

JIS

JAPANESE INDUSTRIAL STANDARD

Rotary shaft lip type seals

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Rotary shaft lip type seals

1 Scope This Japanese Industrial Standard specifies the rotary shaft lip type seals (hereafter, referred to as "rotary shaft lip seals") conforming to the ranges of shaft diameter from 6 mm to 500 mm and diameter of housing bore from 16 mm to 550 mm and the related matters thereof.

Remarks 1 The cited standards to this Standard are given in the following:

JIS B 0401	<i>System of limits and fits</i>
JIS B 0601	<i>Surface roughness - Definitions and designation</i>
JIS G 3141	<i>Cold-reduced carbon steel sheets and strip</i>
JIS G 3521	<i>Hard drawn steel wires</i>
JIS G 3522	<i>Piano wires</i>
JIS G 4051	<i>Carbon steels for machine structural use</i>
JIS K 2215	<i>Internal combustion engine oils</i>
JIS K 6257	<i>Accelerated aging test methods for vulcanized rubber</i>
JIS K 6258	<i>Testing methods of the effect of liquids for vulcanized rubber</i>
JIS K 6261	<i>Low temperature testing methods for vulcanized rubber</i>
JIS K 6262	<i>Permanent set testing methods for vulcanized rubber</i>
JIS K 6301	<i>Physical testing methods for vulcanized rubber</i>

2 The corresponding International Standards to this Standard are given in the following:

ISO 6194-1:1982	<i>Rotary shaft lip type seals—Part 1: Nominal dimensions and tolerances</i>
ISO 6194-2:1991	<i>Rotary shaft lip type seals—Part 2: Vocabulary</i>
ISO 6194-3:1988	<i>Rotary shaft lip type seals—Part 3: Storage, handling and installation</i>
ISO 6194-4:1988	<i>Rotary shaft lip type seals—Part 4: Performance test procedures</i>
ISO 6194-5:1990	<i>Rotary shaft lip type seals—Part 5: Identification of visual imperfections</i>

2 Definitions The definitions of the terms to be used in this Standard shall be in accordance with Annex 1.

3 Types The types of the rotary shaft lip seals shall be nine types classified according to the structure, and be in accordance with Attached Table 1.

4 Qualities

4.1 Performances The performances of the rotary shaft lip seals shall be in accordance with the following:

- (1) **Rotary shaft lip seal with spring** The rotary shaft lip seal with spring, when tested in accordance with the performance test procedures of Annex 2 using the Class 1 No. 2 for land specified in JIS K 2215 or the test oil as agreed between the parties concerned with delivery, shall conform to the Class 1 of Table 1. However, upon agreement between the parties concerned with delivery, the provisions of Class 2 may also be applied.

Further, the performances and the test procedures of the rotary shaft lip seal with spring used for the grease shall be as agreed between the parties concerned with delivery.

Table 1 Performances

Division	Performance
Class 1	There shall be no oil leakage.
Class 2 ⁽¹⁾	The maximum permitted oil leakage from 6 pieces of test rotary shaft lip seals shall be 12 g and the maximum leakage from any single seal be 3 g.

Note ⁽¹⁾ The performance of the Class 2 is in accordance with ISO 6194-4.

- (2) **Rotary shaft lip seal without spring** The performances and test procedures of the rotary shaft lip seal without spring shall be as agreed between the parties concerned with delivery.

4.2 Appearance The sealing edge part of rotary shaft lip seal shall be finished well and be free from the defect of harmful flaws, unevenness and the like and deterioration, and the metal portion shall be free from harmful flaws, deformation, rust and the like.

Further, the area of the sealing edge part of rotary shaft lip seal is indicated in Attached Fig. 1, the types and names of visual imperfections in Attached Fig. 2, and the examples of visual imperfections in Attached Figs 3.1 to 3.5.

Remarks: The Attached Figs 1 to 3.5 are based on ISO 6194-5.

5 Nominal dimensions and tolerances

5.1 Nominal dimensions The nominal dimensions of the rotary shaft lip seals shall be in accordance with Attached Table 2.1 or Attached Table 2.2.

For the inside diameter (d_1), the nominal dimension of the shaft diameter corresponding to the rotary shaft lip seal shall be used, and for the outside diameter (D), the nominal dimension of the housing bore diameter shall be used. The width (b) shall be the nominal width of the rotary shaft lip seal, and it shall be related to the housing bore depth.

