

# SPECIFICATIONS

Specification	ASTM A53		ASTM A500				ASTM A513												
	A	B	A		B		MT 1010	MT 1015	MTX 1015	MT 1020	MTX 1020	1025	1026	1030	1035	4130	8630		
Classification	Ordinary piping		General structural purposes				Machine structural purposes												
Application	Ordinary piping		General structural purposes				Machine structural purposes												
Chemical composition(%)	C(Max.)	0.25	0.30	Heat 0.26	Product 0.30	Heat 0.26	Product 0.30	0.05 - 0.15	0.10 - 0.20	0.10 - 0.20	0.15 - 0.25	0.15 - 0.25	0.22 - 0.28	0.22 - 0.28	0.27 - 0.34	0.31 - 0.38	0.28 - 0.33	0.28 - 0.33	
	Si(Max.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.15 - 0.35	0.15 - 0.35	
	Mn(Max.)	0.95	1.20	-	-	-	-	0.30 - 0.60	0.30 - 0.60	0.60 - 0.90	0.30 - 0.60	0.70 - 1.00	0.30 - 0.60	0.60 - 0.90	0.60 - 0.90	0.60 - 0.90	0.40 - 0.60	0.70 - 0.90	
	P(Max.)	0.05	0.05	0.035	0.045	0.035	0.045	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	
	S(Max.)	0.045	0.045	0.035	0.045	0.035	0.045	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.040	0.040
	Others	-	-	Cu 0.20 (Min.)	Cu 0.18 (Min.)	Cu 0.20 (Min.)	Cu 0.18 (Min.)	-	-	-	-	-	-	-	-	-	-	Cr 0.80-1.10 Mo 0.15-0.25 Ni 0.40-0.70	Cr 0.40-0.60 Mo 0.15-0.25 Ni 0.40-0.70
Mechanical properties	Tensile strength (Min.)	PSI	48000	6000	R 45000	S 45000	R 58000	S 58000	Type		Grade		Tensile strength Min. (PSI)		Yield point Min. (PSI)		Elongation Min(%)		
		MPa	330	415	310	310	400	400	As-welded	1010 1015 1020 1025 1030 1035	45000 48000 52000 56000 62000 66000	32000 35000 38000 40000 45000 50000	15 15 12 12 10 10						
		kgf/mm <sup>2</sup>	33.8	42.2	31.6	31.6	40.8	40.8											
	Yield point (Min.)	PSI	30000	35000	33000	39000	42000	46000	Normalized	1010 1015 1020 1025 1030 1035	40000 45000 50000 55000 60000 65000	25000 30000 35000 37000 40000 45000	30 30 25 25 25 20						
		MPa	205	240	228	269	290	317											
		kgf/mm <sup>2</sup>	21.1	24.6	23.3	27.4	29.6	32.3											
	Elongation (Min.)	e = 625.000 A <sup>92</sup> /U <sup>95</sup>		25 (56t + 17.5)		23 (61t + 12)		Mandrel-drawn	1010 1015 1020 1025 1030 1035	60000 65000 70000 75000 85000 90000	50000 55000 60000 65000 75000 80000	5 5 5 5 5 5							
						Mandrel-drawn stress-relieved	1010 1015 1020 1025 1030 1035						55000 60000 65000 70000 80000 85000	45000 50000 55000 60000 70000 75000	12 12 10 10 10 10				
	Flattening test	H : Distance between Flattening plates(mm) H' : Inside disance between flattening plates(mm) D : Outside diameter of the pipe(mm) D' : Inside diameter of the pipe(mm) t : Wall thickness of the pipe(mm)	NPS2 over Weld H = 2/3D Base metal H = 1/3D		Weld H = 2/3D Base metal H = 1/3D Soundness Test H = Contact Welded part is located at 90 degree				Welded part H = 2/3D Base metal H = 1/3D Welded part is located at 90 degree										
Bending test	Bending angle X Inside radius (D : Outside diameter of the pipe)	NPS2 below 90° x 12D close coiling 180° x 8D																	
Hydrostatic test	P : Test pressure (PSI, MPa) D : Outside diameter(mm) t : Thickness(mm)	P = $\frac{2St}{D}$						P = $\frac{2St}{D}$ s = allowable fiber stress of 14000PSI or 96.5MPa											
NDT (Non-Destructive Test)		Ultrasonic Test or Eddy current test						Eddy - Current Test or Ultrasonic Test or Flux leakage Test											
Others		Weight of zinc coating Average : Min. 550 g/m <sup>2</sup> Individual : Min. 490g/m <sup>2</sup>						Flaring Test ID' = 1.15D' (60° tool) D' : Inside diameter ID' : Enlarged inside diameter											

