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**Automotive parts — Hydraulic brake
master cylinders for hydraulic brake
systems using a non-petroleum base
hydraulic brake fluid**

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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 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 2603 : 1993** is replaced with this Standard.

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Automotive parts—Hydraulic brake master cylinders for hydraulic brake systems using a non-petroleum base hydraulic brake fluid

1 Scope This Japanese Industrial Standard specifies hydraulic brake tandem master cylinders and single master cylinders (hereafter referred to as "master cylinders") for automobiles using non-petroleum base brake fluids.

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 the amendments) indicated below shall be applied.

- JIS B 0209-1 *ISO general purpose metric screw threads—Tolerances—Part 1 : Principles and basic data*
- JIS B 0401-1 *ISO system of limits and fits—Part 1 : Bases of tolerances, deviations and fits*
- JIS B 0633 *Geometrical Product Specification (GPS)—Surface texture : Profile method—Rules and procedures for the assessment of surface texture*
- JIS B 2704 *Helical compression and extension springs—Requirements for design, performance test method*
- JIS D 2605 *Automotive parts—Rubber cups for hydraulic braking cylinders using a non-petroleum base hydraulic brake fluid*
- JIS D 2608 *Automotive parts—Rubber boots for hydraulic brake wheel cylinders using a non-petroleum base hydraulic brake fluid*
- JIS G 3101 *Rolled steels for general structure*
- JIS G 3141 *Cold-reduced carbon steel sheets and strips*
- JIS G 3521 *Hard drawn steel wires*
- JIS G 3522 *Piano wires*
- JIS G 4051 *Carbon steels for machine structural use*
- JIS G 4303 *Stainless steel bars*
- JIS G 4313 *Cold rolled stainless steel strip for springs*
- JIS G 4401 *Carbon tool steels*
- JIS G 5501 *Grey iron castings*
- JIS H 3100 *Copper and copper alloy sheets, plates and strips*

JIS H 3110	<i>Phosphor bronze and nickel silver sheets, plates and strips</i>
JIS H 4040	<i>Aluminium and aluminium alloy rods, bars and wires</i>
JIS H 5202	<i>Aluminium alloy castings</i>
JIS K 2228	<i>Rubber lubricant of non-petroleum base for motor vehicle brake systems</i>
JIS K 2233	<i>Non-petroleum base motor vehicle brake fluids</i>
JIS K 6259	<i>Rubber, vulcanized or thermoplastics—Determination of ozone resistance</i>

3 Classification Master cylinders shall be classified as shown in table 1.

Table 1 Classification

Class	Description
Class 1	Products usable under working conditions at ordinary temperature
Class 2	Products usable under working conditions at high temperature
Class 3	Products usable under special working conditions at high temperature

4 Maximum service pressure The maximum service pressure of master cylinders shall have the pressure stages of 10 MPa, 20 MPa, and 25 MPa.

5 Performance

5.1 Performance of components The performance of the main components of master cylinders shall meet the following requirements :

- There shall be no air leakage when an air pressure of 100 kPa is applied to the inside of the cylinder body and reservoir.
- There shall be no air leakage when an air pressure of 100 kPa is applied to the push rod inserting hole of the primary piston ⁽¹⁾.

Note ⁽¹⁾ In the case of single master cylinder, piston or plunger shall be used instead of primary piston (hereafter the same applies).

- The primary cup, secondary cup, and pressure cup shall satisfy the performance requirements of Class 1, Class 2 or Class 3 specified in **JIS D 2605**.
- The return spring shall conform to the requirements specified in **JIS B 2704**.

5.2 Performance of assembled product The performance of the assembled product shall meet the following requirements.

The test fluid shall be the fluid conforming to **JIS K 2233**.

- a) **Operating pressure of check valve** The operating pressure of the check valve shall meet the following requirements :
- 1) When air at the pressure of 100 kPa is supplied from the reservoir, the air shall flow out of the hydraulic outlet.
 - 2) When air is supplied from the hydraulic outlet at a pressure not exceeding the specified value, no air shall flow out into the reservoir. This specified value should be chosen from the residual pressure of the master cylinder shown in table 2 as agreed upon between the parties concerned with acceptance.

