JIS G3466 Carbon Steel Square for general structural purposes

1. Scope

This Japanese Industrial Standard specified the carbon steel square pipes, hereinafter referred to as the "square tubes", used for civil engineering architecture and other structures.

Remark

The units and numerical values given in { }in this Standard are based on the International System of Units (SI) and are appended for informative reference.

Further, the traditional units accompanied by numerical values in this Standard shall be converted, January 1, 1991, to the SI units and numerical values.

2. Grade and Designation

Square tubes shall be classified into 2 grades, and their designation shall be as given in Table 1.

Table 1 Designation of Grade

Designation of grade	Former grade
STKR 400 STKR 490	STKR 41 STKR 50

World Standard Comparative Table

KS		ASTM		JIS		DIN		BS	
NUMBER	GRADE	NUMBER	GRADE	NUMBER	GRADE	NUMBER	GRADE	NUMBER	GRADE
D 3568	SPSR 400 (new) SPSR 41 (old)	A500	Gr B	G-3466	STKR 400 (new) STKR 41 (old)	-	-	EN 10025	S275JR
	SPSR 490 (new) SPSR 50 (old)		Gr C		STKR 490 (new) STKR 50 (old)		-		S355JO
	-		Gr A Gr D		-		-		-

3. Method of Manufacture

(1) Square tubes shall be manufactured by forming welded steel tubes (by means of electric resistance welding. forging welding or automatic arc welding) or seamless steel tubes into square section, or manufactured by forming a steel sheet in coil into square section or into one pair of channel section followed by a continuous electric resistance welding or automatic arc welding process.

(2) Square tubes shall be furnished as manufactured condition and, as a rule, not heat-treated.

4. Chemical Composition

The pipe shall be tested in accordance with 8.1 and the resulting ladle analysis values shall conform to Table 2.

Table 2. Chemical Composition

Designation of grade	Chemical Composition				
	C	Si	Mn	P	S
STKR 400	0.25 max.	-	-	0.040 max.	0.040 max.
STKR 490	0.18 max.	0.55 max.	1.50 max.	0.040 max.	0.040 max.

Remark

When a pipe is made from killed steel and the purchaser requires product analysis, the tolerances on the values given in the above table shall be as specified in Table 1 in JIS G0321.

5. Mechanical Properties

5.1 Tensile Strength, Yield Point or Proof Stress and Elongation

The tube shall be tested in accordance with 8.2 and the resulting tensile strength, yield point or proof stress and elongation shall conform to Table 3.

Table 3. Mechanical Properties

Designation of grade			
	Tensile strength N/㎟{kgf/㎟}	Yield point or proof stress N/㎟{kgf/㎟}	Elongation % (No.5 test piece)
STKR 400	400 {41} min.	245 {25} min.	23 min.
STKR 490	490 {50} min.	325 {33} min.	23 min.

Remark

1. When the tube under 8 mm in thickness is subjected to tensile test, the minimum value of elongation shall be calculated by subtracting 1.5 % from the value of elongation given in Table 3 for each decrease of 1 mm and rounding off the result to a whole number according to JIS Z 8401.

2. When a tensile test piece is to be taken from the welded steel square tube, one shall be taken from a seamless portion.

5.2 Bendability

For a square tube manufactured by welding. a bending test on welded zone shall be made as required by the purchaser. In this case, the specified values, test method and sampling method shall be agreed upon by the purchaser and the manufacturer.

6. Appearance

6.1 Square tubes shall be free from defects that are detrimental to practical use.

6.2 The surface finishing of square tubes and plating, if particularly required by the purchaser, shall be agreed upon between the purchaser and the manufacturer.

7. Dimensions, Mass and Dimensional Tolerances

7.1 Dimensions and Weight

The Dimensions and mass of square tubes shall be as given Attached Table. However, the standard radius if curvature at corner shall be 1.5t of wall thickness on the center line of the wall thickness.

The standard lengths of the tube shall be 6m, 8m, 10m and 12m.

7.2 Dimensional Tolerance

The tolerances on side length, unevenness of flat plate portion for each side, angularity made between adjacent flat plate portions, dimension at corner, length, unstraightness and wall measurement of dimensions of sectional profile and angle at corner shall be made at any point except both ends of the Square tube.