5.2 Tolerances on outside diameter and width In order to maintain the interference fit between the rotary shaft lip seal and housing, the tolerances on the seal outside diameter shall be in accordance with Attached Table 3.1 or Attached Table 3.2. The tolerances on width shall be in accordance with Attached Table 4.

6 Materials The materials of the rotary shaft lip seals shall be in accordance with the following:

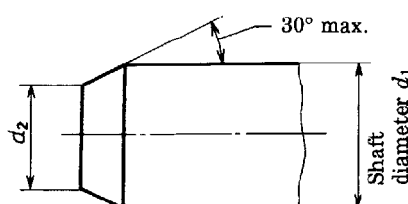
- (1) **Rubber material** The rubber material shall be that of equivalent to the nitrile rubber or that of equivalent to the acrylic rubber, and when tested in accordance with JIS K 6301 using the test pieces manufactured under the same conditions as the products, the results shall conform to the physical properties of Attached Table 5. However, the test may also be carried out in accordance with 4 of JIS K 6257, JIS K 6258, 4 of JIS K 6261 and JIS K 6262. The physical properties in this case shall be as agreed between the parties concerned with delivery.
- (2) **Case material** The case material shall be the material specified in JIS G 3141 or that equal to or superior to this.
- (3) **Spring material** The spring material shall be the material specified in JIS G 3521 or G 3522, or that equal to or superior to these.

7 Shaft The shaft shall be in accordance with the following:

- (1) **Chamfering of shaft end** The shaft end shall be provided with a lead-in chamfer as given in Table 2, and be free from burrs, sharp corners, rough machining marks.

Table 2 Lead-in chamfer of shaft end

Unit: mm



Nominal shaft diameter d_1	$d_1 - d_2$ ⁽²⁾	Nominal shaft diameter d_1	$d_1 - d_2$ ⁽²⁾
$d_1 \leq 10$	1.5 or over	$50 < d_1 \leq 70$	4.0 or over
$10 < d_1 \leq 20$	2.0 or over	$70 < d_1 \leq 95$	4.5 or over
$20 < d_1 \leq 30$	2.5 or over	$95 < d_1 \leq 130$	5.5 or over
$30 < d_1 \leq 40$	3.0 or over	$130 < d_1 \leq 240$	7.0 or over
$40 < d_1 \leq 50$	3.5 or over	$240 < d_1 \leq 500$	11.0 or over

Note ⁽²⁾ If a shaft lead-in chamfer radius is to be processed, it shall be not less than this value.

(2) **Tolerances on shaft diameter** The tolerances on the shaft diameter shall be h11 of JIS B 0401.

(3) **Surface conditions and finish of shafts** The surface conditions of the shafts shall be free from flaws and machining leads.

The finish should preferably be made by plunge grinding without feed.

(4) **Surface roughness of shaft** The surface roughness of shaft shall be (0.63 to 0.2) $\mu\text{m}R_a$ and (2.5 to 0.8) $\mu\text{m}R_z$ specified in JIS B 0601.

Informative reference: The material of shaft should preferably be the material specified in JIS G 4051 or low alloy steel.

The hardness of shaft should preferably be 30HRC or harder.

The shaft runout shall be expressed by the difference between the maximum value and minimum value of the readings of the dial gauge, when the shaft has been rotated, and it should preferably be 0.25 mm max.

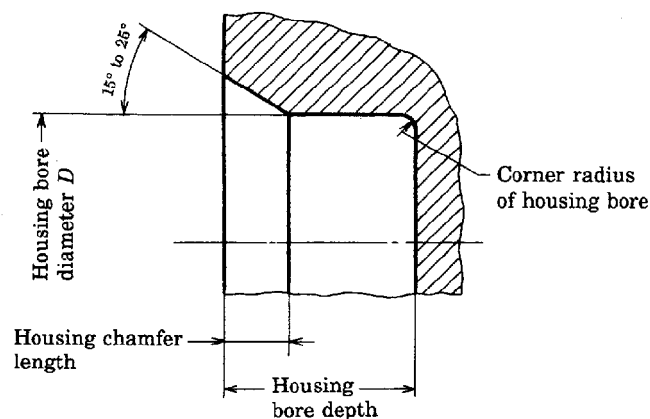
8 Housing The housing, when the material is of machined iron or steel, shall be in accordance with the following: However, when the housing is of nonferrous or nonmetallic material, and when it is of press formed, these shall be as agreed between the parties concerned with delivery.

(1) **Dimensions of housing** The dimensions of housing shall be in accordance with Table 3.

Further, the chamfered part shall be free from burrs.