Table 2 Residual pressure of master cylinder

Unit : kPa

Residual pressure		
0	50 ± 30	90 ± 40

- b) **Stroke to closure of relief port** The pressurized air within a range from 50 kPa to 150 kPa shall be supplied from the hydraulic outlet to be flown out of the relief port into the reservoir and push the piston ⁽²⁾ quietly in. The strokes of primary piston and secondary piston when the primary cup shuts the relief port and the air ceases to flow into the reservoir shall not be more than 3 mm respectively and shall satisfy the value agreed upon between the parties concerned with acceptance. For the portless type, the stroke shall be until the inlet valve shuts the fluid supply port.

Note ⁽²⁾ Primary piston and secondary piston of tandem master cylinder, or piston or plunger of single master cylinder (Hereafter the same applies).

- c) **Fluid delivery function** When the inside of the cylinder body and reservoir are filled with the test fluid and the primary piston is continuously reciprocated, the fluid shall be sent out intermittently from the respective hydraulic outlets. However, the hydraulic outlets shall be closed when the primary piston retreats.
- d) **Fluid pressure generating function** When the inside of the cylinder body and reservoir are filled with the test fluid and the primary piston is pushed in with the hydraulic outlets closed, the maximum service fluid pressure shall be produced in the respective separate pressure chambers without the occurrence of abnormalities such as fluid leakage.

In addition, even if no fluid pressure is produced in either one of the pressure chambers, the maximum service pressure shall be produced in the other remaining pressure chamber.

- e) **Airtightness of secondary cup** When the inside of the cylinder body and reservoir are filled with the test fluid and the push rod is reciprocated several times, no fluid leakage shall occur from the secondary cup of the primary piston side.
- f) **Quickness of return** After the inside of the cylinder body and reservoir are filled

with the test fluid and the primary piston is advanced through the effective stroke by pushing the push rod, the respective hydraulic outlets are closed and the push rod is promptly returned. The time spent by the primary piston to return perfectly to the original position shall not exceed 1.5 s.

- g) **Pressure resistance** Neither fluid leakage nor other abnormalities shall occur in the respective parts when the piston is advanced until the primary cup passes the relief port, or until the inlet valve shuts the fluid supply port, then the hydraulic outlets connected to respective separate pressure chambers are closed simultaneously or alternately, then the primary piston is further advanced to produce 130 % of the maximum service pressure in those separate pressure chambers simultaneously or alternately, and such a pressure is maintained constant respectively for 5 s.
- h) **Smoothness of piston operation** The master cylinder shall be assembled by using the lubricant conforming to JIS K 2228 or the assembling liquid specified by the agreement between the parties concerned with acceptance. When the hydraulic outlet is opened, the primary piston is operated several times and then reciprocated at the speed of about 1 mm/s, the piston shall be operated smoothly all over the effective stroke range.

The force to move the primary piston at the time of starting of the piston shall be in accordance with the agreement between the parties concerned with acceptance.

5.3 Low-temperature operability The low-temperature operability of master cylinders shall be such that no fluid leakage occurs from the secondary cup when the test specified in 6.7 of JIS D 2605 is performed.

5.4 Operation durability The operation durability of master cylinders when tested as specified in 6.8 of JIS D 2605 shall be such that the results satisfy the requirements of Class 1, Class 2 or Class 3 specified in 4.2 of JIS D 2605. The test conditions shall be as shown in table 3. In addition, the respective parts shall satisfy the respective performance requirements shown in 5.2 without producing detrimental deformation, wear, or other defects.

Table 3 Test conditions of master cylinder operation durability

Condition	Classification		
	Class 1	Class 2	Class 3
Test fluid	Fluid conforming to JIS K 2233		
Temperature	70 °C ± 2 °C (Fluid temperature) or 70 °C ± 5 °C (Ambient temperature)	120 °C ± 2 °C (Fluid temperature) or 120 °C ± 5 °C (Ambient temperature) 100 °C ± 2 °C (Fluid temperature) or 100 °C ± 5 °C (Ambient temperature) may be applied by agreement between the parties concerned	120 °C ± 2 °C (Fluid temperature) or 120 °C ± 5 °C (Ambient temperature)
Number of strokes/h	1 000 ± 100 cycles		
Piston stroke	Approx. 90 % of effective stroke		
Time	120 h ± 2 h	70 h ± 2 h	
Maximum fluid pressure ⁽³⁾	3.5 MPa ± 0.3 MPa	7 MPa ± 0.3 MPa	
Relations between piston stroke and fluid pressure ⁽⁴⁾	(1)	Raise fluid pressure gradually so that the primary cup passes through the relief port at low pressure within the range not exceeding 1.0 MPa in the first <i>L</i> stroke ⁽⁶⁾ of piston, and the maximum fluid pressure reaches 3.5 MPa ± 0.3 MPa in the remaining stroke. However, the pressure 3.5 MPa ± 0.3 MPa may be kept within 3.2 mm in the last stroke by a relief valve. (see figure 1 ①).	
		In the case of port-less cylinders the maximum fluid pressure should be 3.5 MPa ± 0.3 MPa. This maximum may be maintained by a relief valve within 3.2 mm of the final stroke [see figure 1 ①].	
	(2)	The test shall be performed by using a setup in which the brake assembly to be equipped with the master cylinder to be used for the intended vehicle is connected with a piping system similar to that used in the actual vehicle, and the clearance between the shoe and drum, or between the disc pad and disc wheel is adjusted to the specified value, and as required, a pressure relief valve is provided at a suitable location. In the case of a vehicle using auxiliary brake parts (valves), such parts shall be connected with a piping system similar to that used in the actual vehicle.	