TABLE 4. Dimensional Tolerance

Specified item and dimension		Dimensional tolerance
Length of side	100mm or under	【1.5mm
	Over 100mm	【1.5%
Unevenness of flat plate portion of each side	Side length 100mm or under	0.5mm max.
	Side length over 100mm	Within 0.5% of side length
Angularity made by adjacent flat plate portions		【1.5∑
Dimension at corner : S		3t max.
Length		+ not specified 0
Unstraightness		Within
Wall thickness	Square steel tube manufacture by welding	under 3mm 【0.3mm 3mm or over 【10%
	Seamless square steel tube	Under 45mm 【0.6mm 45mm or over 【15%

Remarks

1. The "flat plate portion" is defined as the hatched portion shown in the figure below.
2. The tolerances on the dimensions at corner be altered by agreement between the purchaser and the manufacturer.
3. The tolerance on unstraightness shall be applied to the upper to lower bend and the right to left bend with a long pitch.
4. The tolerances on wall thickness shall be applied to the flat plate portion.

8. Test

8.1 Chemical Analysis

8.1.1 General matters of chemical analysis and method of sampling specimens for analysis shall be in accordance with 3. in JIS G 0303.

8.1.2 Analytical Method

The analytical method shall be in accordance with one of the following Standards:

JIS G 1253, JIS G 1256, JIS G 1257, JIS G 1214

JIS G 1215, JIS G 1211, JIS G 1212, JIS G 1213

8.2 Tensile Test

8.2.1 The test piece shall be No. 5 test piece specified in JIS Z 2201 to be cut from the flat plate portion of the square tube along its longitudinal axis.

8.2.2 Test Method

The test method shall be n accordance with JIS Z 2241.

9. Inspection

(1) General matters of inspection shall be in accordance with JIS G 0303.

(2) The chemical composition, mechanical properties, appearance and dimensions for square tubes shall conform to the requirements specified in 3., 4., 5, and 6.

(3) The method of sampling test specimens and the number of test pieces for tensile test shall be as given in Table 5.

Table 5. Method of Sampling Test Specimens and Number of Test Piece

Length of longer side	Sampling method of test specimen and number of test piece
100mm or under	Take one test specimen from each 5000 m or its fraction of square tubes of the same grade and dimension, and from the specimen take one tensile test piece,
Over 100 mm up to and incl. 200 mm	To take one test specimen from each 2500 m or its fraction of square tubes of the same grade and dimension, and from the specimen take one tensile test piece.
Over 200mm	To take one test specimen from each 1250 m or its fraction of square tubes of the same grade and dimension, and from the specimen take one tensile test piece.

10. Reinspection

The tube is entitled to a retest in accordance with 4.4 in JIS G 0303 for final acceptance.

11.Marking

Each square tube having passed the inspection shall be legibly marked with the following items. The order of arranging the items is not specified.

However, smaller square tubes may be bundled together and be marked for each bundle by suitable means.

(1) Designation of grade

(2) Dimensions

(3) Manufacturer's name or its identifying brand

12. Report

The manufacturer shall submit a test report if previously required by the purchaser.

Attached Table. Dimension and Mass of Carbon Steel Square Pipes for Structural Purposes

1.Square

Side length A】B mm	Wall thickness t mm	Unit mass kg/m	Informative reference			
			Cross sectional area	Geometrical moment of inertia	Modulus of section	Radius of gyration of area
			P	H^4	ЖК	H
				I_x, I_y	Z_x, Z_y	i_x, i_y
20x20	1.2	0.697	0.865	0.53	0.52	0.769
20x20	1.6	0.872	1.123	0.67	0.65	0.751
25x25	1.2	0.867	1.105	1.03	0.824	0.965
25x25	1.6	1.12	1.432	1.27	1.02	0.942
30x30	1.2	1.06	1.345	1.83	1.22	1.17
30x30	1.6	1.38	1.752	2.31	1.54	1.15
40x40	1.6	1.88	2.392	5.79	2.90	1.56
40x40	2.3	2.62	3.332	7.73	3.86	1.52
50x50	1.6	2.38	3.032	11.7	4.68	1.96
50x50	2.3	3.34	4.252	15.9	6.34	1.93
50x50	3.2	4.50	5.727	20.4	8.16	1.89
60x60	1.6	2.88	3.672	20.7	6.89	2.37
60x60	2.3	4.06	5.172	28.3	9.44	2.34
60x60	3.2	5.50	7.007	36.9	12.3	2.30
75x75	1.6	3.64	4.632	41.3	11.0	2.99
75x75	2.3	5.14	6.552	57.1	15.2	2.95
75x75	3.2	7.01	8.927	75.5	20.1	2.91
75x75	4.5	9.55	12.17	98.6	26.3	2.85
80x80	2.3	5.50	7.012	69.9	17.5	3.16
80x80	3.2	7.51	9.567	92.7	23.2	3.11