Table 3 Dimensions of housing

Unit: mm



Nominal width of rotary shaft lip seal b	Housing bore depth	Housing chamfer length	Housing bore corner radius (Max.)
≤ 10	$b + 0.9$	0.70 to 1.00	0.50
> 10	$b + 1.2$	1.20 to 1.50	0.75

- (2) **Tolerances on housing bore diameter** The tolerances on housing bore diameter shall be H8 of JIS B 0401.
- (3) **Surface roughness of housing bore** The surface roughness of housing bore shall be (3.2 to 0.4) $\mu\text{m}R_a$ or (12.5 to 1.6) $\mu\text{m}R_y$ specified in JIS B 0601.

Further, the surface conditions of housing bore may be of as machined.

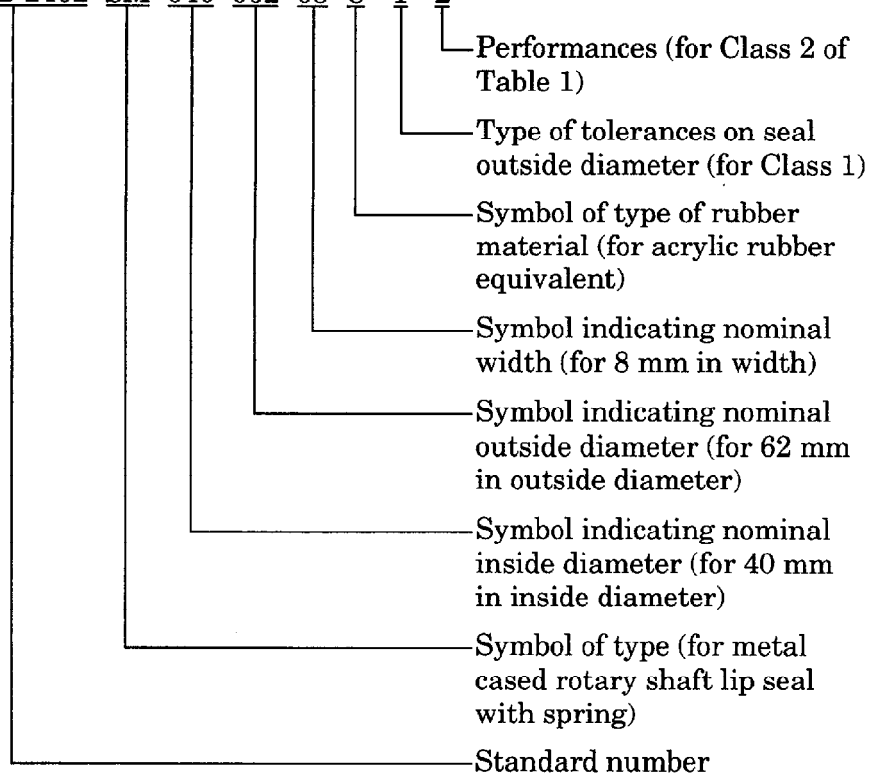
Remarks: The surface roughness may require the smaller values than the values of above (3) when the metal cased rotary shaft lip seals are used.

9 Inspection The inspection on the rotary shaft lip seals shall be carried out on the performances, appearance, dimensions and materials, and the results shall conform to the requirements of 4 to 6.

10 Designation The products shall be designated by the following matters in this order.

- (1) Standard number
- (2) Symbol of type
- (3) Symbol indicating nominal inside diameter (a number of three figures)
- (4) Symbol indicating nominal outside diameter (a number of three figures)
- (5) Symbol indicating nominal width (a number of two figures)
- (6) Symbol of type of rubber material given in Attached Table 5
- (7) Type of tolerances on seal outside diameter
- (8) Symbol indicating performances of rotary shaft lip seal with spring (For the Class 1 of Table 1, this is omitted.)

Example: JIS B 2402 SM 040 062 08 C - 1 - 2

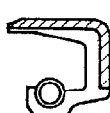
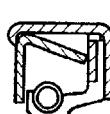
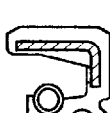
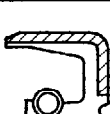
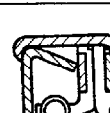