Specification Classification	ASTM A589					BS 1387	BS 3601			BS 3602		BS 1775																	
	TYPE 1		TYPE 2	TYPE 3	TYPE 4	(L)Light (M)Medium (H)Heavy	ERW 320	ERW 360	ERW 430	ERW 360	ERW 410	ERW 11	ERW 16	ERW 20	ERW 23														
Application	Drive Pipe (Grade A)	Drive Pipe (Grade B)	Water-Well Beam and Drift Pipe (Grade A)	Driven Well Pipe (Grade A)	Water-Well Casing Pipe (Grade A)	Ordinary piping	Pressure services			High-pressure services		Machine structural purposes, General structural purposes																	
Chemical composition (%)	C(Max.)	-	-	-	-	0.20	0.16	0.17	0.21	0.17	0.21	-	-	-	-														
	Si(Max.)	-	-	-	-	-	-	0.35	0.35	0.35	0.35	-	-	-	-														
	Mn(Max.)	-	-	-	-	1.20	0.30-0.70	0.40-0.80	0.40-1.20	0.40-0.80	0.40-1.20	-	-	-	-														
	P(Max.)	0.050	0.050	0.050	0.050	0.050	0.045	0.040	0.040	0.040	0.045	0.045	0.060	0.060	0.060	0.060													
	S(Max.)	0.060	0.060	0.060	0.060	0.060	0.045	0.040	0.040	0.040	0.045	0.045	0.060	0.060	0.060	0.060													
	Others	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-													
Mechanical properties	Tensile strength (Min.)	PSI	48000	60000	48000		-	-	-	-	-	-	-	-	-	-													
		MPa	331	413	331		320-460	320-460	360-500	430-570	360-500	410-550	309	386	463	494													
		kgf/mm <sup>2</sup>	33.8	42.1	33.8		32.7-46.9	32.7-46.9	36.7-51.0	43.9-58.2	36.7-51.0	41.8-58.1	31.5	39.4	47.2	50.4													
	Yield point (Min.)	PSI	30000	35000	30000		-	-	-	-	-	-	-	-	-	-													
		MPa	207	241	207		195	195	235	275	215	245	170	247	309	355													
		kgf/mm <sup>2</sup>	21.1	24.6	21.1		19.9	19.9	24.0	28.1	21.9	25.0	17.3	25.2	31.5	36.2													
Elongation(Min.)	e = 625,000(A <sup>0.5</sup> /U <sup>0.5</sup> )					20	25	25	22	24	22	600/TS(700/TS) TS : Ton/in <sup>2</sup> , Kgf/mm <sup>2</sup>																	
Flattening test	H : Distance between Flattening plates H' : Inside distance between flattening plates D : Outside diameter of the pipe D' : Inside diameter of the pipe t : Wall thickness of the pipe					DN Over 50 Welded part H = 0.75D Base metal H = 0.60D Welded part is located at 90 degree	$H = \frac{(1+e)t}{e+t/D}$ <table border="1"> <tr> <td rowspan="2">Class</td> <td colspan="2">Constant</td> </tr> <tr> <td>Welded part</td> <td>Base metal</td> </tr> <tr> <td>320</td> <td>0.029</td> <td>0.10</td> </tr> <tr> <td>360</td> <td>0.026</td> <td>0.09</td> </tr> <tr> <td>460</td> <td>0.023</td> <td>0.08</td> </tr> </table>			Class	Constant		Welded part	Base metal	320	0.029	0.10	360	0.026	0.09	460	0.023	0.08	$H = \frac{(1+e)t}{e+t/D}$		H'=3t or H'=1/2D' whichever is the smaller	H'=6t or H'=3/4D' whichever is the smaller	H'=8t or H'=7/8D' whichever is the smaller	H'=6t or H'=3/4D' whichever is the smaller
	Class	Constant																											
Welded part		Base metal																											
320	0.029	0.10																											
360	0.026	0.09																											
460	0.023	0.08																											
Bending test	Bending angle × inside radius (D : Outside diameter, t : Wall thickness )					DN 50below Black pipes 180° × 6D Galvanized pipes 90° × 8D				Outside diameter of bar is 4t																			
Hydrostatic test	P : Test pressure S : Fiber stress, PSI(mPa) D : Outside diameter(mm) t : Thickness(mm)					51 (50 bar)	$P = \frac{20St}{D}$ (bar) S : 80% of the specified minimum yield strength			$P = \frac{20St}{D}$ (bar) S : 80% of the specified minimum yield strength Max : 143Kg/cm <sup>2</sup> (140bar)																			
NDT (Non-Destructive Test)						Eddy Current Test(substitut e with hydrostatic test)	Eddy Current Test (Applied to pipes with Outside diameter of 180mm or less as substitution for hydrostatic test)			Ultrasonic Test																			
Others						Bore Test(hot- dip zinc coated tubes)				The Charpy V-notch Impact test		Drift Expanding Test 1D = 1.125D'    1D = 1.10D'    1D = 1.075D'    1D = 1.10D'																	