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Chain slings for lifting purposes

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee, as the result of proposal for revision of Japanese Industrial Standard submitted by The Japan Society of Industrial Machinery Manufacturers (JSIM)/ Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14. Consequently **JIS B 8816** : 1998 is replaced with this Standard.

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Chain slings for lifting purposes

Introduction This Japanese Industrial Standard has been prepared with the corresponding International Standards, which are the first edition of **ISO 1835** *Short link chain for lifting purposes—Grade M (4), non-calibrated, for chain slings etc.* published in 1980, the first edition of **ISO 3056** *Non-calibrated round steel link lifting chain and chain slings—Use and maintenance* published in 1986, the first edition of **ISO 3075** *Short link chain for lifting purposes—Grade S (6), non-calibrated, for chain slings etc.* published in 1980, the first edition of **ISO 3076** *Short link chain for lifting purposes—Grade T (8), non-calibrated, for chain slings etc.* published in 1984, the first edition of **ISO 4778** *Chain slings of welded construction—Grades M (4), S (6) and T (8)* published in 1981, the first edition of **ISO 7593** *Chain slings of assembled by methods other than welding—Grade T (8)* published in 1986, and the first edition of **ISO 8539** *Forged steel lifting components for use with grade T (8) chain* published in 1986 described as annex 5 (informative) to annex 11 (informative) since it is not practical to establish **JIS** based on the corresponding International Standards owing to the difference in technical contents.

In addition, the comparison table between **JIS** and the corresponding International Standards is given in annex 12 (informative).

1 Scope This Standard specifies the chain slings assembled with the method of weld, etc. used for the lifting equipment, etc. (hereafter referred to as “chain slings”).

NOTES 1 The master link is specified in annex 1.

2 The working load of chain slings is specified in annex 2.

3 The use standard of chain slings is specified in annex 3.

4 The checking standard of chain slings is specified in annex 4.

5 This Standard does not apply the fine-tolerance hoist chain used for chain hoists.

6 The International Standards corresponding to this Standard are as follows:

In addition, symbols which denote the degree of correspondence in the content between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

ISO 1835 : 1980 *Short link chain for lifting purposes—Grade M (4), non-calibrated, for chain slings etc.* (NEQ)

ISO 3056 : 1986 *Non-calibrated round steel link lifting chain and chain slings—Use and maintenance* (NEQ)

ISO 3075 : 1980 *Short link chain for lifting purposes—Grade S (6), non-calibrated, for chain slings etc.* (NEQ)

ISO 3076 : 1984 *Short link chain for lifting purposes—Grade T (8), non-calibrated, for chain slings etc.* (NEQ)

- ISO 4778 : 1981 *Chain slings of welded construction—Grades M (4), S (6) and T (8) (NEQ)*
- ISO 7593 : 1986 *Chain slings of assembled by methods other than welding—Grade T (8) (NEQ)*
- ISO 8539 : 1986 *Forged steel lifting components for use with grade T (8) chain (NEQ)*

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions (including amendments) indicated below shall be applied.

- JIS B 0148 *Lifting equipments—Terminology*
- JIS B 2803 *Hooks*
- JIS B 8812 *Link chain for chain hoists*
- JIS B 8841 *Toughness test of link chains—Impact test method of chain links*
- JIS G 0551 *Methods of austenite grain size determination for steel*
- JIS G 0565 *Method for magnetic particle testing of ferromagnetic materials and classification of magnetic particle indication*
- JIS Z 2343-1 *Non-destructive testing—Penetrant testing—Part 1 : General principles—Method for liquid penetrant testing and classification of the penetrant indication*
- JIS Z 2343-2 *Non-destructive testing—Penetrant testing—Part 2 : Testing of penetrant materials*
- JIS Z 2343-3 *Non-destructive testing—Penetrant testing—Part 3 : Reference test blocks*
- JIS Z 2343-4 *Non-destructive testing—Penetrant testing—Part 4 : Equipment*
- JIS Z 8601 *Preferred numbers*

3 Definitions For the purposes of this Standard, the definitions given in **JIS B 0148** and **JIS B 8841** and the following definitions apply.

- a) **grab hook** a hook having the construction such that it is directly hung on a link chain (hereafter referred to as “chain”)
- b) **foundry hook** a hook with a large opening
- c) **working load limit** the maximum mass which a chain sling is designed to sustain in general service
- d) **working load** the maximum mass which a chain sling should be used to sustain in a particular stated service
- e) **mode factor** the ratio between the working load and the working load limit of a chain sling according to the number of branches and angle of inclination
- f) **breaking force** the maximum force reached during the tensile testing of a chain sling

- g) **weld type** a chain sling which uses a welded joining link to connect between a chain and a master link, etc.
- h) **assembly type** a chain sling which uses a special mechanical joining device to connect between a chain and a master link, etc.
- i) **reach** the effective length of a chain sling (see figure 1 to figure 4)

4 Kind

4.1 Kind of chain sling The kind of chain sling shall be classified according to the combination of a chain, a master link, a hook, a foundry hook and a grab hook and the grade, and shall be as follows:

- a) The chain sling is obtained by connecting a master link, a hook, a foundry hook, or a grab hook at the both ends, and shall be classified into a single-branch, a double-branch, a three-branch and a four-branch according to the number of chains (see figure 1 to figure 4).

In addition, the symbol of a master link, an intermediate link, a hook, a foundry hook, and a grab hook shall be as given in table 1.

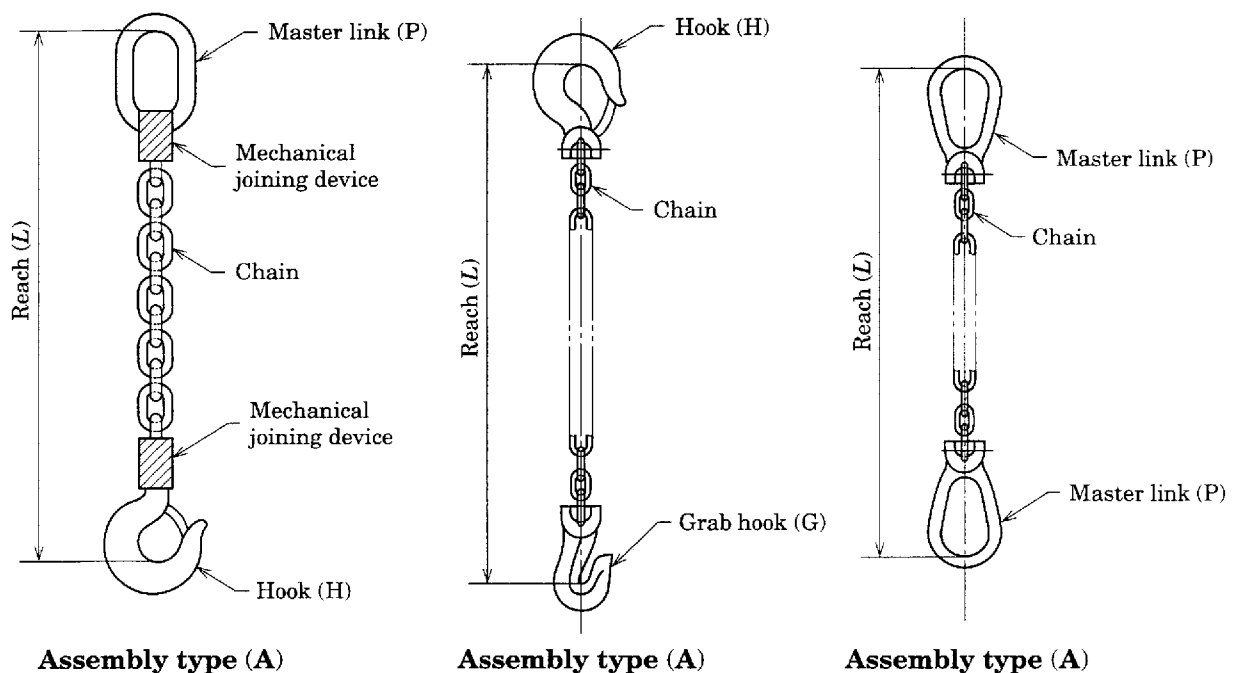
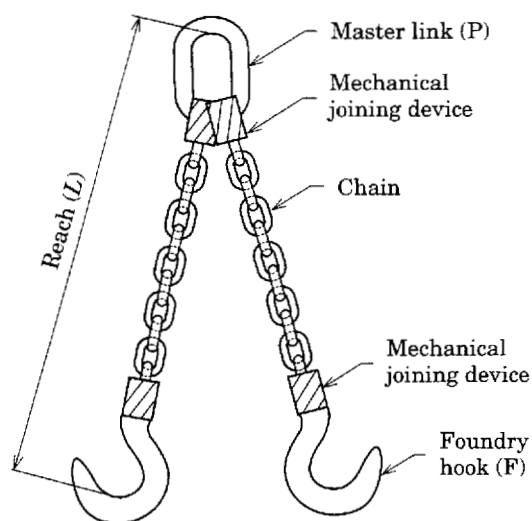
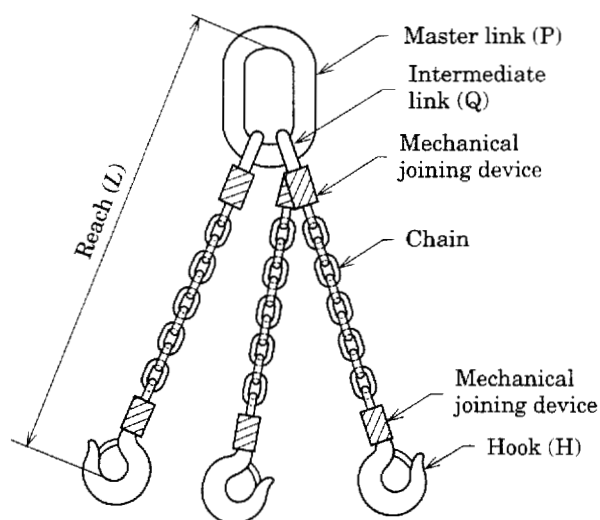


