

Hydraulic clutch master cylinders

1. Scope

This standard specifies hydraulic clutch master cylinders (hereinafter referred to as “master cylinders”) used for automobiles.

Remark:

The applicable standards of this standard are shown in **Attached table 1**.

2. Classification

The classification of the master cylinders is as shown in **Table 1**.

3. Maximum working pressure

The maximum working pressure of the master cylinders shall be, in general, 10 MPa.

4. Performance

4.1 Performance of components

The performances of the major components of the master cylinders shall be as follows.

- (1) When an air pressure of 100 kPa is applied to the cylinder body and reservoir, an air leakage must not occur.
- (2) When an air pressure of 100 kPa is applied to the piston or push rod inserting hole in the plunger, an air leakage must not occur.
- (3) The primary and secondary cups shall meet the performance requirements of Types 1, 2, and 3 specified in **JIS D 2605**.
- (4) The return spring shall meet the requirements specified in **JIS B 2707**.

4.2 Performance of assemblies

The performance of assemblies shall be as follows.

The testing fluid shall be that meeting the requirements specified in **JIS K 2233** or that determined by the agreement made between two parties concerned.

(1) Interconnection

When air is fed from the hydraulic fluid delivery port, it must flow out from the relief port or supply port.

(2) Ineffective stroke

While air with an air pressure of 50 to 150 kPa is fed from the hydraulic fluid delivery port to flow it out from the relief port or supply port into the reservoir, the piston or plunger is pushed in gently for the primary cup to close the relief port or for the inlet valve to close the supply port, stopping the air flow into the reservoir. Then the stroke of the piston or plunger must be within the range of 0.5 to 2.3 mm.

(3) Delivery function

When the piston or plunger is reciprocated continuously with the cylinder body and reservoir filled with the testing fluid, the fluid must flow out continuously from the hydraulic fluid delivery port.

(4) Air tightness of secondary cup and operational smoothness of piston and plunger

When the push rod is reciprocated gently several times through the effective stroke with the cylinder body and reservoir filled with the testing fluid, the piston or plunger must operate smoothly and also a fluid leakage must not occur from the secondary cup.

Table 1 Classification

Classification	Performance
Class 1	Master cylinders that can be used under normal temperature operating conditions.
Class 2	Master cylinders that can be used under high temperature operating conditions.
Class 3	Master cylinders that can be used under special high temperature operating conditions.

(5) Return speed

When the hydraulic fluid delivery port is closed and the push rod is returned rapidly after the piston or plunger has been moved forward through the effective stroke with the cylinder body and reservoir filled with the testing fluid, the piston or plunger must be returned fully to the original position within two seconds.

(6) Pressure tightness

When a fluid pressure of 130 % of the maximum working pressure is applied to the cylinder body and held for 5 seconds after the piston or plunger has been moved forward until the relief port is closed by the primary cup or supply port is closed by the inlet valve, a fluid leakage and other abnor-

malities must not occur on each part of the cylinder body.

4.3 Durability test

The master cylinder must undergo the durability test under the conditions shown in **Table 2**, and the following troubles must not occur on it.

The test procedures shall be in accordance with **JIS D 2605**. The test article shall be, in general, a master cylinder from which its boot is removed. The boot durability test is made also under these conditions.

