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**Construction of wooden framed
boxes for packing**

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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 Packing Association (Jpa)/ 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 Z 1403**:2003 is replaced with this Standard.

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Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public or utility model right. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public or utility model right.

Construction of wooden framed boxes for packing

Introduction

This Japanese Industrial Standard was established in 1953 and has been revised 5 times up to the present. The last revision was made in 2003, and the revision at this time has been made with the purposes of corresponding to the necessity to review the basic numerical figures in this Standard in accordance with the International System of Units (SI), the application of which has spread over the years since the last revision, and to bring the contents into greater consistency with International Standards so as to facilitate the internationalization of this Standard.

No corresponding International Standard has been established at this point.

1 Scope

This Standard specifies the wooden framed boxes for packing (hereafter referred to as “framed boxes”) which are intended for transportation of contents of 0.5 t or over up to and including 60 t in mass which have external dimensions not more than 15.0 m in length, 5.0 m in width, and 5.0 m in height.

2 Normative references

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

JIS A 5508 *Nails*

JIS B 1180 *Hexagon head bolts and hexagon head screws*

JIS B 1181 *Hexagon nuts and hexagon thin nuts*

JIS G 3141 *Cold-reduced carbon steel sheet and strip*

JIS G 3302 *Hot-dip zinc-coated steel sheet and strip*

JIS Z 0107 *Glossary of terms used in wooden box for packing*

JIS Z 0108 *Packaging—Vocabulary*

JIS Z 1402 *Wooden boxes for packing*

JIS Z 1514 *Polyethylene coated paper*

Japanese Agricultural Standard (JAS) *Normal plywood*

Japanese Agricultural Standard (JAS) *Structural plywood*

Japanese Agricultural Standard (JAS) *Structural laminated veneer lumber*

3 Terms and definitions

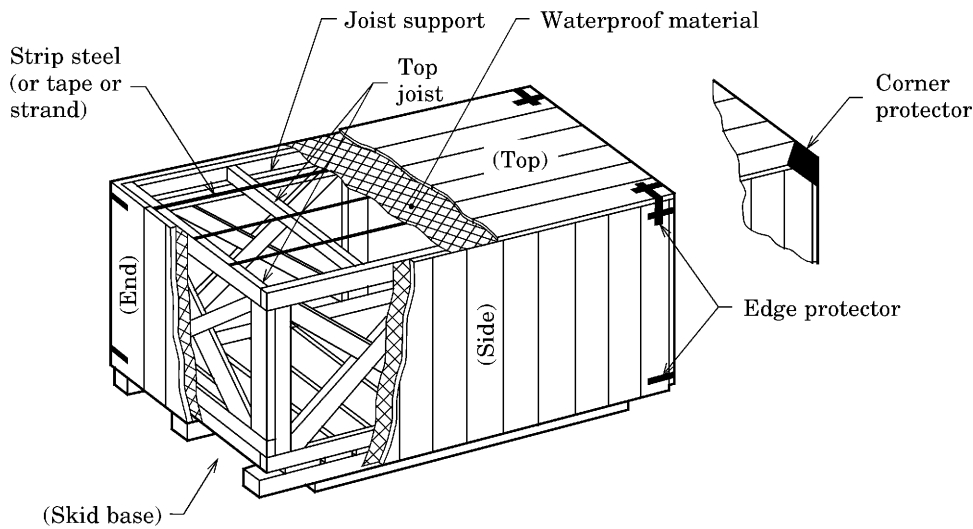
For the purpose of this Standard, the terms and definitions given in **JIS Z 0107** and **JIS Z 0108** apply.

4 Classification

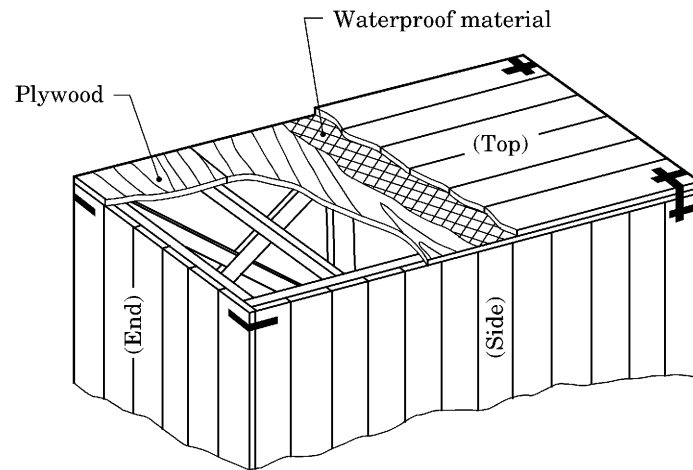
The framed boxes shall be classified as shown in table 1 according to the methods of outer boarding and assembly.

Table 1 Classification

Type		Classification		Criterion for selection	NOTE
Designation	Method of outer boarding	Symbol	Method of assembly		
Type 1	Sealed	1A	Nailed	a) Where it is required to protect the contents from water, moisture and the like, or prevent the falling out of the contents. b) Bolting shall be selected where easy unpacking or reassembly is required.	Figure 1 and figure 2
		1B	Bolted		
Type 2	Plywood-sealed	2A	Nailed	b) Bolting shall be selected where easy unpacking or reassembly is required.	Figure 3 and figure 4
		2B	Bolted		
Type 3	Open-crate	3A	Nailed	Where the waterproofing of the contents is not required and only local protection is required.	Figure 5 and figure 6
		3B	Bolted	Where criterion of 3A is met, and easy packing or reassembly is required.	

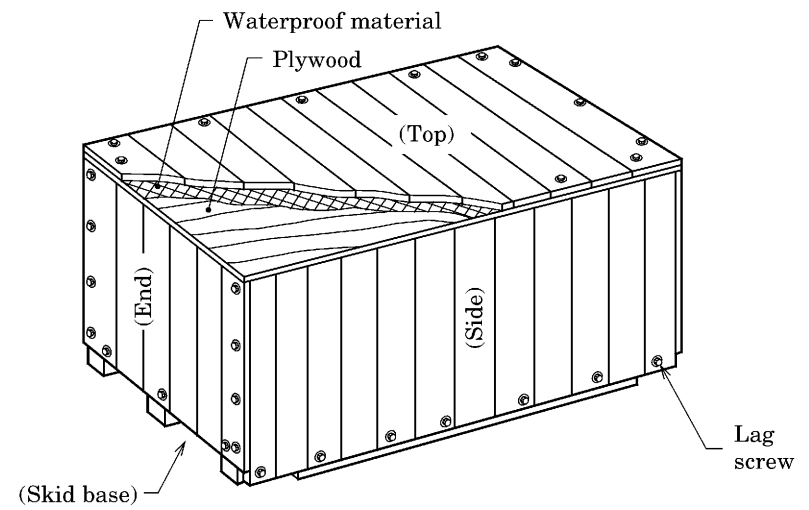


a) Use of strip steel at top

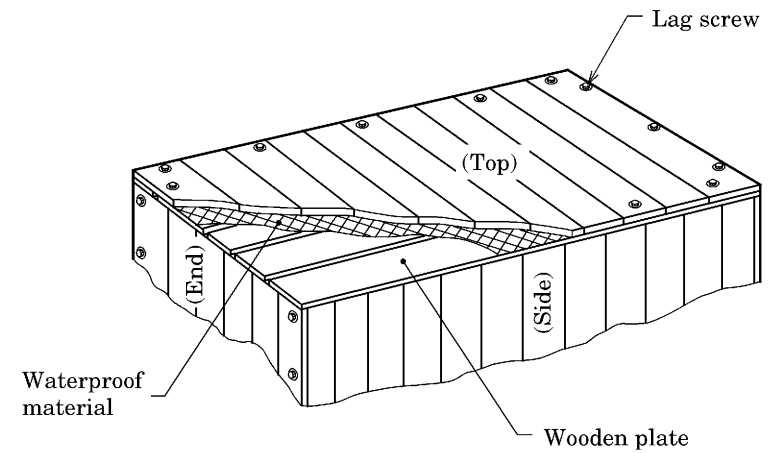


b) Use of plywood for under layer top sheathing

Figure 1 Structure of Type 1A (Boarding-sealed, nailed)



a) Use of plywood for under layer top sheathing



b) Use of wooden plate for under layer top sheathing

Figure 2 Structure of Type 1B (Boarding-sealed, bolted)