Notes ⁽³⁾ The maximum fluid pressure used for Class 1 shall, as a rule, be 3.5 MPa ± 0.3 MPa, but where agreed upon between the parties concerned with acceptance, 7 MPa ± 0.3 MPa may be used.

- (4) The relation between the piston stroke and fluid pressure can be selected from (1) or (2).

- (5) $L = H + x$

where, L : stroke (mm) which is necessary for primary cup to pass through relief port. However, primary piston stroke (L_p) of tandem master cylinder shall be nearly twice the secondary piston stroke (L_s).

H : height (mm) of primary cup

x : stroke (mm) until relief port is closed, shown in 5.2 b).

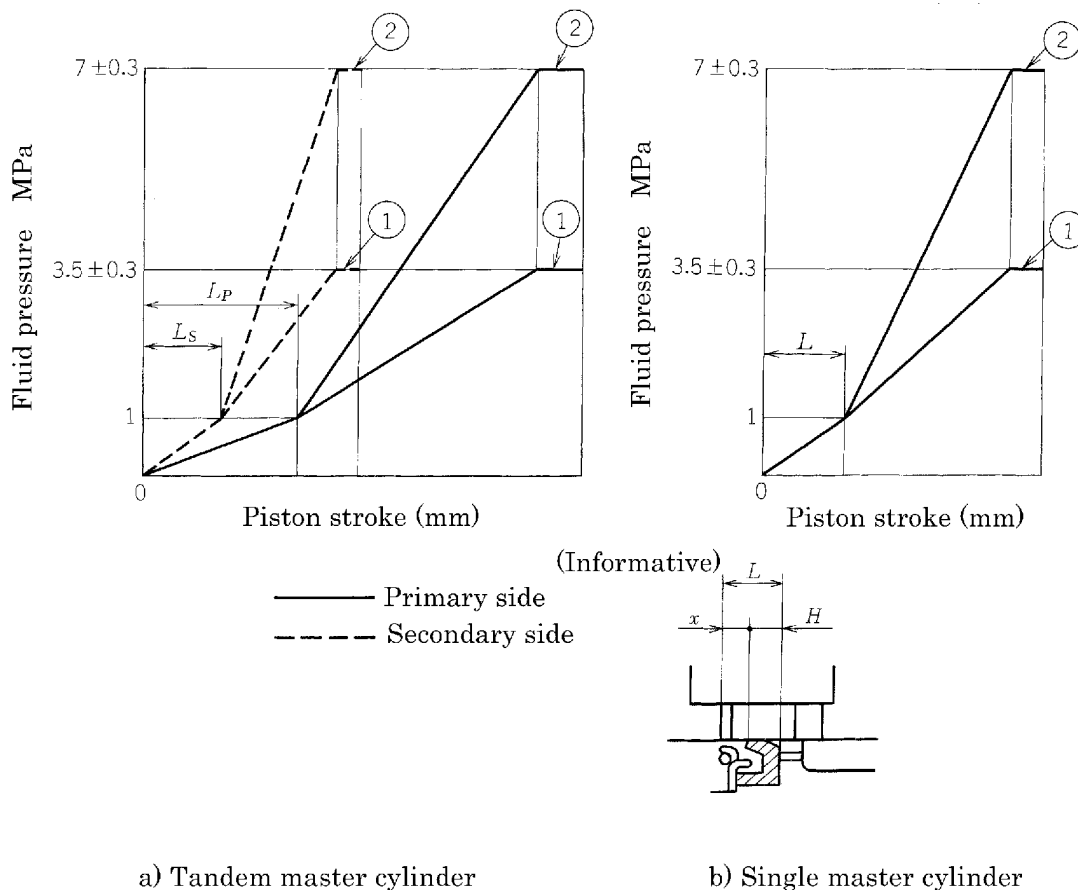


Figure 1 Relation between piston stroke and fluid pressure for master cylinder

5.5 Storage corrosion resistance The storage corrosion resistance of master cylinders shall be such that the piston shall actuate smoothly throughout the effective stroke when the test specified in 6.9 of JIS D 2605 is performed and then the push rod is reciprocated several times. As for the master cylinders, the requirements for storage corrosion resistance specified in 4.2 of JIS D 2605 shall be satisfied.

