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(JSAE/JSA)

**Road vehicles—Elastomeric seals
for hydraulic disc brake cylinders
using a non-petroleum base
hydraulic brake fluid**

ICS 23.100.60; 43.040.40

Reference number : JIS D 2609 : 2002 (E)

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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 Society of Automotive Engineers of Japan, Inc. (JSAE)/the 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 2609 : 1993** is replaced with this Standard.

For the revision at this time, in order to conform this Japanese Industrial Standard to International Standards **ISO 6119 : 1980** *Road vehicles—Elastomeric seals for hydraulic disc brake cylinders using a non-petroleum base hydraulic brake fluid (service temperature 120 degrees C max.)* and **ISO 4930 : 1978** *Road vehicles—Elastomeric seals for hydraulic disc brake cylinders using a non-petroleum base hydraulic brake fluid (service temperature 150 °C max.)* have been used as the basis.

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the original JIS is to be the final authority.

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Road vehicles—Elastomeric seals for hydraulic disc brake cylinders using a non-petroleum base hydraulic brake fluid

Introduction This Japanese Industrial Standard has been prepared based on **ISO 6119** *Road vehicles—Elastomeric seals for hydraulic disc brake cylinders using a non-petroleum base hydraulic brake fluid (service temperature 120 degrees C max.)* published in 1980 and **ISO 4930** *Road vehicles—Elastomeric seals for hydraulic disc brake cylinders using a non-petroleum base hydraulic brake fluid (service temperature 150 °C max.)* published in 1978, with modifying some parts.

Portions sidelined or underlined with dots are the matters which are altered or added to the original International Standards.

1 Scope This Standard specifies the elastomeric seals (hereafter referred to as “seals”) of hydraulic disc brake cylinder using a non-petroleum base hydraulic brake fluid for road vehicles.

Remarks : The International Standards corresponding to this Standard are as follows.

In addition, 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**.

ISO 6119 : 1980 *Road vehicles—Elastomeric seals for hydraulic disc brake cylinders using a non-petroleum base hydraulic brake fluid (service temperature 120 degrees C max.)* (MOD)

ISO 4930 : 1978 *Road vehicles—Elastomeric seals for hydraulic disc brake cylinders using a non-petroleum base hydraulic brake fluid (service temperature 150 °C max.)* (MOD)

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

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

JIS G 3303 *Template and blackplate*

JIS G 5501 *Grey iron castings*

JIS H 2201 *Zinc alloy ingots for die casting*

JIS H 3100 *Copper and copper alloy sheets, plates and strips*

JIS H 4000 *Aluminium and aluminium alloy sheets and plates, strips and coiled sheets*

JIS K 2228 *Rubber lubricant of non-petroleum base for motor vehicle brake systems*

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

Remarks : **ISO 4926** *Road vehicles—Hydraulic brake system—Non petroleum base brake fluid* is equivalent to the said standard.

JIS K 2503 *Testing method of lubricating oil for aircraft*

JIS K 2839 *Glasswares for testing apparatus of petroleum products*

JIS K 6250 *Rubber—General rules of physical testing methods*

JIS K 6251 *Tensile testing methods for vulcanized rubber*

JIS K 6253 *Hardness testing methods for rubber, vulcanized or thermoplastic*

Remarks : **ISO 48** : 1994 *Rubber, vulcanized or thermoplastic—Determination of hardness (hardness between 10 IRHD and 100 IRHD)* is equivalent to the said standard.

JIS K 6257 *Accelerated aging test methods for vulcanized rubber*

Remarks : **ISO 188** : 1982 *Rubber, vulcanized—Accelerated ageing and heat-resistance test* is equivalent to the said standard.

JIS K 6258 *Testing methods of the effect of liquids for vulcanized rubber*

Remarks : **ISO 1817** : 1996 *Rubber, vulcanized—Determination of the effect of liquids* is equivalent to the said standard.

