

Front Disc Brakes

KES

KES D-B301

(EST.)1993-06-01 [SI]

Contents

1. Purpose
2. Scope of Application
3. Report of Evaluation Result
4. Definition of Terminology
5. Specification Indicated in Drawings
6. Evaluation Standard
7. Evaluation Method
8. Alteration of Specification
9. Indication Method on Drawings
10. Quoted Standards

Appendix



1. Purpose

This standard aims at securing proper quality by standardizing specifications.

Remark: This standard and a drawing communicate together our requirements.

2. Scope of Application

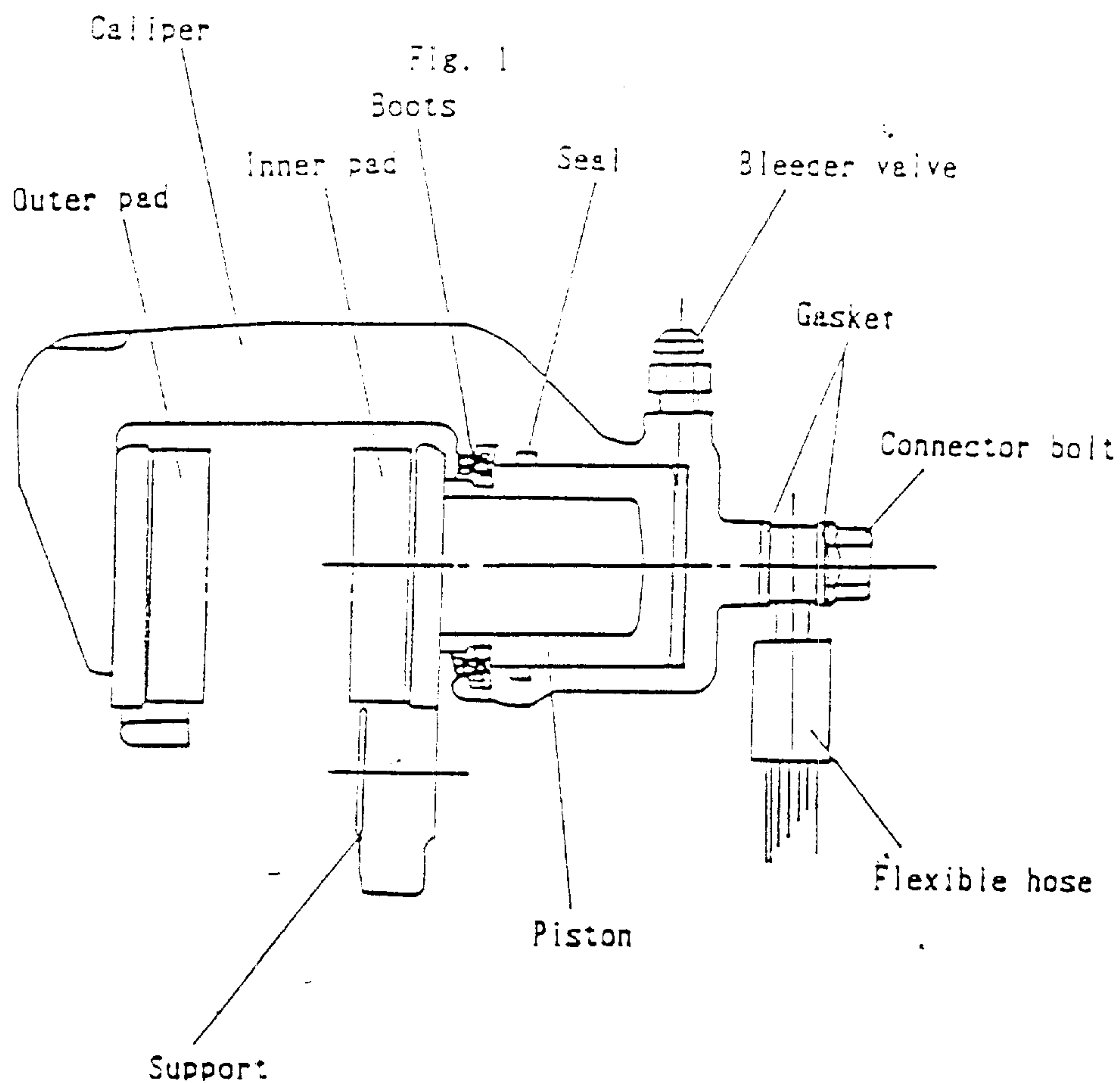
This standard specifies front disc brakes (hereinafter referred to as the "disc brake").