Figure 1 Example of single-branch sling



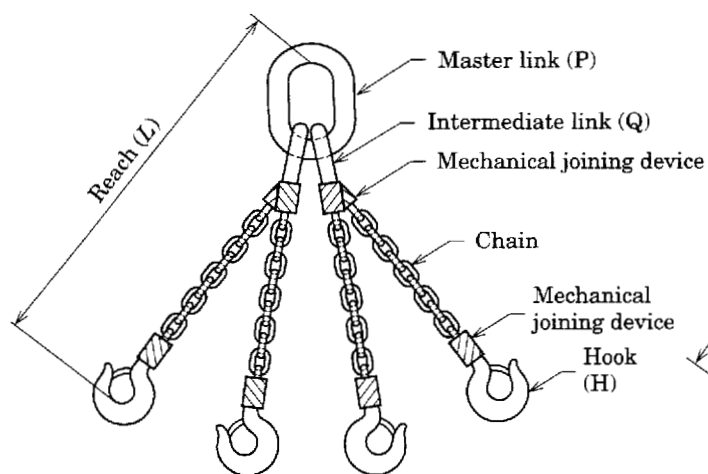
Assembly type (A)

Figure 2 Example of double-branch sling

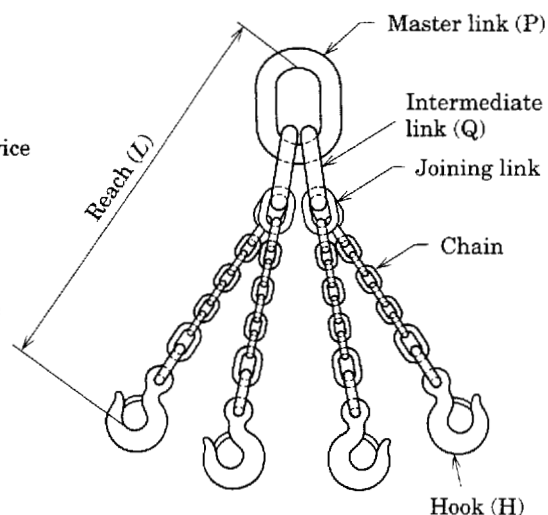


Assembly type (A)

Figure 3 Example of three-branch sling



Assembly type (A)



Weld type (W)

Figure 4 Example of four-branch sling

Table 1 Symbol of master link, etc.

Name	Symbol
Master link	P
Intermediate link	Q
Hook	H
Foundry hook	F
Grab hook	G

- b) The means of connection between a chain and a master link, an intermediate link, a hook, a foundry hook, or a grab hook shall be taken as a weld type (W) and an assembly type (A).
- c) A weld type chain sling shall be taken as the grade 4, and an assembly type chain sling shall be taken as the grade 8 and grade 10.
- d) Each different grade of chain slings can be prepared by combining a chain, a master link, an intermediate link, a hook, a foundry hook, a grab hook, a joining link and a mechanical joining device. The grade of a chain sling in this case shall be taken as the grade of a chain.

4.2 Kind and grade of chain The kind and grade of chains used for chain slings shall be classified according to the nominal size and the grade, and shall be as given in table 2.

4.3 Kind and grade of master link The kind and grade of master links used for chain slings shall be as given in annex 1.

4.4 Grade of intermediate link The intermediate link shall be taken as the grade 4, grade 8, and grade 10.

4.5 Kind and grade of hook The kind and grade of hooks used for chain slings shall be in accordance with **JIS B 2803**.

4.6 Grade of foundry hook and grab hook The foundry hook and grab hook shall be taken as the grade 4, grade 8 and grade 10.

4.7 Grade of joining link and mechanical joining device The joining link shall be taken as the grade 4, and the mechanical joining device shall be taken as the grade 8 and grade 10.

Table 2 Kind of chains

Classification		Non-quenched and tempered chain	Quenched and tempered chain	
Grade		4	8	10
Type		C4	C8	C10
Nominal size ⁽¹⁾ mm	5	C4-5	C8-5	C10-5
	5.6	C4-5.6	C8-5.6	C10-5.6
	6.3	C4-6.3	C8-6.3	C10-6.3
	7.1	C4-7.1	C8-7.1	C10-7.1
	8	C4-8	C8-8	C10-8
	9	C4-9	C8-9	C10-9
	10	C4-10	C8-10	C10-10
	11.2	C4-11.2	C8-11.2	C10-11.2
	12.5	C4-12.5	C8-12.5	C10-12.5
	14	C4-14	C8-14	C10-14
	16	C4-16	C8-16	C10-16
	18	C4-18	C8-18	C10-18
	20	C4-20	C8-20	C10-20
	22.4	C4-22.4	C8-22.4	C10-22.4
	25	C4-25	C8-25	C10-25
	28	C4-28	C8-28	C10-28
	32	C4-32	C8-32	C10-32

Note (1) In accordance with **JIS Z 8601**.

5 Performance

5.1 Working load limit The working load limit of a chain sling shall be as given in table 3.

5.2 Proof force The chain sling, when the test of proof force is performed in accordance with **10.1**, shall not have the permanent elongation or the permanent deformation exceeding the following value in each part.

- Permanent elongation of a chain 0.5 %
- Permanent deformation of a master link, an intermediate link, a hook, a foundry hook, a grab hook, a joining link and a mechanical joining device 0.25 %

5.3 Breaking force of chain sling The breaking force of a chain sling, when the test is performed in accordance with **10.2**, shall conform to the specification of table 3.

5.4 Static strength of chain The breaking force and total ultimate elongation of a chain, when the test is performed in accordance with **10.2**, shall conform to the specification of table 3.

5.5 Impact value of chain link The impact value of a chain link, when the test is performed in accordance with **10.4**, shall conform to the specification of table 4. However, the grade 4 shall not be applied.

5.6 Bending strength of chain The bending strength of a chain, when the test is performed in accordance with **10.5**, shall withstand deformation of not less than the value specified in table 4 and shall be free from defects which can be visually checked.

5.7 Breaking force of master link, intermediate link, hook, foundry hook, grab hook, joining link and mechanical joining device The breaking force of a master link, an intermediate link, a hook, a foundry hook, a grab hook, a joining link and a mechanical joining device, when the test is performed in accordance with **10.2**, shall conform to the specification of table 3.

Table 3 Mechanical properties of chain sling and chain (1)

Mechanical properties		Working load limit			Proof force			Breaking force			Total ultimate elongation		
		t			kN			kN			%		
Grade		4	8	10	4	8	10	4	8	10	4	8	10
Nominal size mm	5	0.4 max.	0.8 max.	1.0 max.	8	16	20	16 min.	31.5 min.	40 min.	20 min.	17 min.	20 min.
	5.6	0.5 max.	1.0 max.	1.25 max.	10	20	25	20 min.	40 min.	50 min.			
	6.3	0.63 max.	1.25 max.	1.6 max.	12.5	25	31.5	25 min.	50 min.	63 min.			
	7.1	0.8 max.	1.6 max.	2.0 max.	16	31.5	40	31.5 min.	63 min.	80 min.			
	8	1.0 max.	2.0 max.	2.5 max.	20	40	50	40 min.	80 min.	100 min.			
	9	1.25 max.	2.5 max.	3.2 max.	25	50	63	50 min.	100 min.	128 min.			
	10	1.6 max.	3.2 max.	4.0 max.	31.5	63	80	63 min.	128 min.	160 min.			
	11.2	2.0 max.	4.0 max.	5.0 max.	40	80	100	80 min.	160 min.	200 min.			
	12.5	2.5 max.	5.0 max.	6.3 max.	50	100	125	100 min.	200 min.	250 min.			
	14	3.2 max.	6.3 max.	8.0 max.	63	125	160	128 min.	250 min.	315 min.			
	16	4.0 max.	8.0 max.	10 max.	80	160	200	160 min.	315 min.	400 min.			
	18	5.0 max.	10 max.	12.5 max.	100	200	250	200 min.	400 min.	500 min.			
	20	6.3 max.	12.5 max.	16 max.	125	250	315	250 min.	500 min.	630 min.			
	22.4	8.0 max.	16 max.	20 max.	160	315	400	315 min.	630 min.	800 min.			
	25	10 max.	20 max.	25 max.	200	400	500	400 min.	800 min.	1 000 min.			
	28	12.5 max.	25 max.	31.5 max.	250	500	630	500 min.	1 000 min.	1 250 min.			
	32	16 max.	31.5 max.	40 max.	315	630	800	630 min.	1 250 min.	1 600 min.			

