

REF: E18501

ALT. NO.	AUTHORITY	DESCRIPTION	DATE	INITIAL
K	DY. CEE/TMD	DIMENSION 40±0.5 CHANGED TO 30.5±0.3 REF. LNO. EL/TM/2013, DT. 21.9.05 & LNO. ELDD/3221/AKM, DT. 3.3.06	21.9.2005	dhuty

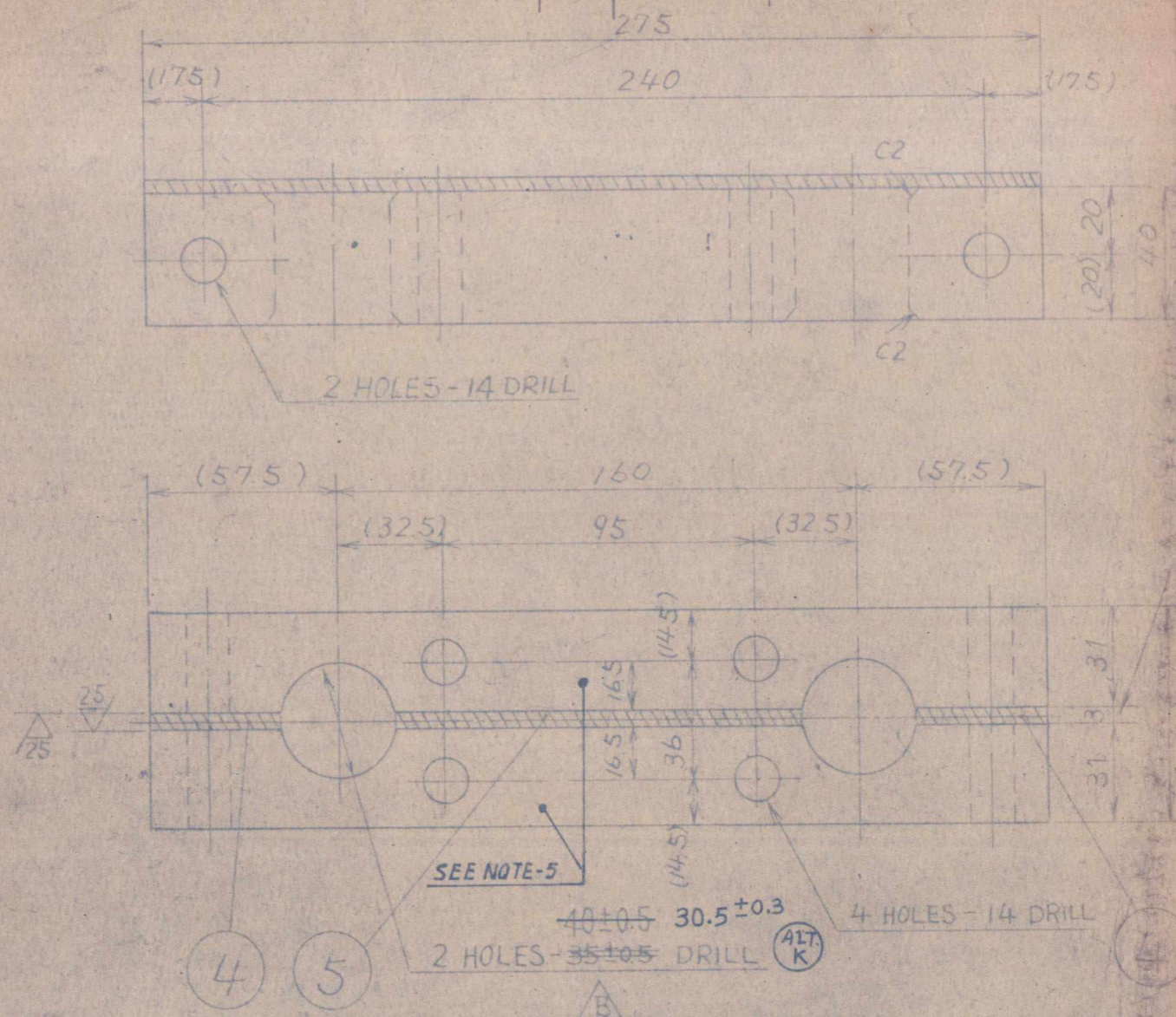
SYM.	REVISIONS	DATE	REVD.	CHKD.	RE	MTR.	RE
A	ADDED SPECIFICATION	88-03-29	2/	Thara	2/	Thara	
B	CHANGED DUE TO IR REQUEST	88-05-31	2/	Thara	2/	Thara	
C	REVISED TABLE NUMBER	88-10-14	2/	Thara	2/	Thara	
D	NOTE 1&2 DELETED AND NOTE 3 ADDED.	93-3-31		Koo			
E	LENGTH OF PACKING FOR REF. 4&5 CHANGED.	95-8-29		SEE/TMD			
F	NOTE-4 ADDED. REF. NOTE NO. EL/TM/2013, DATED: 12/12/97	97-12-23		DY. CEE/TMD			
G	PUBLICATION YEAR OF IS: 3513 (PART-1) FOR REF. 1&3 UP-DATED. REF. LNO. EL/TM/2013, DT. 30-01-99.	99-02-02		SEE/TMD			
H	NOTE-5 ADDED. REF. LNO. EL/TM/2013 DT. 29.8.2002	04-9-02		He			
I	NOTE-6 ADDED. REF. LNO. EL/TM/2013 DT. 12.09.2002	12-9-02		He			
J	NOTE 3 DELETED, NOTE 7&8 ADDED AND DRG NO ADDED IN REF. 2, 4, 5, 6. REF. LNO. EL/TM/2013 DT. 05-7-04	08-7-04		dhuty			

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SPLIT AFTER MACHINING

NOTE - J

1. STICK A PACKING (2) ON THE SUPPORTER (1) WITH A SUITABLE BONDING AGENT.
2. STICK PACKINGS (4, 5, 6) ON THE SUPPORTER (3) WITH A SUITABLE BONDING AGENT.
3. ONLY SUPPORTER (REF. 1&3) WILL BE SUPPLIED AND PACKINGS (REF. 2, 4, 5&6) WILL BE SEPERATELY PURCHASED.



NOTE:-

4. TENDERERS MAY ALSO QUOTE FOR THIS ITEM TO ALTERNATE MATERIAL SYNTHETIC RESIN BONDED GLASS FIBRE GR. UP1 OF IS: 10192-1982 WHICH MAY BE CONSIDERED FOR SMALL QUANTITY (SAY ABOUT 5 TO 15%) FOR DEVELOPMENT PURPOSE IF FOUND SUITABLE. TENDERERS SHALL ALSO NOTE THAT BULK PURCHASE WILL BE MADE TO MATERIAL AS GIVEN IN REF: 1&3.
5. MANUFACTURERS IDENTIFICATION TO BE STAMPED AT THE LOCATION SHOWN.
6. GLASS MAT EPOXY LAMINATE (FIRE RETERDANT) AS PER IS: 10192 GRADE EP:2 IS APPROVED FOR BULK SUPPLY IN ADDITION TO IS: 3513 Pt-I TYPE-VI
7. STICK PACKING (REF-2) WITH SUPPORTER (REF-1) WITH A SUITABLE BONDING AGENT.
8. STICK PACKING (REF-4, 5, & 6) ON THE SUPPORTER (REF-3) WITH A SUITABLE BONDING AGENT.

