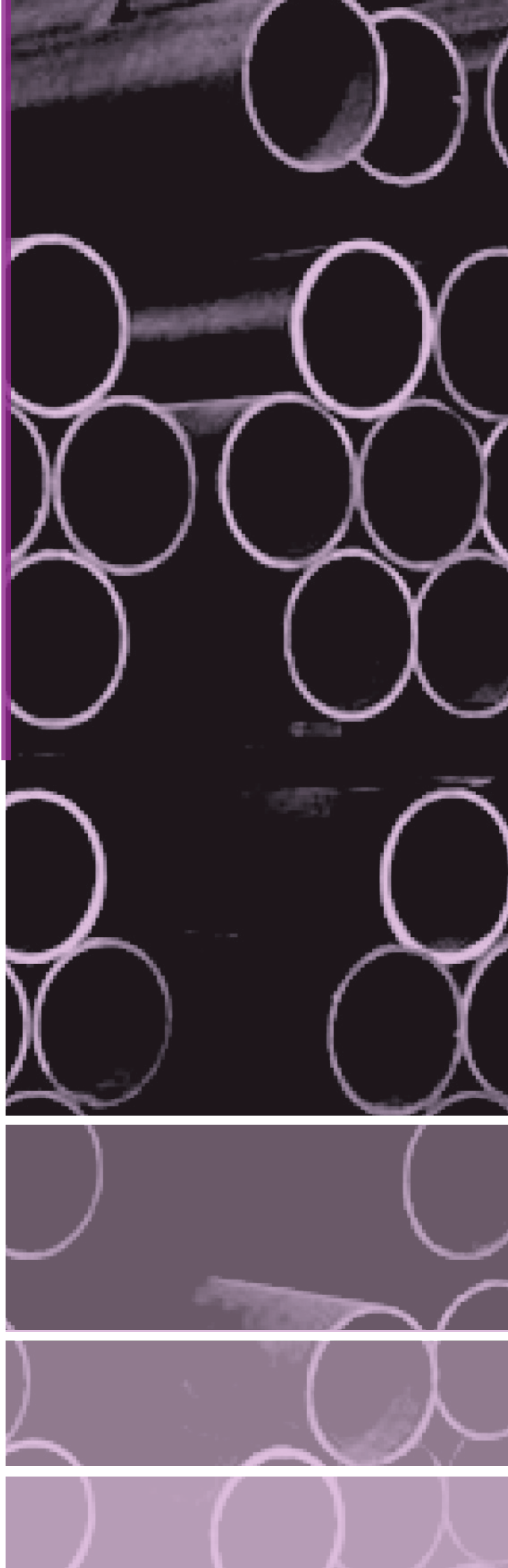


# STEEL PIPES



## 7I) Carbon Steel Tubes For General Structural Purposes

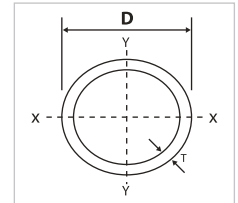
Japanese Industrial Standard ( Extracts from JIS G 3445 : 2006 )