Table 4 Mechanical properties of chain (2)

Mechanical properties	Impact value of chain link T_c J/mm ³		Bending strength Amount of deformation f mm			Minimum breaking stress N/mm ²		
	8	10	4	8	10	4	8	10
Grade	8	10	4	8	10	4	8	10
Type	C8	C10	C4	C8	C10	C4	C8	C10
	0.08 min.		0.8d			400	800	1 000

6 Shape and dimensions

6.1 Shape and dimensions of chain sling The shape and dimensions of a chain sling shall be as follows:

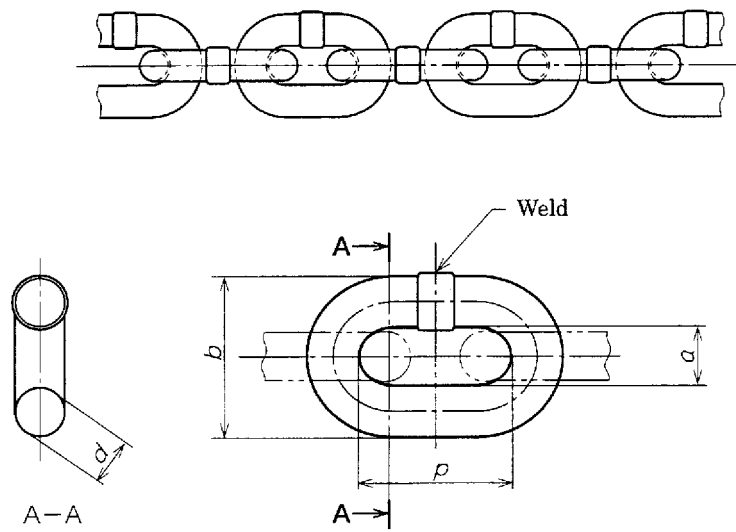
- The shape is illustrated by examples in figure 1 to figure 4.
- The reference of the reach (L) shall be 1.5 m, 2 m, and 3 m. The reach may be determined in accordance with the agreement between the manufacturer and the purchaser.
- The tolerance on reach shall be taken as the number of links $^{+2}_0$.
- The difference between the longest and the shortest with respect to each reach of multi-branch chain slings shall be not more than 10 mm for the reach of 2 m or less. Furthermore, for the reach exceeding 2 m, 5 mm is made to be increased by every increase of 1 m.

6.2 Shape and dimensions of chain The shape and dimensions of a chain shall be as given in figure 5 and table 5.

6.3 Shape and dimensions of master link The shape and dimensions of a master link shall be as given in annex 1.

6.4 Shape and dimensions of hook The shape and dimensions of a hook shall be in accordance with JIS B 2803.

6.5 Shape and dimensions of intermediate link, foundry hook, grab hook, joining link, and mechanical joining device The shape and dimensions of an intermediate link, a foundry hook, a grab hook, a joining link, and a mechanical joining device shall be those required for satisfying the performance of clause 5, and shall be in accordance with the agreement between the manufacturer and the purchaser.



Enlarged view of chain link

Figure 5 Example of shape of chain

Table 5 Dimensions of chain

Unit: mm

Grade			Nominal size	Pitch	Nominal inside width	Nominal outside width
4	8	10	d	p	a	b
C4-5	C8-5	C10-5	5 $\begin{smallmatrix} +0.10 \\ -0.30 \end{smallmatrix}$	15.0 $\begin{smallmatrix} +2.5 \\ -1.3 \end{smallmatrix}$	6.3 min.	17.5 max.
C4-5.6	C8-5.6	C10-5.6	5.6 $\begin{smallmatrix} +0.11 \\ -0.34 \end{smallmatrix}$	16.8 $\begin{smallmatrix} +2.8 \\ -1.4 \end{smallmatrix}$	7.0 min.	19.6 max.
C4-6.3	C8-6.3	C10-6.3	6.3 $\begin{smallmatrix} +0.13 \\ -0.38 \end{smallmatrix}$	18.9 $\begin{smallmatrix} +3.2 \\ -1.6 \end{smallmatrix}$	7.9 min.	22.1 max.
C4-7.1	C8-7.1	C10-7.1	7.1 $\begin{smallmatrix} +0.14 \\ -0.43 \end{smallmatrix}$	21.3 $\begin{smallmatrix} +3.6 \\ -1.8 \end{smallmatrix}$	8.9 min.	24.9 max.
C4-8	C8-8	C10-8	8 $\begin{smallmatrix} +0.16 \\ -0.48 \end{smallmatrix}$	24.0 $\begin{smallmatrix} +4.0 \\ -2.0 \end{smallmatrix}$	10.0 min.	28.0 max.
C4-9	C8-9	C10-9	9 $\begin{smallmatrix} +0.18 \\ -0.54 \end{smallmatrix}$	27.0 $\begin{smallmatrix} +4.5 \\ -2.3 \end{smallmatrix}$	11.3 min.	31.5 max.
C4-10	C8-10	C10-10	10 $\begin{smallmatrix} +0.20 \\ -0.60 \end{smallmatrix}$	30.0 $\begin{smallmatrix} +5.0 \\ -2.5 \end{smallmatrix}$	12.5 min.	35.0 max.
C4-11.2	C8-11.2	C10-11.2	11.2 $\begin{smallmatrix} +0.22 \\ -0.67 \end{smallmatrix}$	33.6 $\begin{smallmatrix} +5.6 \\ -2.8 \end{smallmatrix}$	14.0 min.	39.2 max.
C4-12.5	C8-12.5	C10-12.5	12.5 $\begin{smallmatrix} +0.25 \\ -0.75 \end{smallmatrix}$	37.5 $\begin{smallmatrix} +6.3 \\ -3.1 \end{smallmatrix}$	15.6 min.	43.8 max.
C4-14	C8-14	C10-14	14 $\begin{smallmatrix} +0.28 \\ -1.84 \end{smallmatrix}$	42.0 $\begin{smallmatrix} +7.0 \\ -3.5 \end{smallmatrix}$	17.5 min.	49.0 max.
C4-16	C8-16	C10-16	16 $\begin{smallmatrix} +0.32 \\ -0.96 \end{smallmatrix}$	48.0 $\begin{smallmatrix} +8.0 \\ -4.0 \end{smallmatrix}$	20.0 min.	56.0 max.
C4-18	C8-18	C10-18	18 ± 0.09	54.0 $\begin{smallmatrix} +9.0 \\ -4.5 \end{smallmatrix}$	22.5 min.	63.0 max.
C4-20	C8-20	C10-20	20 ± 1.00	60.0 $\begin{smallmatrix} +10.0 \\ -5.0 \end{smallmatrix}$	25.0 min.	70.0 max.
C4-22.4	C8-22.4	C10-22.4	22.4 ± 1.10	67.2 $\begin{smallmatrix} +11.2 \\ -5.6 \end{smallmatrix}$	28.0 min.	78.4 max.
C4-25	C8-25	C10-25	25 ± 1.25	75.0 $\begin{smallmatrix} +12.5 \\ -6.3 \end{smallmatrix}$	31.2 min.	87.5 max.
C4-28	C8-28	C10-28	28 ± 1.40	84.0 $\begin{smallmatrix} +14.0 \\ -7.0 \end{smallmatrix}$	35.0 min.	98.0 max.
C4-32	C8-32	C10-32	32 ± 1.60	96.0 $\begin{smallmatrix} +16.0 \\ -8.0 \end{smallmatrix}$	40.0 min.	112.0 max.

7 Appearance The chain slings shall be free from hazardous defects such as a crack, remarkable rust.

8 Material

8.1 Chain The material of chains shall be as follows:

- The material of chains shall be killed steel with the chemical composition specified in table 6, and the weldability shall be excellent.
- For the austenite grain size of material of chains, the crystal-grain-size number of grade 4 and grade 8 shall be 5 or more, and that of grade 10 shall be 6 or more.

Table 6 Content of sulfur and phosphor

Chemical composition	Maximum content %			
	Cast analysis		Check analysis	
	Grade 4	Grade 8 and grade 10	Grade 4	Grade 8 and grade 10
S	0.030	0.020	0.035	0.025
P	0.030	0.020	0.035	0.025
S+P	0.055	0.035	0.065	0.045

8.2 Hook The material of a hook shall be in accordance with **JIS B 2803**.

Remarks : The material of a hook may be based on the check analysis.

8.3 Master link, intermediate link, foundry hook, grab hook, joining link and mechanical joining device The material of a master link, an intermediate link, a foundry hook, a grab hook, a joining link and a mechanical joining device shall be killed steel with the chemical composition specified in table 7, and shall satisfy the performance of clause 5.

Table 7 Content of sulfur and phosphor

Chemical composition	Maximum content %			
	Cast analysis		Check analysis	
	Grade 4	Grade 8 and grade 10	Grade 4	Grade 8 and grade 10
S	0.035	0.030	0.040	0.035
P	0.030	0.030	0.035	0.035
S+P	0.060	0.055	0.070	0.065

9 Manufacturing method

9.1 Chain The manufacturing method of chains shall be as follows:

- Weld the chain at the centre of a chain parallel portion as shown in figure 5.
- Apply the proper heat treatment after welding. For the grade 4, the heat treatment may be omitted.
- Apply the manufacturing proof force of not less than 63 % of ultimate strength specified in table 3 to the chain after the heat treatment, and perform the pre-set process⁽²⁾.