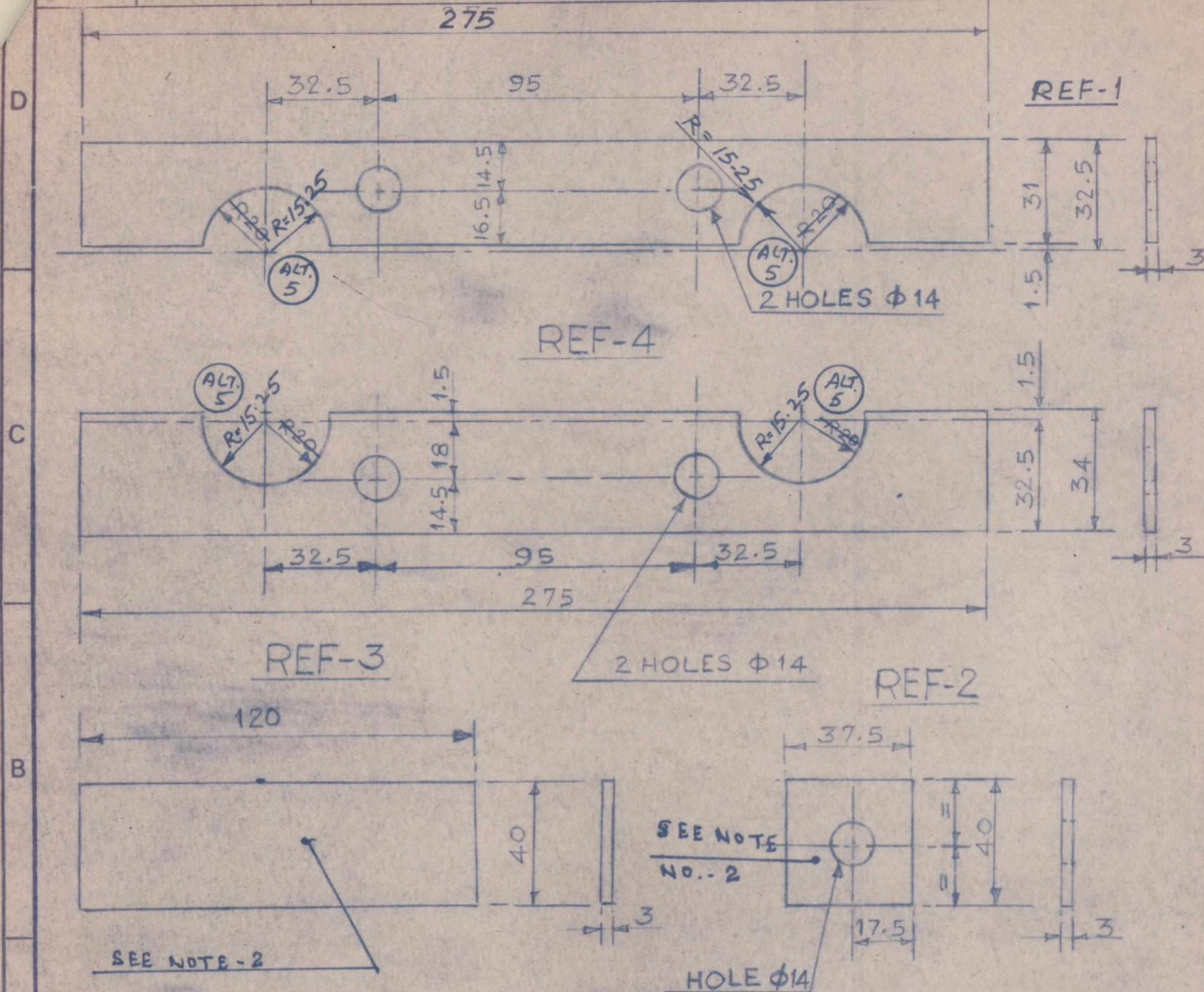
ITEM NO.	PARTS NAME	NO. OF PIECES PER MOTOR	NAME OF MATERIAL	RAW MATERIAL	SPECIFICATION	RAW FINISHED	REMARK
6	PACKING	2	NEOPREN RUBBER-3T	34-275	JIS K6380-A407	4TWD.095.035 REF-4	
5	PACKING	2	NEOPREN RUBBER-3T	40-120	JIS K6380-A407	4TWD.095.035 REF-3	
4	PACKING	4	NEOPREN RUBBER-3T	40-37.5	JIS K6380-A407	4TWD.095.035 REF-2	
3	SUPPORTER	2	RIGID POLYVINYL CHLORIDE PLATES		JIS K6745-1-3	043	
2	PACKING	2	NEOPREN RUBBER-3T	31-275	JIS K6380-A407	4TWD.095.035 REF-1	
1	SUPPORTER	2	RIGID POLYVINYL CHLORIDE PLATES	70-280	JIS K6745-1-3	143	

ALT. MATL.

OWN	E. Masaoaka	88-02-03	THIRD	TITLE	HS15250A
CHKD	H. Thara	88-02-05	ANG PROJ		
APPD	H. Thara	88-02-05	REGD SCALE	1:2	LEAD SUPPORTER
Hitachi, Ltd. Tokyo Japan			HITACHI WORKS DWG NO. 105813-538		



4	3	2	1
ALT. NO.	AUTHORITY	DESCRIPTION	INITIAL
5	DY.CEE/TMD	DIMENSIONS R=20 CHANGED TO R=15.25 REF. L.NO. EL/TM/2013 Dt. 21.9.05 & L.NO. ELDD/3221/AKM.Dt. 3.05	Alt 5
DATE	21.9.200		



### NOTE:-

1. MATERIAL FOR REF-1,2,3&4, NEOPREN RUBBER TO  
ASTM. D 2000 GR. BC 407-1995 (ALT 3)  
JIS: K6380-A407 OR ~~ASTM. D735 GR. NO. SC625B.~~

2. MANUFACTURER'S IDENTIFICATION TO BE STAMPED AT THE LOCATION SHOWN

DESCRIPTION	INITIAL	DATE	ALT	REF.	PART DRG. NO.	DESCRIPTION	QTY.	MATL.	SPEN.	WT. OF EACH			
5560/406	4	-	-	-	-	PACKING	2 NOS	SEE NOTE-1	-	-			
5560/405	3	-	-	-	-	PACKING	2 NOS	SEE NOTE-1	-	-			
5560/404	2	-	-	-	-	PACKING	4 NOS	SEE NOTE-1	-	-			
5560/403	1	-	-	-	-	PACKING	2 NOS	SEE NOTE-1	-	-			
C & D NO.	REF.	PART DRG. NO.	DESCRIPTION	QTY.	MATL.	SPEN.	WT. OF EACH	CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL, INDIA					
DATE	NAME	HS-15250A T.M											
DGN.													
DRN.	29.8.95												
CKD.	29.8.95												
TRD.													
NOTE 2 ADDED. Ref. L/No E/TM/ 2013 dt. 29.8.02			4			PACKING (FOR							

HEP-TPTNOMNX(58)/40/2026-HEP-TXM20500 (Computer No. 318341)

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JIS

JAPANESE INDUSTRIAL STANDARD

Industrial Rubber Packing Materials

JIS K 6380 -1976 ✓

Translated and Published

by

Japanese Standards Association

Printed in Japan

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Translation without guarantee  
In the event of any doubt arising, the original  
standard in Japanese is to be evidence.

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JAPANESE INDUSTRIAL STANDARD

Industrial Rubber Packing Materials

K 6380-1976  
(Reaffirmed: 1979)

1. Scope

This Japanese Industrial Standard specifies rubber materials used for industrial rubber packings and the similar industrial rubber products, hereinafter referred to as the "rubber materials". However, rubber materials for ebonite, sponge and O-rings are excluded.

Remark: In this standard, the units and numerical values shown in { } are in accordance with the International System of Units (SI), and are given together for reference.

2. Classification

Rubber materials shall be classified into shapes and classes as shown in Table 1 according to the purpose for use, further, according to the hardness and the tensile strength, subdivided into grades as shown in Table 4 to 9.

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Applicable Standards:

- JIS B 7503-Dial Gauges Reading in 0.01 mm
- JIS K 6301-Physical Testing Methods for Vulcanized Rubber
- JIS K 6340-Suction Hose for Excrement Cars
- JIS K 6342-Chemical Resistant Hose
- JIS R 3503-Glass Apparatus for Chemical Analysis
- JIS R 6252-Abrasive Papers

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Table 1

Purpose for the use	Shape	Class
Materials for use which does not need the oil resistance	A	—
Materials for use which is the most superior in oil resistance	B	I
Materials for use which is superior in oil resistance	B	II
Materials for use which is ordinary in oil resistance	B	III
Materials for use which is the most superior in heat resistance and cold resistance	C	I
Materials for use which is superior in heat resistance and oil resistance	C	II

3. Testing Items

Testing items specified in this standard shall be as follows:

3.1 General Tests Hardness test, tensile test, oil resistance test, aging test, heat resistance test, compression permanent set test, compressive force test, bend test at low temperature.

3.2 Special Tests When special tests are necessary, they shall be distinguished from general tests by adding the incidental letter to the end of marks of shape and class as shown in Table 2.

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Table 2

Incidental letter	Testing items
a	Aging test (100°C x 70 h)
b	Compression permanent set test
c	Compressive force test (at 20 %)
d <sub>1</sub>	Oil resistance test [ JIS K 6301, 12. Oil for test No. 1 oil, during oil resistance test ]
d <sub>3</sub>	Oil resistance test [ JIS K 6301, 12. Oil for test No. 3 oil, during oil resistance test ]
d <sub>4</sub>	Oil resistance test (fuel oil A) <sup>(1)</sup>
d <sub>5</sub>	Oil resistance test (fuel oil B) <sup>(1)</sup>
f <sub>1</sub>	Bend test at the low temperature of -40°C
f <sub>2</sub>	Bend test at the low temperature of -50°C
g	Test for property of water absorption
h <sub>1</sub>	Acid resistance test [ hydrochloric acid (30 %) ]
h <sub>2</sub>	Acid resistance test [ sulfuric acid (60 %) ]
i	Alkali resistance test [ sodium hydroxide solution (15 %) ]

Note <sup>(1)</sup> Compositions of oils for the tests shall be as shown in Table 3.

Table 3

Grade	Composition (volume)
Fuel oil A	Isooctane 100 %
Fuel oil B	Isooctane 70 % Industrial toluene 30 %

#### 4. Quality

The quality of rubber materials shall meet the requirements of general tests shown in Table 4 to 9, when tested according to Test Methods of 5.

When special tests are added according to the agreement between the parties concerned, they shall meet the requirements of Table 4 to 9. However, the qualities which are not specified in Table 4 to 9 among special tests shall be in accordance with the agreement between the parties concerned.