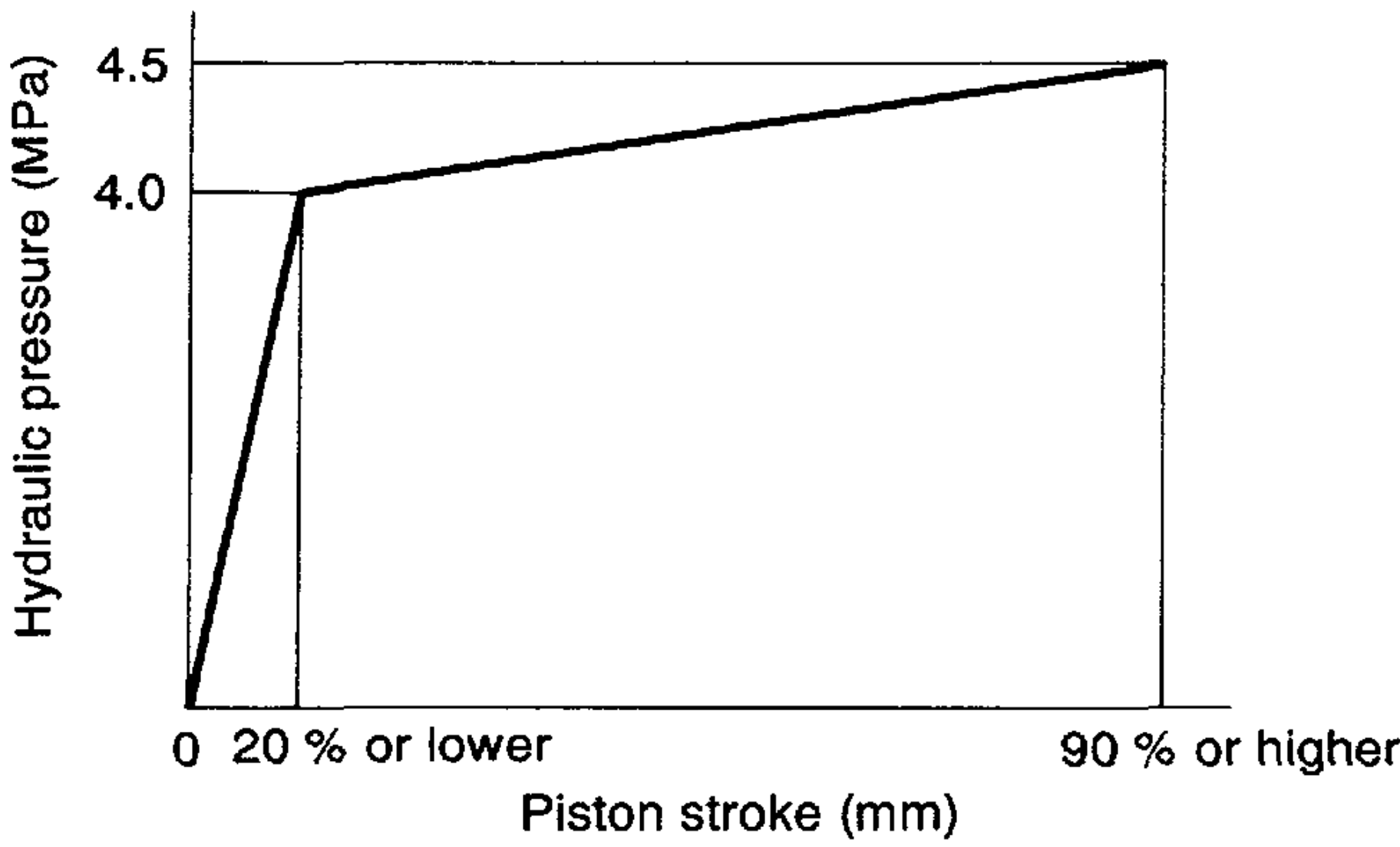
- (1) Pressure drop due to fluid leakage from primary cup.
- (2) Dripping fluid leakage from secondary cup.
- (3) Harmful deformation, wear, and defects on each part.

Table 2 Durability test conditions

Classification		Class 1	Class 2	Class 3
Conditions				
Temperature	°C	70 ± 5	100 ± 5	120 ± 5
Time	h	120 ± 2	70 ± 2	70 ± 2
Number of strokes per hour	Times	1000 ± 100		
Piston stroke		90 % or higher of effective stroke		
Testing fluid		Fluid meeting the requirements specified in JIS K 2233 or that determined by the agreement made between two parties concerned.		
Relation between piston stroke and hydraulic pressure	(1)	Fig. 1		
	(2)	Device using a clutch body and piping equivalent to those used on the vehicle on which the master cylinder is installed.		

Remark 1: The relation between the piston stroke and hydraulic pressure shall be selected from items (1) and (2) above.

Fig. 1 Relation between piston stroke and fluid pressure



5. Construction and functions

5.1 Construction

- (1) The master cylinder shall operate the piston or plunger by the push rod to generate a required hydraulic pressure.
- (2) When the piston or plunger is returned to the original position (open condition), the cylinder body shall be interconnected to the reservoir through the relief port or supply port.

5.2 Functions

The functions shall be as follows.

- (1) When the push rod is reciprocated, the piston or plunger must operate smoothly following the push rod through the effective stroke to deliver the testing fluid from the hydraulic fluid delivery port.
- (2) The master cylinder must withstand the maximum working pressure and be free from fluid leakage and other abnormalities.

6. Major dimensions

6.1 Cylinder body

The major dimensions of the cylinder body shall be as follows.

- (1) The basic sizes of the cylinder body inner diameter and effective strokes for the sizes shall be, in general, as shown in **Table 3**.
- (2) The inner diameter tolerances of the cylinder body for the basic sizes shown in **Table 3** shall be those obtained by adding 0.020 mm to the upper deviation of H9 specified in **JIS B 0401**.
- (3) The inner surface roughness of the cylinder body shall be 2 μm R_{max} specified in **JIS B 0601**.

6.2 Piston

The tolerances of the outer sliding surface diam-

eter of the piston for the basic sizes shown in **Table 3** shall be IT8 specified in **JIS B 0401**.

6.3 Plunger

The plunger shall have the following requirements.

