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**Automotive parts—Rubber boots
for hydraulic brake wheel cylinders
using a non-petroleum base
hydraulic brake fluid**

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Contents

	Page
Introduction.....	1
1 Scope.....	1
2 Normative references	1
3 Terms and definitions	2
4 Classification	2
5 Quality	3
5.1 Appearance	3
5.2 Performance	3
6 Properties of material	5
7 Performance test methods.....	6
7.1 Original state test (informative)	6
7.2 Ageing test.....	6
7.3 Fluid resistance test	7
7.4 Stroking durability test.....	9
7.5 Low-temperature stroking test.....	10
7.6 Tension set test	11
7.7 Ozone resistance test	12
8 Material test methods.....	12
8.1 Original state test	12
8.2 Ageing test.....	13
8.3 Compression set test	14
8.4 Fluid resistance test	15
8.5 Low-temperature flexibility test	17
8.6 Ozone resistance test	18
9 Storage	19
Annex JA (informative) Comparison table between JIS and corresponding International Standards	20

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 Japan Auto Parts Industries Association (JAPIA)/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 D 2608:1998** is replaced with this Standard.

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Automotive parts—Rubber boots for hydraulic brake wheel cylinders using a non-petroleum base hydraulic brake fluid

Introduction

This Japanese Industrial Standard has been prepared based on the second editions of **ISO 4927** and **ISO 6117** published in 2005 by modifying some of the technical contents to adapt them to the actual needs of the Japanese market.

The portions with continuous sidelines or dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications with explanations is given in Annex JA.

1 Scope

This Standard specifies moulded rubber boots used at end closures on automotive drum-type brake wheel cylinders using a non-petroleum-base brake fluid to prevent the entrance of dirt and moisture into the cylinder (hereafter referred to as “boots”).

NOTE : The International Standards corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 4927:2005 *Road vehicles—Elastomeric boots for cylinders for drum type hydraulic brake wheel cylinders using a non-petroleum base hydraulic brake fluid (Service temperature 120 °C max.)*

ISO 6117:2005 *Road vehicles—Elastomeric boots for drum-type, hydraulic brake wheel cylinders using a non-petroleum base hydraulic brake fluid (service temperature 100 °C max.)* (Overall evaluation: MOD)

The symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

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 D 0107 *Road vehicles—Braking equipments—Vocabulary*

JIS D 2605 *Automotive parts—Rubber cups for hydraulic braking cylinders using a non-petroleum base hydraulic brake fluid*

NOTE : Corresponding International Standard: ISO 4928:1980 *Road vehicles—Elastomeric cups and seals for cylinders for hydraulic braking systems using a non-petroleum base hydraulic brake fluid (Service temperature 120 °C max.)* (MOD)

JIS K 2233 *Non-petroleum base motor vehicle brake fluids*

NOTE : Corresponding International Standard: ISO 4925:2005 *Road vehicles—Specification of non-petroleum-base brake fluids for hydraulic systems* (MOD)

JIS K 6251 *Rubber, vulcanized or thermoplastics—Determination of tensile stress-strain properties*

JIS K 6253 *Rubber, vulcanized or thermoplastic—Determination of hardness*

NOTE : Corresponding International Standard: ISO 48:1994 *Rubber, vulcanized or thermoplastic—Determination of hardness (hardness between 10 IRHD and 100 IRHD)* and Amendment 1:1999 (MOD)

JIS K 6257 *Rubber, vulcanized or thermoplastic—Determination of heat ageing properties*

NOTE : Corresponding International Standard: ISO 188:1998 *Rubber, vulcanized or thermoplastic—Accelerated ageing and heat resistance tests* (MOD)

JIS K 6258 *Rubber, vulcanized or thermoplastic—Determination of the effect of liquids*

JIS K 6259 *Rubber, vulcanized or thermoplastics—Determination of ozone resistance*

NOTE : Corresponding International Standard: ISO 1431-1:1989 *Rubber, vulcanized or thermoplastic—Resistance to ozone cracking—Part 1: Static strain test*, ISO 1431-2:1994 *Rubber, vulcanized or thermoplastic—Resistance to ozone cracking—Part 2: Dynamic strain test* and ISO 1431-3:2000 *Rubber, vulcanized or thermoplastic—Resistance to ozone cracking—Part 3: Reference and alternative methods for determining the ozone concentration in laboratory test chambers* (Overall evaluation: MOD)

JIS K 6262 *Rubber, vulcanized or thermoplastic—Determination of compression set at ambient, elevated or low temperatures*

JIS Z 8401 *Guide to the rounding of numbers*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in JIS D 0107 apply.

4 Classification

The boots are classified by the working conditions as given in table 1.

Table 1 Classification

Classification	Symbol	Application
Class 1	—	Suitable for operation at an ordinary temperature
Class 2	H	Suitable for operation at a high temperature
Class 3	S	Suitable for operation at an extra high temperature

5 Quality

5.1 Appearance

The boots shall be free from blisters, pin-holes, cracks or embedded foreign material.

5.2 Performance

The performance of the boots, when tested in accordance with clause 7, shall satisfy the requirements given in table 2.