Note ⁽²⁾ For the chains which are not heat-treated, the preset process shall be performed after welding.

9.2 Master link and intermediate link The master link and intermediate link shall be formed by forging or welding. After forming, the suitable heat treatment and the machine work as necessary shall be performed. In the case of welding, the weld shall be performed at the centre of a linear portion.

9.3 Hook The manufacturing method of a hook shall be in accordance with **JIS B 2803**.

9.4 Foundry hook and grab hook The foundry hook and grab hook shall be formed by forging. After forging, the suitable heat treatment and the machine work as necessary shall be performed.

9.5 Joining link The joining link shall be formed by welding. After welding, the suitable heat treatment and the machine work as necessary shall be performed. However, those used for the grade 4 of chains may not be heat-treated.

9.6 Mechanical joining device The mechanical joining device shall be formed by forging or machining. After forming, the suitable heat treatment and the machine work as necessary shall be performed.

9.7 Means of connection The means of connection between a chain and a master link, an intermediate link, a hook, a foundry hook, or a grab hook shall be taken as a weld type (W) using a joining link or an assembly type (A) using a mechanical joining device.

10 Test method

10.1 Proof-force test For the proof-force test, fix the both ends of a chain sling to the fixture of a tensile tester, apply the initial force of 5 % of proof force given in table 3, measure the gauge length of a chain, a master link, an intermediate link, a hook, a foundry hook, a grab hook, a joining link and a mechanical joining device, and take this as the initial gauge length.

Next, apply the proof force given in table 3, and when returning to the initial force again, measure each gauge length, and obtain the permanent elongation or the permanent amount of deformation. However, when each proof-force test of a chain⁽³⁾, a master link, an intermediate link, a hook, a foundry hook, a grab hook, a joining link and a mechanical joining device is individually performed, the proof-force test as a chain sling may be omitted⁽⁴⁾.

In addition, for the sample, the number of a series of links shall be 9 links for the nominal size of 5.6 mm or under, 7 links for the nominal size of 6.3 mm or over up to and including 16 mm, 5 links for the nominal size of 18 mm or over.

Notes ⁽³⁾ The test method of a chain is in accordance with **JIS B 8812**.

⁽⁴⁾ Each test method individually performed is in accordance with **JIS B 2803**. In this case, the tensile direction with respect to an intermediate link, a foundry hook, a grab hook, a joining link and a mechanical joining device is the direction in which the load is applied in the direction of work load. The master link shall be in the direction of centre line of annex 1 figure 1.

10.2 Static strength test For the tensile test of a chain sling, apply the static tensile force to the sample after the proof-force test by the tensile tester, and measure the maximum force (breaking force) until the sample is broken and the total ultimate elongation of a chain.

When each proof-force test of a chain⁽³⁾, a master link, an intermediate link, a hook, a foundry hook, a grab hook, a joining link and a mechanical joining device is individually performed, the tensile test as a chain sling may be omitted⁽⁴⁾.

10.3 Measurement of austenite grain size The austenite grain size of material of a chain shall be measured in accordance with the method specified in **JIS G 0551**.

10.4 Impact test The impact test of a chain link shall be performed in accordance with **JIS B 8841**, and three chain links shall be sampled from one chain. The test temperature shall be as given in table 8.

Table 8 Test temperature of impact test

Unit: °C

Classification	Quenched and tempered chain	
Grade	8	10
Type	C8	C10
Test temperature	-40	

Remarks : When it is difficult to perform the impact test because the nominal size of a chain is large, the test may be performed using the following test piece.

- a) The test piece shown in figure 6 (hereafter referred to as “I-shaped test piece”) is prepared by cutting work, etc. from the chain links which are sampled from chains of a product.

$$d' < d$$

where, d : nominal size of chain link (mm)

d' : diameter of I-shaped test piece (mm)

- b) The dimensions of I-shaped test piece shall be as specified in table 1 of **JIS B 8841**, provided that d equals to d' .
- c) The impact-test method shall be in accordance with **JIS B 8841**, provided that d equals to d' .
- d) It shall be described in the test result that the I-shaped test piece was used for the test.

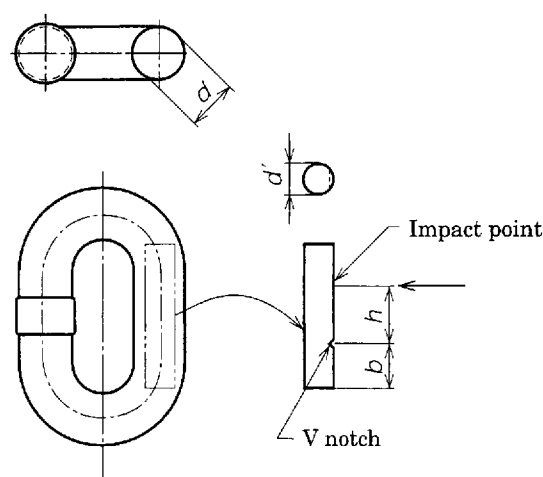


Figure 6 I-shaped test piece

10.5 Bending test For the bending test of a chain, put the chain link on the 90° V block horizontally, as shown figure 7, and apply the bending force to the centre of the link parallel portion with an indenter without impact force.

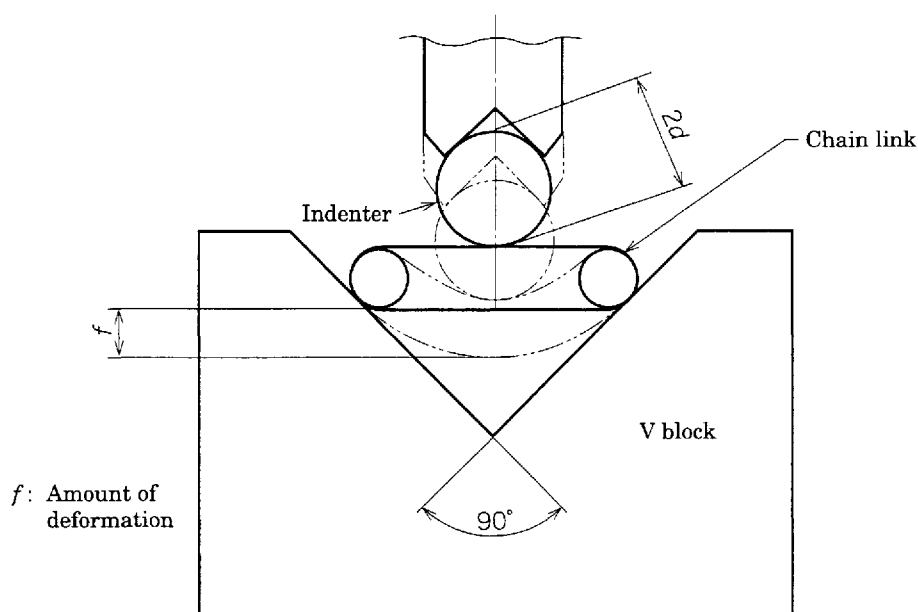


Figure 7 Bending-test method of chain

11 Designation of product The designation of chain slings shall be determined according to a standard title⁽⁵⁾ or standard number, kind⁽⁶⁾, grade⁽⁷⁾, working load limit⁽⁸⁾ and reach.

Examples 1 In the case of single branch, an assembly type as means of connection with a chain comprised of components of a chain, a master link and a hook, all grades of components being the same, working load limit of 2.0 t, reach of 1.5 m

Chain slings for lifting purposes or **JIS B 8816**, single branch, master link, hook, grade 8, 2.0 t, 1.5 m

- 2 In the case of double branch, an assembly type as means of connection with a chain comprised of components of a chain, a master link, a mechanical joining device and a hook, the grades of components being different, angle of inclination of 90° or under, working load limit of 1.4 t, angle of inclination of over 90° up to and including 120°, working load limit of 1.0 t, reach of 1.5 m

Chain slings for lifting purposes or **JIS B 8816**, double branch, chain grade 8, master link, mechanical joining device and hook grade 10, angle of inclination of 90° or under, 1.4 t, angle of inclination of over 90° up to and including 120°, 1.0 t, 1.5 m

Notes ⁽⁵⁾ The chain slings for lifting purposes may also call chain slings.

- ⁽⁶⁾ The kind shall be taken as the number of chains, the name of part which constitutes a chain sling.
- ⁽⁷⁾ The grade shall refer to each grade of a chain, a master link, an intermediate link, a hook, a foundry hook, a grab hook, a joining link and a mechanical joining device.

In addition, the grade of a chain may call that including the nominal size (see table 2).

- ⁽⁸⁾ In the case of double branch, it shall refer to each working load according to the angle of inclination (see annex 2 table 1 to table 3).

12 Marking The marking shall be performed as follows:

- a) The following matter shall be marked on the master link or the hook in such a way that there is no possibility of reduction of strength⁽⁹⁾.