- (1) The tolerances of the outer sliding surface diameter of the plunger for the basic sizes shown in **Table 3** shall be IT8 specified in **JIS B 0401**.
- (2) The sliding surface roughness of the plunger shall be 2 μm R_{max} specified in **JIS B 0601**.

6.4 Primary and secondary cups

The tolerances of the primary and secondary cup lip outer diameters shall be those specified in **JIS D 2605**.

6.5 Thread accuracy

The accuracy of the threads used for the hydraulic circuit shall be Class 2 specified in **JIS B 0209** or **JIS B 0211**.

7. Appearance

The appearance of the master cylinder shall be as follows.

- (1) The metallic parts shall be rust – inhibited by a suitable method, if required functionally.
- (2) Dirt, chips, sand, and other harmful substance must not adhere on the inner surfaces of the cylinder body and the reservoir.
- (3) The inner surfaces of the cylinder body through the effective sliding stroke of the primary and secondary cups must be free from harmful scratches, blow holes, pin holes, and rust.

Table 3 Basic sizes of inner diameter and effective strokes

Unit : mm

Inner diameter		Effective stroke			
Nominal diameter	Basic size				
5/ 8	15.87	25	30	35	—
11/16	17.46	—	30	35	—
3/4	19.05	—	30	35	40
13/16	20.64	—	30	35	40
7/8	22.22	—	30	35	40
1	25.40	—	—	35	40

Remark : The effective stroke is the maximum range of stroke in which the piston can be operated effectively from the returned position (open condition).

- (4) The wall thickness of the boot must not be uneven excessively.
- (5) The piston and a cup protector on it, if equipped, must be held concentrically with each other.

8. Names and materials of major parts

8.1 Names of parts

The names of major parts of the master cylinder shall be as shown in **Attached Figs. 1 to 4.**

8.2 Materials

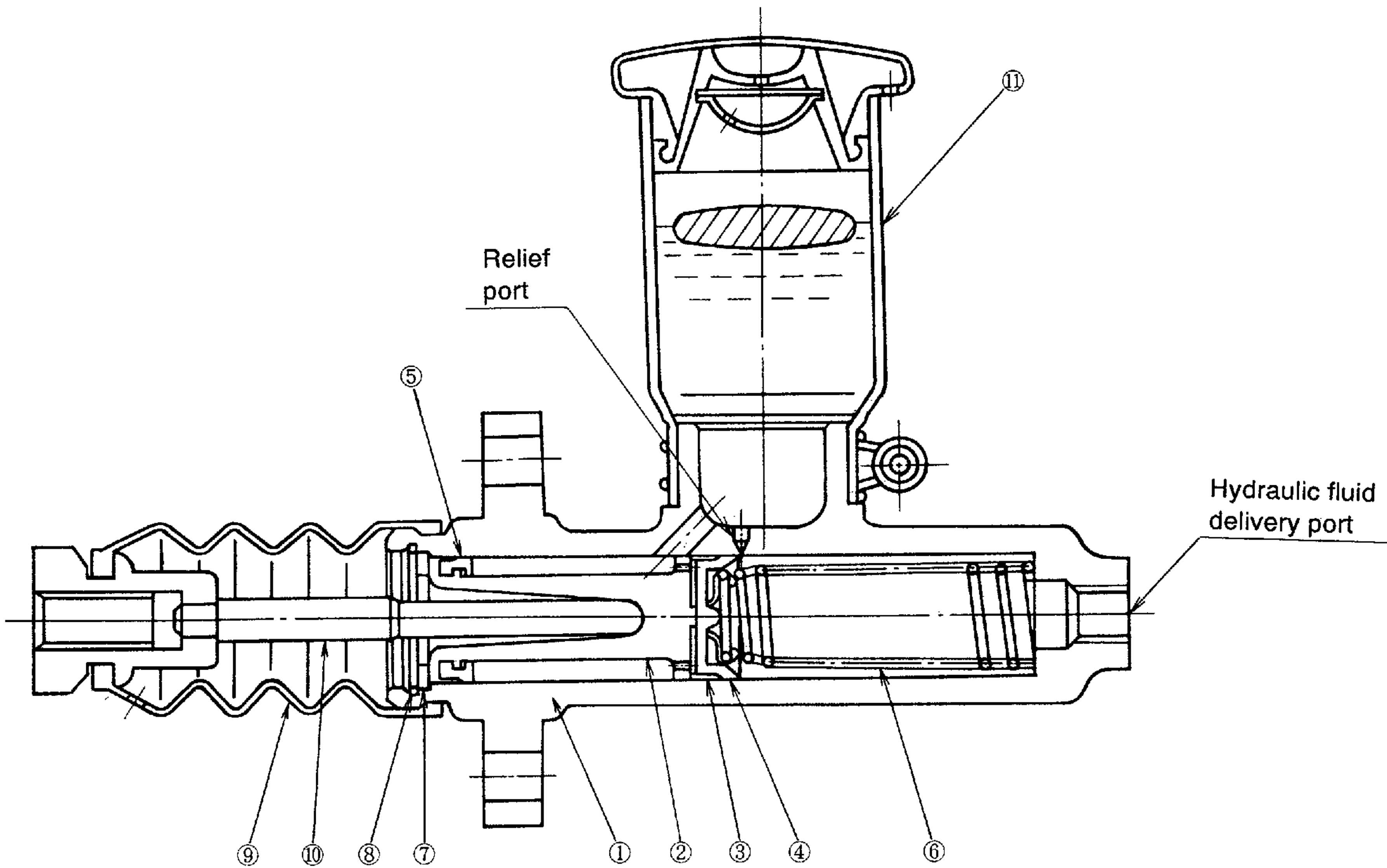
The materials of major parts of the master cylinder shall be, in general, as shown in **Attached Figs. 1 to 4.**