Table 2 Performance of boots

Item		Class			Test method
		Class 1	Class 2	Class 3	
Original state	Hardness (informative)	A 50 ± 5 or A 60 ± 5			Specified in 7.1
Ageing property	Temperature ^{a)} °C	100 ± 2	120 ± 2	150 ± 2	Specified in 7.2
	Duration ^{a)} h	70 ± 2			
	Hardness change (informative)	A - 5 to + 10			
	State	During testing, when the boot is flexed to service condition, it shall be free from cracks or extreme tackiness.			
Fluid resistance	Temperature ^{a)} °C	100 ± 2	120 ± 2	150 ± 2	Specified in 7.3
	Duration ^{a)} h	70 ± 2			
	Test fluid ^{a)}	Fluid conforming to JIS K 2233			
	Volume change ratio %	- 15 to + 15		- 20 to + 15	
	Hardness change (informative)	A - 10 to + 10			
	State	After testing, the boot shall be free from blisters and peelings.			
Stroking durability	Temperature ^{a)} °C	100 ± 2 (fluid temperature) or 100 ± 5 (atmospheric temperature)	120 ± 2 (fluid temperature) or 120 ± 5 (atmospheric temperature)	150 ± 2 (fluid temperature) or 150 ± 5 (atmospheric temperature)	Specified in 7.4
	Duration ^{a)} h	70 ± 2			
	State	After testing, the boot shall not crack, or separate from its assembled position on the cylinder or become loose on the piston. Further, there shall be interference in the assembled position.			
Low-temperature stroking	Temperature ^{a)} °C	- 43 to - 40			Specified in 7.5
	Duration ^{a)} h	22 ± 1			
	State	After testing, the boot shall not crack, or separate from its assembled position on the cylinder or become loose on the piston.			
Tension set property	Temperature ^{a)} °C	100 ± 2	120 ± 2	150 ± 2	Specified in 7.6
	Duration ^{a)} h	70 ± 2			
	Pre-stretch ^{a)} %	15 ⁰ ₋₃			
	Tension %	75 max.			
Ozone resistance	Ozone concentration ^{a)} pphm	50 ± 5			Specified in 7.7
	Temperature ^{a)} °C	40 ± 2			
	Duration ^{a)} h	70 ± 2			
	Strain (static) ^{a)} %	15 ⁰ ₋₃			
	State	The boot surface shall show no evidence of cracking under 2 × magnification.			
Note ^{a)} These items indicate the test conditions.					

6 Properties of material

The properties of material used for boots, when tested in accordance with clause 8, should satisfy the requirements given in table 3.

Table 3 Properties of material

Item			Classification			Test method
			Class 1	Class 2	Class 3	
Original state	Hardness		A 50 ± 5 or A 60 ± 5			Specified in 8.1
	Tensile strength	MPa	10 min.		8 min.	
	Elongation	%	300 min.			
Ageing property	Temperature ^{a)}	°C	100 ± 2	120 ± 2	150 ± 2	Specified in 8.2
	Duration ^{a)}	h	70 ± 2			
	Hardness change		A 0 to + 10			
	Tensile strength change ratio (decreasing)	%	40 max.			
	Elongation change ratio (decreasing)	%	40 max.			
Compression set	Temperature ^{a)}	°C	100 ± 2	120 ± 2	150 ± 2	Specified in 8.3
	Duration ^{a)}	h	22 ± 1			
	Compression set	%	30 max.	40 max.	55 max.	
Fluid resistance	Temperature ^{a)}	°C	100 ± 2	120 ± 2	150 ± 2	Specified in 8.4
	Duration ^{a)}	h	70 ± 2			
	Test fluid ^{a)}		Fluid conforming to JIS K 2233			
	Hardness change		A - 10 to + 10			
	Tensile strength change ratio (decreasing)	%	40 max.			
	Elongation change ratio (decreasing)	%	40 max.			
	Volume change ratio	%	- 15 to + 15		- 20 to + 15	
Low-temperature flexibility	Temperature ^{a)}	°C	- 43 to - 40			Specified in 8.5
	Duration ^{a)}	h	22 ± 1			
	State		The boot shall be free from cracks.			
Ozone resistance	Ozone concentration ^{a)}	pphm	50 ± 5			Specified in 8.6
	Temperature ^{a)}	°C	40 ± 2			
	Duration ^{a)}	h	70 ± 2			
	Strain (static) ^{a)}	%	20 ⁰ ₋₃			
	State		The boot surface shall show no evidence of cracking under 2 × magnification.			

Note ^{a)} These items indicate the test conditions.

7 Performance test methods

7.1 Original state test (informative)

7.1.1 Test specimens

Two boots shall be used as test specimens for hardness measurement.

7.1.2 Apparatus

The hardness tester shall be a type A durometer specified in clause 6 of **JIS K 6253**. Alternatively, a micro size international rubber hardness tester for method M specified in clause 5 of **JIS K 6253** may be used upon agreement between the parties concerned with delivery. Where a rubber anvil is used for the test, it shall have a hardness in the same range as a boot being tested.