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Table 4

Test item Grade	General tests							Special tests	
	Hardness JIS spring type (A) Hs	Tensile strength (kgf/cm <sup>2</sup> ) {MPa} (Min.)	Elongation (%) (Min.)	Aging resistance properties (70°C · 70 h)			Compression permanent set (70°C · 22 h) (%) (Max.)	c	b
				Tensile strength change rate (%) (Max.)	Elongation change rate (%) (Max.)	Hardness change (Max.)		Compressive force test (at 20 %)  (kgf/cm <sup>2</sup> ) {MPa}	Compression permanent set (70°C · 22 h) (%) (Max.)
A 307	30 ± 5	70 { 6.8647 }	400	-25	-35	+10	50	—	25
A 310	30 ± 5	100 { 9.8066 }	500	-25	-25	+10	50	5.0±0.5 {0.49±0.05}	25
A 315	30 ± 5	150 {14.710 }	600	-25	-25	+10	50	5.0±0.5 {0.49±0.05}	25
A 317	30 ± 5	170 {16.671 }	600	-25	-25	+10	50	5.0±0.5 {0.49±0.05}	35
A 407	40 ± 5	70 { 6.8647 }	400	-25	-35	+10	50	—	25
A 410	40 ± 5	100 { 9.8066 }	500	-25	-25	+ 7	50	7.0±1.0 {0.69±0.10}	25
A 415	40 ± 5	150 {14.710 }	500	-25	-25	+ 7	50	7.0±1.0 {0.69±0.10}	25
A 417	40 ± 5	170 {16.671 }	500	-25	-25	+ 7	50	7.0±1.0 {0.69±0.10}	25
A 420	40 ± 5	200 {19.613 }	600	-25	-25	+ 7	50	7.0±1.0 {0.69±0.10}	35
A 505	50 ± 5	50 { 4.9033 }	350	-25	-35	+10	50	—	—
A 507	50 ± 5	70 { 6.8647 }	400	-25	-35	+10	50	—	25
A 510	50 ± 5	100 { 9.8066 }	400	-25	-25	+ 7	50	10.0±1.5 {0.98±0.15}	25
A 515	50 ± 5	150 {14.710 }	500	-25	-25	+ 7	50	10.0±1.5 {0.98±0.15}	25
A 520	50 ± 5	200 {19.613 }	600	-25	-25	+ 7	50	10.0±1.5 {0.98±0.15}	35
A 605	60 ± 5	50 { 4.9033 }	300	-25	-35	+10	50	—	—
A 607	60 ± 5	70 { 6.8647 }	300	-25	-35	+10	50	—	25
A 610	60 ± 5	100 { 9.8066 }	350	-25	-25	+ 7	50	14.0±2.0 {1.37±0.20}	25
A 615	60 ± 5	150 {14.710 }	400	-25	-25	+ 7	50	14.0±2.0 {1.37±0.20}	25
A 620	60 ± 5	200 {19.613 }	500	-25	-25	+ 7	50	14.0±2.0 {1.37±0.20}	35
A 705	70 ± 5	50 { 4.9033 }	150	-25	-35	+10	50	—	—
A 707	70 ± 5	70 { 6.8647 }	200	-25	-35	+10	50	—	25
A 710	70 ± 5	100 { 9.8066 }	250	-25	-25	+ 7	50	21.0±5.0 {2.06±0.49}	25
A 715	70 ± 5	150 {14.710 }	300	-25	-25	+ 7	50	21.0±5.0 {2.06±0.49}	25
A 720	70 ± 5	200 {19.613 }	400	-25	-25	+ 7	50	21.0±5.0 {20.6±0.49}	35
A 803	80 ± 5	30 { 2.9420 }	100	-25	-35	+10	50	—	—
A 807	80 ± 5	70 { 6.8647 }	150	-25	-35	+10	50	—	—
A 815	80 ± 5	150 {14.710 }	250	-25	-25	+ 7	50	35.0±7.0 {3.47±0.69}	—
A 903	90 ± 5	30 { 2.9420 }	75	-25	-35	+10	50	—	—
A 907	90 ± 5	70 { 6.8647 }	100	-25	-35	+10	50	—	—
A 910	90 ± 5	100 { 9.8066 }	120	-25	-25	+ 7	50	—	—

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Table 5

Test item  Grade	General tests										Special tests				
	H Hardness JIS spring type (A) Hs	Tensile strength (kgf/cm <sup>2</sup> ) [MPa] (Min.)	Elon- gation % (Min.)	Oil resistance (100°C. 70 h)		Aging resistance properties (100°C. 70 h)			Compres- sion permanent set (70°C. 22 h) (%) (Max.)	d <sub>1</sub>			d <sub>2</sub>		
				No. 3 test oil	No. 1 test oil	Tensile strength change rate (%) (Max.)	Elongation change rate (%) (Max.)	Hardness change (Max.)		Oil resistance (No. 1 test oil, 100°C. 70 h)		Oil resistance (No. 3 test oil, 100°C. 70 h)			
										Volume change rate (%)	Volume change rate (%)	Tensile strength change rate (%) (Max.)	Hardness change (%)	Elon- gation change rate (%) (Max.)	Tensile strength change rate (%) (Max.)
B I 403	40 ± 5	30 {2.9420}	400	0 to +10	-3 to +10	-15	-40	+15	65	-20	-50	-5 to +10	-20	-50	-5 to +10
B I 503	50 ± 5	30 {2.9420}	400	0 to +10	-3 to +10	-15	-40	+15	60	-20	-50	-5 to +10	-20	-50	-5 to +10
B I 605	60 ± 5	50 {4.9033}	300	0 to +10	-3 to +10	-15	-40	+10	50	-30	-50	-5 to +10	-20	-50	-5 to +10
B I 707	70 ± 5	70 {6.8647}	250	0 to +10	-3 to +10	-15	-40	+10	50	-30	-50	-5 to +10	-30	-50	-5 to +10
B I 807	80 ± 5	70 {6.8647}	150	0 to +10	-3 to +10	-15	-40	+10	50	-30	-50	-5 to +10	-30	-50	-5 to +10
B I 907	90 ± 5	70 {6.8647}	100	0 to +10	-3 to +10	-15	-40	+10	50	-30	-50	-5 to +10	-30	-50	-5 to +10