9. Marking

The master cylinder shall be marked visibly with the following items by an unerasable method.

- (1) Nominal inner diameter of cylinder body
- (2) Manufacturer's name or his trade mark

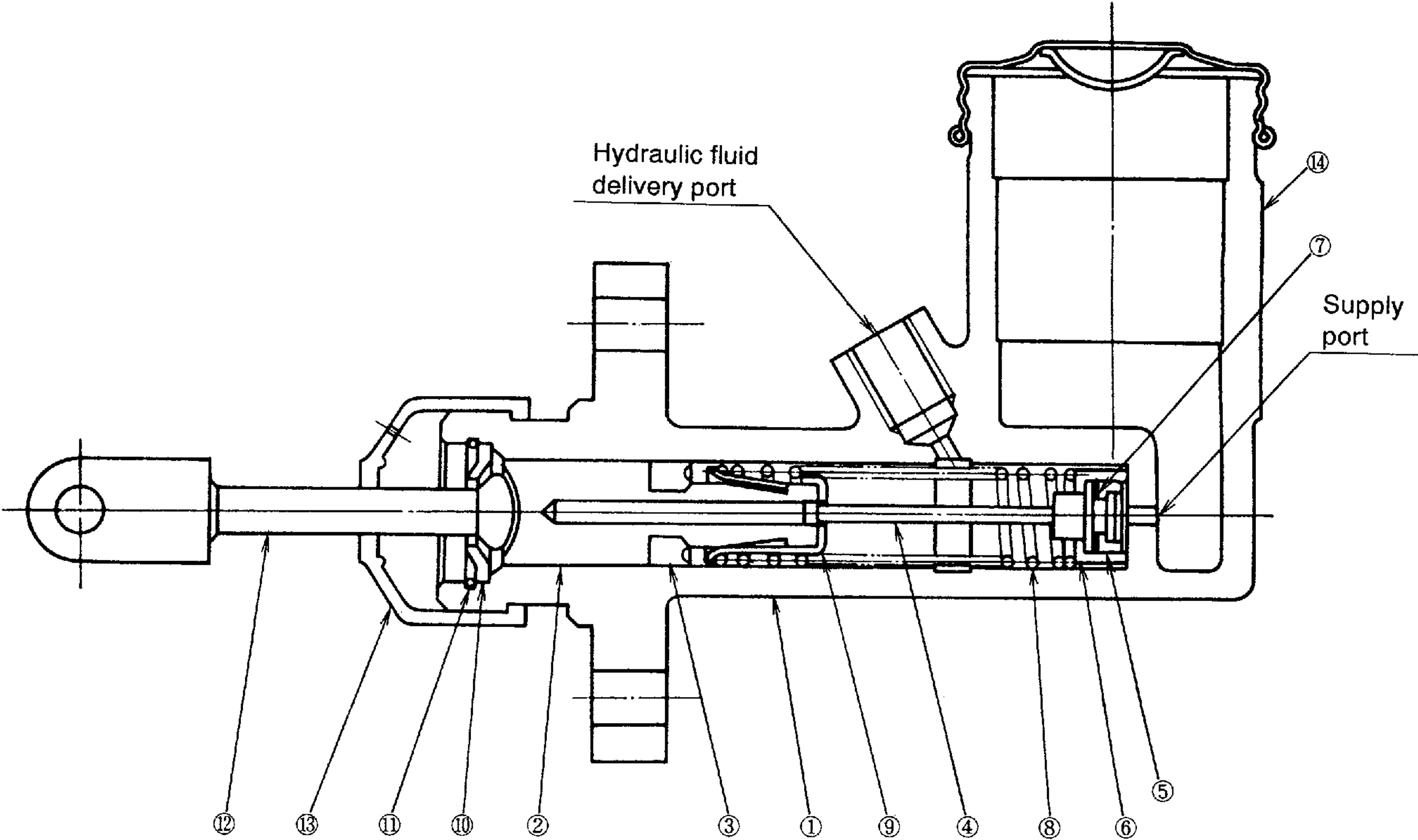
Attached Fig. 1 Clutch master cylinder (conventional type)



Remark : The construction of the master cylinder shown in the figure above is a typical example.