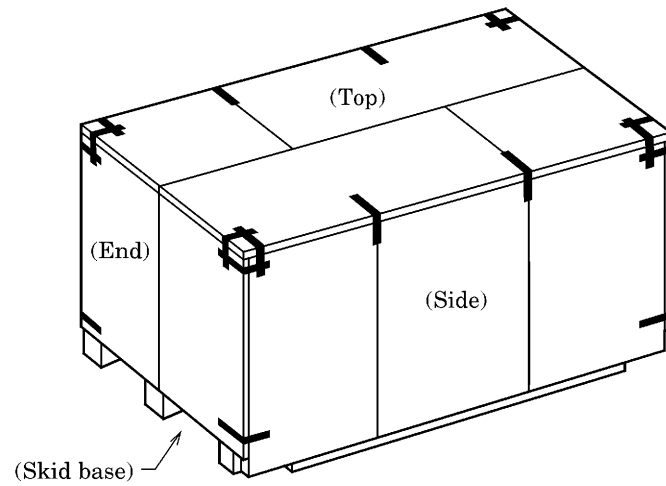


Figure 3 Structure of Type 2A (Plywood-sealed, nailed)

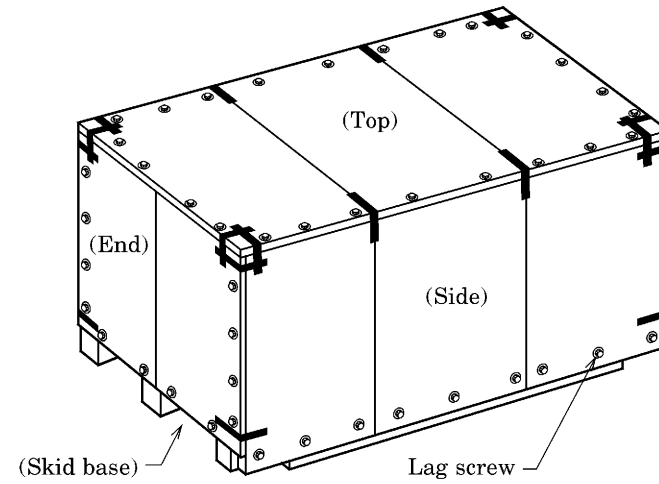


Figure 4 Structure of Type 2B (Plywood-sealed, bolted)

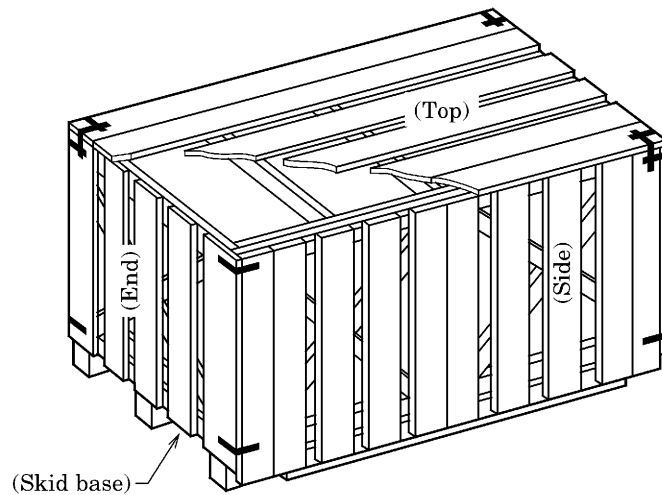


Figure 5 Structure of Type 3A (Boarding open-crate, nailed)

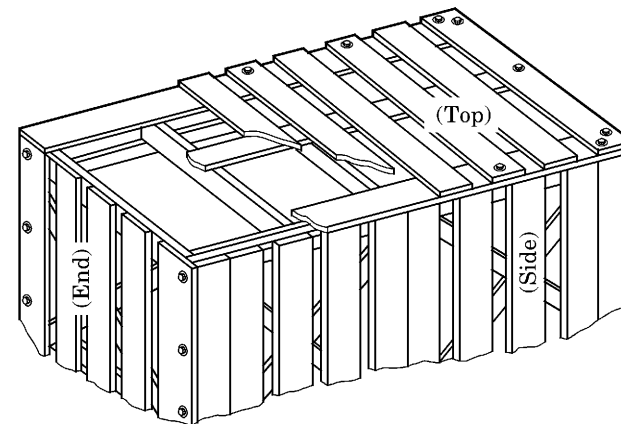


Figure 6 Structure of Type 3B (Boarding open-crate, bolted)

5 Structure and dimensions

5.1 General conditions

Framed boxes shall consist of skid base, sides, ends, and top, and shall be designed to be minimum in volume based on the following general considerations.

- a) **Design elements** The distribution conditions as design elements shall be divided into the following two classes.
 - 1) **Class 1** Applications where framed boxes are subjected to many transmissions and transshipments and likely to be exposed to massive external loads, and where they are mainly intended for exports in conventional vessels, and also for exports in containers from which they are vanned at ports, or taken out at the destination and further delivered elsewhere.
 - 2) **Class 2** Applications where framed boxes are subjected to only limited amount of transmissions and transshipments, and not likely to be exposed to massive external loads, and where they are mainly intended for domestic transportations, sometimes for exports in which through transit by unit loads is performed.
- b) **Permissible conditions**
 - 1) **Basic strength of lumber** The allowable strength of lumbers used for framed boxes is shown in table 2.

Table 2 Allowable strength of lumber

Unit: MPa

Bending strength perpendicular to the length		Compressive strength in longitudinal direction	Tensile strength in longitudinal direction
Flat	Edge of lumber		
			
10.5	8.1	6.0	15.0

For the specified values in the above table, the allowable strength requirements for radiata pines that are generally used, among other lumbers listed in table 13, are adopted.

According to the type of tree actually used, the quantity used or the dimensions of members may be altered based on the ratio of the strength value of the lumber to the strength value specified in table 2 (for the strength of respective types of lumbers, see Annex 2 table 1 of **JIS Z 1402**).

- 2) **Upper portion load** The normally anticipated upper portion load shall consist of the following.
 - 2.1) **Top face load**¹⁾ The top face load exerted on the top joists shall be 4.0 kPa for Class 1, and 2.7 kPa for Class 2 based on the area of the top.

Note ¹⁾ For the purpose of this Standard, the term “top face load” means the upper portion load supported mainly by the top joists, and the “stacking load” means the upper portion load supported mainly by the sides. Consequently, when a freight smaller in width than the

top of the box is directly placed on the framed box, the box will be subjected to both the top face load and stacking load, but when a freight of the same width or any width is placed on the framed box by interposing a suitable wooden block of a length not smaller than the width of the top, the box will be mainly subjected to stacking load.

- 2.2) **Stacking load** The stacking load applied to the sides shall be as shown in table 3 based on the mass of contents (see Annex B).

Table 3 Stacking load

Mass of contents t	Stacking load kPa
10 or under	10.0 (6.7)
Over 10 up to and incl. 30	15.0 (10.0)
Over 30	20.0 (13.3)
The parenthesized values shall apply to Class 2.	