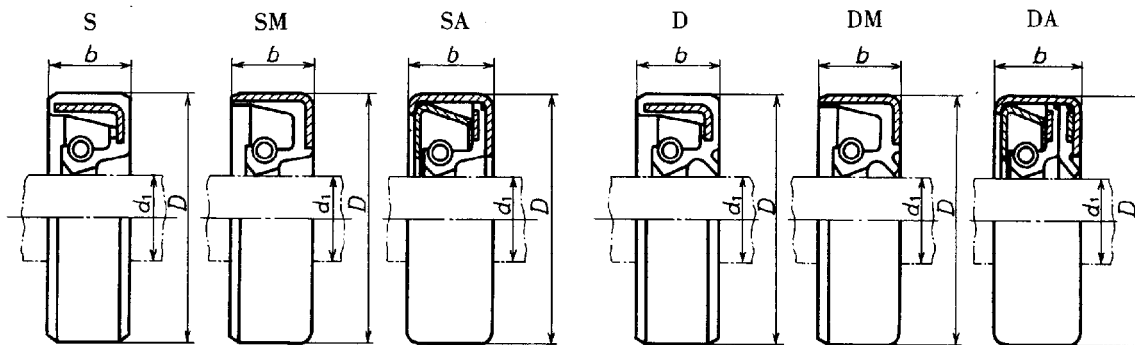
11 Marking The products shall be clearly marked with the following information on the package.

- (1) Designation (The Standard number shall be omitted.)
- (2) Manufacturer's name or abbreviation
- (3) Year and month of manufacture

12 Storage, handling and installation The storage, handling and installation, in general, as regards the rotary shaft lip seals should preferably be in accordance with the Annex 3.

Attached Table 1 Types

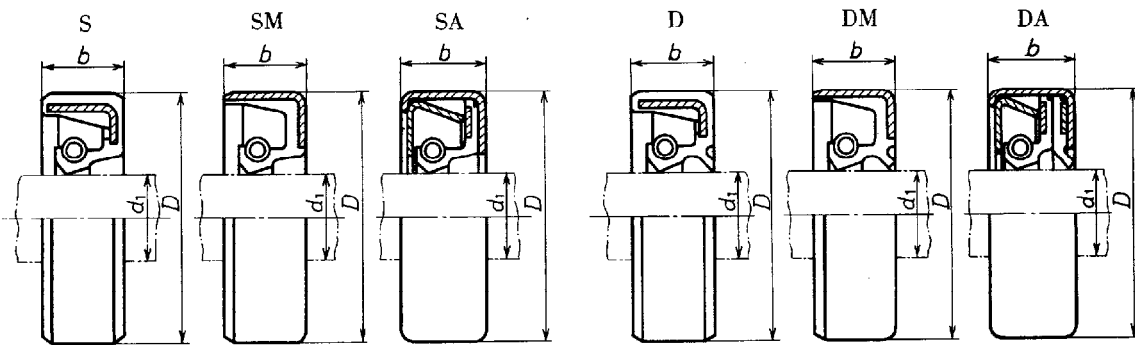
Type		Symbol	Informative reference	
			Illustrative diagram	Type in ISO 6194-1
Rotary shaft lip seals with spring	Rubber covered rotary shaft lip seal	S		Type 1
	Metal cased rotary shaft lip seal	SM		Type 2
	Assembled rotary shaft lip seal	SA		Type 3
	Rubber covered rotary shaft lip seal with minor lip	D		Type 4
	Metal cased rotary shaft lip seal with minor lip	DM		Type 5
	Assembled rotary shaft lip seal with minor lip	DA		Type 6
Rotary shaft lip seals without spring	Rubber covered rotary shaft lip seal	G		
	Metal cased rotary shaft lip seal	GM		
	Assembled rotary shaft lip seal	GA		

Attached Table 2.1 Nominal dimensions of rotary shaft lip seals with spring

Unit: mm

Inside diameter d_1	Outside diameter D	Width b	Inside diameter d_1	Outside diameter D	Width b	Inside diameter d_1	Outside diameter D	Width b
6	16	7	15	25	7	26	38	8
	22			26			42	
7	18	7		30		28	40	7
	20			35	45			
	22		16	28	7			
8	18	7		30	30		52	
	22		17			30	8	42
	24	32		45		8		
9	20	7	18	30		7	47	7
	22			35	52			
10	20	7	20	32	8	32	45	8
	22			35	7		47	
	25			40	52			
11	22	7	22	35	7	35	50	8
	25			38	8		52	
12	22	7		40	7		38	
	24			47		58		
	25		24	38	8	62		
	30			40				
13	25	7	25	38	8	40	55	8
	28			40	7		62	
14	25	7		47	42	55	8	
	28			52				62

Attached Table 2.1 (continued)