No.	Major part name	Material
1	Cylinder body	FC200 specified in JIS G 5501 or AC2A, AC2B, or AC4C specified in JIS H 5202.
2	Piston	AC2A or AC2B specified in JIS H 5202, materials in accordance with therequirements specified in JIS G 4040, JIS G 4051, or JIS G 4804, or synthetic resin.
3	Cup protector	SK5 specified in JIS G 4401, C5111 or C5102 specified in JIS H 3110, or materials in accordance with the requirements specified in JIS H 3100.
4	Primary cup	Class 1, 2, or 3 specified in JIS D 2605.
5	Secondary cup	
6	Return spring	Materials in accordance with the requirements specified in JIS G 3521 or JIS G 3522.
7	Piston stopper	SS330 specified in JIS G 3101 or materials in accordance with the requirements specified in JIS G 3141.
8	Snap ring	Materials in accordance with the requirements specified in JIS G 3521 or JIS G 3522, or SK5 specified in JIS G 4401.
9	Boot	Class 1, 2, or 3 specified in JIS D 2603.
10	Push rod	SS400 specified in JIS G 3101 or materials in accordance with the requirements specified in JIS G 4051.
11	Reservoir	Metal or synthetic resin.

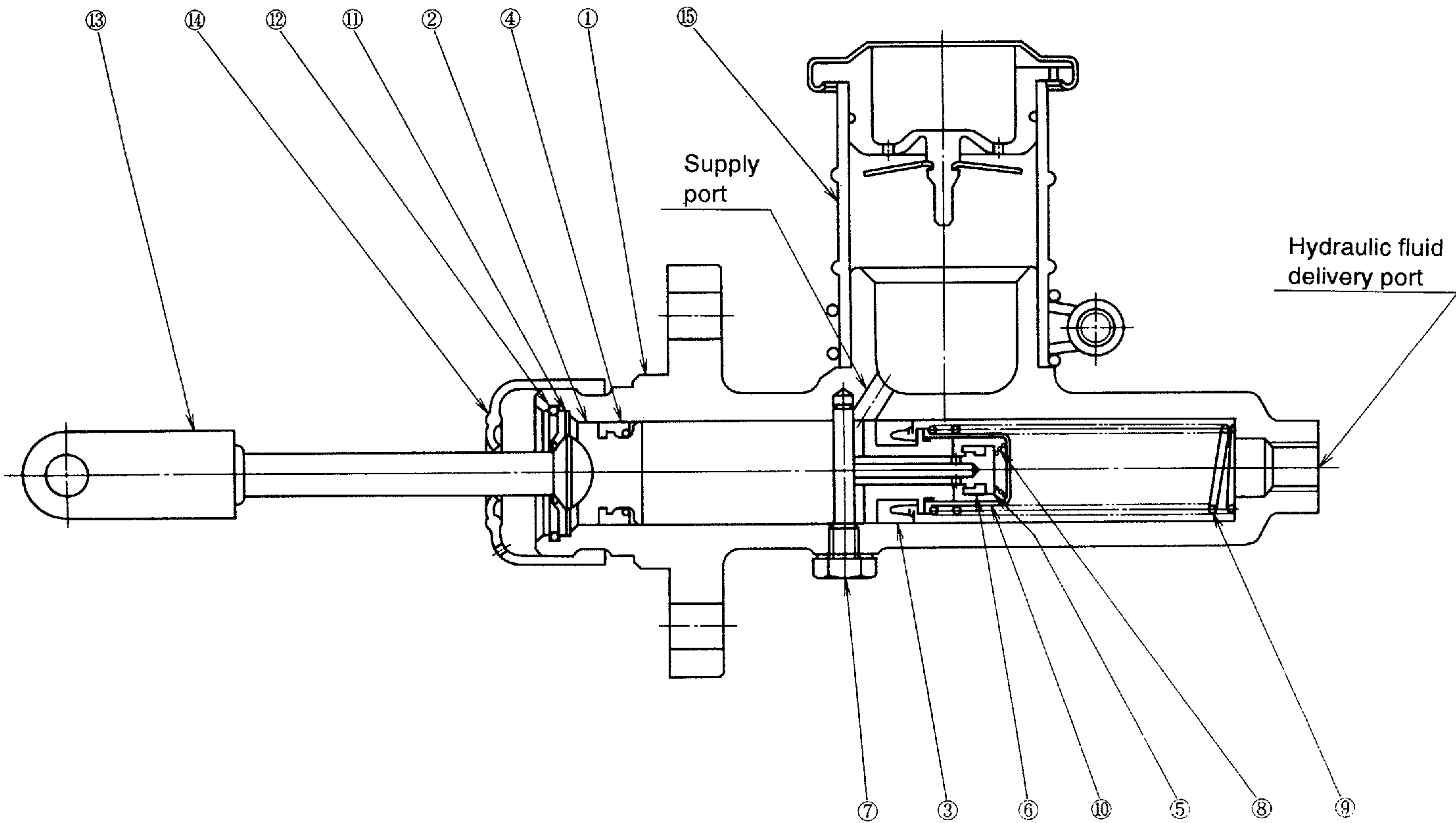
Attached Fig. 2 Clutch master cylinder (center valve type No. 1)