- c) **Spacing** Where the contents have the possibility of being damaged by contact with the inner surface of the framed box, a shock absorbing material shall be applied in between or, where required, spaces shall be provided.
- d) **Designation of dimensions** The size of framed boxes shall be designated by either of the following internal or external dimensions.
- 1) **Internal dimensions** The internal dimensions shall be as follows.
 - Length: The distance between the inner surfaces of end struts
 - Width: The distance between the both inner edges of side struts
 - Height: The distance between the both outer edges of the upper frame member and under frame member
 - 2) **External dimensions** The external dimensions shall be as follows.
 - Length: Internal length + (thickness of end strut + thickness of end outer board) × 2
 - Width: Internal width + (thickness of side strut + thickness of side outer board) × 2
 - Height: Internal height + thickness of top board (upper layer and under layer top sheathings) + thickness of floor member + thickness of skid + thickness of rubbing strip
- e) **Dimensions of lumber** The minimum dimensions for the nominal dimensions of lumber are shown in table 4.

Table 4 Minimum dimensions of thickness and width of lumber

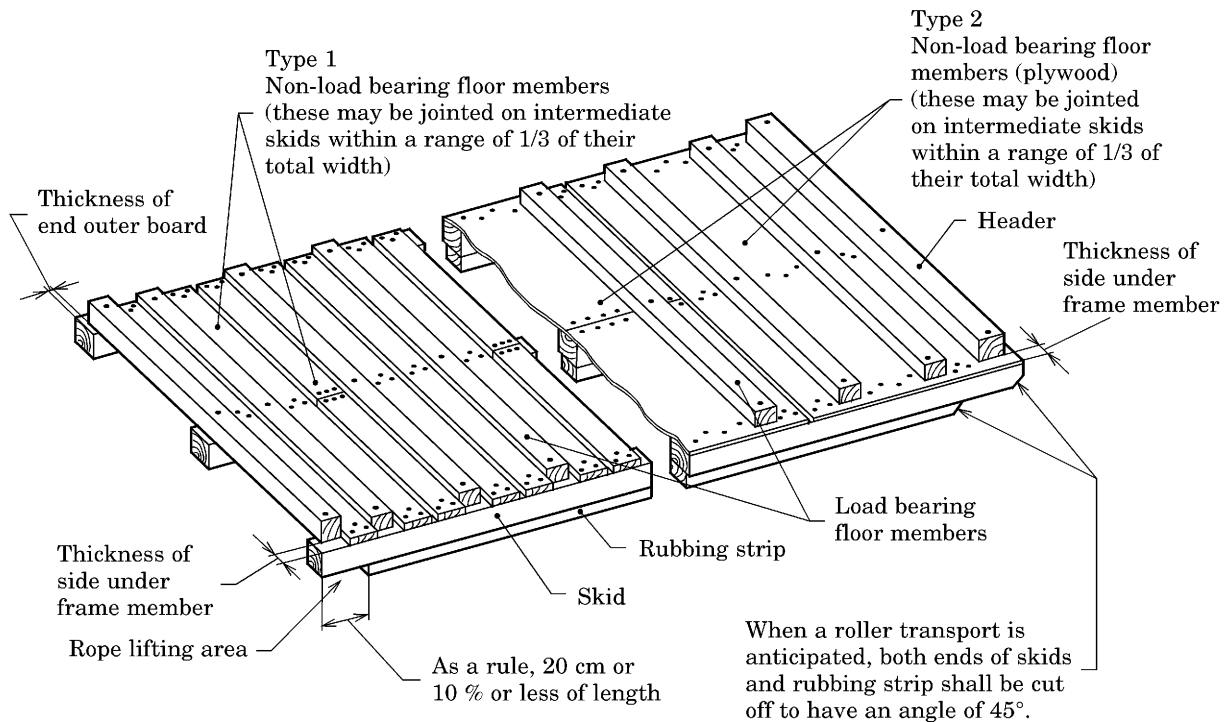
Unit: cm

Nominal dimension	Minimum dimension	Nominal dimension	Minimum dimension
1.2	1.00	6.0	5.55
1.5	1.25	7.5	7.00
1.8	1.55	9.0	8.45
2.1	1.85	10.0	9.45
2.4	2.15	12.0	11.40
3.0	2.70	15.0	14.35
4.0	3.65	18.0	17.30
4.5	4.15	21.0	20.20
5.0	4.60	Over 21.0	(Nominal dimension) – 0.80

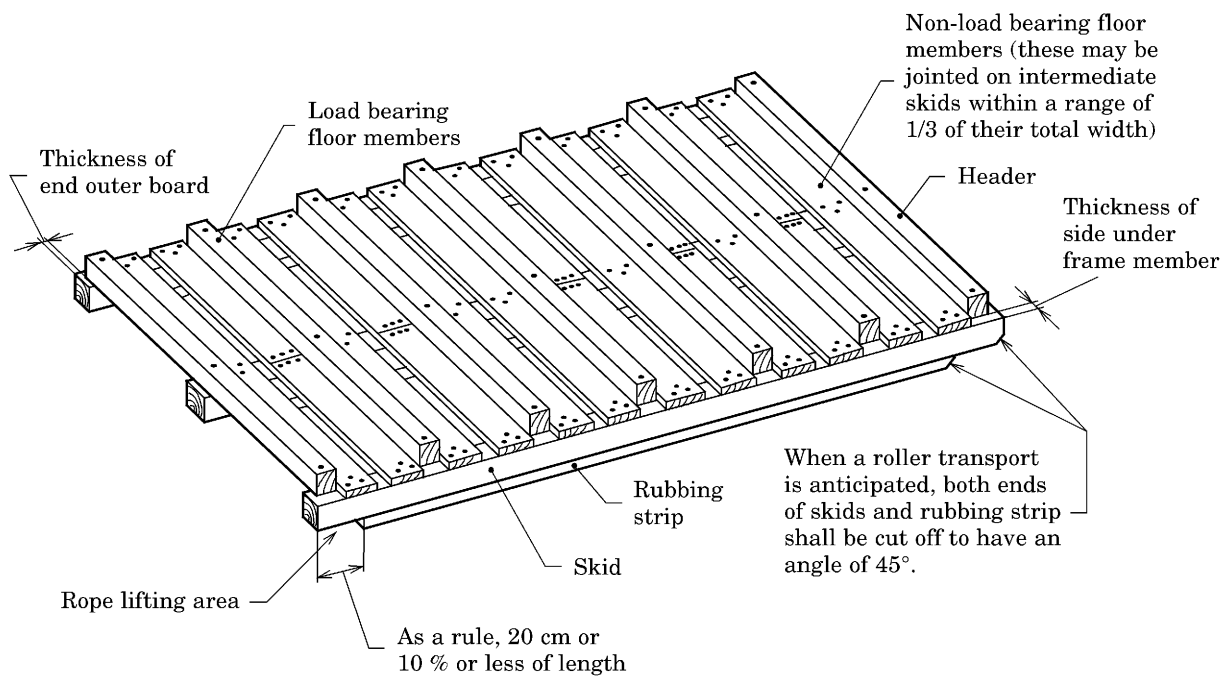
5.2 Skid base

The skid base shall constitute the bottom surface of a framed box, and the sides and ends shall be fastened to the skid base together to support the contents (see figure 7 and figure 8).

Material handling by lifting shall not be performed by using the skid base alone without attaching the sides and ends.

