	1.60 max	0.045 max	0.045 max	0.45 max	0.25 max	-	0.44 max	for thk<20mm-410 for thk 20-40mm-390 for thk>40mm-380	540	20 min	50 J at R.T. 25J at -20degC	for thk=<25mm-2t for thk>25mm-3t	-
		E-450 Gr-D	0.22 max	1.60 max	0.045 max	0.045 max	0.45 max	0.25 max	-	0.46 max	for thk<20mm-450 for thk 20-40mm-430 for thk>40mm-420	570	20 min	45 J at R.T. 20J at -20degC	for thk=<25mm-2t for thk>25mm-3t	-
		E-450 Gr-E	0.22 max	1.80 max	0.045 max	0.045 max	0.45 max	0.25 max	-	0.48 max	for thk<20mm-450 for thk 20-40mm-430 for thk>40mm-420	590	20 min	45 J at R.T. 20J at -20degC	for thk=<25mm-2t for thk>25mm-3t	-
2	ASTM A36 General structural steel	-	0.25 max	0.80-1.20	0.05 max	0.050 max	0.40 max	-	-	-	250	400-550	18 min	-	-	-
3	ASTM A283 M Low & intermediate tensile strength plate	A	0.14max	0.90max	0.035max	0.035max	0.15-0.40	-	-	-	165min	310-415	30 min	-	-	-
		B	0.17max	0.90max	0.035max	0.035max	0.15-0.40	-	-	-	185min	345-450	28min	-	-	-
		C	0.24max	0.90max	0.035max	0.035max	0.15-0.40	-	-	-	205min	380-515	25min	-	-	-
		D	0.27max	0.90max	0.035max	0.035max	0.15-0.40	-	-	-	230min	415-550	23min	-	-	-
4	BSEN 10025 Structural steel	S235	0.17max	1.40max	0.035max	0.035max	-	-	90ppm max	0.35max	235min	340-470	23min	27J at -20degC	-	-
		S275	0.18max	1.50max	0.035max	0.035max	-	-	90ppm max	0.40max	275min	410-5602	21min	27J at -20degC	-	-
		S355	0.20max	1.60max	0.035max	0.035max	0.55max	-	90ppm max	0.45max	355min	490-630	19min	27J at -20degC	-	-
5	DIN 17100 Micro alloyed structural steel	St 37	0.17max	1.60max	0.040max	0.040max	0.55max	-	90ppm max	-	235min	360-510	26min	27J at +20degC	-	-
		St 44	0.20max	1.60max	0.040max	0.040max	0.55max	-	90ppm max	-	275min	430-580	22min	27J at -20degC	-	-
		St 52	0.20max	1.60max	0.040max	0.040max	0.55max	-	90ppm max	-	355min	510-680	22min	27J at -20degC	-	-