JIS K 6262 *Permanent set testing methods for rubber, vulcanized or thermoplastic*

Remarks : **ISO 815** : 1991 *Rubber, vulcanized or thermoplastic—Determination of compression set at ambient, elevated or low temperatures* is equivalent to the said standard.

JIS R 6253 *Waterproof abrasive papers*

JIS Z 8401 *Guide to the rounding of numbers*

ISO 4926 *Road vehicles—Hydraulic brake systems—Non-petroleum base reference fluids*

3 Classification The classification of seals shall be as shown in Table 1.

Table 1 Classification of seals

Type	Symbol	Performance
Type 1	—	The seals capable of being used under operating conditions at ambient temperature.
Type 2	H	The seals capable of being used under operating conditions at elevated temperature.

4 Quality

4.1 Appearance The surface of seals shall be finished well and free from harmful bubbles, flaws, flash, foreign matters, etc.

4.2 Performance The performance of seals shall comply with the requirements of Table 2, when tested in accordance with clause 6.

Table 2 Performance of seals

Item				Performance	Test method
Ordinary state	Hardness IRHD			70 ± 5 or 75 ± 5	It shall be in accordance with 6.1.
Ageing resistance	Hardness change IRHD			0 to +15	It shall be in accordance with 6.2.
	State			Seals shall be free from extreme tackiness and other abnormal appearance.	
Liquid resistance	Volume change rate %			0 to +15	It shall be in accordance with 6.3.
	Hardness change IRHD			-15 to 0	
	State			Seals shall be free from extreme tackiness and other abnormal appearance.	
Precipitation	Precipitate amount vol%			0.3 max.	It shall be in accordance with 6.4.
Metal corrosion resistance	Metal test piece	Changing amount of mass mg/cm ²	Tin plate	± 0.2	It shall be in accordance with 6.5.
			Steel	± 0.2	
			Aluminium	± 0.1	
			Cast iron	± 0.2	
			Brass	± 0.4	
			Copper	± 0.4	
		Zinc	± 0.4		
	Appearance		Seals shall be free from pitting or surface roughening to a extent capable of being observed with the naked eye. However, stains or discoloration may exist.		
Precipitate amount vol%			0.2 max.		
State of seals	Appearance			The shape and surface state of seals shall not be observed to be changed noticeably.	
	Change of hardness IRHD			-15 to 0	
Cold resistance	Bending at low temperature			Without generation of cracks, the seals shall be elastomeric and shall return almost to the original state within 1 min.	It shall be in accordance with 6.6.
Low temperature leakage	State			There shall not be liquid leakage.	It shall be in accordance with 6.7.

Table 2 (concluded)

Item		Performance	Test method
Resistance to ambient temperature stroking	State	(1) Pressure reduction due to the liquid leakage from seals shall not be occurred during the period of testing. (2) After leakage test, there shall not be the liquid leakage from the seals. (3) There shall not be harmful deformation, wear and other defects on the seals. (4) The contact part of seals and its neighborhood in piston and cylinder shall be free from the corrosion to be identified by the naked eye. However, a little stain or discoloration may exist.	It shall be in accordance with 6.8.
	Hardness change IRHD	-15 to 0	
Resistance to elevated temperature stroking	State	The same as in the resistance to ambient temperature stroking.	It shall be in accordance with 6.9.
	Hardness change IRHD	-15 to 0	
Storage corrosion resistance	State	There shall not be the defects harmful to use such as corrosion, pitting, adhesion, corrosion products and other factors resulting from interaction between the materials involved.	It shall be in accordance with 6.10.

5 Materials The materials used for seals should conform to the requirements in Table 3 when tested in accordance with the specification in clause 7.