- 1) Grade⁽¹⁰⁾
- 2) Working load limit
- 3) Manufacturer's name or its abbreviation
- 4) Other required matter (in accordance with the agreement between the manufacturer and the purchaser)

Example : In the case of grade 10 and working load limit 2.0 t

C10-2.0 t manufacturer's name

- b) The following matter shall be marked indelibly on the chain at intervals of about 50 cm in such a way that there is no possibility of reduction of strength.

- 1) Type
- 2) Manufacturer's name or its abbreviation
- 3) Production lot number or its abbreviation

- c) In the case of double or more branch, the working load (see annex 2) according to an angle of inclination, etc. shall be marked on a metal tag or a label.

Notes ⁽⁹⁾ They may be marked on a metal tag or a label.

- (10) When each grade of a chain, a master link, an intermediate link, a hook, a foundry hook, a grab hook, a joining link, and a mechanical joining device differs, the grade of a chain sling shall mark the grade of a chain.

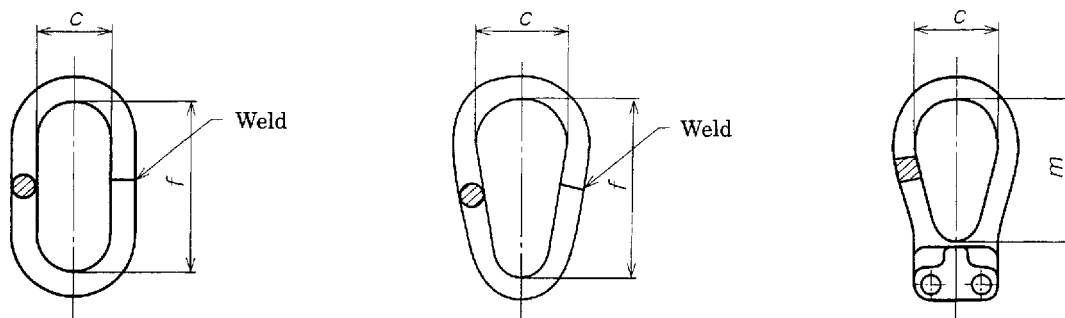
Related standards:

- ISO 1835 : 1980 *Short link chain for lifting purposes—Grade M (4), non-calibrated, for chain slings and etc.*
- ISO 3056 : 1986 *Non-calibrated round steel link lifting chain and chain slings—Use and maintenance*
- ISO 3075 : 1980 *Short link chain for lifting purposes—Grade S (6), non-calibrated, for chain slings etc.*
- ISO 3076 : 1984 *Short link chain for lifting purposes—Grade T (8), non-calibrated, for chain slings etc.*
- ISO 4778 : 1981 *Chain slings of welded construction—Grades M (4), S (6) and T (8)*
- ISO 7593 : 1986 *Chain slings assembled by methods other than welding—Grade T (8)*
- ISO 8539 : 1986 *Forged steel lifting components for use with grade T (8) chain*

Annex 1 (normative)

Master link

1 Kind and shape The master links shall be taken as three kinds of O-shaped type (O), pear-shaped type (P), and pear-shaped assembly type (PA), and the shape shall be as shown in annex 1 figure 1.



O-shaped type (O)

Pear-shaped type (P)

Pear-shaped assembly type (PA)

Annex 1 Figure 1 Shape of master link (example)

2 Grade The grade of master links shall be taken as the grade 4, grade 8, and grade 10 specified in table 2 of the text.

3 Dimensions The dimensions with respect to the working load limit of a master link shall be as given in annex 1 table 1.

Annex 1 Table 1 Dimensions

Working load limit t	Dimensions mm			Working load limit t	Dimensions mm		
	$c^{(1)}$	$f^{(1)}$	$m^{(1)}$		$c^{(1)}$	$f^{(1)}$	$m^{(1)}$
0.4	33.5 min.	67 min.	54 min.	4.0	60 min.	120 min.	96 min.
0.5	35.5 min.	71 min.	57 min.	5.0	63 min.	126 min.	101 min.
0.63	37.5 min.	75 min.	60 min.	6.3	67 min.	134 min.	108 min.
0.8	40 min.	80 min.	64 min.	8.0	75 min.	150 min.	120 min.
1.0	42.5 min.	85 min.	68 min.	10.0	80 min.	160 min.	128 min.
1.25	45 min.	90 min.	72 min.	12.5	90 min.	180 min.	144 min.
1.6	47.5 min.	95 min.	76 min.	16.0	100 min.	200 min.	160 min.
2.0	50 min.	100 min.	80 min.	20.0	112 min.	224 min.	180 min.
2.5	53 min.	106 min.	85 min.	31.5	140 min.	280 min.	224 min.
3.2	56 min.	112 min.	90 min.	40.0	160 min.	320 min.	256 min.

Note (1) c, f, m are as shown in annex 1 figure 1.

Remarks : Dimensions other than those of c, f, m shall satisfy the performance of chain slings.

Annex 2 (normative)

Working load of chain slings

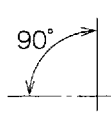
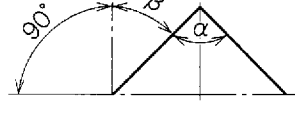
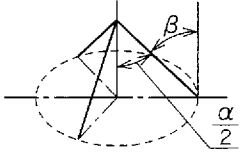
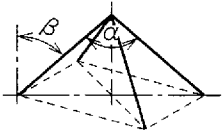
The working load of chain slings shall be used in the range of the value obtained by multiplying mode factor⁽¹⁾ by the working load of single branch while confirming the method of hanging, number of chains, and angle of inclinations, and the working load by the nominal size of each grade shall as given in annex 2 table 1 to table 3.

Note ⁽¹⁾ Mode factor (M) shall be as follows:

In the case of double branch $M = 2 \times \cos\beta$

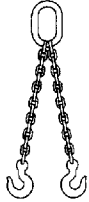
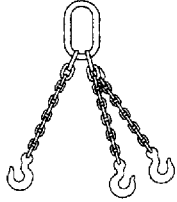
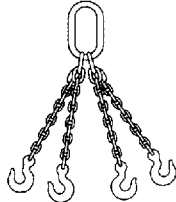
In the case of three branch and four branch $M = 3 \times \cos\beta$

Mode factor

Method of hanging							
Number of chains	1	2		3		4	
Angle of inclination α	—	90°	120°	—	—	90°	120°
Angle from vertical line β	—	45°	60°	45°	60°	45°	60°
Mode factor M	1	1.4	1	2.1	1.5	2.1	1.5

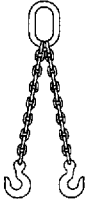
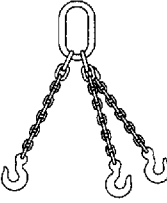
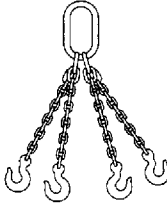
Annex 2 Table 1 Working load of chain slings of grade 4

Unit: t

Method of hanging		Single branch	Double branch		Three branch and four branch	
					 	
Angle of inclination α		$\alpha = 0^\circ$	$\alpha \leq 90^\circ$	$90^\circ < \alpha \leq 120^\circ$	$\alpha \leq 90^\circ$	$90^\circ < \alpha \leq 120^\circ$
Angle from vertical line β		$\beta = 0^\circ$	$\beta \leq 45^\circ$	$45^\circ < \beta \leq 60^\circ$	$\beta \leq 45^\circ$	$45^\circ < \beta \leq 60^\circ$
Mode factor M		1	1.4	1	2.1	1.5
Nominal size (mm)	5	0.4 max.	0.56 max.	0.4 max.	0.84 max.	0.6 max.
	5.6	0.5 max.	0.7 max.	0.5 max.	1.05 max.	0.75 max.
	6.3	0.63 max.	0.88 max.	0.63 max.	1.32 max.	0.94 max.
	7.1	0.8 max.	1.12 max.	0.8 max.	1.68 max.	1.2 max.
	8	1.0 max.	1.4 max.	1.0 max.	2.1 max.	1.5 max.
	9	1.25 max.	1.75 max.	1.25 max.	2.62 max.	1.87 max.
	10	1.6 max.	2.24 max.	1.6 max.	3.36 max.	2.4 max.
	11.2	2.0 max.	2.8 max.	2.0 max.	4.2 max.	3.0 max.
	12.5	2.5 max.	3.5 max.	2.5 max.	5.25 max.	3.75 max.
	14	3.2 max.	4.48 max.	3.2 max.	6.72 max.	4.8 max.
	16	4.0 max.	5.6 max.	4.0 max.	8.4 max.	6.0 max.
	18	5.0 max.	7.0 max.	5.0 max.	10.5 max.	7.5 max.
	20	6.3 max.	8.82 max.	6.3 max.	13.23 max.	9.45 max.
	22.4	8.0 max.	11.2 max.	8.0 max.	16.8 max.	12.0 max.
	25	10.0 max.	14.0 max.	10.0 max.	21.0 max.	15.0 max.
	28	12.5 max.	17.5 max.	12.5 max.	26.25 max.	18.75 max.
	32	16.0 max.	22.4 max.	16.0 max.	33.6 max.	24.0 max.