Table 6

Grade	Test item	General tests									Special tests										
		Hardness JIS spring type (A) Hs	Tensile strength (kgf/cm <sup>2</sup> ) [MPa] (Min.)	Elongation (%) (Min.)	Oil resistance (100°C · 70 h)		Aging resistance properties (100°C · 70 h)			Compression permanent set (100°C · 70 h) (L) (Max.)	b	d <sub>1</sub>				d <sub>2</sub>					
					No. 3 test oil	No. 1 test oil	Tensile strength change rate (%) (Max.)	Elongation change rate (%) Max.	Hardness change (Max.)			Oil resistance (No. 1 test oil, 100°C · 70 h)				Oil resistance (No. 3 test oil, 100°C · 70 h)					
												Volume change rate (%)	Volume change rate (%)	Tensile strength change rate (%) (Max.)	Elongation change rate (%) (Max.)	Volume change rate (%)	Hardness change	Tensile strength change rate (%) (Max.)	Elongation change rate (%) (Max.)	Volume change rate (%)	Hardness change
B II 407	40 ± 5	70 { 6.8647 }	450	-5 ± 40	-20 ± 5	-25	-50	+20	80	40	-25	-50	-15 ± 5	-5 ± 15	-40	-50	0 ± 30	-15 ± 5			
B II 410	40 ± 5	100 { 9.8066 }	450	0 ± 40	-15 ± 5	-25	-50	+20	80	40	-30	-50	-10 ± 5	-5 ± 10	-45	-50	0 ± 35	-15 ± 5			
B II 505	50 ± 5	50 { 4.9033 }	300	0 ± 40	-15 ± 5	-25	-50	+15	75	35	-25	-45	-10 ± 5	-5 ± 10	-45	-50	0 ± 25	-15 ± 5			
B II 507	50 ± 5	70 { 6.8647 }	350	0 ± 40	-15 ± 5	-25	-50	+15	75	35	-25	-45	-10 ± 5	-5 ± 10	-45	-50	0 ± 25	-15 ± 5			
B II 510	50 ± 5	100 { 9.8066 }	400	0 ± 60	-10 ± 5	-25	-50	+15	75	35	-25	-45	-10 ± 5	-5 ± 10	-45	-50	0 ± 30	-15 ± 5			
B II 514	50 ± 5	140 { 13.729 }	400	0 ± 60	-10 ± 5	-25	-50	+15	75	35	-30	-45	-10 ± 5	-5 ± 10	-50	-55	0 ± 30	-15 ± 5			
B II 605	60 ± 5	50 { 4.9033 }	200	0 ± 40	-15 ± 5	-20	-50	+15	75	35	-20	-40	-10 ± 5	-5 ± 10	-35	-40	0 ± 25	-10 ± 5			
B II 607	60 ± 5	70 { 6.8647 }	250	0 ± 40	-15 ± 5	-20	-50	+15	75	35	-20	-40	-10 ± 5	-5 ± 10	-35	-40	0 ± 25	-10 ± 5			
B II 610	60 ± 5	100 { 9.8066 }	390	0 ± 50	-10 ± 5	-20	-50	+15	75	35	-20	-40	-10 ± 5	-5 ± 10	-40	-45	0 ± 25	-10 ± 5			
B II 614	60 ± 5	140 { 13.729 }	350	0 ± 50	-10 ± 5	-20	-50	+15	75	35	-20	-40	-10 ± 5	-5 ± 10	-40	-45	0 ± 30	-10 ± 5			
B II 617	60 ± 5	170 { 16.671 }	350	0 ± 50	-10 ± 5	-20	-50	+15	75	35	-20	-40	-10 ± 5	-5 ± 10	-45	-50	0 ± 30	-10 ± 5			
B II 705	70 ± 5	50 { 4.9033 }	150	0 ± 30	-15 ± 5	-20	-50	+15	75	35	-20	-40	-10 ± 5	-5 ± 10	-35	-35	0 ± 25	-10 ± 5			
B II 707	70 ± 5	70 { 6.8647 }	200	0 ± 30	-15 ± 5	-20	-50	+15	75	35	-20	-40	-10 ± 5	-5 ± 10	-35	-35	0 ± 25	-10 ± 5			
B II 710	70 ± 5	100 { 9.8066 }	250	0 ± 40	-10 ± 5	-20	-50	+15	75	35	-20	-40	-10 ± 5	-5 ± 10	-35	-35	0 ± 25	-10 ± 5			
B II 714	70 ± 5	140 { 13.729 }	250	0 ± 40	-10 ± 5	-20	-50	+15	75	35	-20	-40	-10 ± 5	-5 ± 10	-40	-40	0 ± 30	-10 ± 5			
B II 717	70 ± 5	170 { 16.671 }	300	0 ± 40	-10 ± 5	-20	-50	+15	75	35	-20	-40	-10 ± 5	-5 ± 10	-40	-40	0 ± 30	-10 ± 5			
B II 803	80 ± 5	30 { 2.9420 }	100	0 ± 30	-15 ± 5	-20	-50	+15	75	35	-20	-40	-10 ± 5	-5 ± 10	-35	-35	0 ± 30	-10 ± 5			
B II 807	80 ± 5	70 { 6.8647 }	100	0 ± 30	-15 ± 5	-20	-50	+15	75	35	-20	-40	-10 ± 5	-5 ± 10	-35	-35	0 ± 20	-10 ± 5			
B II 810	80 ± 5	100 { 9.8066 }	120	0 ± 30	-10 ± 5	-20	-50	+15	75	35	-20	-40	-10 ± 5	-5 ± 10	-35	-35	0 ± 20	-10 ± 5			
B II 814	80 ± 5	140 { 13.729 }	120	0 ± 30	-10 ± 5	-20	-50	+15	75	35	-20	-40	-10 ± 5	-5 ± 10	-35	-35	0 ± 20	-10 ± 5			
B II 903	90 ± 5	30 { 2.9420 }	50	0 ± 25	-10 ± 5	-20	-50	+10	75	35	-20	-40	-10 ± 5	-5 ± 10	-35	-35	0 ± 20	-10 ± 5			
B II 907	90 ± 5	70 { 6.8647 }	100	0 ± 25	-10 ± 5	-20	-50	+10	75	35	-20	-40	-10 ± 5	-5 ± 10	-35	-35	0 ± 20	-10 ± 5			
B II 910	90 ± 5	100 { 9.8066 }	100	0 ± 25	-10 ± 5	-20	-50	+10	75	35	-20	-40	-10 ± 5	-5 ± 10	-35	-35	0 ± 20	-10 ± 5			

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Table 7

Grade	Test item	General tests								Special tests						
		Hardness JIS spring type (A) Hs	Tensile strength (kgf/cm <sup>2</sup> ) [MPa]  (Min.)	Elongation (%) (Min.)	Oil resistance (100°C · 70 h)		Aging resistance properties (100°C · 70 h)			Compression permanent set (70°C · 22 h) (%) (Max.)	b Compression permanent set (100°C · 70 h) (%) (Max.)	d <sub>1</sub> Oil resistance (No. 1 test oil, 100°C · 70 h)			d <sub>3</sub> Oil resistance (No. 3 test oil, 100°C · 70 h)	
					No. 3 test oil	No. 1 test oil	Tensile strength change rate (%) (Max.)	Elongation change rate (%) (Max.)	Hardness change			Tensile strength change rate (%) (Max.)	Elongation change rate (%) (Max.)	Hardness change	Tensile strength change rate (%) (Max.)	Elongation change rate (%) (Max.)
B III 303	30 ± 5	30 { 2.9420 }	300	+50 $\epsilon$ +120	-10 $\epsilon$ +15	-15	-40	+20	80	50	-20	-30	± 10	-80	-60	
B III 307	30 ± 5	70 { 6.8647 }	400	+50 $\epsilon$ +120	-10 $\epsilon$ +15	-15	-40	+20	75	50	-20	-30	± 10	-80	-60	
B III 310	30 ± 5	100 { 9.8066 }	500	+50 $\epsilon$ +120	-10 $\epsilon$ +15	-15	-40	+20	65	50	-30	-30	± 10	-80	-60	
B III 314	30 ± 5	140 { 13.729 }	500	+50 $\epsilon$ +140	-10 $\epsilon$ +15	-15	-40	+20	60	45	-30	-30	± 10	-80	-60	
B III 403	40 ± 5	30 { 2.9420 }	300	+50 $\epsilon$ +120	-10 $\epsilon$ +15	-15	-40	+20	65	45	-20	-30	± 10	-75	-55	
B III 407	40 ± 5	70 { 6.8647 }	400	+50 $\epsilon$ +120	-10 $\epsilon$ +15	-15	-40	+20	65	45	-20	-30	± 10	-75	-55	
B III 410	40 ± 5	100 { 9.8066 }	500	+50 $\epsilon$ +120	-10 $\epsilon$ +15	-15	-40	+15	65	45	-20	-30	± 10	-75	-55	
B III 414	40 ± 5	140 { 13.729 }	500	+50 $\epsilon$ +140	-10 $\epsilon$ +15	-15	-40	+15	60	40	-30	-30	± 10	-80	-55	
B III 417	40 ± 5	170 { 16.671 }	500	+50 $\epsilon$ +140	-10 $\epsilon$ +15	-15	-40	+15	60	40	-30	-30	± 10	-80	-55	
B III 507	50 ± 5	70 { 6.8647 }	300	+40 $\epsilon$ +100	-10 $\epsilon$ +15	-15	-40	+20	60	40	-30	-30	± 10	-70	-55	
B III 510	50 ± 5	100 { 9.8066 }	350	+40 $\epsilon$ +110	-10 $\epsilon$ +15	-15	-40	+15	60	40	-30	-30	± 10	-70	-55	
B III 515	50 ± 5	150 { 14.710 }	400	+40 $\epsilon$ +120	-10 $\epsilon$ +15	-15	-40	+15	50	40	-30	-30	± 10	-70	-55	
B III 517	50 ± 5	170 { 16.676 }	450	+40 $\epsilon$ +130	-10 $\epsilon$ +15	-15	-40	+15	50	40	-40	-30	± 10	-70	-55	
B III 520	50 ± 5	200 { 19.613 }	500	+40 $\epsilon$ +140	-10 $\epsilon$ +15	-15	-40	+15	50	40	-40	-30	± 10	-80	-55	
B III 605	60 ± 5	50 { 4.9033 }	300	+40 $\epsilon$ +100	-10 $\epsilon$ +15	-15	-40	+20	50	45	-30	-30	± 10	-65	-55	
B III 607	60 ± 5	70 { 6.8647 }	300	+40 $\epsilon$ +100	-10 $\epsilon$ +15	-15	-40	+15	50	45	-30	-30	± 10	-65	-55	
B III 610	60 ± 5	100 { 9.8066 }	350	+40 $\epsilon$ +110	-10 $\epsilon$ +10	-15	-40	+15	50	45	-30	-30	± 10	-65	-55	
B III 615	60 ± 5	150 { 14.710 }	350	+40 $\epsilon$ +110	-10 $\epsilon$ +10	-15	-40	+15	50	45	-30	-30	± 10	-65	-55	
B III 620	60 ± 5	200 { 19.613 }	400	+40 $\epsilon$ +140	-10 $\epsilon$ +10	-15	-40	+15	50	45	-40	-30	± 10	-80	-55	
B III 705	70 ± 5	50 { 4.9033 }	200	+30 $\epsilon$ +100	-5 $\epsilon$ +10	-15	-40	+15	50	50	-15	-30	-5 $\epsilon$ +10	-65	-50	
B III 707	70 ± 5	70 { 6.8647 }	200	+30 $\epsilon$ +100	-5 $\epsilon$ +10	-15	-40	+15	50	50	-15	-30	-5 $\epsilon$ +10	-65	-50	
B III 710	70 ± 5	100 { 9.8066 }	250	+30 $\epsilon$ +100	-5 $\epsilon$ +10	-15	-40	+15	50	50	-15	-30	-5 $\epsilon$ +10	-65	-50	
B III 714	70 ± 5	140 { 13.729 }	300	+30 $\epsilon$ +100	-5 $\epsilon$ +10	-15	-40	+15	50	50	-15	-30	-5 $\epsilon$ +10	-65	-50	
B III 717	70 ± 5	170 { 16.671 }	300	+30 $\epsilon$ +120	-5 $\epsilon$ +10	-15	-40	+15	50	50	-20	-30	-5 $\epsilon$ +10	-70	-50	
B III 803	80 ± 5	30 { 2.9420 }	100	+20 $\epsilon$ + 80	-5 $\epsilon$ +10	-15	-40	+15	45	50	-15	-30	-5 $\epsilon$ +10	-45	-30	
B III 807	80 ± 5	70 { 6.8647 }	100	+20 $\epsilon$ + 80	-5 $\epsilon$ +10	-15	-40	+15	45	50	-15	-30	-5 $\epsilon$ +10	-45	-30	
B III 810	80 ± 5	100 { 9.8066 }	100	+20 $\epsilon$ + 80	-5 $\epsilon$ +10	-15	-40	+15	45	50	-15	-30	-5 $\epsilon$ +10	-45	-30	
B III 814	80 ± 5	140 { 13.729 }	150	+20 $\epsilon$ + 80	-5 $\epsilon$ +10	-15	-40	+15	45	50	-15	-30	-5 $\epsilon$ +10	-45	-30	
B III 903	90 ± 5	30 { 2.9420 }	50	+10 $\epsilon$ + 70	-5 $\epsilon$ +10	-15	-40	+10	45	50	-15	-30	-5 $\epsilon$ + 5	-40	-20	
B III 907	90 ± 5	70 { 6.8647 }	100	+10 $\epsilon$ + 70	-5 $\epsilon$ +10	-15	-40	+10	45	50	-15	-30	-5 $\epsilon$ + 5	-40	-20	
B III 910	90 ± 5	100 { 9.8066 }	150	+10 $\epsilon$ + 70	-5 $\epsilon$ +10	-15	-40	+10	45	50	-15	-30	-5 $\epsilon$ + 5	-40	-20	
B III 914	90 ± 5	140 { 13.729 }	150	+10 $\epsilon$ + 70	-5 $\epsilon$ +10	-15	-40	+10	45	50	-15	-30	-5 $\epsilon$ + 5	-40	-20	