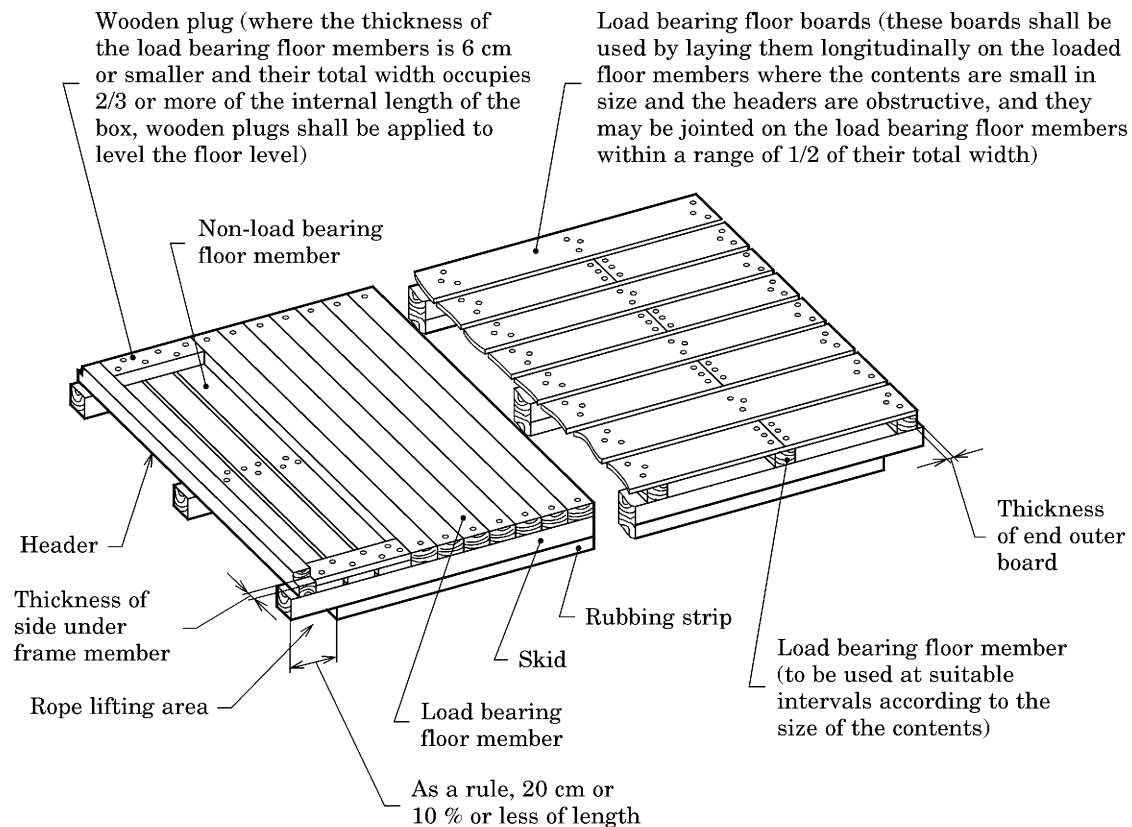


a) Type 1 and Type 2



b) Type 3

Figure 7 Skid base (1)



a) **Example of use of wooden plug**

b) **Example of use of load bearing floor members**

(Modification of floor members, common to Type 1 to Type 3)

Figure 8 Skid base (2)

a) **Skids** Skids are the longitudinal members of the foundational part of the skid base to support the load of the contents in combination with the load bearing floor members and the sides.

- 1) **Dimensions of skids** The dimensions of skids shall be as shown in table 5 according to the mass of the contents and the internal length of the box (or the distance between the points of support by rope lifting). However, where the internal height of the box is 65 cm or smaller, Annex A shall apply.
- 2) **Distance between skids** The centre distance of skids shall be 120 cm or less. However, this distance should preferably be 100 cm or less (80 cm or less if the mass of the contents is 1.5 t or under) where the fork is inserted from the end side of the box for handling.

If the centre distance exceeds the above value, skids of the same dimensions or the same thickness shall be added at intermediate positions.

- 3) **Jointing of skids** It is preferable to use single through members as the skids, but where long lumber is not available, they may be jointed as shown in figure 9. When jointed, however, the skids shall be staggered so that they are not jointed at the centre of the length.

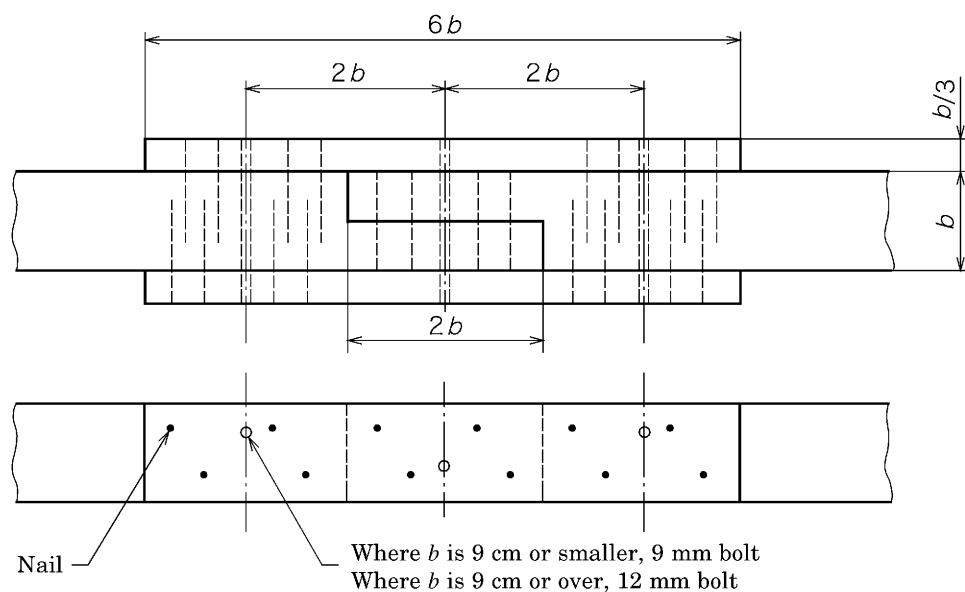
The position of jointing shall be such that the centre of gravity is shifted within the range of rubbing strips and skids at both are staggered. When jointing skids through butt joint, the length of reinforcing member shall be not less than $8b$ when the width of skid is b , and at least two bolts shall be used on the left and on the right.

- 4) **Both ends of skids** Where material handling on rollers is anticipated, the both ends of skids should be cut off to have an angle of 45° within the depth of $1/2$ of their thickness.

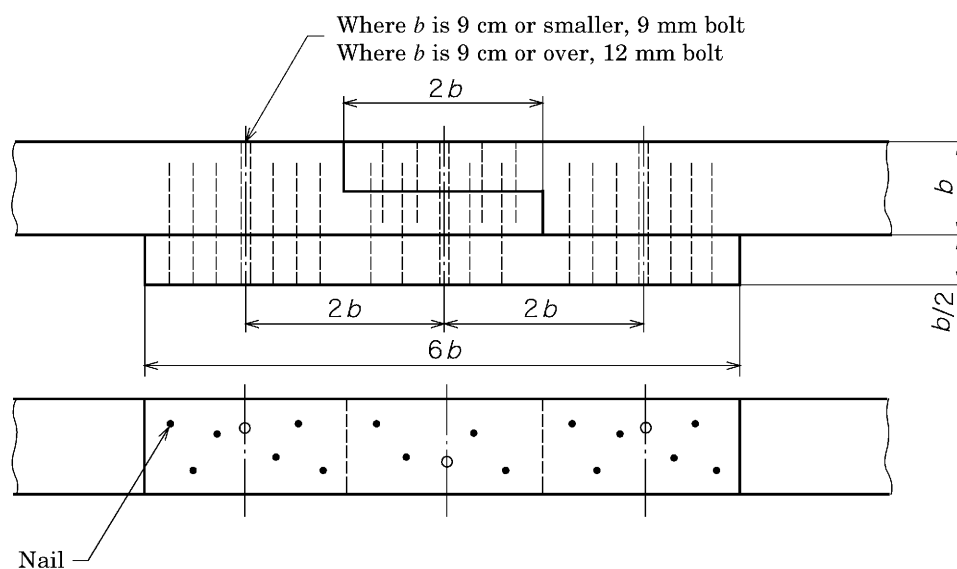
Table 5 Dimensions of respective members