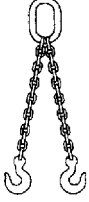
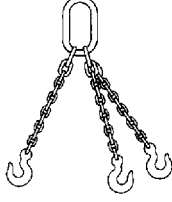
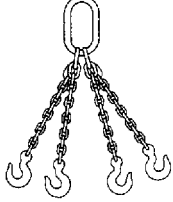
Annex 2 Table 2 Working load of chain slings of grade 8

Unit: t

Method of hanging		Single branch	Double branch		Three branch and four branch	
					 	
Angle of inclination α		$\alpha = 0^\circ$	$\alpha \leq 90^\circ$	$90^\circ < \alpha \leq 120^\circ$	$\alpha \leq 90^\circ$	$90^\circ < \alpha \leq 120^\circ$
Angle from vertical line β		$\beta = 0^\circ$	$\beta \leq 45^\circ$	$45^\circ < \beta \leq 60^\circ$	$\beta \leq 45^\circ$	$45^\circ < \beta \leq 60^\circ$
Mode factor M		1	1.4	1	2.1	1.5
Nominal size (mm)	5	0.8 max.	1.12 max.	0.8 max.	1.68 max.	1.2 max.
	5.6	1.0 max.	1.4 max.	1.0 max.	2.1 max.	1.5 max.
	6.3	1.25 max.	1.75 max.	1.25 max.	2.62 max.	1.87 max.
	7.1	1.6 max.	2.24 max.	1.6 max.	3.36 max.	2.4 max.
	8	2.0 max.	2.8 max.	2.0 max.	4.2 max.	3.0 max.
	9	2.5 max.	3.5 max.	2.5 max.	5.25 max.	3.75 max.
	10	3.2 max.	4.48 max.	3.2 max.	6.72 max.	4.8 max.
	11.2	4.0 max.	5.6 max.	4.0 max.	8.4 max.	6.0 max.
	12.5	5.0 max.	7.0 max.	5.0 max.	10.5 max.	7.5 max.
	14	6.3 max.	8.82 max.	6.3 max.	13.23 max.	9.45 max.
	16	8.0 max.	11.2 max.	8.0 max.	16.8 max.	12.0 max.
	18	10.0 max.	14.0 max.	10.0 max.	21.0 max.	15.0 max.
	20	12.5 max.	17.5 max.	12.5 max.	26.25 max.	18.75 max.
	22.4	16.0 max.	22.4 max.	16.0 max.	33.6 max.	24.0 max.
	25	20.0 max.	28.0 max.	20.0 max.	42.0 max.	30.0 max.
	28	25.0 max.	35.0 max.	25.0 max.	52.5 max.	37.5 max.
	32	31.5 max.	44.1 max.	31.5 max.	66.15 max.	47.25 max.

Annex 2 Table 3 Working load of chain slings of grade 10

Unit: t

Method of hanging		Single branch	Double branch		Three branch and four branch	
					 	
Angle of inclination α		$\alpha = 0^\circ$	$\alpha \leq 90^\circ$	$90^\circ < \alpha \leq 120^\circ$	$\alpha \leq 90^\circ$	$90^\circ < \alpha \leq 120^\circ$
Angle from vertical line β		$\beta = 0^\circ$	$\beta \leq 45^\circ$	$45^\circ < \beta \leq 60^\circ$	$\beta \leq 45^\circ$	$45^\circ < \beta \leq 60^\circ$
Mode factor M		1	1.4	1	2.1	1.5
Nominal size (mm)	5	1.0 max.	1.4 max.	1.0 max.	2.1 max.	1.5 max.
	5.6	1.25 max.	1.75 max.	1.25 max.	2.62 max.	1.87 max.
	6.3	1.6 max.	2.24 max.	1.6 max.	3.36 max.	2.4 max.
	7.1	2.0 max.	2.8 max.	2.0 max.	4.2 max.	3.0 max.
	8	2.5 max.	3.5 max.	2.5 max.	5.25 max.	3.75 max.
	9	3.2 max.	4.48 max.	3.2 max.	6.72 max.	4.8 max.
	10	4.0 max.	5.6 max.	4.0 max.	8.4 max.	6.0 max.
	11.2	5.0 max.	7.0 max.	5.0 max.	10.5 max.	7.5 max.
	12.5	6.3 max.	8.82 max.	6.3 max.	13.23 max.	9.45 max.
	14	8.0 max.	11.2 max.	8.0 max.	16.8 max.	12.0 max.
	16	10.0 max.	14.0 max.	10.0 max.	21.0 max.	15.0 max.
	18	12.5 max.	17.5 max.	12.5 max.	26.25 max.	18.75 max.
	20	16.0 max.	22.4 max.	16.0 max.	33.6 max.	24.0 max.
	22.4	20.0 max.	28.0 max.	20.0 max.	42.0 max.	30.0 max.
	25	25.0 max.	35.0 max.	25.0 max.	52.5 max.	37.5 max.
	28	31.5 max.	44.1 max.	31.5 max.	66.15 max.	47.25 max.
	32	40.0 max.	56.0 max.	40.0 max.	84.0 max.	60.0 max.

Annex 3 (normative)

Standard for use of chain slings

Attention shall be given to the following matter when using chain slings.

- a) Use the working load within the range of the working load marked on a metal tag or a label.
- b) Confirm the angle of inclination, and use the chain sling of the working load corresponding to the angle.
- c) Do not use the chain with the chain twisted or tangled.
- d) When a chain contacts the corner of a load, apply a pad to it, and protect also the chain while protecting goods.
- e) Be sure to hang a load at the centre of a hook, and do not hang it at the edge of a hook.
- f) Keep the application limits by wear and elongation of a chain, and do not use the chains which produce deformation and cracks.
- g) When using chain slings under the high-temperature atmosphere, or when using chain slings at ordinary temperatures again after using them once under the condition of high temperature, use them by reducing the working load according to the temperature.

The working load shall be as given in annex 3 table 1.

Annex 3 Table 1 Working load at each operating temperature

Unit: %

Operating temperature		Over -40 °C up to and incl. 100 °C	Over 100 °C up to and incl. 200 °C	Over 200 °C up to and incl. 300 °C	Over 300 °C up to and incl. 350 °C	Over 350 °C up to and incl. 400 °C	Over 400 °C up to and incl. 475 °C	Over 475 °C
Grade	4	100	100	100	85	75	50	Nonusable
	8	100	100	90	75	75	Nonusable	
	10	100	90	75	65	60	Nonusable	

- h) When lifting a load, carry out slowly, and when lifting down, calmly.
- i) When using chain slings for the application always subjected to vibration, use them with the work load reduced.
- j) Do not leave chain slings for a long time with a load hung.
- k) Hang a load in a well-balanced posture.
- l) Do not use the chain slings which produced defects by performing the weld, the weld overlay or the heat treatment, etc.
- m) When not using chain slings, store them in the suitable place with a good environment so that rust is not produced with chain slings hung by preparing the storage location where the pendant equipment is installed.

Annex 4 (normative)

Standard for checking of chain slings

The checking of chain slings shall be performed according to the daily checking⁽¹⁾ and the periodic inspection⁽²⁾, and shall be as given in annex 4 table 1.

Notes ⁽¹⁾ It refers to the checking before use.

⁽²⁾ It refers to the checking performed periodically, which is usually performed every one month although the frequency in inspection differs according to the frequency in use.

Annex 4 Table 1 Standard for checking

Checking item	Kind of checking		Checking method	Standard for checking
	Daily	Periodic		
Whole of chain slings				
Working load	○	○	Visual check	Confirm the working load by a tag or a label.
Condition of assembly	○	○	Visual check	All parts shall be correctly assembled, and there shall be no slackness in the connection portion.
Chain				
Elongation of five links of chain		○	Measurement	Do not use links which are increased in length by not less than 5 % of the original value. (Before use, prepare the dimension table.)
Wear of links	○		Visual check	Do not use links of which the nominal size is reduced due to wear by not less than 10 %.
		○	Measurement	
Bending of links	○		Visual check	Do not use links of which the bending reaches not less than 10 % of the nominal size.
		○	Measurement	
Twisting of links	○	○	Visual check	Free from twisting.
Flaws, other hazardous defects	○	○	Visual check, magnetic particle testing ⁽⁴⁾ , or liquid penetrant testing ⁽⁵⁾	Free from flaws, cracks, other hazardous defects.
Corrosion	○	○	Visual check	No remarkable rust produced.

Annex 4 Table 1 (concluded)

Checking item	Kind of checking		Checking method	Standard for checking
	Daily	Periodic		
Master link, intermediate link				
Deformation	○		Visual check	Do not use links of which the deformation in the horizontal direction and the vertical direction reaches not less than 5 %. (Before use, prepare the dimension table.)
		○	Measurement	
Wear	○		Visual check	Do not use links of which the nominal size is reduced due to wear by not less than 10 % of the original value.
		○	Measurement	
Flaws, other hazardous defects	○	○	Visual check, magnetic particle testing ⁽⁴⁾ , or liquid penetrant testing ⁽⁵⁾	Free from flaws, cracks, other hazardous defects.
Corrosion	○	○	Visual check	No remarkable rust produced.
Hook, foundry hook, grab hook				
Opening of hook	○		Visual check	No deformation compared with the original dimension. (Before use, prepare the dimension table.)
		○	Measurement	
Deformation	○	○	Visual check	Free from twisting and tangling.
Latch ⁽³⁾	○	○	Visual check	Correctly works without remarkable wear and deformation.
Wear, corrosion	○	○	Visual check	Free from remarkable wear and corrosion.
Flaws, other hazardous defects	○	○	Visual check, magnetic particle testing ⁽⁴⁾ , or liquid penetrant testing ⁽⁵⁾	Free from flaws, cracks, other hazardous defects.
Mechanical joining device				
Deformation	○	○	Visual check	Free from deformation.
Wear, corrosion	○	○	Visual check	Free from remarkable wear and corrosion.
Flaws, other hazardous defects	○	○	Visual check, magnetic particle testing ⁽⁴⁾ , or liquid penetrant testing ⁽⁵⁾	Free from flaws, cracks, other hazardous defects.
Slackness of pins	○	○	Visual check	Free from slackness.