<b>General Information</b>	This Japanese Industrial Standard specifies the carbon steel tubes, used for machinery, automobiles, bicycles, furniture, appliance and other machine parts.																																																																				
<b>Chemical Composition</b>	<p>The Chemical composition values shall conform to Table 1.</p> <p>Table 1. Chemical Composition <span style="float: right;">Unit: %</span></p> <table border="1"> <thead> <tr> <th colspan="2">Grade</th> <th>Symbol Of Grade</th> <th>C</th> <th>Si</th> <th>Mn</th> <th>P</th> <th>S</th> </tr> </thead> <tbody> <tr> <td>Grade 11</td> <td>A</td> <td>STKM 11 A</td> <td>0.12 max.</td> <td>0.35 max.</td> <td>0.60 max.</td> <td>0.040 max.</td> <td>0.040 max.</td> </tr> </tbody> </table>	Grade		Symbol Of Grade	C	Si	Mn	P	S	Grade 11	A	STKM 11 A	0.12 max.	0.35 max.	0.60 max.	0.040 max.	0.040 max.																																																				
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<b>Mechanical Strength (Tensile Test)</b>	<p>The tensile strength, yield point or proof stress and elongation shall conform to Table 2.</p> <p>The minimum elongation value of tensile test in the case of *No.12 test piece or *No.5 test piece of tubes under 8 mm in wall thickness shall be as Table 3. The minimum value of elongation shall conform to Table 4 for testing by *No.4 test piece.</p> <p>Table 2. Mechanical properties</p> <table border="1"> <thead> <tr> <th colspan="2">Grade</th> <th>Symbol Of Grade</th> <th>Tensile Strength N/mm<sup>2</sup></th> <th>Yield Point Or Proof Strength N/mm<sup>2</sup></th> <th colspan="2">Elongation %</th> </tr> <tr> <th colspan="2"></th> <th></th> <th></th> <th></th> <th>*No. 11 Test Piece *No. 12 Test Piece Longitudinal Direction</th> <th>*No. 5 Test Piece Transverse Direction</th> </tr> </thead> <tbody> <tr> <td>Grade 11</td> <td>A</td> <td>STKM 11 A</td> <td>290 min.</td> <td>-</td> <td>35 min.</td> <td>30 min.</td> </tr> </tbody> </table> <p>Table 3. The minimum elongation value of tensile test in the case of *No. 12 test piece (longitudinal direction) and *No. 5 test piece (transverse direction) of tubes under 8 mm in wall thickness <span style="float: right;">Unit %</span></p> <table border="1"> <thead> <tr> <th rowspan="2">Grade</th> <th rowspan="2">Symbol Of Grade</th> <th rowspan="2">The Shape Of Test Piece</th> <th colspan="9">Elongation For Each Division Of Thickness</th> </tr> <tr> <th>1 mm Or under</th> <th>Over 1mm up to and incl. 2 mm</th> <th>Over 2mm up to and incl. 3 mm</th> <th>Over 3mm up to and incl. 4 mm</th> <th>Over 4mm up to and incl. 5 mm</th> <th>Over 5mm up to and incl. 6 mm</th> <th>Over 6mm up to and incl. 7 mm</th> <th>Over 7mm up to and excl. 8 mm</th> </tr> </thead> <tbody> <tr> <td rowspan="2">11</td> <td rowspan="2">A</td> <td rowspan="2">STKM 11A</td> <td>*No. 5 Test Piece</td> <td>20</td> <td>21</td> <td>22</td> <td>24</td> <td>26</td> <td>27</td> <td>28</td> <td>30</td> </tr> <tr> <td>*No. 12 Test Piece</td> <td>24</td> <td>26</td> <td>28</td> <td>29</td> <td>30</td> <td>32</td> <td>34</td> <td>35</td> </tr> </tbody> </table> <p>Table 4. The minimum elongation value of Tensile test using No. 4 test piece <span style="float: right;">Unit %</span></p> <table border="1"> <thead> <tr> <th>Symbol Of Grade</th> <th>Longitudinal Direction</th> <th>Transverse Direction</th> </tr> </thead> <tbody> <tr> <td>STKM 11A</td> <td>33</td> <td>28</td> </tr> </tbody> </table> <p>* Please refer to Tension Test Pieces for Metallic Materials - JIS Z 2201</p>	Grade		Symbol Of Grade	Tensile Strength N/mm <sup>2</sup>	Yield Point Or Proof Strength N/mm <sup>2</sup>	Elongation %							*No. 11 Test Piece *No. 12 Test Piece Longitudinal Direction	*No. 5 Test Piece Transverse Direction	Grade 11	A	STKM 11 A	290 min.	-	35 min.	30 min.	Grade	Symbol Of Grade	The Shape Of Test Piece	Elongation For Each Division Of Thickness									1 mm Or under	Over 1mm up to and incl. 2 mm	Over 2mm up to and incl. 3 mm	Over 3mm up to and incl. 4 mm	Over 4mm up to and incl. 5 mm	Over 5mm up to and incl. 6 mm	Over 6mm up to and incl. 7 mm	Over 7mm up to and excl. 8 mm	11	A	STKM 11A	*No. 5 Test Piece	20	21	22	24	26	27	28	30	*No. 12 Test Piece	24	26	28	29	30	32	34	35	Symbol Of Grade	Longitudinal Direction	Transverse Direction	STKM 11A	33	28
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<b>Bending Test</b>	<p>The purchaser can specify the bendability test instead of flattening test for the tubes of 50 mm or under of outside diameter. A suitable length of a tube shall be cut off from one end of the tube to be made into a test piece. The test piece shall be bent, at an ordinary temperature around a cylinder of the bend angle and the inside radius specified in Table 5, and then examined for the existence of flaws or cracks on the test piece. The weld zone shall be placed in the outermost part of the bent portion. In bending test, the test piece shall be free from flaws or cracks.</p> <p>Table 5. Bending test</p> <table border="1"> <thead> <tr> <th colspan="4">Bending Strength</th> </tr> <tr> <th>Grade</th> <th>Designation</th> <th>Bend Angle</th> <th>Inside Radius (<i>D</i> Is Outside Dia. Of The Tube)</th> </tr> </thead> <tbody> <tr> <td>Grade 11</td> <td>A</td> <td>STKM 11 A</td> <td>180°</td> </tr> <tr> <td></td> <td></td> <td></td> <td>4 D</td> </tr> </tbody> </table>	Bending Strength				Grade	Designation	Bend Angle	Inside Radius ( <i>D</i> Is Outside Dia. Of The Tube)	Grade 11	A	STKM 11 A	180°				4 D																																																				
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<p><b>Cold Flattening Test</b></p>	<p>A test piece of 50 mm or over in length shall be cut off from the end of a pipe. The test piece shall be placed at ordinary temperature between two flat plates and flattened by compression until the distance between the plates reaches the value specified in Table 6, and then examined for the existence of flaws or cracks on the test piece. The weld zone shall be placed at right angle to the direction of compression. In flattening test, the test piece shall be free from flaws or cracks.</p> <p>Table 6. Flattening test</p> <table border="1"> <thead> <tr> <th colspan="5">Flattening Strength</th> </tr> <tr> <th colspan="2">Grade</th> <th>Designation</th> <th>Flattening Angle</th> <th>Distance Between Flat Plates (H) (D is Outside Dia. Of The Tube)</th> </tr> </thead> <tbody> <tr> <td>Grade 11</td> <td>A</td> <td>STKM 11 A</td> <td>90°</td> <td>1/2 D</td> </tr> </tbody> </table>	Flattening Strength					Grade		Designation	Flattening Angle	Distance Between Flat Plates (H) (D is Outside Dia. Of The Tube)	Grade 11	A	STKM 11 A	90°	1/2 D																																																																																																																																																
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7(l) Carbon Steel Tubes For Machine Structural Purposes