80x80	4.5	10.3	13.07	122	30.4	3.05
90x90	2.3	6.23	7.932	101	22.4	3.56
90x90	3.2	8.51	10.85	135	29.9	3.52
100x100	2.3	6.95	8.852	140	27.9	3.97
100x100	3.2	9.52	12.13	187	37.5	3.93
100x100	4.0	11.7	14.95	226	45.3	3.89
100x100	4.5	13.1	16.67	249	49.9	3.87
100x100	6.0	17.0	21.63	311	62.3	3.79
100x100	9.0	24.1	30.67	408	81.6	3.65
100x100	12.0	30.2	38.53	471	94.3	3.50
125x125	3.2	12.0	15.33	376	60.1	4.95
125x125	4.5	16.6	21.17	506	80.9	4.89
125x125	5.0	18.3	23.36	553	88.4	4.86
125x125	6.0	21.7	27.63	641	103	4.82
125x125	9.0	31.1	39.67	865	138	4.67
125x125	12.0	39.7	50.53	103x10	165	4.52
150x150	4.5	20.1	25.67	896	120	5.91
150x150	5.0	22.3	28.36	982	131	5.89
150x150	6.0	26.4	33.63	115x10	153	5.84
150x150	9.0	38.2	48.67	158x10	210	5.69
175x175	4.5	23.7	30.17	145x10	166	6.93
175x175	5.0	26.2	33.36	159x10	182	6.91
175x175	6.0	31.1	39.63	186x10	213	6.86
200x200	4.5	27.2	34.67	219x10	219	7.95
200x200	5.0	35.8	45.63	283x10	283	7.88
200x200	6.0	46.9	59.79	362x10	362	7.78
200x200	9.0	52.3	66.67	399x10	399	7.73
200x200	12.0	67.9	86.53	498x10	498	7.59
250x250	5.0	38.0	48.36	481x10	384	9.97
250x250	6.0	45.2	57.63	567x10	454	9.92
250x250	8.0	59.5	75.79	732x10	585	9.82

250x250 250x250	9.0 12.0	66.5 86.8	84.67 110.5	809x10 $103x10^2$	647 820	9.78 9.63
300x300 300x300 300x300 300x300	4.5 6.0 9.0 12.0	41.3 54.7 80.6 106	52.67 69.63 102.7 134.5	763x10 996x10 $143x10^2$ $183x10^2$	508 664 956 122x10	12.0 12.0 11.8 11.7
350x350 350x350	9.0 12.5	94.7 124	120.7 158.5	$232x10^2$ $298x10^2$	132x10 170x10	13.9 13.7

Attached Table (Continued)

2. Rectangle

Side length A】B mm	Wall thickness t mm	Unit mass kg/m	Informative reference						
			Cross sectional area	Geometrical moment of inertia		Modulus of section		Radius of fraction of area	
			P	H^4		ЖК		H	
				I_x	I_y	Z_x	Z_y	i_x	i_y
30x20 30x20	1.2 1.6	0.868 1.124	1.105 1.4317	1.34 1.66	0.711 0.879	0.890 1.11	0.711 0.879	1.10 1.80	0.802 0.784
40x20 40x20	1.2 1.6	1.053 1.357	1.3453 1.7517	2.73 3.43	0.923 1.15	1.36 1.72	0.923 1.15	1.42 1.40	0.828 0.810
50x20 50x20 50x30 50x30	1.6 2.3 1.6 2.3	1.63 2.25 1.88 2.62	2.072 2.872 2.392 3.332	6.08 8.00 7.96 10.6	1.42 1.83 3.60 4.76	2.43 3.20 3.18 4.25	1.42 1.83 2.40 3.17	1.71 1.67 1.82 1.79	0.829 0.798 1.23 1.20
60x30 60x30 60x30	1.6 2.3 3.2	2.13 2.98 3.99	2.721 3.792 5.087	12.5 16.8 21.4	4.25 5.65 7.08	4.16 5.61 7.15	2.83 3.76 4.72	2.15 2.11 2.05	1.25 1.22 1.18
75x20 75x20 75x45	1.6 2.3 1.6	2.25 3.16 2.88	2.872 4.022 3.672	17.6 23.7 28.4	2.10 2.73 12.9	4.69 6.31 7.56	2.10 2.73 5.75	2.47 2.43 2.78	0.855 0.824 1.88