Notes ⁽³⁾ This article is deleted for the hook without a latch.

⁽⁴⁾ In accordance with **JIS G 0565**.

⁽⁵⁾ In accordance with **JIS Z 2343-1** to **-4**.

Annex 5 (informative)
ISO 4778 Chain slings of welded construction—
Grades M (4), S (6) and T (8)

Introduction This annex 5 (informative) has been prepared based on **ISO 4778 Chain slings of welded construction—Grades M (4), S (6) and T (8)** published in 1981 as the first edition without modifying the technical contents.

This annex 5 (informative) is to supplement the matters related to the text and not to constitute the provision of this Standard.

1 Scope This annex 5 specifies the requirements, methods of rating and testing of single, two, three and four branch (or leg) welded chain slings of grades M (4), S (6) and T (8) using chain conforming to annexes 9, 10, 11 and **ISO 1834** together with the appropriate range of components.

This annex 5 does not apply to welded slings having multiple branches of unequal nominal reach or mechanically joined slings.

2 Normative references

- ISO 1834 : 1980 *Short link chain for lifting purposes—General conditions of acceptance*
- ISO 1835 : 1980 *Short link chain for lifting purposes—Grade M (4) non-calibrated, for chain slings etc.*
- ISO 2766 : 1973 *Single lifting hooks with shank—Capacity up to 25 tonnes—Grades M, P, S (T, V)—Hammer and drop forged hooks*
- ISO 3075 : 1980 *Short link chain for lifting purposes—Grade S (6), non-calibrated, for chain slings etc.*
- ISO 3076 : 1984 *Short link chain for lifting purposes—Grade T (8), non-calibrated, for chain slings etc.*

3 Definitions

3.1 chain sling an assembly consisting of chain or chains joined to upper and lower terminal fittings suitable according to the requirements of this annex 5 for attaching loads to be lifted to the hook of a crane or other lifting machine (see annex 5 figures 2 to 5)

3.2 master link a parallel-sided link forming the upper terminal fitting of a chain sling by means of which it is attached to the hook of a crane or other lifting machine (see annex 5 figures 2 to 5)

3.3 intermediate master link a link used to connect two or more branches to a master link (see annex 5 figures 2 to 5)

3.4 joining link a link fitted to the end of a chain to connect it either directly or through an intermediate link to an upper or lower terminal fitting (see annex 5 figures 2 to 5)

3.5 intermediate link a link used to form a connection between the terminal fitting and the joining link fitted to the chain (see annex 5 figures 2 to 5)

3.6 lower terminal a link, hook or other device fitted at the end of a branch remote from the master link or upper terminal

3.7 proof force a force applied as a test to the whole sling, or a force applied as a test to a section of a sling (see clause 10)

3.8 working load limit (WLL) the maximum mass which a sling is designed to support in general service

3.9 working load (WL) the maximum mass which a sling should be used to support in a particular stated service

4 Designations The following designations should be used in specifying slings to this annex 5.

4.1 Nominal size The nominal size of a chain sling is the nominal size of the short link chain used in its manufacture.

The nominal size of each individual master link, joining or intermediate link where it is of round section is the nominal diameter of the material from which it is made.

4.2 Nominal reach of sling The nominal reach of the finished sling is the effective length from the inside of the lower terminal fitting to the inside of the upper terminal fitting (see annex 5 figures 2 to 5).

4.3 Grade of a sling The nominal grade of a sling, for the purpose of its designation under this annex 5, shall be the same as the grade of the chain used, i.e. grade M (4,) S (6) or T (8) (see clause 1).

4.4 Rating The rating of the chain sling shall be as specified in clause 9.

5 Construction Some examples of chain slings conforming to this annex 5 are shown in annex 5 figures 2 to 5.

Joining links and intermediate links may be

- a) parallel sided links or
- b) egg-shaped links, these being links with differing radii at either end, i.e. pear-shaped.

Egg- or pear-shaped links shall not be used as master links or as lower terminals in any situation where the link could be inverted, leading to a wedging action or subsequent distortion of the link.

6 Dimensions and tolerances The dimensions and tolerances of the chain, master links, joining links and intermediate links used in the construction of chain slings conforming to this annex 5 shall be as follows:

6.1 Chain The dimensions and tolerances of the chain shall be in accordance with the appropriate International Standards listed in clause 1.

6.2 Master links and intermediate master links

6.2.1 The inside dimension and the section of the material shall be such that:

- a) the master link fits on an **ISO** grade **M** hook two sizes larger than the rating of the sling (see annex 5 tables 1 and 2);
- b) the inside width of the master link is not less than 1.2 times the maximum width (L_h) of the hook section defined in **a**);
- c) for slings with hooks as lower terminals, unless another means of securing the hooks when not loaded is provided, the inside dimensions and section are such as to allow the lower terminals to be hooked into the master link while it is on a hook as defined in **a**).

6.2.2 Master links and intermediate master links may be of round or other suitable section but the section of the material shall be chosen so that:

- a) after the proof-force test (see clause 10) the master link and intermediate master links do not show any significant permanent deformation (see also 8.1);
- b) the minimum elongation at breaking is at least that of the corresponding grade of chain.

6.3 Lower terminal links, joining links and intermediate links

6.3.1 The number and internal dimensions of lower terminal, joining and intermediate links shall be such as to ensure free articulation of the links.

6.3.2 The section of the material shall be such that:

- a) after the proof-force test (see clause 10) the lower terminal, joining and intermediate links do not show any significant permanent deformation (see also 8.1);
- b) the minimum elongation at breaking is at least that of the corresponding grade of chain.

NOTE : A method of calculating the sections of master links and intermediate links is given in the annex 5 annex A.

6.4 Eyehooks Eyehooks shall be compatible with the chain (see 6.1).

6.5 Tolerances When constructing the sling, a tolerance of $^{+2}_0$ links is permissible on the nominal reach ordered by the purchaser. After the proof-force test, the difference between the longest and shortest branches of a multi-branch sling, when measured under a tension of 1/5 of the working load limit, shall not exceed 6 mm for branches up to 2 m in length. For slings in excess of 2 m, the difference between the longest and shortest branches may be increased by 3 mm/m.

7 Materials The materials used in the manufacture of components shall meet the conditions laid down in the annex 5 for the appropriate grade of chain.

8 Manufacturing methods and workmanship

8.1 Master links and intermediate master links Welding methods (where applicable), workmanship, materials, form and heat treatment of master links shall be such as to ensure that the ratio between the breaking force and the appropriate proof force is not less than 2 : 1 up to working load limits of 25 t (see annex 5 figure 1).

8.2 Lower terminal links, joining links and intermediate links Welding methods (where applicable), workmanship, materials, form and heat treatment of links shall be such as to ensure that the breaking force is not less than the minimum breaking force of the chain.

8.3 Heat treatment All master links, intermediate master links, joining links, intermediate links, lower terminals and chain shall, before application of the proof force, be heat treated in such a way as to ensure that they have the required mechanical and metallurgical properties.

NOTE : No one but the chain manufacturer, his licensee or an organization authorized by an appropriate authority should be allowed to weld or heat-treat slings covered by this annex 5. Where chain assemblies need to be altered or repaired, this should be undertaken only by the manufacturer, his licensee, or a manufacturer authorized by an appropriate authority.

8.4 Test data Upon request to proven design, the sling manufacturer shall supply test data representing an actual test of a master link, intermediate master link, joining link, lower terminal link or intermediate link of equivalent size, shape, material and heat treatment to the link supplied.

9 Rating

9.1 Single-branch sling Single-branch slings shall have a working load limit equal to that of the chain used in their construction.

9.2 Multi-branch slings There are two alternative methods of rating multi-branch slings, i.e.

- a) **Uniform load method** The slings are rated at a uniform working load limit for any angle between branches of 0 to 90° (0 to 45° to the vertical) or additionally at a uniform working load limit for any angle between branches of 90° to 120° (45° to 60° to the vertical).
- b) **Trigonometric method** The slings are rated at a working load limit according to the particular angle between branches at which the sling is to be used; for this purpose reference is usually made to trigonometric tables.

9.2.1 Uniform load method

- a) **Double-branch slings** For all angles between branches from 0 to 90° (0 to 45° to the vertical)

WLL = $1.4 \times$ WLL of a single branch made from similar chain

When additionally marked for angles between branches of 90 to 120° (45 to 60° to the vertical)

WLL = $1 \times$ WLL of a single branch made from similar chain

- b) **Three- and four-branch slings** For all angles between branches from 0 to 90° (0 to 45° to the vertical).