( JIS G 3445 : 2006 STKM 11A / Manufacturer’s Standard )



7(l) Carbon Steel Tube - I

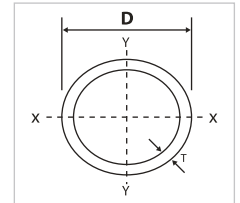
Nominal Size	Outside Diameter		Thickness (t)											
			SWG : 19				SWG : 18				SWG : 17			
	D		1.0 mm				1.2 mm				1.4 mm			
	D		0.039 in				0.047 in				0.056 in			
mm	in	mm	kg/m	kg/6m	kg/ft	lb/ft	kg/m	kg/6m	kg/ft	lb/ft	kg/m	kg/6m	kg/ft	lb/ft
12	1/2	12.7	0.289	1.734	0.088	0.194	0.340	2.040	0.104	0.228	0.390	2.340	0.119	0.262
16	5/8	15.9	0.368	2.208	0.112	0.247	0.435	2.610	0.133	0.292	0.501	3.006	0.153	0.337
19	3/4	19.1	0.447	2.682	0.136	0.300	0.530	3.180	0.162	0.356	0.611	3.666	0.186	0.411
22	7/8	22.2	0.523	3.138	0.159	0.351	0.622	3.732	0.190	0.418	0.718	4.308	0.219	0.482
25	1	25.4	0.602	3.612	0.183	0.405	0.716	4.296	0.218	0.481	0.829	4.974	0.253	0.557
28	1 1/8	28.6	0.681	4.086	0.208	0.458	0.811	4.866	0.247	0.545	0.939	5.634	0.286	0.631
32	1 1/4	31.8	0.760	4.560	0.232	0.511	0.906	5.436	0.276	0.609	1.050	6.300	0.320	0.706
35	1 3/8	34.9	-	-	-	-	1.000	6.000	0.305	0.672	1.160	6.960	0.354	0.779
38	1 1/2	38.1	0.915	5.490	0.279	0.615	1.092	6.552	0.333	0.734	1.267	7.602	0.386	0.851
41	1 5/8	41.3	-	-	-	-	1.187	7.122	0.362	0.798	1.378	8.268	0.420	0.926
44	1 3/4	44.5	-	-	-	-	1.281	7.686	0.390	0.861	1.488	8.928	0.454	1.000
47	1 7/8	47.6	-	-	-	-	1.373	8.238	0.418	0.923	1.595	9.570	0.486	1.072
50	2	50.8	-	-	-	-	1.468	8.808	0.447	0.986	1.705	10.230	0.520	1.146
54	2 1/8	54.0	-	-	-	-	1.563	9.378	0.476	1.050	1.816	10.896	0.554	1.220
57	2 1/4	57.2	-	-	-	-	-	-	-	-	1.926	11.556	0.587	1.294
60	2 3/8	60.3	-	-	-	-	1.749	10.494	0.533	1.175	2.033	12.198	0.620	1.366
65	2 1/2	63.5	-	-	-	-	-	-	-	-	2.144	12.864	0.653	1.441
80	3	76.2	-	-	-	-	-	-	-	-	-	-	-	-