75x45	2.3	4.06	5.172	38.9	17.6	10.4	7.82	2.74	1.84
75x45	3.2	5.50	7.007	50.8	22.8	13.5	10.1	2.69	1.80
80x40	1.6	2.88	3.672	30.7	10.5	7.68	5.26	2.89	1.69
80x40	2.3	4.06	5.172	42.1	14.3	10.5	7.14	2.85	1.66
80x40	3.2	5.50	7.007	54.9	18.4	13.7	9.21	2.80	1.62
90x45	2.3	4.60	5.862	61.0	20.8	13.6	9.22	3.23	1.88
90x45	3.2	6.25	7.967	80.2	27.0	17.8	12.0	3.17	1.84
100x20	1.6	2.88	3.672	38.1	2.78	7.61	2.78	3.22	0.870
100x20	2.3	4.06	5.172	51.9	3.64	10.4	3.64	3.17	0.839
100x40	1.6	3.38	4.312	53.5	12.9	10.7	6.44	3.52	1.73
100x40	2.3	4.78	6.092	73.9	17.5	14.8	8.77	3.48	1.70
100x40	4.2	8.32	10.60	120	27.6	24.0	10.6	3.36	1.61
100x50	1.6	3.64	4.632	61.3	21.1	12.3	8.43	3.64	2.13
100x50	2.3	5.14	6.552	84.8	29.0	17.0	11.6	3.60	2.10
100x50	3.2	7.01	8.927	112	38.0	22.5	15.2	3.55	2.06
100x50	4.5	9.55	12.17	147	48.9	29.3	19.5	3.47	2.00
125x40	1.6	4.01	5.112	94.4	15.8	15.1	7.91	4.30	1.76
125x40	2.3	5.69	7.242	131	21.6	20.9	10.8	4.25	1.73
125x75	2.3	6.95	8.852	192	87.5	30.6	23.3	4.65	3.14
125x75	3.2	9.52	12.13	257	117	41.1	31.1	4.60	3.10
125x75	4.0	11.7	14.95	311	141	49.7	37.5	4.56	3.07
125x75	4.5	13.1	16.67	342	155	54.8	41.2	4.53	3.04
125x75	6.0	17.0	21.63	428	192	68.5	51.1	4.45	2.98
150x75	3.2	10.8	13.73	402	137	53.6	36.6	5.41	3.16
150x80	4.5	15.2	19.37	563	211	75.0	52.9	5.39	3.30
150x80	5.0	16.8	21.36	614	230	81.9	57.5	5.36	3.28
150x80	6.0	19.8	25.23	710	264	94.7	66.1	5.31	3.24
150x100	3.2	12.0	15.33	488	262	65.1	52.5	5.64	4.14
150x100	4.5	16.6	21.17	658	352	87.7	70.4	5.58	4.08
150x100	6.0	21.7	27.63	835	444		88.8	5.50	4.01
150x100	9.0	31.1	39.67	113 x 10	595		119	5.33	3.87

200x100	4.5	20.1	25.67	133x10	455	133	90.9	7.20	4.21
200x100	6.0	26.4	33.63	170x10	577	170	115	7.12	4.14
200x100	9.0	38.2	48.67	235x10	782	235	156	6.94	4.01
200x150	4.5	23.7	30.17	176x10	133x10	176	151	7.64	6.13
200x150	6.0	31.1	39.63	227x10	146x10	227	194	7.56	6.06
200x150	9.0	45.3	57.67	317x10	202x10	317	270	7.41	5.93
250x150	6.0	35.8	45.63	389x10	177x10	311	236	9.23	6.23
250x150	9.0	52.3	66.67	548x10	247x10	438	330	9.06	6.09
250x150	12.0	67.9	86.53	685x10	307x10	548	409	8.90	5.95
300x200	6.0	45.2	57.63	737x10	396x10	491	396	11.3	8.29
300x200	9.0	66.5	84.67	105x10	563x10	702	563	11.2	8.16
300x200	12.0	86.8	110.5	$134x10^2$	711x10	890	711	11.0	8.02
350x150	6.0	45.2	57.63	891x10	239x10	509	319	12.4	6.44
350x150	9.0	66.5	84.67	$127x10^2$	337x10	726	449	12.3	6.31
350x150	12.0	86.8	110.5	$161x10^2$	421x10	921	562	12.1	6.17
400x200	6.0	54.7	69.63	$148x10^2$	509x10	739	509	14.6	8.55
400x200	9.0	80.6	102.7	$213x10^2$	727x10	107x10	727	14.4	8.42
400x200	12.0	106	134.5	$273x10^2$	923x10	136x10	923	14.2	8.23

Remark

1. Dimensions other than those listed in the above table if particularly required shall agreed upon by the purchaser and the manufacturer.
2. The symbols given in Attached Table are arranged in the figures below.
3. Calculate the values of mass from the following formula assuming 1 cm of steel tube 7.85g and round off the result to three significant figures in accordance with JIS Z 8401,

$$W = 0.0157t\ (A+B-3.287t)$$

Where

w: unit mass of the square tube kg/m

t: wall thickness of the square tube mm

A.B: slide length of the square tube mm