7.1.3 Test method

The test method shall be as follows.

- a) For determination of type A durometer hardness, holding the tester vertically, contact the pressing surface to the boot surface such that the pressing needle is perpendicular to the boot surface to be measured, and immediately read the indication.
- b) For determination of international rubber hardness, the method specified in **5.6.2** of **JIS K 6253** shall be applied.

7.1.4 Expression of test results

For expression of test results, as specified in **6.6** or **5.7** of **JIS K 6253**, round the medium value¹⁾ of the measurements at five points per boot to a whole number according to the method specified in **JIS Z 8401**. Report the mean value of the results of two boots.

Note ¹⁾ The medium value is, when the obtained values are placed in numerical order, the middle value in the case of odd number of values, and the mean of two middle values in the case of even number of values.

7.2 Ageing test

7.2.1 Test specimens

Two boots shall be used as test specimens.

7.2.2 Apparatus

The apparatus shall be as follows.

- a) **Test oven**, specified in **5.3** of **JIS K 6257**.
- b) **Hardness tester**, specified in **7.1.2**.

7.2.3 Test conditions

The test conditions shall be as given in table 4.

Table 4 Ageing test conditions

Classification	Test temperature °C	Test duration h
Class 1	100 ± 2	70 ± 2
Class 2	120 ± 2	
Class 3	150 ± 2	

7.2.4 Test method

The test method shall be as follows.

- Procedure** For the hardness determination, determine the hardness before test (H_0) by the method specified in **7.1.3**, perform the test by the method specified in **4.3**, clause **9** and clause **10** of **JIS K 6257** under the conditions given in table 4, and then determine the hardness after test (H_1) by the same method.
- Observation of surface condition** After the testing of **a)**, examine for crack generation and surface conditions when the boot is flexed to the service condition.

7.2.5 Calculation (informative)

Calculate the hardness change from the following formula:

$$A_H = H_1 - H_0$$

where, A_H : hardness change
 H_0 : hardness before test
 H_1 : hardness after test

7.2.6 Expression of test results

For the hardness change, express values obtained from the calculation of **7.1.4** according to **7.2.5**, and report the mean of the two specimen values.

7.3 Fluid resistance test

7.3.1 Test specimens

Test specimens shall be two pieces weighing approximately 3 g to 5 g cut from each of two boots. For the boot not exceeding 5 g in mass, two whole products shall be used as specimens.

7.3.2 Apparatus

The apparatus shall be as follows.

- Test oven**, capable of maintaining the test temperature as given in table 5.
- Test container**, in accordance with **6.3.2 b)** of **JIS D 2605**.
- Hardness tester**, in accordance with **7.1.2**.

7.3.3 Test conditions

The fluid resistance test conditions shall be as given in table 5.

Table 5 Fluid resistance test conditions

Classification	Test temperature °C	Test duration h	Test fluid
Class 1	100 ± 2	70 ± 2	Fluid conforming to JIS K 2233 .
Class 2	120 ± 2		
Class 3	150 ± 2		

7.3.4 Test method

The test method shall be as follows.

Determinations and observations prescribed in **c)**, **d)** and **e)** shall be made within 60 min of rinsing with alcohol after completion of the immersion test. The tests **c)**, **d)** and **e)** may be made on the same test specimen.

- a) **Cleaning of test specimens** Rinse the test specimens in isopropyl alcohol or ethyl alcohol (hereafter both referred to as “alcohol”) to remove adhered dirt, test fluid and the like, and wipe off the alcohol with a dry cloth. Do not allow the specimens to remain in the alcohol for more than 30 s.
- b) **Immersion test** Putting the test specimens into the weighing jar specified in **6.3.2 b)** of **JIS D 2605**, pour 75 ml of test fluid, cap and place the jar in the pressure tight vessel. Sealing up the lid of the pressure tight vessel, place the vessel in the circulating air oven and hold it under the conditions given in table 5.

After completion of the immersion, immerse the specimens into a fresh test fluid (at room temperature) of the same kind for about 30 min to cool to room temperature.

- c) **Determination of volume change ratio** After rinsing the test specimens by the method of **a)**, determine each specimen mass in air (m_1) to the nearest 1 mg. Then determine the apparent mass in distilled water at room temperature (m_2), and rinse again by **a)**. Successively, perform the immersion test by **b)**, then clean by **a)**, immediately determine the specimen mass in air (m_3), and further determine the apparent mass in distilled water at room temperature (m_4).
- d) **Determination of hardness** For the hardness determination of each test specimen, determine the hardness before test by the method specified in **7.1.3**. Then, perform the immersion test in **b)**, rinse according to the method in **a)**, and determine the hardness by the method specified in **7.1.3**.
- e) **Observation of surface condition** After the immersion test of **b)**, observe the surface condition of each test specimen to examine for blisters and peelings.

7.3.5 Calculation

The calculation shall be as follows.

- a) **Volume change ratio** Calculate the volume change ratio from the following formula:

$$\Delta V_{100} = \frac{(m_3 - m_4) - (m_1 - m_2)}{(m_1 - m_2)} \times 100$$