Table 3 Property of materials

Item		Property		Test method
Ordinary state	Hardness	IRHD	70 ± 5 or 75 ± 5	
	Tensile strength	MPa	10 min.	
	Elongation	%	Type 1: 200 min.	Type 2: 140 min.
Ageing resistance	Hardness change	IRHD	0 to +15	
	Tensile strength change rate (reduction rate)	%	40 max.	
	Elongation change rate (reduction rate)	%	40 max.	
Compression permanent set	Compression permanent set	%	30 max.	
Liquid resistance	Volume change rate	%	0 to +15	
	Tensile strength change rate (reduction rate)	%	40 max.	
	Elongation change rate (reduction rate)	%	40 max.	
	Hardness change	IRHD	-15 to 0	

6 Performance test method

6.1 Ordinary state test

6.1.1 Test specimens The test specimens to be used for hardness test shall be not less than two seals.

6.1.2 Test apparatus The test apparatus shall be the micro size of international rubber hardness tester used for method M specified in clause 4 of **JIS K 6253**.

6.1.3 Test method The measurement of hardness shall be carried out according to the method specified in 4.5.2 of **JIS K 6253**.

6.1.4 Summarizing method of test results For the summarizing method of test results, round-off the median value of three or five measured values according to **JIS Z 8401** as specified in 4.6 of **JIS K 6253**, and express by an integer. Report the mean value of measured values.

6.2 Ageing resistance test

6.2.1 Test specimens The test specimens shall be not less than two seals.

6.2.2 Test apparatus The test apparatus shall be as follows:

- a) The test apparatus shall be in accordance with a Geer type ageing tester specified in 4.2 of JIS K 6257 or the equivalent apparatus to that.
- b) The hardness tester shall be in accordance with the apparatus specified in 6.1.2.

6.2.3 Test conditions The test conditions shall be as shown in Table 4.

Table 4 Ageing test conditions

Classification of seals	Test temperature °C	Test time h
Type 1	120 ± 2	70 ± 1
Type 2	150 ± 2	70 ± 1
However, the conditions of 175 °C ± 2 °C and 22 h ± 1 h are permitted according to the agreement between the parties concerned with delivery.		

6.2.4 Test method The test method shall be as follows:

- a) The test operation shall be carried out by the method specified in 4.4.2 of JIS K 6257 under the conditions specified in Table 4.
- b) The measurement of hardness shall be carried out by the method specified in 6.1.3.
- c) For the observation of state of seals, examine the existence of abnormality such as tackiness, blister, cracking, deformation and the like by observing the surface state of seals.

6.2.5 Calculation The hardness change shall be calculated according to the following formula.

$$\Delta H = H_2 - H_1$$

where, ΔH : hardness change (IRHD)

H_1 : hardness before test (IRHD)

H_2 : hardness after test (IRHD)

6.2.6 Summarizing method of test results For the hardness change, round-off the value obtained from the calculation of 6.2.5 by an integer and report the mean value.

6.3 Liquid resistance test

6.3.1 Test specimens The test specimens shall be as follows:

- a) The test specimens shall be not less than two seals.
- b) Seals shall be used within 6 months in the case of being preserved at 30 °C or lower of temperature after manufacturing or within 36 months after manufacturing in the case of being preserved at -15 °C or lower of temperature after manufacturing.

The seals taken out from a freezing chamber shall be placed as they are on a flat plate at room temperature at least for 12 h until they have recovered to the original shape.

- c) Wash the test specimens with using of isopropyl alcohol or ethyl alcohol (hereafter, the both are referred to as “alcohol”) within 30 s, remove fiber and refuse, and dry them.

6.3.2 Test apparatus The test apparatus shall be as follows:

- a) The hardness tester shall be in accordance with the apparatus specified in **6.1.2**.
b) The test container shall consist of weighing bottle and pressure container and an example of shape and dimensions of test container is shown in Fig. 1.

The test specimens of different material and of different type shall not be put in the same container.