WLL = $2.1 \times$ WLL of a single branch made from similar chain

When additionally marked for angles between branches of 90 to 120° (45 to 60° to the vertical)

WLL = $1.5 \times$ WLL of a single branch made from similar chain.

NOTE : In the case of a three-branch sling the angle between branches shall be taken as twice the angle to the vertical, i.e. $2 \times \beta$ (see annex 5 figure 6).

In the case of a four-branch sling the angle between branches shall be that between diagonally opposite branches (see annex 5 figure 6).

9.2.2 Trigonometric method

- a) **Double-branch slings:**

WLL = $2 \times$ WLL of a single branch $\times \cos \beta$

- b) **Three- and four-branch slings:**

WLL = $3 \times$ WLL of a single branch $\times \cos \beta$

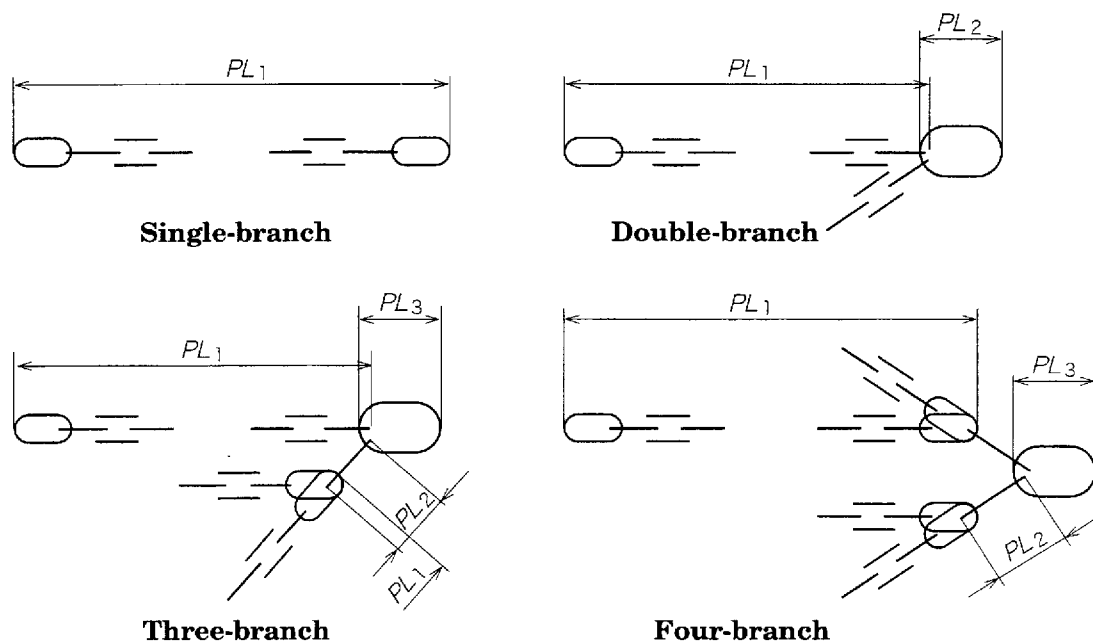
9.3 Nominal rating The nominal rating of any multi-branch sling whether rated by the uniform load or trigonometric method shall be the WLL for that sling when used at an angle of 90° between the branches (45° to the vertical).

10 Proof force After final heat treatment, slings with accessories shall be tested as an assembly; multi-branch chain slings shall be tested in sections.

Individual sections of the chain slings shall be subjected to twice the force to which that section will be subjected, when the assembly is subjected to its working load limit in accordance with the following plan.

10.1 Method of proof loading where uniform load method of rating is used (see annex 5 figure 1)

10.2 Method of proof loading where trigonometric method or rating is used



	Factors for		
	PL_1	PL_2	PL_3
Working load limit	1.0	1.4	2.1
Proof force ($2 \times \text{WLL}$)	2.0	2.8	4.2

NOTE : If WLL is 25 t or over, it is permissible to apply proof forces to the links PL_2 and PL_3 reduced 2 in accordance with ILO Recommendations.

Annex 5 Figure 1 Factors for proof loading

10.2.1 Double-branch slings The proof force on each branch of a double-branch sling shall be twice the working load limit of the chain. The proof force on the master link shall be four times the working load limit on the chain.

10.2.2 Three- and four-branch slings The proof force on each branch of a three- or four-branch sling shall be twice the working load limit of the chain. The proof force for the master link shall be six times the working load limit of the chain. For intermediate master links, the proof force shall be four times the working load limit of the chain.

10.3 After completion of the proof loading and removal of the force, the sling shall be carefully examined by a competent person and any faulty components replaced.

11 Marking The following information shall be shown on a label or metal tag permanently attached to the master link or adjacent link. Alternatively, all or part of the information may be marked on the master link, provided that the mechanical properties of the link are not significantly impaired.

11.1 For single branch slings:

- a) working load limit (kg or t);
- b) individual identification number or symbol;
- c) grade [M (4), S (6) or T (8)];
- d) manufacturer's name or its abbreviation;
- e) size of chain (optional);
- f) other information as agreed between the user and manufacturer.

11.2 For slings rated uniformly for use with angles 0 to 90° (0 to 45° to the vertical):

- a) the working load limit in kilogrammes or tonnes, thus
WLL (kg or t) 0 to 90° (0 to 45° to the vertical);
- b) individual identification number or symbol;
- c) grade [M (4), S (6) or T (8)];
- d) manufacturer's name or its abbreviation;
- e) size of chain (optional);
- f) number of branches;
- g) other information as agreed between the user and manufacturer;
- h) additionally there may be marked on the tag or label or on a separate tag or label attached in a similar manner, the working load limit applicable for use between 90 to 120° (45 to 60° to the vertical), thus
WLL (kg or t) 90 to 120° (45 to 60° to the vertical).

11.3 For slings rated for use with trigonometrical tables:

- a) working load limit at 90° between the branches (45° to the vertical), this
WLL (kg or t) 90° (45° to the vertical);
- b) individual identification number or symbol;
- c) grade [M (4), S (6) or T (8)];
- d) manufacturer's name or its abbreviation;
- e) size of chain (optional);
- f) number of branches;
- g) other information as agreed between the user and manufacturer.

11.4 If a tag or label described in 11.1, 11.2 or 11.3 becomes detached, the chain sling may be used only in accordance with the rating shown on a remaining tag or label. If no tag or label remains, the chain sling should be taken out of service if the necessary information is not marked on the master link itself.

12 Certification Every sling shall be provided with a dated test certificate giving the following information:

- a) name of manufacturer or supplier;
- b) establishment where the sling was proof tested;
- c) identification mark or symbol (see clause 11);
- d) type of sling (see clause 5);
- e) size and grade of chain;
- f) nominal reach;
- g) proof force or proof forces applied;
- h) working load limit;
- i) working load where stated service demands;
- j) certification that the sling was proof tested and then examined by a competent person.

13 Working load limits

Annex 5 Table 1 Working load limits for chain slings rated 0 to 90° between branches; hooks on which master links are required to fit

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Size of chain in grade			Working load limit			To fit grade M (4) crane hook t
Grade M (4) mm	Grade S (6) mm	Grade T (8) mm	Single-branch t	Double-branch t	Three- and four-branch t	
						1
						1.25
						1.6
6.3			0.63	0.8	1.3	2.0
7.1		5.0	0.8	1.1	1.6	2.5
8.0	6.3		1.0	1.4	2.1	3.2
9.0	7.1	6.3	1.25	1.7	2.6	4.0
10.0	8.0	7.1	1.6	2.2	3.3	5.0
11.2	9.0	8.0	2.0	2.8	4.2	6.3
12.5	10.0	9.0	2.5	3.5	5.2	8.0
14.0	11.2	10.0	3.2	4.4	6.7	10.0
16.0	12.5	11.2	4.0	5.6	8.4	12.5
18.0	14.0	12.5	5.0	7.0	10.5	16.0
20.0	16.0	14.0	6.3	8.8	13.2	20.0
22.4	18.0	16.0	8.0	11.2	16.8	25.0
25.0	20.0	18.0	10.0	14.0	21.0	32.0
28.0	22.4	20.0	12.5	17.5	26.2	40.0
32.0	25.0	22.4	16.0	22.4	33.6	50.0
36.0	28.0	25.0	20.0	28.0	42.0	63.0

NOTES 1 These values are based on the uniform load method of rating (see 9.2.1).

- 2 Columns (1), (2) and (3) give the sizes of chain in each grade necessary to produce, single, double and three- and four-branch slings of the ratings 0 to 90° (0 to 45° to the vertical) shown in columns (4), (5) and (6). The single branch slings are in the R10 series. The rating of the double, and three- and four-branch slings are derived from the single by multiplying by 1.4 and 2.1 respectively. These factors are not in the R10 series and therefore the double, three- and four-branch are only approximately in the series.

The dotted lines connect the ratings of slings for which the master link is required to fit on the same grade M (4) hook (see 6.2.1).

For example, a 5.6 t double branch sling [column (5)] reading to the left, on the same line, will be made in 11.2 mm size grade T (8) chain, 12.5 mm size grade S (6) chain, 16 mm size grade M (4) chain, and following the dotted line to the right, the master link is required to fit on an 8 t grade M (4) crane hook.