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Table 8

Test item   Grade		General tests					Special tests										
		Hardness JIS spring type (A) Hs	Tensile strength  (kgf/cm <sup>2</sup> ) [MPa]  (Min.)	Elongation  (%)  (Min.)	Heat resistance (230°C · 70 h)			b  Compression permanent set (150°C · 70 h) (%) (Max.)	d <sub>1</sub>  Oil resistance (No. 1 test oil, 150°C · 70 h)				d <sub>2</sub>  Oil resistance (No. 3 test oil, 150°C · 70 h)		f <sub>2</sub>  Low temper- ature test (-50°C · 5 h)	g  Water absorbing capacity (100°C · 70 h)	
					Hardness change	Tensile strength change rate (%) (Max.)	Elong- ation change rate (%) (Max.)		Tensile strength change rate (%) (Max.)	Elong- ation change rate (%) (Max.)	Hardness change	Volume change rate (%)	Hardness change	Volume change rate (%) (Max.)		Hardness change	Volume change rate (%) (Max.)
C I 503	50 ± 5	30 {2.9420}	200	+20	-30	-40	50	-20	-20	-15	0 to +20	-30	+60	Free from abnormalities	-10	+ 5	
C I 603	60 ± 5	30 {2.9420}	100	+20	-30	-50	40	-20	-20	-15	0 to +20	-35	+60	Free from abnormalities	-10	+ 5	
C I 703	70 ± 5	30 {2.9420}	75	+20	-25	-40	40	-20	-20	-15	0 to +20	-40	+60	Free from abnormalities	-10	+ 5	
C I 803	80 ± 5	30 {2.9420}	50	+20	-25	-40	40	-20	-20	-15	0 to +20	-45	+60	Free from abnormalities	-10	+ 5	

Table 9

Test item  Grade		General tests							Special tests								
		Hardness JIS spring type (A) Hs	Tensile strength  (kgf/cm <sup>2</sup> ) {MPa}	Elongation  (%)	Heat resistance (175°C · 70 h)				Compression permanent set (150°C · 70 h) (f) (Max.)	d <sub>1</sub>				d <sub>2</sub>			
					Hardness change	Tensile strength change rate (%)	Elongation change rate (%)	Bending test (180 degs.)		Oil resistance (No. 1 test oil, 150°C · 70 h)				Oil resistance (No. 3 test oil, 150°C · 70 h)			
										Tensile strength change rate (%) (Max.)	Elongation change rate (%) (Max.)	Hardness change	Volume change rate (%)	Tensile strength change rate (%) (Max.)	Elongation change rate (%) (Max.)	Hardness change	Volume change rate (%)
		(Min.)	(Min.)														
C II 405		40 ± 5	50 {4.9033}	220	0 % +15	−30	−50	No crack shall be occurred.	60	−20	−30	−5 % +10	−3 % +5	−30	−20	−10	0 % +20
C II 508		50 ± 5	80 {7.8453}	220	0 % +10	−30	−50		60	−20	−30	−5 % +10	−3 % +5	−30	−20	−10	0 % +20
C II 610		60 ± 5	100 {9.8066}	200	0 % +10	−30	−50		60	−20	−30	−5 % +10	−3 % +5	−30	−20	−10	0 % +20
C II 710		70 ± 5	100 {9.8066}	170	0 % +10	−40	−50		60	−20	−30	−5 % +10	−3 % +5	−30	−20	−10	0 % +20
C II 810		80 ± 5	100 {9.8066}	120	0 % +10	−40	−50		70	−20	−30	−5 % +10	−3 % +5	−30	−20	−10	0 % +20

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5. Test Methods

5.1 Hardness Test The test shall be in accordance with 5.2 of JIS K 6301.

5.2 Tensile Test The test shall be in accordance with 3.4 of JIS K 6301.

5.3 Oil Resistance Test The test shall be in accordance with 12.5 of JIS K 6301.

5.4 Aging Test The test shall be in accordance with 6.3 of JIS K 6301.

5.5 Heat Resistance Test The test shall be applied correspondingly to 6.6 of JIS K 6301.

5.6 Compression Permanent Set Test The test shall be in accordance with 10.4 of JIS K 6301.

5.7 Compressive Force (at 20 %) Test Compressive force test shall be carried out as follows:

5.7.1 Apparatus

- (1) Compression Tester The tester for the test may be available to any type of testers so far as they apply compressive force, and further can indicate precisely the force, and whose pressurizing speed is about 10 mm per minute, and whose construction is convenient for the measurement of deflections of test pieces.
- (2) Measuring Instrument for Deflection For the measurement of deflection, the dial gauge specified in JIS B 7503 shall be used.
- (3) Thickness Gauge for Test Piece For the measurement of the thickness of test pieces, thickness gauge specified in 3.2.4 of JIS K 6301 shall be used.

5.7.2 Test Piece The preparation of test pieces shall be in accordance with 10.2 of JIS K 6301.

5.7.3 Testing Conditions The conditions shall be in accordance with 2.1 and 2.2 of JIS K 6301.

5.7.4 Measurement of Thickness of Test Piece The measurement of the thickness of the test piece shall be carried out to the nearest of 1/100 mm by means of the thickness gauge prescribed in 5.7.1 (3).

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5.7.5 Attachment of Test Piece The test piece shall be placed precisely between the pressurizing plates of the tester prescribed in 5.7.1 (1). In this case, two grinding papers [about No. 400 of JIS R 6252 is suitable] shall be put face to face of upper and lower rubber faces of the test piece, for the purpose of preventing from slipping at contact surfaces of pressurizing plates.

However, when both upper and lower surfaces of the test piece are adhered with metal, grinding papers shall not be used.

5.7.6 Testing Method Apply the pressure by the tester prescribed in 3.7.1(1). When the deflection ratio attains to 20 %, remove the load at the same speed as that of pressurizing, and repeat this operation twice.

Thereafter, apply a small load which does not exceed 1 % of each load of previous two operations, attach the deflection measuring instrument specified in 5.7.1 (2) and make zero point. Then apply a load until the deflection ratio attains to 20 %, read the load and record it.

In this case by recording the loads at every suitable deflection ratio, the stress-strain curve can be obtained.

5.7.7 Deflection Ratio of Test Piece When the deflection ratio of the test piece is calculated, the value of the thickness of the test piece of 5.7.4 previously measured before compression test shall be used.

5.7.8 Rounding-Off Method of Test Results The test result shall be expressed unless otherwise specified as the average value of compressive forces of three test pieces, and the following information shall be recorded.

- (1) Percentage of deflections to original thicknesses of test pieces (%)
- (2) Loads per original sectional area of the test pieces (kgf/cm<sup>2</sup>) { MPa }
- (3) Description of samples and sampling method of test pieces and others
- (4) Description of the testing apparatus
- (5) Temperature of the testing room (°C)

#### 5.8 Bend Test at Low Temperature

5.8.1 Test Piece Take a test piece 6.3 mm in width, 114 mm in length,  $2.00 \pm 0.25$  mm in thickness from a vulcanized rubber plate manufactured at the same conditions of the product.