5.6 Reservoir capacity The master cylinder shall be mounted in the same condition as in the actual vehicle ⁽⁶⁾ and after filling the inside of the cylinder body and reservoir with the test fluid, the test fluid shall be drawn out until the upper surface of the relief port or a hole connecting the cylinder and the reservoir appears. Then using a meas-

uring cylinder, the test fluid shall be introduced to the indicated level (maximum or minimum) of the reservoir and the fluid quantity introduced shall be measured. The reservoir capacity shall satisfy the value decided by agreement between the parties concerned with acceptance.

Note (6) Including the attachment of a filter and a liquid level alarm.

5.7 Vacuum retentivity The vacuum supplier shall be contacted to the master cylinder and all air passing parts other than connected ones shall be closed to make the vacuum pressure inside the master cylinder – 70 kPa or less. Then the vacuum supplier is closed and the stabilized vacuum pressure inside the cylinder shall be measured. This vacuum pressure shall satisfy the value agreed upon between the parties concerned with acceptance.

6 Construction The master cylinder shall be so constructed that at the reset position (the position at which the released condition is restored) of the piston, the inside of the cylinder body is connected to the reservoir by the relief port or fluid supply port, and when a fluid pressure or air pressure is applied from the hydraulic outlet, the test fluid or air shall flow into the reservoir.

Examples of the construction of master cylinder are shown in attached figures 1 to 7.

7 Principal dimensions

7.1 Cylinder body The principal dimensions of the cylinder body shall meet the following requirements :

- a) The basic size of the cylinder body inner diameter and the effective stroke shall, as a rule, be as shown in table 4.

Table 4 Inner diameter and effective stroke

Unit : mm

Inner diameter		Effective stroke											
Nominal size	Basic size	Tandem master cylinder						Single master cylinder					
$\frac{5}{8}$	15.87	28	30	32	36	38	40	20	25	30	35	40	
$\frac{11}{16}$	17.46							20	25	30	35		
$\frac{3}{4}$	19.05												
$\frac{13}{16}$	20.64												
$\frac{7}{8}$	22.22												
$\frac{15}{16}$	23.81												
1	25.40												
1 $\frac{1}{16}$	26.99												
1 $\frac{1}{8}$	28.57												
1 $\frac{1}{4}$	31.75												
1 $\frac{3}{8}$	34.93												
1 $\frac{1}{2}$	38.10												
1 $\frac{5}{8}$	41.30												
1 $\frac{3}{4}$	44.45										50		

Remarks 1 The effective stroke means the maximum extent up to which the piston can operate effectively from the reset position.

- 2 It is desirable that the maximum stroke of a single master cylinder, when it is attached to the actual vehicle, shall be within 90 % of the effective stroke.

- b) The permissible deviation of the cylinder body inner diameter shall be H9 specified in **JIS B 0401-1** based on the basic size shown in table 4. However, the permissible deviation of inner diameters having basic sizes not exceeding 25.40 mm shall be the upper deviation of H9 plus 0.020 mm.
- c) The permissible maximum value of roughness of the inner surface of the cylinder body shall be 2 μmR_z specified in 5.3 of **JIS B 0633**.

7.2 Piston The tolerance on the outer diameter of the sliding surface of the piston shall be IT8 specified in **JIS B 0401-1** based on the basic sizes of the cylinder body inner diameter shown in table 4. The permissible maximum value of roughness of the plunger sliding surface shall be 2 μmR_z specified in 5.3 of **JIS B 0633**.

7.3 Screw thread The screw threads used for hydraulic lines shall be metric coarse screw threads or metric fine screw threads and their accuracy shall be 6H or 6 g as specified in **JIS B 0209-1**.

8 Appearance The appearance of master cylinders shall meet the following requirements :

- a) Metal part shall be treated to be deterrent to rusting by a suitable method, if such