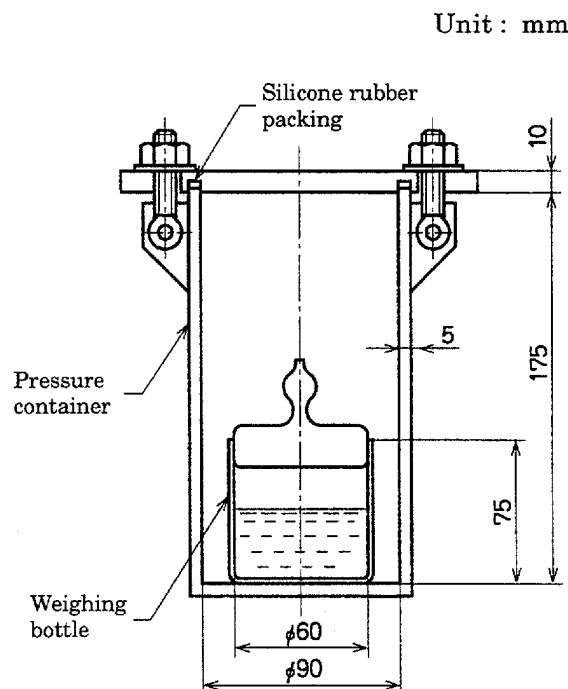


Fig. 1 Test container for liquid resistance (example)

6.3.3 Test conditions The test conditions shall be as shown in Table 5.

Table 5 Conditions of liquid resistance test and precipitation test

Classification of seals	Test temperature °C	Test time h	Test liquid
Type 1	120 ± 2	70 ± 1	The liquid conforming to JIS K 2233 or the one agreed upon between the parties concerned with delivery.
Type 2	150 ± 2	70 ± 1	

6.3.4 Test method The test method shall be as follows:

- a) **Immersion** Weigh the mass (m_1) of seal in air to the nearest 1 mg, next, weigh the apparent mass (m_2) in distilled water at room temperature and then immerse it in alcohol take out it quickly and remove moisture by wiping it with a dry cloth. Successively, put the seal into a weighing bottle, add 75 ml of test liquid, stopper it and place it in a pressure container.

The test specimens of different material and of different type shall not be tested by putting them in the same container. Seal the lid of pressure container tightly and keep it in the air tank under the condition as shown in Table 5. After the completion of immersion, immerse the seal into the same kind of new test liquid approximately for 30 min and cool it to room temperature.

Next, wash it with alcohol. After washing out the adhering test liquid, wipe off alcohol with a dry cloth.

- b) **Measurement of volume change** After tested by the method of a), immediately weigh the mass (m_3) of seals in air and further weigh the apparent mass (m_4) in distilled water at room temperature.
- c) **Measurement of hardness change** Measure the hardness of seals before immersion in accordance with 6.1.3. Next, after tested by the method of a), measure the hardness of seals after immersion in accordance with 6.1.3.
- d) **Observation of state of seals** After tested by the method of a), observe the state of seal surface and examine the existence of tackiness and other abnormality.

Remarks : The measurement and observation in c) and d) shall be carried out within 60 min after cooling.

6.3.5 Calculation The calculation shall be as follows:

- a) The volume change rate shall be calculated according to the following formula.

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

where, ΔV : volume change rate (%)

m_1 : mass in air before immersion (mg)

m_2 : apparent mass in water before immersion (mg)

m_3 : mass in air after immersion (mg)

m_4 : apparent mass in water after immersion (mg)

- b) The hardness change shall be calculated according to the following formula.

$$\Delta H = H_2 - H_1$$

where, ΔH : hardness change (IRHD)

H_1 : hardness before immersion (IRHD)

H_2 : hardness after immersion (IRHD)

6.3.6 Summarizing method of test results The summarizing method of test results shall be as follows:

- a) For the volume change rate, round-off the value obtained from the calculation in **6.3.5 a)** according to **JIS Z 8401**, express it by an integer and report the mean value.
- b) For the hardness change, express the value obtained from the calculation in **6.3.5 b)** by an integer and report the mean value.