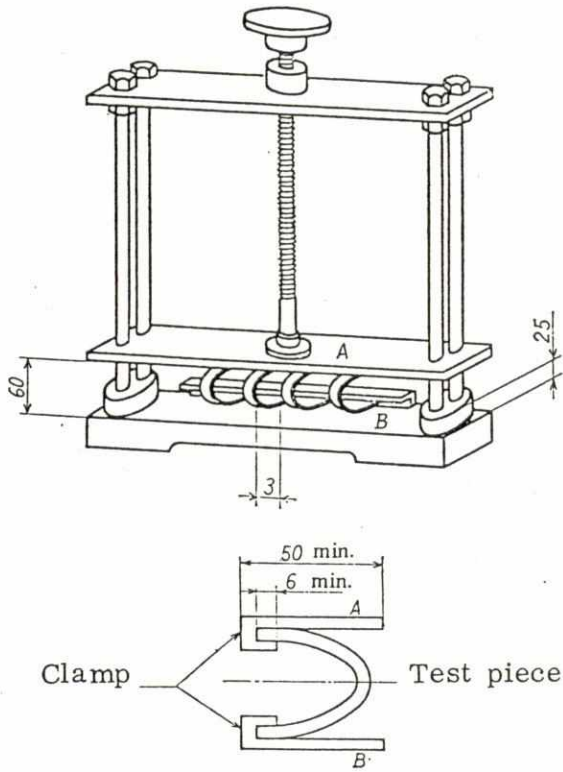
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5.8.2 Tester The tester shall consist of parallel plates A and B having the width 50 mm and over as shown in the following Figure, and shall be such one that B is fixed and A is movable and the distance between A and B is changeable at least from 60 mm to 25 mm.

Figure

Unit: mm



5.8.3 Testing Method Catch the both ends at 6 mm of the test pieces by clamps as shown in Figure and the intervals of each test piece shall be 3 mm and over, attach test pieces in curved shape between the parallel plates. The distance between the parallel plates shall be 60 mm. Leave for 5 h in low temperature bath refrigerated at  $-40 \pm 2^\circ\text{C}$  or  $-50 \pm 2^\circ\text{C}$  by air or mixed gas of carbon dioxide and air. After 5 h elapsing, bend by changing the distance between parallel plates from 60 mm to 25 mm in the low temperature bath as rapidly as possible, and examine the state of the sample pieces.

5.8.4 Rounding-Off of the Test Results Test results, unless otherwise specified, shall be recorded about the existence of abnormalities of three test pieces in the bend test, the test temperature, the time, the testing apparatus and shapes of test pieces.

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5.9 Water Absorbing Test

5.9.1 Test Piece Test pieces shall be taken from vulcanized rubber plates manufactured at the same conditions of the product. For measurements of hardnesses and volume change, a rectangular test piece 25 mm in width, 50 mm in length,  $2.00 \pm 0.15$  mm in thickness shall be used.

5.9.2 Test Apparatus For the test, distilled water and a test tube with a countercurrent cooler <sup>(2)</sup>, shall be used, and the size of the test tube shall be about 40 mm in outside diameter, and about 300 mm in length and made of glass.

Note <sup>(2)</sup> The one specified in JIS R 3503 shall be used.

5.9.3 Testing Conditions Each test piece shall be put in a separate container and immersed, and the immersion shall be carried out in a place free from direct sunshine.

The water shall be replaced every time of the test.

The test temperature and the time shall be as follows, unless otherwise specified:

Test temperature	$100 \pm 1^{\circ}\text{C}$
Test time	70 h

5.9.4 Testing Method

- (1) Test for Change of Hardness The measurement shall be carried out by means of spring-type hardness tester specified in 5.2 of JIS K 6301. After the immersion at the conditions specified in 5.9.3, immediately wipe lightly with a filter paper, and again measure the hardness..
- (2) Test for Volume Change Rate Test pieces shall be measured corresponding with 12.5 of JIS K 6301.

5.9.5 Rounding-Off of Test Results Test results shall be in accordance with the method of 12.6 of JIS K 6301, unless otherwise specified.

5.10 Bending Test after Heating Take a test piece of No. 3 Dumbbell shape according to 3.2 of JIS K 6301, maintain at 175°C for 70 h, leave for cooling in test room, rotate 180 degrees around a circular rod of 6 mm in diameter, and examine the existence of cracks.

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5.11 Acid Resistance and Alkali Resistance Tests The tests shall be carried out correspondingly with 7.6 of JIS K 6342.

6. Inspection

Rubber materials shall be tested according to 5. Testing Methods, and be judged the acceptance or the rejection. However, the sampling method of test specimens shall be determined by the rational method.

7. Marking

For rubber materials, each piece or each package shall be marked its class.

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K 6380-1976  
Edition 1

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Japanese Text

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# JIS

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## JAPANESE INDUSTRIAL STANDARD

### Rigid Polyvinyl Chloride Plates

Ⓜ JIS K 6745 <sup>-1976</sup> 1976

Translated and Published

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9 S

Translation without guarantee  
In the event of any doubt arising, the original  
standard in Japanese is to be evidence





JAPANESE INDUSTRIAL STANDARD

J I S

Rigid Polyvinyl Chloride Plates

K 6745-1976  
(Reaffirmed: 1984)1. Scope

This Japanese Industrial Standard specifies rigid polyvinyl chloride plates more than 0.8 mm in thickness, hereinafter referred to as the "plates".

Remark: The units and numerical values in { } in this standard are based on the International System of Units (SI), and are attached for reference.

2. Classification

Plates shall be classified as follows:

Class 1    No. 1,    No. 2,    No. 3

Class 2

3. Quality

3.1 Appearance    Plates shall have an appearance free from visible flaws, irregularity in color tone, surface unevenness and the like harmful to the use of the plates when visually inspected from a distance of about 60 cm. Provided, the requirements for color tone and transparency may be agreed between the parties concerned.

3.2 Properties    Plates shall be tested in accordance with 7., and the results shall comply with the requirements given in Table 1.

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Applicable Standards:

JIS B 7502-External Micrometers

JIS B 7512-Steel Tape Measures

JIS K 6911-Testing Methods for Thermosetting Plastics

JIS K 7111-Method of Charpy Impact Test for Rigid Plastics

JIS K 7113-Testing Method for Tensile Properties of Plastics

JIS K 7114-Testing Method for Evaluation of the Resistance to Plastics of Chemical Substances

JIS Z 8401-Rules for Rounding Off of Numerical Values

JIS Z 8701-Specification of Colour According to the CIE (1931) Standard Colorimetric System

Reference Standard:

JIS Z 8203-SI Units and Recommendations for the Use of Their Multiples and of Certain Other Units

Table 1

Test item		Classification	Class 1			Class 2	Test method
			No. 1	No. 2	No. 3		
Tensile strength (kgf/mm <sup>2</sup> ) {N/mm <sup>2</sup> }	Impact strength	Plates not more than 2.00 mm in nominal thickness	5.3 min. {52.0}	5.5 min. {53.9}	5.5 min. {53.9}	4.8 min. {47.1}	In accordance with 7.3
		Plates more than 2.00 mm in nominal thickness (kgf·cm/cm <sup>2</sup> ){J/cm <sup>2</sup> }	5.0 min. {0.49}	4.0 min. {0.39}	3.0 min. {0.29}	3.0 min. {0.29}	In accordance with 7.4.1
Torsional softening temperature (°C)		73 min.	65 min.	60 min.	52 min.	In accordance with 7.4.2	
Lamination property (1)		Not to split				In accordance with 7.5	
Thermal shrinkage (%)		Within ± 3.0	Within ± 3.0	Within ± 3.0	—	In accordance with 7.6	
Burning resistance		To be nonflammable				In accordance with 7.7	
Chemical resistance	Water (mg/cm <sup>2</sup> )		Within ± 0.15				In accordance with 7.8
	Sulphuric acid (mg/cm <sup>2</sup> )		Within ± 0.12				
	Hydrochloric acid (mg/cm <sup>2</sup> )		Within ± 0.20				
	Nitric acid (mg/cm <sup>2</sup> )		Within ± 0.20				
	Sodium chloride solution (mg/cm <sup>2</sup> )		Within ± 0.15				
	Sodium hydroxide solution (mg/cm <sup>2</sup> )		Within ± 0.10				
	Hydrogen sulfide (2)		—	No remarkable change in color tone			

Notes <sup>(1)</sup> This test item shall apply only to laminated plates.

<sup>(2)</sup> This test item shall apply only when required by the purchaser.



4. Dimensions and Tolerances

The dimensions and tolerances shall conform to Table 2. Provided, the tolerances on length and width shall be expressed in the unit of 1 mm, and that on thickness in the unit of 1/100 mm.

Table 2

Nominal	Dimensions		Tolerances on width and length(%)	Tolerance on thickness (%)
	Width (mm)	Length (mm)		
4 x 8	1212	2424		
3 x 6	909	1818		
2.2 x 4.8	660	1440		
3 x 3	909	909	+ 2	± 10
2.1 x 3.3	650	1000	0	
25 x 55	635	1395		
24 x 54	609	1372		
1 x 2	1000	2000		

Provided, dimensions other than those shown above may be used by the agreement between the manufacturer and the purchaser.