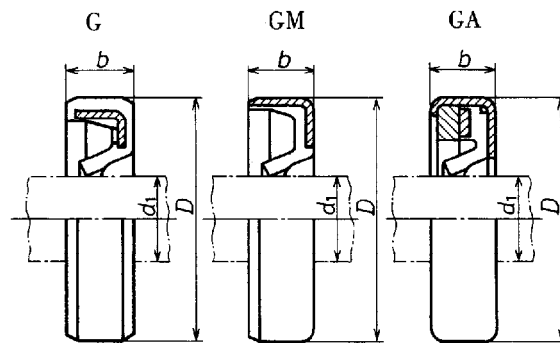
Unit: mm

Inside diameter d_1	Outside diameter D	Width b	Inside diameter d_1	Outside diameter D	Width b	Inside diameter d_1	Outside diameter D	Width b
42	65	12	75	95	10	180	210	15
45	62	8		100		190	220	15
	65		80	100	10	200	230	15
	68	12		105	13	210	240	15
48	70	12		110	10	220	250	15
50	68	8	85	110	12	230	260	15
	72			120		240	270	15
52	75	12	90	115	13	250	280	15
55	72	8		120	12	260	300	20
	78	12	95	120	12	270	310	20
	80	8	100	125	12	280	320	20
56	78	12	105	135	14	290	330	20
58	80	12	110	140	12	300	340	20
60	80	8	115	145	14	320	360	20
	82	12	120	150	12	340	380	20
	85	8	125	155	14	360	400	20
62	85	12	130	160	12	380	420	20
63	85	12	135	165	14	400	440	20
65	85	10	140	170	14, 15	420	470	25
	90		145	175	14	440	490	25
68	95	13	150	180	14, 15	460	510	25
70	90	10	160	190	14, 15	480	530	25
	95		170	200	15	500	550	25

Remarks: The rotary shaft lip seals of which dimensions are indicated by bold figures indicate those specified in ISO 6194-1.

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Attached Table 2.2 Nominal dimensions of rotary shaft lip seals without spring



Unit: mm

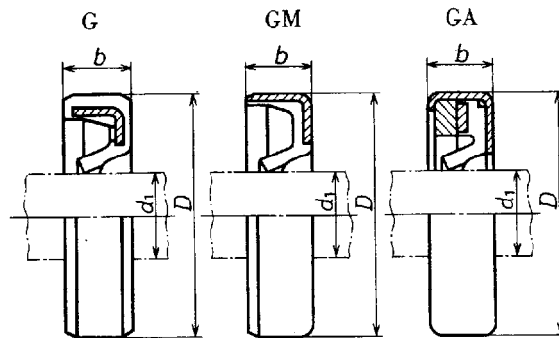
Inside diameter d_1	Outside diameter D	Width b	Inside diameter d_1	Outside diameter D	Width b	Inside diameter d_1	Outside diameter D	Width b
7	18	4	20	32	5	45	60	6
	20	7		35	8		68	12
8	18	4	22	35	5	48	62	6
	22	7		38	8		70	12
9	20	4	24	38	5	50	65	6
	22	7		40	8		72	12
10	20	4	25	38	5	52	65	6
	25	7		40	8		75	12
11	22	4	26	38	5	55	70	6
	25	7		42	8		78	12
12	22	4	28	40	5	56	70	6
	25	7		45	8		78	12
13	25	4	30	42	5	58	72	6
	28	7		45	8		80	12
14	25	4	32	45	5	60	75	6
	28	7		52	11		82	12
15	25	4	35	48	5	62	75	6
	30	7		55	11		85	12
16	28	4	38	50	5	63	75	6
	30	7		58	11		85	12
17	30	5	40	52	5	65	80	6
	32	8		62	11		90	13
18	30	5	42	55	6	68	82	6
	35	8		65	12		95	13



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Attached Table 2.2 (continued)



Unit: mm

Inside diameter d_1	Outside diameter D	Width b	Inside diameter d_1	Outside diameter D	Width b	Inside diameter d_1	Outside diameter D	Width b
70	85	6	100	115	6	130	145	7
	95	13		125	13		160	14
75	90	6	105	120	7	135	165	14
	100	13		135	14		170	14
80	95	6	110	125	7	145	175	14
	105	13		140	14		180	14
85	100	6	115	130	7	160	190	14
	110	13		145	14			
90	105	6	120	135	7			
	115	13		150	14			
95	110	6	125	140	7			
	120	13		155	14			

Remarks: GA should not preferably be used.