# Steel for Pressure Vessels & Boilers

S. No.	Specification & Description	Grade	Chemistry (%)										Mechanical Properties		
			C	Mn	S	P	Si	Cr	Ni	Cu	Mo	Nb+V+Ti	YS	UTS	%El
1	ASTM A 515 grade Pressure vessel plates for intermediate & high temperature service	60 (415)	0.24 max	0.90 max	0.035 max	0.035 max	0.15-0.40	-	-	-	-	-	220 min	415-550	21 min
		65 (450)	0.28 max	0.90 max	0.035 max	0.035 max	0.15-0.40	-	-	-	-	-	240 min	450-585	19 min
		70 (485)	0.31 max	1.20 max	0.035 max	0.035 max	0.15-0.40	-	-	-	-	-	260 min	485-620	17 min
2	ASTM A 516 grade Pressure vessel plates for moderate & low tempera- ture service	55 (380)	0.18 max	0.60-0.90	0.035 max	0.035 max	0.15-0.40	-	-	-	-	-	205 min	380-515	23 min
		60 (410)	0.21 max	0.60-0.90	0.035 max	0.035 max	0.15-0.40	-	-	-	-	-	220 min	415-585	21 min
		65 (450)	0.24 max	0.85-1.20	0.035 max	0.035 max	0.15-0.40	-	-	-	-	-	240 min	450-585	19 min
		70 (485)	0.27 max	0.85-1.20	0.035 max	0.035 max	0.15-0.40	-	-	-	-	-	260 min	485-620	17 min
3	IS 2002-1992 Pressure vessel plates for intermediate & high temperature service	1	0.18 max	0.50-1.20	0.040 max	0.035 max	0.15-0.35	-	-	-	-	-	235 min	360-480	24 min
		2	0.20 max	0.50-1.20	0.040 max	0.035 max	0.15-0.35	-	-	-	-	-	265 min	410-510	22 min
		3	0.22 max	0.50-1.20	0.040 max	0.035 max	0.15-0.35	-	-	-	-	-	290 min	460-560	21 min
4	ASTM A 537 class I High strength pressure vessel plates-heat treated	-	0.24 max	0.70-1.35	0.040 max	0.035 max	0.15-0.50	0.25 max	0.25 max	0.35 max	0.08 max	0.15 max	345 min	485-620	22 min
5	ASTM A387M Steel alloy for high temp. & pressure vessels	Gr 2 Cl-1	0.05-0.21	0.55-0.80	0.035max	0.035max	0.15-0.40	0.50 - 0.80	-	-	0.45 - 60	-	228min	380-550	22 min
		Cl-2	-	-	-	-	-	-	-	-	-	-	310min	485-620	22 min
		Gr 11 Cl-1	0.05-0.17	0.40-0.65	0.035max	0.035max	0.15-0.40	0.80 - 1.15	-	-	0.45 - 60	-	242min	415-585	22 min
		Cl-2	-	-	-	-	-	-	-	-	-	-	310min	515-690	22 min
		Gr 12 Cl-1	0.05-0.17	0.40-0.65	0.035max	0.035max	0.50-0.80	1.0 - 1.5	-	-	0.45 - 65	-	228min	380-550	22 min
		Cl-2	-	-	-	-	-	-	-	-	-	-	275min	450-585	23 min
		Gr22 Cl-1	0.05-0.15	0.30-0.60	0.035max	0.035max	0.50max	2.0 - 2.5	-	-	0.90-1.10	-	210min	415-585	18 min
		Cl-2	-	-	-	-	-	-	-	-	-	-	310min	515-690	18 min
6	ASTM A204M-93 Steel alloy for pressure vessel plate	A	0.18max	0.90max	0.035max	0.035max	0.15-0.40	-	-	-	-	-	255 min	450-585	23 min
		B	0.20max	0.90max	0.035max	0.035max	0.15-0.40	-	-	-	-	-	275min	485-620	21 min
		C	0.23max	0.90max	0.035max	0.035max	0.15-0.40	-	-	-	-	-	295min	515-655	20 min



# Steel for Oil & Gas Line Pipes

S. No.	Specification	Grade	Chemistry (%)						Mechanical Properties		
			C	Mn	S	P	Ti	Nb+V+Ti	YS	UTS	%EI
1	API 5L	B	0.22 max	1.20 max	0.015 max	0.025 max	0.04 max	0.15 max	241-448	414-758	22-30 % (As per thickness)
2	API 5L	X-42	0.22 max	1.30 max	0.015 max	0.025 max	0.04 max	0.15 max	290-496	414-758	---do---
3	API 5L	X-46	0.22 max	1.40 max	0.015 max	0.025 max	0.04 max	0.15 max	317-524	434-758	---do---
4	API 5L	X-52	0.22 max	1.40 max	0.015 max	0.025 max	0.04 max	0.15 max	359-531	455-758	---do---
5	API 5L	X-56	0.22 max	1.40 max	0.015 max	0.025 max	0.04 max	0.15 max	386-544	490-758	---do---
6	API 5L	X-60	0.22 max	1.40 max	0.015 max	0.025 max	0.04 max	0.15 max	514-565	517-758	---do---
7	API 5L	X-65	0.22 max	1.45 max	0.015 max	0.025 max	0.06 max	0.15 max	448-600	531-758	---do---
8	API 5L	X-70	0.22 max	1.65 max	0.015 max	0.025 max	0.06 max	0.15 max	483-621	565-758	---do---
9	API 5L	X-80	0.22 max	1.85 max	0.015 max	0.025 max	0.06 max	0.15 max	552-690	621-827	---do---