5. Material

The term, plate shall mean one produced from a vinyl chloride polymer or a copolymer mainly consisting of vinyl chloride as the main material.

6. Sampling Method

Test pieces as specified in 7. Test Method shall be taken from one plate at locations excluding the marginal areas. Provided, for plates in coil form, test pieces may be taken from the end portion.

7. Test Method

7.1 Standard Test Conditions

7.1.1 Temperature Condition of Test Room The temperature on the test room shall be, as a rule, room temperature of  $20 \pm 2^{\circ}\text{C}$ .

7.1.2 Presentation of Numerical Values of Test Results The test results shall be calculated to the next lower place to that of the specified values, and then rounded off in accordance with JIS Z 8401. Provided, when the number of values obtained from the test are two or more, the rounding off shall be carried out after the mean value is calculated.

## 7.2 Determination of Dimensions

### 7.2.1 Length and Width

- (1) Measuring Tool The measuring tool used shall have an accuracy and precision equivalent or superior to that of Class 1 of JIS B 7512.
- (2) Procedure The plate shall be maintained horizontally, and the length and the width shall respectively measured at two locations in a direction parallel to the periphery in the marginal area within 3 cm of the periphery of the plate. Provided, this shall not apply when the measurement is made according to the agreement between the parties concerned.

### 7.2.2 Thickness

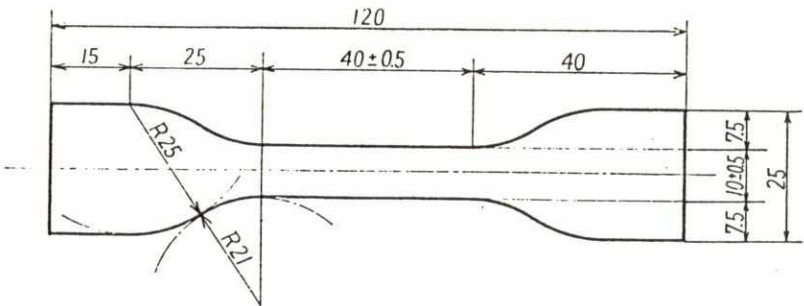
- (1) Measuring Tool The measuring tool used shall have an accuracy equivalent or superior to that of Class 1 specified in JIS B 7502.
- (2) Procedure The plate shall be maintained horizontally, and the thickness shall be measured at three locations, at both side ends within 10 mm of the periphery and at the centre of the plate.

## 7.3 Tension Test

7.3.1 Apparatus The testing machine shall be of the constant-rate-of-crosshead-movement type and of such that the breaking load of the specimen falls in a range of 15 to 85 % capacity; provided, a testing machine of the pendulum type or the constant-rate-of-loading type may be used.

7.3.2 Test Piece Four test pieces having the original thickness shall be prepared from the plate, two taken in the longitudinal direction and the other two in the transverse direction of the plate. Each test piece shall conform to the shape and dimensions shown in Fig. 1. Gauge marks shall be attached at the positions 20 mm apart from the centre of the test piece.

Fig. 1  
Unit: mm



Note (3) For plates having nominal thickness of 2.00 mm or more, test pieces may be finished to a thickness of about 2.0 mm.



7.3.3 Procedure

- (1) The width (W) at the centre and the thickness (t) at several points between the gauge marks shall be measured correctly to 0.01 mm with an external micrometer.
- (2) The test piece shall be attached to the testing machine, then according to the method of JIS K 7113, a load shall be applied at the test speed C (10 ± 2 mm/min), and the maximum load until the test piece breaks shall be determined. Provided, when the breakage has occurred outside the gauge marks, retest shall be performed by the number of times of the breakage.

7.3.4 Calculation The tensile strength T (kgf/mm<sup>2</sup>) { N/mm<sup>2</sup> } for each test piece shall be calculated from the following equation, and the tensile strength of the plate shall be represented by the respective mean values of the longitudinal and transverse test pieces.

$$T = \frac{P}{A} = \frac{P}{t \times W}$$

where

- P: maximum load until breakage of test piece (kgf){N}
- A: original minimum sectional area of test piece (mm<sup>2</sup>)
- t: minimum thickness of test piece (mm)
- W: width at the centre of test piece (mm)

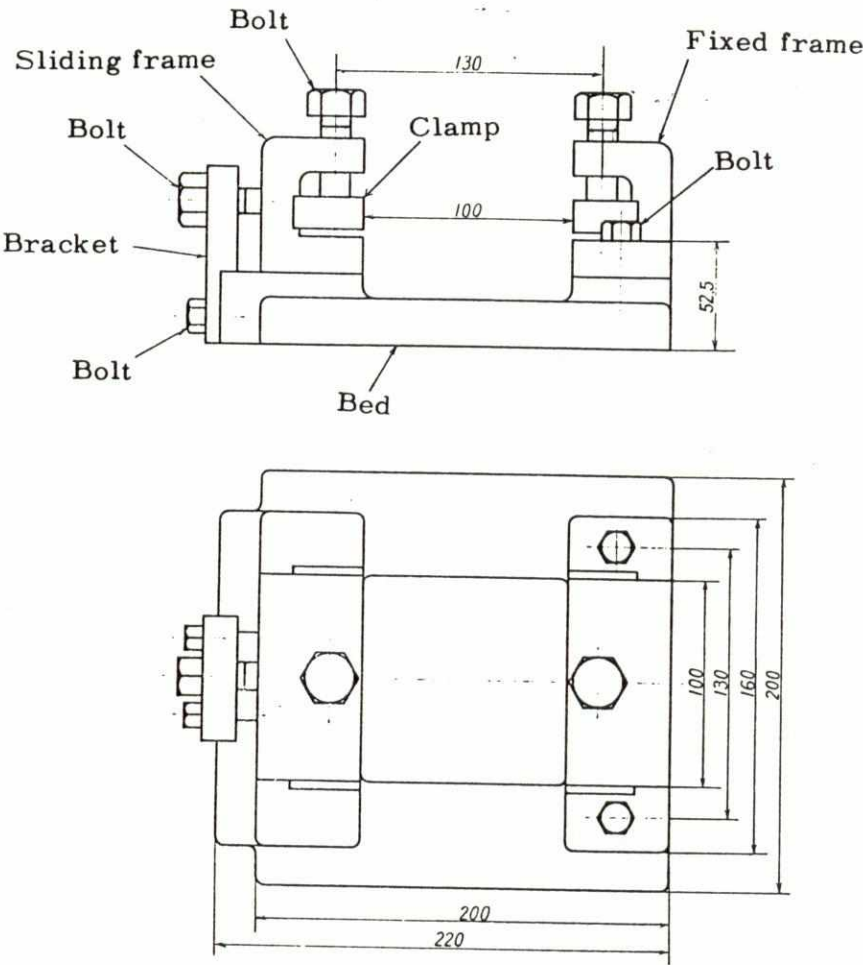
7.4 Impact Test

7.4.1 Falling-Ball Impact Test This method applies to plates having nominal thicknesses of 2.00 mm or less.

- (1) Test Apparatus The apparatus shown in Fig. 2 shall be used.

Fig. 2

Unit: mm



- (2) Test Piece Four test pieces 50 mm in width and 150 mm in length shall be prepared.
- (3) Procedure Both end parts of the 150 mm long test piece each 25 mm length shall be placed on the solid floor and held horizontally by the clamp shown in Fig. 2. A steel ball weighing 500 g for a test piece 1.00 mm or less in thickness, and a steel ball weighing 1000 g for a test piece more than 1.00 mm in thickness, sustained by a magnet, shall be let free-fall from the height specified in Table 3 to hit the centre of the test piece, then the test piece shall be inspected to see if cracking has occurred.



Table 3. Dropping Height

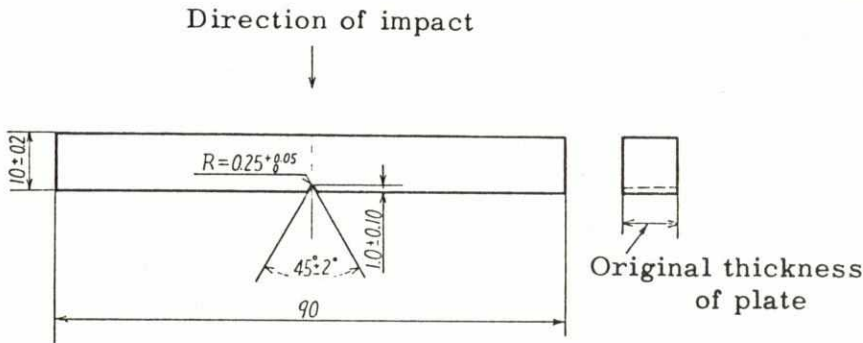
Nominal thickness (mm)	Dropping height (cm)			
	Class 1			Class 2
	No. 1	No. 2	No. 3	
0.81 to 1.00	80	60	45	40
1.01 to 1.50	70	55	40	35
1.51 to 2.00	100	75	50	35

**7.4.2 Charpy Impact Test** This method shall be applied to plates having a nominal thickness of more than 2.00 mm. Provided, plates 10 mm or more in thickness may be machined to 10 mm thickness for the test.