7(l) Carbon Steel Tube - II

Nominal Size	Outside Diameter		Thickness (t)			
			1.5 mm			
	D		0.059 in			
mm	in	mm	kg/m	kg/6m	kg/ft	lb/ft
25	1	25.4	0.884	5.304	0.269	0.594
32	1 1/4	31.8	1.121	6.726	0.342	0.753
38	1 1/2	38.1	1.354	8.124	0.413	0.910
50	2	50.8	1.824	10.944	0.556	1.226
60	2 3/8	60.3	2.175	13.050	0.663	1.462

Note : Calculated based on 1kg=2.2046 lb and 1m=3.2808 feet

7(I) Carbon Steel Tubes For Machine Structural Purposes



( JIS G 3445 : 2006 STKM 11A / Manufacturer’s Standard )

7(I) Carbon Steel Tube - III

Nominal Size	Outside Diameter		Thickness (t)											
			SWG : 16				SWG : 15				SWG : 14			
	D		1.6 mm				1.8 mm				2.0 mm			
	D		0.063 in				0.071 in				0.079 in			
mm	in	mm	kg/m	kg/6m	kg/ft	lb/ft	kg/m	kg/6m	kg/ft	lb/ft	kg/m	kg/6m	kg/ft	lb/ft
12	1/2	12.7	0.438	2.628	0.134	0.294	0.484	2.904	0.148	0.325	0.528	3.168	0.161	0.355
16	5/8	15.9	0.564	3.384	0.172	0.379	0.626	3.756	0.191	0.421	0.686	4.116	0.209	0.461
19	3/4	19.1	0.691	4.146	0.211	0.464	0.768	4.608	0.234	0.516	0.844	5.064	0.257	0.567
22	7/8	22.2	0.813	4.878	0.248	0.546	0.906	5.436	0.276	0.609	0.996	5.976	0.304	0.669
25	1	25.4	0.939	5.634	0.286	0.631	1.048	6.288	0.319	0.704	1.154	6.924	0.352	0.775
28	1 1/8	28.6	1.066	6.396	0.325	0.716	1.190	7.140	0.363	0.800	1.312	7.872	0.400	0.882
32	1 1/4	31.8	1.192	7.152	0.363	0.801	1.332	7.992	0.406	0.895	1.470	8.820	0.448	0.988
35	1 3/8	34.9	1.318	7.908	0.402	0.886	1.469	8.814	0.448	0.987	1.623	9.738	0.495	1.091
38	1 1/2	38.1	1.440	8.640	0.439	0.968	1.612	9.672	0.491	1.083	1.781	10.686	0.543	1.197
41	1 5/8	41.3	1.567	9.402	0.478	1.053	1.754	10.524	0.535	1.179	1.938	11.628	0.591	1.302
44	1 3/4	44.5	1.693	10.158	0.516	1.138	1.896	11.376	0.578	1.274	2.096	12.576	0.639	1.408
47	1 7/8	47.6	1.815	10.890	0.553	1.220	2.033	12.198	0.620	1.366	2.249	13.494	0.686	1.511
50	2	50.8	1.942	11.652	0.592	1.305	2.175	13.050	0.663	1.462	2.407	14.442	0.734	1.617
54	2 1/8	54.0	2.068	12.408	0.630	1.390	2.317	13.902	0.706	1.557	2.565	15.390	0.782	1.724
57	2 1/4	57.2	2.194	13.164	0.669	1.474	2.459	14.754	0.750	1.652	2.723	16.338	0.830	1.830
60	2 3/8	60.3	2.316	13.896	0.706	1.556	2.597	15.582	0.792	1.745	2.876	17.256	0.877	1.933
65	2 1/2	63.5	2.443	14.658	0.745	1.642	2.739	16.434	0.835	1.841	3.033	18.198	0.924	2.038
80	3	76.2	2.944	17.664	0.897	1.978	3.303	19.818	1.007	2.220	3.660	21.960	1.116	2.459

Note : Calculated based on 1kg=2.2046 lb and 1m=3.2808 feet