Unit: cm

Mass of contents (t)	Skid		Header (width × thickness)	Thickness of rubbing strip	Non-load bearing floor member		Outer board thickness		Top board thickness									
	Maximum internal length ^{a)}	Dimensions (width × thickness)			Wooden board	Plywood	Wooden board	Plywood	Maximum internal width	Type A	Type 1		Type 2 Type A and Type B	Type 3				
											Type A	Type B		Type A	Type A	Type B		
												Upper layer				Under layer	Upper layer	Under layer
0.7 max.	360	9 × 4.5 ^{b)}	9 × 4.5 or 6 × 6	2.4 min. ^{e)}	1.5	0.55	1.5	0.9	240 ^{f)}	1.8 (1.5)	1.5	1.2 Plywood 0.4	0.9	1.8 (1.5)	1.5	1.2		
1.0 max.		10 × 5 ^{b)}																
1.5 max.		9 × 6	1.8 (1.5)	0.9	1.8 (1.5)													
2.0 max.		7.5 × 7.5 or 12 × 6 ^{c)}	7.5 × 7.5	3 min. ^{e)}														
3.0 max.	500	9 × 9	9 × 9	4 min. ^{e)}														
4.0 max.	450																	
5.0 max.	600	10 × 10																
7.5 max.	500	or 15 × 7.5 ^{d)}																
10.0 max.	800	12 × 12	10 × 10	5 min. ^{e)}														
12.5 max.	700																	
15.0 max.	900	15 × 15	12 × 12	6 min. ^{e)}														
17.5 max.	800																	
20.0 max.	700	18 × 18	15 × 15															
25.0 max.	900																	
30.0 max.	800																	
35.0 max.	700																	
40.0 max.	900	21 × 21	18 × 18	7.5 min. ^{e)}	2.4 (2.1)	1.5 (1.2)	2.4 (2.1)	1.5 (1.2)										
45.0 max.	800																	
50.0 max.	1 000	24 × 24	21 × 21															
55.0 max.	900																	
60.0 max.	800																	
Parentthesized values shall apply to Class 2.																		
Notes ^{a)} Where the skid exceeds the maximum internal length, skid having the dimensions of the next size up shall be used, or the distance between the points of support of rope lifting shall be made shorter than the maximum internal length. However, this shall not apply where the contents are integrally rigid in the longitudinal direction.							^{c)} These dimensions shall be used where the thickness of the under frame member is 4 cm or 4.5 cm.											
							^{d)} These dimensions shall be used where the thickness of the under frame member is 5 cm or 6 cm.											
^{b)} These dimensions shall be used only for division of nailing 1A, 2A and 3A. For 1B, 2B and 3B, the thickness shall be 6 cm or greater.							^{e)} Where a fork entry is provided or where a rope lifting area is provided at the middle part, the dimensions specified in figure 10 shall be applied.											
							^{f)} Where this dimension exceeds 240, top boards one rank thicker shall be used.											
							^{g)} Where this dimension exceeds 300, the values shown in square brackets shall be applied.											



a) Jointing of intermediate skids (with reinforcement)



b) Jointing of skids at both ends (with reinforcement)

Figure 9 Jointing of skids

- b) **Rubbing strips** Rubbing strips shall be nailed or fastened with lag screws to the lower surface of skids in order to adjust the balance between the points of support by the ropes and the centre of gravity, as shown in figure 7 and figure 8. Nails shall be driven in two rows at staggered positions, and the intervals of nails in each row shall be 30 cm or less. The heads of lag screws, if used, shall be sunk under the surface of rubbing strip.

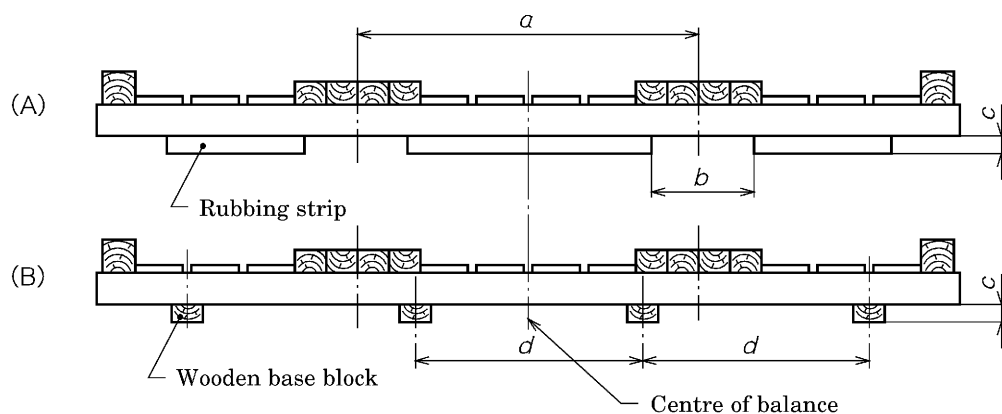
Where the cargo is handled on rollers, both ends of the rubbing strips shall be cut off to have an angle of 45° and two or more nails shall be driven at each cut section.

The thickness of rubbing strips shall be as specified in table 5, and their width shall be 80 % or more of the width of the skids. In addition, they may be jointed in the longitudinal direction.

The length of the rubbing strip shall be smaller than that of the skid at both ends by not more than 20 cm or 10 % of the length of the skid, but depending on the form of the bottom of the contents or the position of the centre of gravity, other dimensions than this may be used.

For framed boxes to be handled by forklifts, it is preferable to provide fork entry by using rubbing strips or wooden base blocks as shown in figure 10 a).

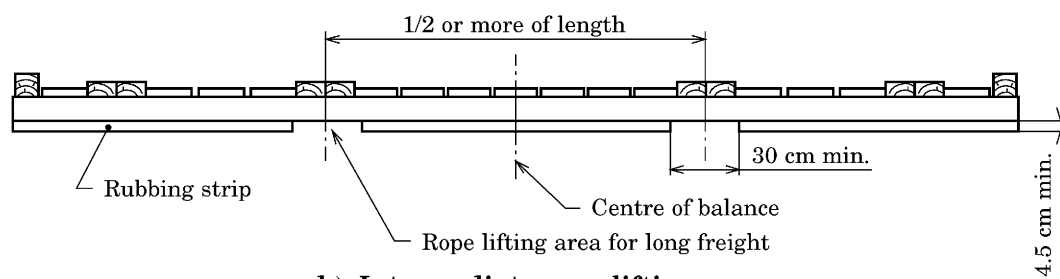
Where ropes are applied at intermediate positions of a long box, rope lifting area shall be provided at intermediate positions as shown in figure 10 b).



Unit: cm

Total mass (t)	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
3 or under	95 max.	30 min.	4.5 min.	65 max.
Over 3 up to and incl. 7	140 max.	30 min.	6.0 min.	110 max.
Over 7 up to and incl. 10	160 max.	40 min.	7.5 min.	110 max.
Over 10 up to and incl. 15	180 max.	40 min.	9.0 min.	110 max.
Over 15 up to and incl. 20	200 max.	40 min.	10.0 min.	120 max.

a) Fork entry



b) Intermediate rope lifting area

Figure 10 Fork entry and intermediate rope lifting area

- c) **Headers** Headers are the members for transverse connection of the skids, and the ends shall be fastened to the headers.

Headers shall be fastened to the skids with bolts such that the both longitudinal ends of the skids protrude from the edges of the headers by the length equal to the thickness of the end outer board (see figure 7).

The dimensions of headers shall be as specified in table 5. The diameter of the bolts used for fastening the headers shall be as specified in table 6. The length of headers shall be equal to the internal width of the box. However, where the thickness of the floor members exceeds 2.4 cm, it is preferable to cut off both ends of the headers by the thickness of the under frame member while leaving the thickness of the floor member, as shown in figure 8.