Remark : The construction of the master cylinder shown in the figure above is a typical example.

No.	Major part name	Material
1	Cylinder body	FC200 specified in JIS G 5501 or AC2A, AC2B, or AC4C specified in JIS H 5202 .
2	Piston	AC2A or AC2B specified in JIS H 5202 , materials in accordance with the requirements specified in JIS G 4051 or JIS G 4804 , or synthetic resin.
3	Primary cup	Class 1, 2, or 3 specified in JIS D 2605 .
4	Valve stem	SS400 specified in JIS G 3101 .
5	Inlet valve	Class 1, 2, or 3 specified in JIS D 2603 .
6	Valve guide	Materials in accordance with the requirements specified in JIS G 3141 .
7	Valve spring	Materials in accordance with the requirements specified in JIS G 3521 or JIS G 3522 , or SK5 specified in JIS G 4401 .
8	Return spring	Materials in accordance with the requirements specified in JIS G 3521 or JIS G 3522 .
9	Spring seat	Materials in accordance with the requirements specified in JIS G 3141 .
10	Piston stopper	Materials in accordance with the requirements specified in JIS G 3141 .
11	Snap ring	Materials in accordance with the requirements specified in JIS G 3521 or JIS G 3522 , or SK5 specified in JIS G 4401 .
12	Push rod	SS400 specified in JIS G 3101 , or materials in accordance with the requirements specified in JIS G 4051 .
13	Boot	Class 1, 2, or 3 specified in JIS D 2603 .
14	Reservoir	Metal or synthetic resin.

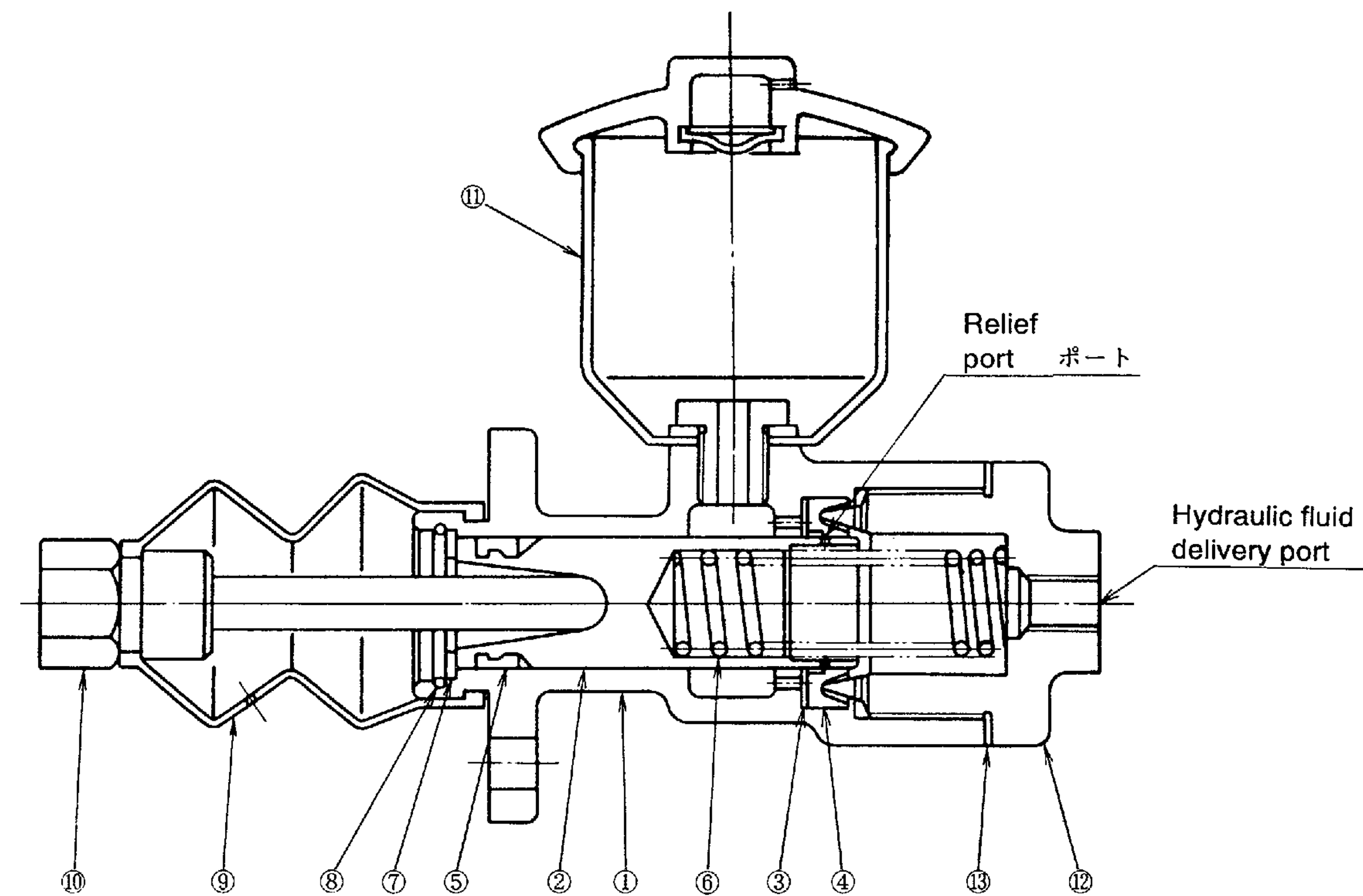
Attached Fig. 3 Clutch master cylinder (centre valve type No. 2)