6.4 Precipitation test

6.4.1 Test specimens The test specimens shall be as follows:

- a) Two sets of test specimen to become of $4\text{ g} \pm 0.5\text{ g}$ shall be prepared. When it is large, it may be cut.
- b) The washing of test specimens shall be in accordance with **6.3.1 c)**.

6.4.2 Test apparatus The test apparatus shall be as follows:

- a) The test tank shall be the apparatus capable of keeping the test temperature in Table 5.
- b) For the test container, two sets specified in **6.3.2 b)** shall be prepared.
- c) The test tube for centrifugal separation shall be the one specified in the Type I graduation test tube shown in Fig. 105 in **JIS K 2839**.
- d) The centrifugal separator to be used shall be the one specified in **4.3 (2)** in **JIS K 2503**.

6.4.3 Test conditions The test conditions shall be in accordance with Table 5.

6.4.4 Test method Put seals in a weighing bottle, add 75 ml of test liquid, stopper it and place it in a pressure container to keep it under the condition as shown in Table 5 and thereafter cool it at room temperature for $24\text{ h} \pm 1\text{ h}$. Afterwards, stir up the liquid to make the precipitate uniform, transfer the test liquid into the test tube for centrifugal separation from the weighing bottle and measure the precipitate amount by means of testing operation specified in (2) and (3) in **4.5** of **JIS K 2503**.

Carry out the above operation for two sets respectively.

6.4.5 Calculation and summarizing method of measurement results Read the volume of precipitate at the bottom of test tube for centrifugal separation and obtain the volume percentage. Report the mean value as the precipitate amount.

6.5 Metal corrosion resistance test

6.5.1 Test specimens The test specimens shall be as follows:

- a) The test specimens shall be in accordance with **6.3.1**.

- b) For the metal test piece, the two groups of the following metal test pieces shall be used.

Tin plate	Hot-dipped tin plate (SPTH) specified in JIS G 3303
Steel	Type 1 (SPCC-B) specified in JIS G 3141
Aluminium	A2024P specified in JIS H 4000
Cast iron	Type 3 (FC200) specified in JIS G 5501
Brass	C2801P specified in JIS H 3100
Copper	C1100P specified in JIS H 3100
Zinc	Type 1 (ZDC1) specified in JIS H 2201

The size of each metal test piece shall be of 20 cm² to 30 cm² in total surface area (approximately 80 mm × 13 mm) and a hole of 4 mm to 5 mm in diameter shall be opened at 6 mm apart from one end of each metal test piece. The hole shall be filed smoothly.

6.5.2 Test apparatus The test apparatus shall be as follows:

- The test tank shall be the one capable of keeping the test temperature in Table 6 for test time.
- The read-out microscope shall be the one on the market capable of measuring to the nearest 1/100 mm.
- The hardness tester shall be the one specified in **6.1.2**.
- The centrifugal separator shall be the one specified in **6.4.2 d**).
- The test tube for centrifugal separation shall be in accordance with **6.4.2 c**).
- For glass bottles with screwed-in cap (hereafter referred to as "glass bottle"), two glass bottles specified in Fig. 16 of **JIS K 2839** shall be used. The cap shall be the one which has no packing and be made of the tin plate not coated with organic matter, and at the centre thereof, one hole of 0.8 mm ± 0.1 mm in diameter shall be opened.
- The waterproof abrasive paper to be used shall be No. 320 of Aw or Cw specified in **JIS R 6253**.
- The steel wool to be used shall be No. 00 steel wool on the market.

6.5.3 Test conditions The test conditions shall be as shown in Table 6.

Table 6 Conditions of metal corrosion resistance test

Classification of seals	Test temperature °C	Test time h	Test liquid
Type 1 Type 2	100 ± 2	120 ± 2	The liquid conforming to JIS K 2233 or the one agreed upon between the parties concerned with delivery.