The headers used for Type 2 shall have a length equal to the internal width of the box, and be fastened on the non-load bearing floor members of plywood (see figure 7).

Table 6 Bolts for fastening headers

Unit: cm

Dimensions of headers (width × thickness)	Diameter of bolt (mm)	Dimensions of headers (width × thickness)	Diameter of bolt (mm)
9 × 4.5 or 6 × 6	9 ^{a)}	12 × 12	16
7.5 × 7.5		15 × 15	16 or 12 × 2 bolts
9 × 9	12	18 × 18	19 or 16 × 2 bolts
10 × 10		21 × 21	
Note ^{a)} Where the dimensions of headers are 9 cm × 4.5 cm, nails may be used in place of bolts.			

d) **Floor members** Floor members shall be laid crosswise on the upper surface of the skids and fastened to the skids.

1) **Non-load bearing floor members** The non-load bearing floor members shall be as follows.

1.1) **Thickness of non-load bearing floor members** The thickness of non-load bearing floor members shall be as specified in table 5 relative to the mass of the contents.

1.2) **Width of non-load bearing floor members** The width of non-load bearing floor members shall be as follows.

- For Type 1, 12 cm or larger
- For Type 2, 20 cm or larger (plywood)
- For Type 3, 15 cm or larger

1.3) **Method of fastening non-load bearing floor members** Non-load bearing floor members shall be fastened with nails according to the following methods.

- **Type 1 and Type 2** For ventilation and water drainage, the floor members shall be arranged in parallel with a spacing of 0.5 cm to 1.0 cm, or by butt-jointing with 4 holes of 1.2 cm diameter drilled at each of 4 positions or more where the contents do not contact the floor members. The plywood for Type 2 should be applied covering the area up to under the headers (see figure 7).

It is permissible that non-load bearing floor members for Type 1 are used for Type 2.

- **Type 3** A spacing of up to 20 cm may be provided according to the shape and quality of the contents.
 - **Common** Non-load bearing floor members may be butt-jointed on the intermediate skid members within a range of 1/3 of their total width.
- 2) **Load bearing floor members** Load bearing floor members shall support the contents, and their dimensions shall be selected based on their length and the mass and shape of the contents.
- 2.1) **Load bearing floor members under uniformly distributed load** The required thickness and total width of floor members under a uniformly distributed load with respect to the transverse direction of the box shall be as shown in table 7, and the respective dimensions and required number of load bearing floor members shall be as shown in table 8.
- 2.2) **Load bearing floor members under centre-concentrated load** Where load bearing floor members receive a concentrated load at the centre of their length, the allowable load shall be 1/2 of the values specified in table 7 and table 8.
- 2.3) **Load bearing floor members under other kinds of loads** The dimensions of load bearing floor members subjected to other kinds of loads shall be as given in Annex 1 of **JIS Z 1402**.

Table 7 Allowable bending load per 1 cm of width of load bearing floor member (uniformly distributed load)

Unit: N

Internal distance between outer skids (cm)	Thickness of load bearing floor member (cm)																	
	1.5	1.8	2.1	2.4	3.0	4.0	4.5	5.0	6.0	7.5	9.0	10.0	12.0	15.0	18.0	21.0	24.0	30.0
60	52.5	75.6	102.9	134.4	210.0	373.3	472.5	583.3	840.0	1 312.5	1 890.0	2 333.3	3 360.0					
70	45.0	64.8	88.2	115.2	180.0	320.0	405.0	500.0	720.0	1 125.0	1 620.0	2 000.0	2 880.0	4 500.0				
80	39.4	56.7	77.2	100.8	157.5	280.0	354.4	437.5	630.0	984.4	1 417.5	1 750.0	2 520.0	3 937.5	5 670.0			
90	35.0	50.4	68.6	89.6	140.0	248.9	315.0	388.9	560.0	875.0	1 260.0	1 555.6	2 240.0	3 500.0	5 040.0	6 860.0		
100	31.5	45.4	61.7	80.6	126.0	224.0	283.5	350.0	504.0	787.5	1 134.0	1 400.0	2 016.0	3 150.0	4 536.0	6 174.0	8 064.0	
120	26.3	37.8	51.4	67.2	105.0	186.7	236.3	291.7	420.0	656.3	945.0	1 166.7	1 680.0	2 625.0	3 780.0	5 145.0	6 720.0	10 500.0
140	22.5	32.4	44.1	57.6	90.0	160.0	202.5	250.0	360.0	562.5	810.0	1 000.0	1 440.0	2 250.0	3 240.0	4 410.0	5 760.0	9 000.0
160	19.7	28.4	38.6	50.4	78.8	140.0	177.2	218.7	315.0	492.2	708.8	875.0	1 260.0	1 968.8	2 835.0	3 858.7	5 040.0	7 875.0
180	17.5	25.2	34.3	44.8	70.0	124.4	157.5	194.4	280.0	437.5	630.0	777.8	1 120.0	1 750.0	2 520.0	3 430.0	4 480.0	7 000.0
200	15.8	22.7	30.9	40.3	63.0	112.0	141.8	175.0	252.0	393.8	567.0	700.0	1 080.0	1 575.0	2 268.0	3 087.0	4 032.0	6 300.0
220		20.6	28.1	36.7	57.3	101.8	128.9	159.1	229.1	358.0	515.5	636.4	916.4	1 431.8	2 061.8	2 806.4	3 665.5	5 727.3
240			25.7	33.6	52.4	93.3	118.1	145.8	210.0	328.1	472.5	583.3	840.0	1 312.5	1 890.0	2 572.5	3 360.0	5 250.0
260				31.0	48.5	86.2	109.0	134.6	193.8	302.9	436.2	538.5	775.4	1 211.5	1 744.6	2 374.6	3 101.5	4 846.2
280					45.0	80.0	101.3	125.0	180.0	281.3	405.0	500.0	720.0	1 125.0	1 620.0	2 205.0	2 880.0	4 500.0

Table 7 (concluded)

Unit: N

Internal distance between outer skids (cm)	Thickness of load bearing floor member (cm)																	
	1.5	1.8	2.1	2.4	3.0	4.0	4.5	5.0	6.0	7.5	9.0	10.0	12.0	15.0	18.0	21.0	24.0	30.0
300						74.7	94.5	116.7	168.0	262.5	378.0	466.7	672.0	1 050.0	1 512.0	2 058.0	2 688.0	4 200.0
320							88.6	109.4	157.5	246.1	354.4	437.5	630.0	984.4	1 417.5	1 929.4	2 520.0	3 937.5
340							83.4	102.9	148.2	231.6	333.5	411.8	592.9	926.5	1 334.1	1 815.9	2 371.8	3 705.9
360								97.2	140.0	218.8	315.0	388.9	560.0	875.0	1 260.0	1 715.0	2 240.0	3 500.0
380								92.1	132.6	207.2	298.4	368.4	530.5	828.9	1 193.7	1 624.7	2 122.1	3 315.8
400									126.0	196.9	283.5	350.0	504.0	787.5	1 134.0	1 543.5	2 016.0	3 150.0
420									120.0	187.5	270.0	333.3	480.0	750.0	1 080.0	1 470.0	1 920.0	3 000.0
440									114.5	179.0	257.7	318.2	458.2	715.9	1 030.9	1 403.2	1 832.7	2 863.6
460									109.6	171.2	246.5	304.3	438.3	684.8	986.1	1 342.2	1 753.0	2 739.1
480										164.1	236.3	291.7	420.0	656.3	945.0	1 286.2	1 600.0	2 625.0

Load bearing floor members under uniformly distributed load shall be as follows.