Remark : The construction of the master cylinder shown in the figure above is a typical example.

No.	Major part name	Material
1	Cylinder body	FC200 specified in JIS G 5501 or AC2A, AC2B, or AC4C specified in JIS H 5202 .
2	Piston	AC2A or AC2B specified in JIS H 5202 , materials in accordance with the requirements specified in JIS G 4051 or JIS G 4804 , or synthetic resin.
3	Primary cup	Class 1, 2, or 3 specified in JIS D 2605 .
4	Secondary cup	
5	Valve stem	SS400 specified in JIS G 3101 .
6	Inlet valve	Class 1, 2, or 3 specified in JIS D 2603 .
7	Stopper	SS400 specified in JIS G 3101 or materials in accordance with the requirements specified in JIS G 4051 .
8	Valve spring	Materials in accordance with the requirements specified in JIS G 3521 or JIS G 3522 , or SK5 specified in JIS G 4401 .
9	Return spring	Materials in accordance with the requirements specified in JIS G 3521 or JIS G 3522 .
10	Spring seat	Materials in accordance with the requirements specified in JIS G 3141 .
11	Piston stopper	Materials in accordance with the requirements specified in JIS G 3141 .
12	Snap ring	Materials in accordance with the requirements specified in JIS G 3521 or JIS G 3522 , or SK5 specified in JIS G 4401 .
13	Push rod	SS400 specified in JIS G 3101 , or materials in accordance with the requirements specified in JIS G 4051 .
14	Boot	Class 1, 2, or 3 specified in JIS D 2603 .
15	Reservoir	Metal or synthetic resin.

Attached Fig. 4 Clutch master cylinder (plunger type)



Remark : The construction of the master cylinder shown in the figure above is a typical example.

No.	Major part name	Material
1	Cylinder body	FC200 specified in JIS G 5501 or AC2A, AC2B, or AC4C specified in JIS H 5202 .
2	Plunger	AC2A or AC2B specified in JIS H 5202 , or materials in accordance with the requirements specified in JIS G 4051 or JIS G 4804 .
3	Cup protector	SK5 specified in JIS G 4401 , C5111 or C5102 specified in JIS H 3110 , or materials in accordance with the requirements specified in JIS H 3100 .
4	Primary cup	Class 1, 2, or 3 specified in JIS D 2605 .
5	Secondary cup	
6	Return spring	Materials in accordance with the requirements specified in JIS G 3521 or JIS G 3522 .
7	Piston stopper	SS330 specified in JIS G 3101 or materials in accordance with the requirements specified in JIS G 3141 .
8	Snap ring	Materials in accordance with the requirements specified in JIS G 3521 or JIS G 3522 , or SK5 specified in JIS G 4401 .
9	Boot	Class 1, 2, or 3 specified in JIS D 2603 .
10	Push rod	SS400 specified in JIS G 3101 or materials in accordance with the requirements specified in JIS G 4051 .
11	Reservoir	Metal or synthetic resin.
12	Cylinder cap	SS400 specified in JIS G 3101 or FC200 specified in JIS G 5501 .
13	Cap gasket	Materials in accordance with the requirements specified in JIS H 3100 .