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Attached Table 3.1 Seal outside diameter tolerances and permissible values (metal cased)

Unit: mm

Nominal outside diameter D	Class 1	Class 2	Roundness ⁽³⁾
$D \leq 30$	+0.09 +0.04	+0.20 +0.08	0.18
$30 < D \leq 50$	+0.11 +0.05	+0.20 +0.08	0.18
$50 < D \leq 80$	+0.14 +0.06	+0.23 +0.09	0.25
$80 < D \leq 120$	+0.17 +0.08	+0.25 +0.10	0.30
$120 < D \leq 180$	+0.21 +0.10	+0.28 +0.12	0.40
$180 < D \leq 300$	+0.25 +0.12	+0.35 +0.15	0.25 % the outside diameter
$300 < D \leq 440$	+0.30 +0.14	+0.45 +0.20	0.25 % the outside diameter
$440 < D \leq 550$	+0.30 +0.14	—	0.25 % the outside diameter

Note ⁽³⁾ The roundness is equal to the difference between the maximum value and the minimum value of diameter measured at three or more equally spaced places.

Remarks: The Class 1 means when a grinding work has been processed, and the Class 2 is in accordance with ISO 6194-1.

Attached Table 3.2 Seal outside diameter tolerances and permissible values (rubber covered)

Unit: mm

Nominal outside diameter D	Class 1	Class 2	Roundness ⁽³⁾
$D \leq 30$	+0.30 +0.10	+0.30 +0.15	0.25
$30 < D \leq 50$	+0.35 +0.10	+0.30 +0.15	0.25
$50 < D \leq 80$	+0.35 +0.10	+0.35 +0.20	0.35
$80 < D \leq 120$	+0.35 +0.10	+0.35 +0.20	0.50
$120 < D \leq 180$	+0.40 +0.15	+0.45 +0.25	0.65
$180 < D \leq 300$	+0.45 +0.15	+0.45 +0.25	0.80
$300 < D \leq 440$	+0.55 +0.20	+0.55 +0.30	1.00
$440 < D \leq 550$	+0.55 +0.20	—	1.20

- Remarks 1 As to the rubber covered rotary shaft seals employing the rubber other than nitrile rubber, in some cases, different tolerances upon agreement between the parties concerned with delivery may be required.
- 2 The Class 1 is in the case where the thickness of rubber cover is of thick one, and the Class 2 is in accordance with ISO 6194-1.
- 3 Application of the tolerances Class 1 or Class 2 shall be as agreed between the parties concerned with delivery.

Attached Table 4 Tolerances on width

Unit: mm

Nominal width b	Tolerances
$b \leq 10$	± 0.3
$10 < b \leq 14$	± 0.4
$14 < b \leq 18$	± 0.5
$18 < b \leq 25$	± 0.6

Attached Table 5 Physical properties of rubber materials

Test items			Types of rubber materials		
			Nitrile rubber equivalent		Acrylic rubber equivalent
			A	B	C
Air oven aging test	Testing temperature and duration		100 °C, 70 h	120 °C, 70 h	150 °C, 70 h
	Change in hardness Hs (JIS A) max.		+15	+10	+10
	Changing rate of tensile strength (%) max.		-20	-20	-40
	Changing rate of elongation (%) max.		-50	-40	-50
Compression set test	Testing temperature and duration		100 °C, 70 h	120 °C, 70 h	150 °C, 70 h
	Compression set rate (%) max.		50	70	70
Immersion test	Lubricating oil No. 1 for testing	Testing temperature and duration	100 °C, 70 h	120 °C, 70 h	150 °C, 70 h
		Change in hardness Hs (JIS A)	-5 to +10	-5 to +5	-5 to +10
		Changing rate of tensile strength (%) max.	-20	-20	-30
		Changing rate of elongation (%) max.	-40	-30	-40
		Volume change (%)	-10 to +5	-5 to +5	-5 to +5
	Lubricating oil No. 3 for testing	Testing temperature and duration	100 °C, 70 h	120 °C, 70 h	150 °C, 70 h
		Change in hardness Hs (JIS A)	-15 to 0	-15 to 0	-20 to 0
		Changing rate of tensile strength (%) max.	-35	-30	-40
		Changing rate of elongation (%) max.	-35	-40	-40
		Volume change (%)	0 to +25	0 to +25	0 to +45
Low temperature impact brittleness test			All of the test pieces shall not be fractured at -13 °C (4).	All of the test pieces shall not be fractured at -13 °C (4).	All of the test pieces shall not be fractured at -1 °C (4).

Note (4) The number of test pieces shall be 10 pieces.