- The thickness of load bearing floor members shall be selected so that the value obtained by multiplying the value of allowable load in the above table by the required total width of the load bearing floor member is not smaller than the load of the contents (N). In this case, the total width of the load bearing floor members shall be not larger than the length of contact by the bottom of the contents. The load of the contents (N) shall be the value obtained by multiplying the mass of the contents (kg) by 9.8.
- Where load bearing floor members are used in layers, they shall be used based on the sum of the allowable loads for the respective thicknesses.
- The allowable load where the internal distance between outer skids is an intermediate value between the values in the above table may be calculated from formula (1) in Annex 1 of **JIS Z 1402**.
- The values of allowable load in the above table have been calculated by taking the allowable strength (f_b) of lumber as 10.5 MPa. Therefore, they may be applied by multiplying by the ratio ($f_b/10.5$) according to the value of f_b of the type of lumber actually used.

Table 8 Allowable bending load per piece of load bearing floor member (uniformly distributed load)

Unit: N

Internal distance between outer skids (cm)	Cross-sectional dimensions of load bearing floor member (width × thickness) (cm)																		
	9×2.4	9×3	9×4	9×4.5	6×6	10×5	9×6	7.5×7.5	12×6	9×9	15×7.5	10×10	18×9	12×12	15×15	181×8	21×21	24×24	30×30
60	1 210	1 890	3 360	4 253	5 040	5 833	7 560	9 844	10 080	17 010	19 688	23 333	34 020	40 320					
70	1 037	1 620	2 880	3 645	4 320	5 000	6 480	8 438	8 640	14 580	16 875	20 000	29 160	34 560	67 500				
80	907	1 418	2 520	3 189	3 780	4 375	5 670	7 383	7 560	12 758	14 766	17 500	25 515	30 240	59 063	102 060			
90	806	1 260	2 240	2 835	3 360	3 889	5 040	6 563	6 720	11 340	13 125	15 556	22 680	26 880	52 500	90 720	144 060		
100	726	1 134	2 016	2 552	3 024	3 500	4 536	5 906	6 048	10 206	11 813	14 000	20 412	24 192	47 250	81 648	129 654	193 536	
110	660	1 031	1 833	2 320	2 749	3 182	4 124	5 369	5 498	9 278	10 739	12 727	18 556	21 993	42 955	74 225	117 867	175 942	
120	605	945	1 680	2 126	2 520	2 917	3 780	4 922	5 040	8 505	9 844	11 667	17 010	20 160	39 375	68 040	108 045	161 280	315 000
130	558	872	1 551	1 963	2 326	2 692	3 489	4 543	4 652	7 851	9 087	10 769	15 702	18 609	36 346	62 806	99 734	148 874	290 769
140	518	810	1 440	1 823	2 160	2 500	3 240	4 219	4 320	7 290	8 438	10 000	14 580	17 280	33 750	58 320	92 610	138 240	270 000
150	484	756	1 344	1 701	2 016	2 333	3 024	3 938	4 032	6 804	7 875	9 333	13 608	16 128	31 500	54 432	86 436	129 024	252 000
160	454	709	1 260	1 595	1 890	2 187	2 835	3 691	3 780	6 379	7 383	8 750	12 758	15 120	29 531	51 030	81 034	120 960	236 250
170	427	667	1 186	1 501	1 779	2 059	2 668	3 474	3 558	6 004	6 949	8 235	12 007	14 231	27 794	48 028	76 267	113 845	222 353
180	403	630	1 120	1 418	1 680	1 944	2 520	3 281	3 360	5 670	6 563	7 778	11 340	13 440	26 250	45 360	72 030	107 520	210 000
190	382	597	1 061	1 343	1 592	1 842	2 387	3 109	3 183	5 372	6 217	7 368	10 743	12 733	24 868	42 973	68 239	101 861	198 947

Table 8 (concluded)

Unit: N

Internal distance between outer skids (cm)	Cross-sectional dimensions of load bearing floor member (width × thickness) (cm)																		
	9×2.4	9×3	9×4	9×4.5	6×6	10×5	9×6	7.5×7.5	12×6	9×9	15×7.5	10×10	18×9	12×12	15×15	181×8	21×21	24×24	30×30
200	363	567	1 008	1 276	1 512	1 750	2 268	2 953	3 024	5 103	5 906	7 000	10 206	12 096	23 625	40 824	64 827	96 768	189 000
220		515	916	1 160	1 375	1 591	2 062	2 685	2 749	4 639	5 309	6 364	9 278	10 996	21 477	37 113	58 934	87 971	171 818
240			840	1 063	1 260	1 458	1 890	2 461	2 520	4 253	4 922	5 833	8 505	10 080	19 688	34 020	54 022	80 640	157 500
260				981	1 163	1 346	1 745	2 272	2 326	3 925	4 543	5 385	7 851	9 305	18 173	31 403	49 867	74 437	145 385
280				911	1 080	1 250	1 620	2 109	2 160	3 645	4 219	5 000	7 290	8 640	16 875	29 160	46 305	69 120	135 000
300					1 008	1 167	1 512	1 969	2 016	3 402	3 938	4 667	6 804	8 064	15 750	27 216	43 218	64 512	126 000
320					945	1 094	1 418	1 846	1 890	3 189	3 691	4 375	6 379	7 560	14 766	25 515	40 517	60 480	118 125
340						1 029	1 334	1 737	1 779	3 002	3 474	4 118	6 004	7 115	13 897	24 014	38 134	56 922	111 176
360						972	1 260	1 641	1 680	2 835	3 281	3 889	5 670	6 720	13 125	22 680	36 015	53 760	105 000
380							1 194	1 554	1 592	2 686	3 109	3 684	5 372	6 366	12 434	21 486	34 119	50 931	99 474
400								1 477	1 512	2 552	2 953	3 500	5 103	6 048	11 813	20 412	32 413	48 384	94 500
420								1 406	1 440	2 430	2 813	3 333	4 860	5 760	11 250	19 440	30 870	46 080	90 000
440									1 375	2 320	2 685	3 182	4 639	5 498	10 739	18 556	29 467	43 985	85 909
460									1 315	2 219	2 568	3 043	4 437	5 259	10 272	17 750	28 186	42 073	82 174
480										2 126	2 461	2 917	4 253	5 040	9 844	17 010	27 011	40 320	78 750
The values of allowable load in the above table have been calculated by taking the allowable strength (f_b) of lumber as 10.5 MPa. Therefore, they may be applied by multiplying by the ratio ($f_b/10.5$) according to the value of f_b of the type of lumber actually used.																			

- 2.4) **Method of fastening load bearing floor members** Load bearing floor members shall be fastened as specified in table 9 and according to the following method.

Except for those load bearing floor members supporting contents fixed with bolts, fastening may be made by using lag screws.

Table 9 Method of fastening load bearing floor members

Thickness of load bearing floor member cm	Method of fastening	
6 or under	Nailing	
9 or under	Bolting (9 mm)	One bolt for width of 15 cm or smaller
Over 9	Bolting (12 mm)	Two bolts for width exceeding 15 cm ^{a)}
Note ^{a)} One bolt may be used for intermediate skids.		

- Load bearing floor members may be fastened from above non-load bearing floor members
- Where all the floor members are used as load bearing floor members, the same method of ventilation as in the case of non-load bearing floor members shall be applied.
- Where load bearing floor members are used in a large proportion, it is preferable to cut off both of their ends so that the cut ends are admitted into the gap between the skids and the under frame members as similarly to the header in figure 8.
- Where load bearing floor members of 6 cm or smaller in thickness are used to occupy most part (2/3 or more of the internal length of the box) of the floor member, it is preferable to make the length of the load bearing floor members equal to the width of the skid base so that the side under frame members ride on the load bearing floor members and to apply wood plugs of a width equal to or larger than the thickness of the under frame members along both ends of the non-load bearing floor members so as to obtain a thickness equal to the thickness of the load bearing floor members [see a) of figure 8].