# Steel for Shipbuilding

S. No.	Specification & Description	Grade	Chemistry (%)									Mechanical Properties			
			C	Mn	S	P	Si	Al (min)	Nb	V	C.E	YS	UTS	%EI	Impact-min Avg. Energy (Longitudinal)
1	LRS	A	0.21max	2.5xminC	0.035max	0.035max	0.50max	-	-	-	0.40max	235	400-520	22	27 J at 20 degree
2	-	B	0.21max	0.80min	0.035max	0.035max	0.35max	-	-	-	0.40max	235	400-520	22	27 J at 0 degree
3	-	D	0.21max	0.60min	0.035max	0.035max	0.10-0.35	0.015	-	-	0.40max	235	400-520	22	27 J at -20 degree
4	-	AH27S	0.18max	0.9-1.6 max	0.035max	0.035max	0.50max	0.015	0.02-0.05	0.03-0.10	0.38max	265	400-530	22	27 J at 0 degree
5	-	DH27S	0.18max	0.9-1.6 max	0.035max	0.035max	0.50max	0.015	0.02-0.05	0.03-0.10	0.38max	265	400-530	22	27 J at -20 degree
6	-	AH32	0.18max	0.9-1.6 max	0.035max	0.035max	0.50max	0.015	0.02-0.05	0.03-0.10	0.38max	315	440-590	22	31 J at 0 degree
7	-	DH32	0.18max	0.9-1.6 max	0.035max	0.035max	0.50max	0.015	0.02-0.05	0.03-0.10	0.38max	315	440-590	22	31 J at -20 degree
8	-	AH36	0.18max	0.9-1.6 max	0.035max	0.035max	0.50max	0.015	0.02-0.05	0.03-0.10	0.40max	355	490-620	21	34 J at 0 degree
9	-	DH36	0.18max	0.9-1.6 max	0.035max	0.035max	0.50max	0.015	0.02-0.05	0.03-0.10	0.40max	355	490-620	21	34 J at -20 degree

\* Equivalent grades as per other class certifications can also be supplied.



# Steel for Corrosion Resistant Applications

S. No.	Specification & Description	Grade	Chemistry (%)									Mechanical Properties			
			C	Mn	S	P	Si	Cr	Ni	Cu	Nb+V+Ti	YS	UTS	%El	Bend
1	IRS M41 / 97 Corrosion resistant steel for railways	CortenA	0.10 max	0.25 - 0.45	0.030 max	0.075-0.112	0.28-0.72	0.35-0.49	0.20-0.49	0.30-0.39	-	340 min	480 min	22 min	1t
2	ASTM A242 Corrosion resistant steel	Type-I	0.15 max	1.0 max	0.05 max	0.15 max	0.25-0.40	0.30-0.50	-	0.2 min	0.15 max	345 min	480 min	16 min	-
3	ASTM A 588 M-93 Corrosion resistant steel High strength low alloy	Grade A	0.19 max	0.80-1.25	0.05 max	0.04 max	0.30-0.65	0.40 - 0.65	0.40 max	0.20-0.40	V : 0.02-0.10	345 min	485 min	21 min	-