- (1) **Testing Apparatus** The apparatus specified in 4. of JIS K 7111 shall be used.
- (2) **Test Piece** For test pieces each 90 mm in length and 10 mm in width shall be taken from the plate, two along the longitudinal and the other two along the transverse direction of the plate, and then machined to the shape and dimensions specified in Fig. 3.

Fig. 3

Unit: mm

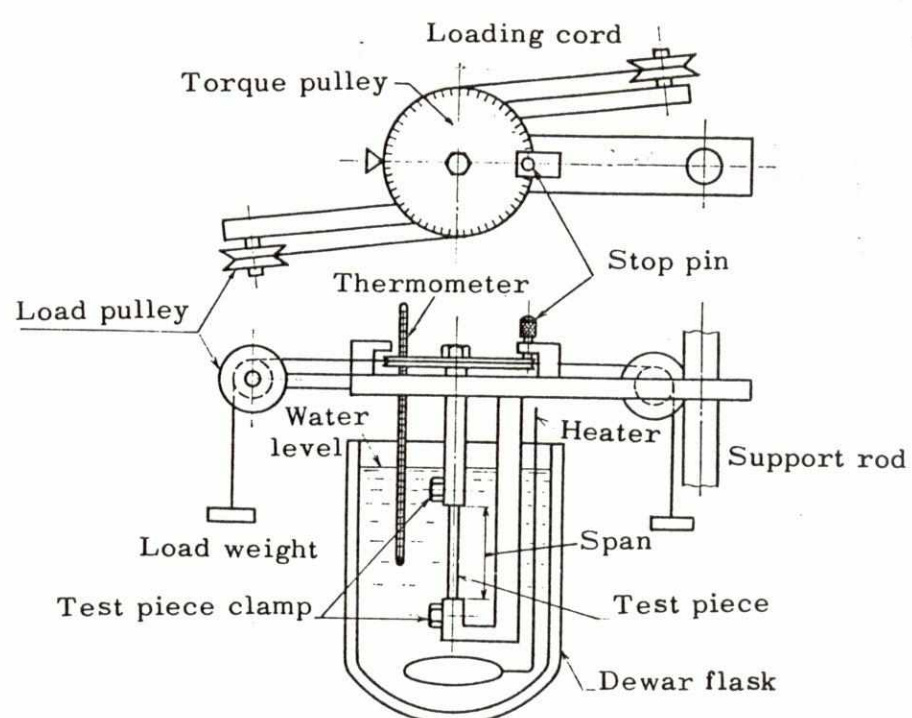


- (3) **Procedure** The test piece shall be attached to the testing apparatus with the distance between the supporting points set at 60 mm, then applied with a impact in accordance with the procedure specified in 8. of JIS K 7111, and the impact energy required for breaking the test piece shall be determined.
- (4) **Calculation** According to the method of 9. Calculation in JIS K 7111 the Charpy impact value  $a_k$  (kgf·cm/cm<sup>2</sup>) { J/cm<sup>2</sup> } shall be calculated from the energy  $E$  (kgf·cm) { J }.

**7.5 Softening Temperature Test**

- 7.5.1 Testing Apparatus** The apparatus specified in Fig. 4 shall be used.

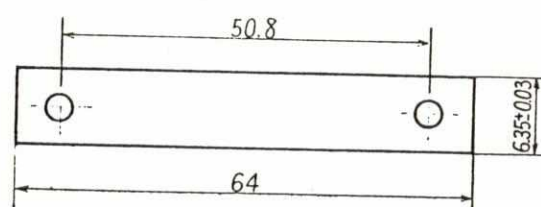
Fig. 4



**7.5.2 Test Piece** For plates with nominal thicknesses of 0.81 mm to 1.50 mm, test pieces as shown in Fig. 5 shall be prepared with the original thickness unchanged. For plates with other nominal thickness, the specimen plate shall be remilled under conditions specified by the manufacturer and pressed at an optimum temperature into a plate of about 1 mm thickness. Then after being left standing at room temperature for 24 hours or more, the above plate shall be shaped into test pieces to the dimensions as shown in Fig. 5.

Fig. 5

Unit: mm

**7.5.3 Procedure**

- (1) The test piece shall be clamped to the tester as shown in Fig. 4 with the span length set at about 40 mm.
- (2) The Dewar flask shall be filled with water, and the stop pin released when the water temperature has reached to 30 °C. After the torque has been applied for 5 seconds, the angle of torsion shall be read from the dial plate of the torque pulley.



- (3) Then the water temperature shall be raised at a rate of 2°C/min and shall be allowed to stand for 3 minutes at every 5°C rise. Then the angle of torsion shall be read as before.

7.5.4 Calculation The value of modulus of rigidity  $G$  (kgf/cm<sup>2</sup>) {N/cm<sup>2</sup>} for each determined temperature shall be calculated according to the following equation, and the temperature corresponding to  $G = 3.17 \times 10^3$  kgf/cm<sup>2</sup> {31.1 kN/cm<sup>2</sup>} shall be found from the temperature modulus of rigidity curve. This temperature shall represent the softening temperature.

$$G = \frac{270 LT}{B^3(1-B)\theta}$$

where  $G$ : modulus of rigidity (kgf/cm<sup>2</sup>) {N/cm<sup>2</sup>}  
 $L$ : span length of test piece (cm)  
 $T$ : torque (kgf·cm) {N·cm}  
 $B$ : thickness of test piece (cm)  
 $\theta$ : angle of torsion (degree)

7.6 Lamination Property Test

7.6.1 Apparatus

- (1) Oil Bath The oil bath shall be of fluidal paraffine.  
 (2) Bisque Plate The bisque plate used shall have dimensions of about 60 cm x 60 cm.

7.6.2 Test Piece A test piece 25 mm in width and 50 mm in length shall be prepared from the plate.

7.6.3 Procedure The test piece mounted on a bisque plate shall be immersed in fluidal paraffine at a temperature and for a duration shown in Table 4. Immediately after the test piece has been withdrawn from the bath, the end sections of the test piece shall be inspected to see if visually perceptible delamination has occurred.

Table 4

Classification of plate Immersion temperature and duration	Class 1				Class 2
	No. 1		No. 2	No. 3	
	Thickness less than 3 mm	Thickness not less than 3 mm			
Temperature of immersion liquid (°C)	180	180	180	180	150
Duration of immersion (min)	10	5	5	5	5

1.2 Reflecting Surface The reflectance standard shall have a uniform and high reflectivity within the whole range of visible light wave lengths. Suitable materials for such a white plate are magnesium oxide, barium sulfate and aluminum oxide.

The surfaces of the interior of the integration sphere shall be coated with a material having the same reflectivity as the reflectance standard.

1.3 Condenser Lense The light flux which is applied to the test piece shall consist of almost parallel light beams, and shall not include any light beams which deviate from the light axis by 3° or more. The centre of the light flux shall agree with the centre of the outlet. The cross-section of the light flux at the outlet shall be circular, and the angle made by the diameter thereof against the centre of the inlet shall be smaller than the angle made by the diameter of the outlet by  $1.3 \pm 0.1^\circ$ .

1.4 Trap The trap shall be capable of perfectly absorbing light when the test piece or reflectance standard is absent.

1.5 Photocell The intensity of the light in the sphere shall be determined with a photocell. The output of the photocell shall be proportional to the intensity of the incident light with a precision of 1 % or less within the range of light intensity used.

A Weston Type III photocell with Viscor Filter is suited for this purpose.

1.6 Light Source The light source used shall be the Standard Light Source C specified in JIS Z 8701, which is a combination of the Standard Light Source A and the Davis-Gibson filter.

2. Test Piece

The test piece shall have the original thickness of the plate and have a size of about 50 mm x 50 mm. Foreign matter or oily matter attached on the surfaces shall be removed.

3. Procedure

After the measuring apparatus is assembled with the reflectance standard attached and the slit adjusted, the galvanometer reading ( $T_1$ ) shall be set at 100. Then tests shall be carried out according to the following procedure, and the galvanometer reading shall be taken.

Table

Galvanometer reading	Attaching of test piece	Attaching of trap	Attaching of reflectance standard	Quantity obtained
$T_1$	Not attached	Not attached	Attached	Incident light quantity (100)
$T_2$	Attached	Not attached	Attached	Total luminous transmittance ratio
$T_3$	Not attached	Attached	Not attached	Quantity of diffuse luminous due to apparatus
$T_4$	Attached	Attached	Not attached	Quantity of diffuse luminous due to apparatus and test piece



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4. Calculation

Calculations shall be carried out according to the following equations.

$$\text{Total luminous transmittance ratio (\%)} = T_t = \frac{T_2}{T_1} \times 100$$

$$\text{Diffuse luminous transmittance ratio (\%)} = T_d = \frac{T_4 - T_3(T_2/T_1)}{T_1} \times 100$$

$$\text{Parallel luminous transmittance ratio (\%)} = T_p = T_t - T_d$$

$$\text{Haze (\%)} = H = \left( \frac{T_4}{T_2} - \frac{T_3}{T_{1.5}} \right) \times 100$$