Where small-sized contents (or contents packed in corrugated fibreboard boxes) are packed all over the floor surface, load bearing floor boards may be laid in the longitudinal direction on the load bearing floor members and headers, as shown in b) of figure 8, in order to avoid the unevenness produced by the headers and load bearing floor members. In this case, the headers and load bearing floor members shall have the same thickness and the thickness of the load bearing floor boards shall be selected according to table 7 by taking the distance between the load bearing floor members as the length. However, where both ends of the contents bear on the load bearing floor members, the thickness of the load bearing floor boards may be 1.2 cm or 0.55 cm (plywood).

- In forklifts handling, if it is necessary to insert the fork from the end surface, a construction to prevent the damage of the floor surface of skid base is necessary, which is acquired either by the fitting of load bearing floor members which would be positioned at the tip of fork, or by fitting of a similarly functioning reinforcement member.
- When the width of skid base is larger than the load carrying platform of the transport vehicle and therefore the skids at both ends do not fit with the load carrying platform, it is necessary to fill up the space between the skids under the load bearing floor member with the lumber of the same thickness as the total thickness of the skid and rubbing strip, so that they fit with the both ends of the load carrying platform. In this case, if four or more skids are used, the lumber should be provided for supporting all load bearing floor members as far as possible except the middle part.

5.3 Sides and ends

The sides shall be fastened to the skids and have the function to support the stacking load and also to support the load of the contents through the skids. The ends shall be fastened to the headers and assembled with both sides, and have a supplementary function in supporting the stacking load. The sides and ends shall be as follows.

- a) **Structure** The structure of Type 1 and Type 3 shall be as shown in figure 11 and figure 12, and that of Type 2 shall be Type A to Type D as shown in figure 13 and figure 14.

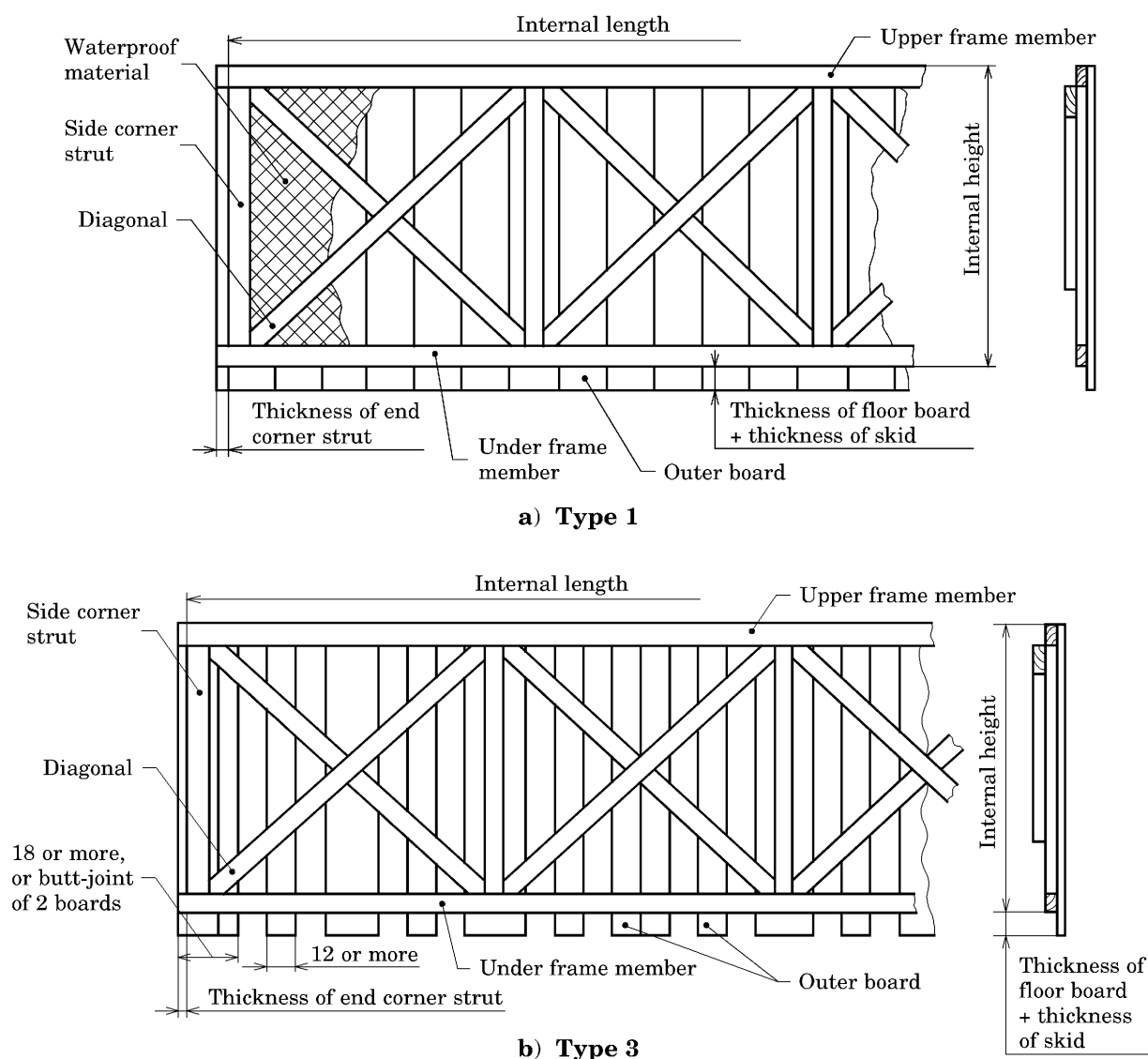
If this structure is applied, the top joints at both ends are not necessary.

- b) **Forms of framing** The forms of framing shall be as follows.

- 1) The form of framing for Type 1 and Type 3 shall be any one of the forms shown in figure 16 based on the table of framing in figure 15.
- 2) The form of framing for Type 2 shall be any one of Type A to Type D in figure 13 and figure 14. However, the form of framing for the ends shall be the same as that employed for the sides.

The centre distance of struts should be 91 cm or less in average, or in order to align the joint line of plywoods with the centre of the strut, it is preferable that the struts are used at the positions of the width (91 cm or less) of the plywoods used from the both ends or 1/2 or 1/3 of the width and the fraction of width is located on the middle part.

Unit: cm



The assembly structure of the under frame members of the side in Type 1 and Type 3 may be as shown in the following figure.

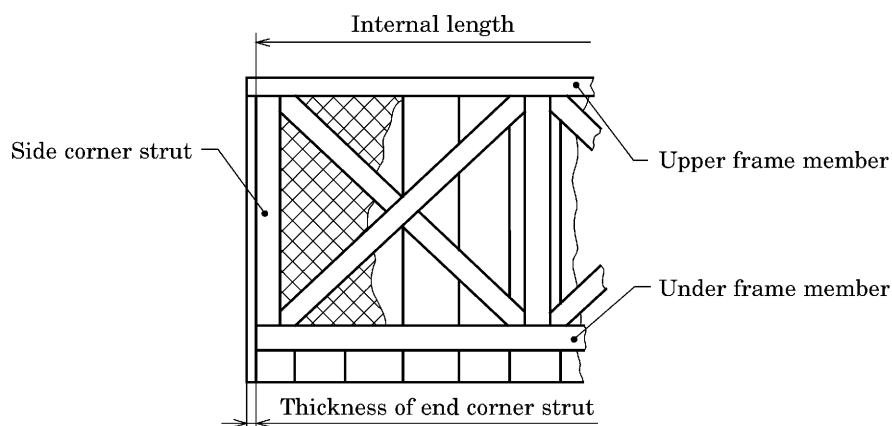


Figure 11 Side (Type 1 and Type 3)