Attached table 1 Applicable standards

Standard code	Standard name
JIS B 0209	Limits of sizes and tolerances for metric coarse screw threads
JIS B 0211	Limits of sizes and tolerances for metric fine screw threads
JIS B 0401	System of limits and fits
JIS B 0601	Surface roughness-Definitions and designation
JIS B 2707	Cold coiled helical compression springs
JIS D 2605	Rubber cups for hydraulic cylinders for automotive hydraulic brake systems using a non-petroleum base hydraulic brake fluid
JIS D 2608	Rubber boots for automotive hydraulic brake wheel cylinders using a non-petroleum base hydraulic brake fluid
JIS G 3101	Rolled steel for general structure
JIS G 3141	Cold rolled carbon steel sheets and strip
JIS G 3521	Hard drawn steel wires
JIS G 3522	Piano wires
JIS G 4051	Carbon steels for machine structural use
JIS G 4401	Carbon tool steels
JIS G 4804	Free cutting carbon steels
JIS G 5501	Grey iron castings
JIS H 3100	Copper and copper alloy sheets, plates, strip and coiled sheets
JIS H 3110	Phosphor bronze and nickel silver sheets, plates and strips
JIS H 4040	Aluminium and aluminium alloy rods, bars and wires
JIS H 5202	Aluminium alloy castings
JIS K 2233	Non-petroleum base motor vehicle brake fluids

Related standards : JIS D 2603 Hydraulic brake master cylinders for automotive hydraulic brake systems using a non-petroleum base hydraulic brake fluid
JIS D 2604 Hydraulic brake wheel cylinders for automotive hydraulic brake systems using a non-petroleum base brake fluid
JIS B 2804 Retaining rings-C type
SAE J 101 MAR80 Hydraulic Wheel Cylinders for Automotive Drum Brakes



Explanatory note on JASO C 103-95 Hydraulic clutch master cylinders

This explanatory note explains the items specified in the main body and their related items, and is not a part of the standards.

1. Reason of revision

- (1) Conformity with revised JIS D 2603, JIS D 2604, and JIS D 2605.
- (2) Correction of Attached tables, Attached Figs., etc. according to the actual conditions.
- (3) Transition to the third phase of International System of Units.
- (4) Conformity in format with JIS Z 8301.

2. Purpose

The purpose of this standard is to standardize the quality, unify the specifications, reduce, by mass-production, the cost, and maintain the proper quality, of hydraulic clutch master cylinders for automobiles.

3. Revisions and supplementary not of each section

3.1 Classification(Clause 2 of the main body)

Though clutch master cylinders were classified into two groups according to use conditions and atmospheric temperatures in the old standard, those that can be used under special high temperature operating conditions are added to the new standard as in JIS D 2603.

3.2 Performance (Clause 4 of the main body)

3.2.1 Durability test (Sub-clause 4.3 of the main body)

For class 3 durability test conditions added this time, their present and predicted future use conditions were investigated, and the temperature and time for them have been determined at 120 ± 5 °C and 70 ± 2 h, respectively, which are the same conditions as those specified in JIS D 2603. Also, because it was found by this

investigation that the hydraulic pressure in classes 1 and 2 durability test conditions was not matched with the actual requirements in the market, the hydraulic pressure has been changed from 4.0 to 4.5 MPa.

3.2.2 Major dimensions(Clause 6 of the main body)

As the result of investigation, it was found that the inner diameter and effective stroke of the standardized cylinder body were matched with the actual conditions in the market and, therefore, the old standard has been kept unchanged.

3.2.3 Materials (Sub-clause 8.2 of the main body)

At present, AC4C is used for many cylinder bodies and will be used increasingly. Therefore it has been newly added.

Though some pistons become to use plastic material, a simple synthetic resin has been used because it is difficult to specify the detail material and also to prevent the future possible application of material from being limited. The major synthetic resins used include polypropylene (PP), polyamid (PA), polyethylene (PE), and others.

For rubber parts such as piston cups, boots, and others, those conforming to class 3 requirements specified in **Sub-clause 3.2.2** have been newly added.

3.2.4 Marking (Clause 9 of the main body)

In the old standard, nominal inner diameter, manufacturer's name, and date of manufacture were specified to be marked. However, because the use of the date of manufacture is less and also not specified in JIS D 2603, it has been specified as option by the manufacturer and omitted from the body.

In the event of any doubt, the original standards in Japanese should be referred.



THIRD PHASED STANDARD

(The standard where SI units and newly values are given and do not using customary units, but it is excepted that the standards are represented in only accustomed metric units as m, A, Hz etc.)

Established by the Standard Council of JSAE

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