# Steel for other special applications

S. No.	Specification & Description	Grade	Chemistry (%)										Mechanical Properties					
			C	Mn	S	P	Si	Cr/Cu/Al	Nb	V	Ti	Nb+V+Ti =	YS	UTS	%El	Impact-min	Bend	Hardness
1	SAILMA Micro alloyed, high strength high impact steel	350/350 HI	0.20 max	1.50 max	0.040 max	0.040 max	0.50 max	-	-	-	-	-	350 min	490-610	21 min	40J at 0 degC	-	-
		410/410 HI	0.20 max	1.50 max	0.040 max	0.040 max	0.50 max	-	-	-	-	-	410 min	540-660	20 min	35J at 0 degC	-	-
		450/450 HI	0.20 max	1.50 max	0.040 max	0.040 max	0.50 max	-	-	-	-	-	450 min	570 min	19 min	30J at 0 degC	-	-
2	SAILHARD/TISCRA Wear resistant steel	-	0.23-0.30	1.60 max	0.050 max	0.050max	0.50 max	Cr : 0.60-0.65	-	-	-	0.15 max	-	-	-	-	-	200 BHN min
3	ASTM A572 High strength low alloy Nb-V Structural steel	290	0.21 max	1.35 max	0.050 max	0.040 max	0.40 max	-	0.005-0.05	-	-	-	290 min	415 min	18 min	-	-	-
		345	0.23 max	1.35 max	0.050 max	0.040 max	0.40 max	-	-	0.01-0.15	-	-	345 min	450 min	16 mi	-	-	-
		415	0.26 max	1.35 max	0.050 max	0.040 max	0.40 max	-	0.05min	0.02-0.15	-	-	415 min	520 min	14min	-	-	-
		450	0.23 max	1.65 max	0.050 max	0.040 max	0.40 max	-	-	-	-	Nb + V = 0.15 max	450 min	550 min	13 min	-	-	-
		450S	0.26 max	1.35 max	0.050 max	0.040 max	0.40 max	-	-	-	-	-	450 min	550 min	13 min	-	-	-
4	ASTM A 573 Structural carbon steel for improved toughness (C-Mn-Si Steel)	400	0.23 max	0.60-0.90	0.40 max	0.035 max	0.10-0.35	-	-	-	-	-	220 min	400-490	19 min	-	-	-
		450	0.24 max	0.85-1.20	0.40 max	0.035 max	0.15-0.40	-	-	-	-	-	240 min	450-530	18 min	-	-	-
		485	0.27 max	0.85-1.20	0.40 max	0.035 max	0.15-0.40	-	-	-	-	-	290 min	485-620	16 min	-	-	-
5	IS 8917 -1979 Steel plate for zinc pot	-	0.05 max	0.25 max	0.025max	0.025max	0.05max	-	-	-	-	-	-	-	-	-	-	-
		-	0.10 max	0.35max	0.030max	0.030max	0.05max	-	-	-	-	-	-	-	-	-	-	-
6	SS 4012 A Fine grained low carbon steel	E34	0.10max	0.70max	0.30max	0.30max	0.20max	-	0.055 max	0.095 max	0.045 max	-	330-410	390-490	27 min	-	0.5t	-
		E38	0.10max	1.00max	0.30max	0.30max	0.40max	-	0.055 max	0.095 max	0.045 max	-	370-460	440-560	25 min	-	0.5t	-
		E42	0.10max	1.20max	0.30max	0.30max	0.40max	-	0.055 max	0.095 max	0.045 max	-	410 min	480-600	23 min	-	0.5t	-
		BSK46	0.12 max	1.10 - 1.40	0.025 max	0.025 max	0.30 max	Cu : 0.25 max	0.080 max	-	-	-	360 min	500-640	21 min	-	1t	-
7	IS1570 C45/ En8 / En9	C45	0.40-0.45	0.70-0.90	0.030max	0.030max	0.15-0.20	Al : 0.01-0.02	-	-	-	300 min	627 min	18 min	-	-	-	