3. Report of Evaluation Results

The quality evaluation results at each stage from development to mass production shall be submitted to Kia according to the Appendix.

4. Definition of Terminology

(1) Disc brake



(2) Metallic pad

Metallic pad manufactured in the same shape as the designated pad.

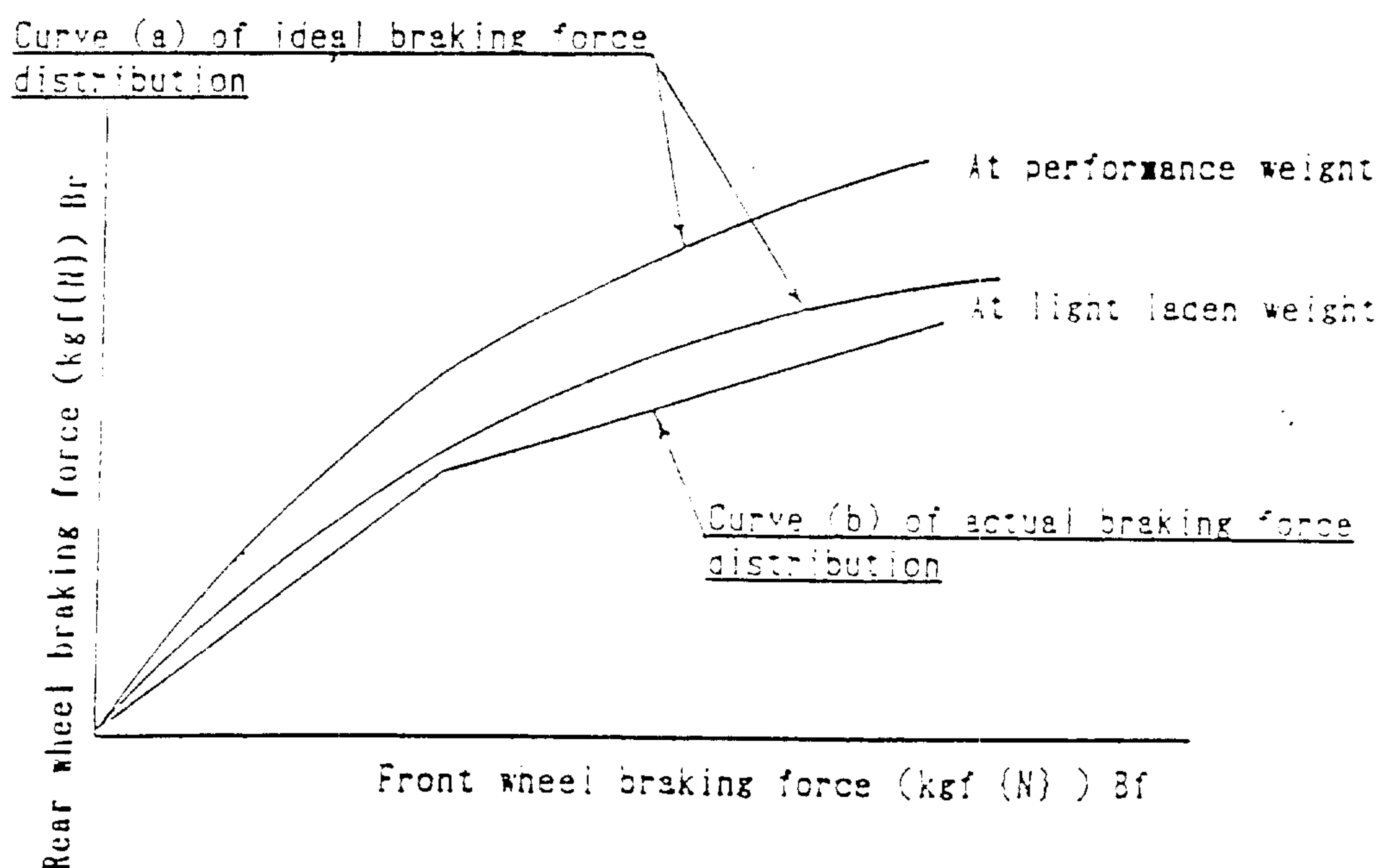
(3) Ideal braking force distribution

Braking force distribution by which both front and rear wheels are locked to generate the maximum braking force at every friction coefficient against the road surface (See (a) in Fig.2)

(4) Actual braking force distribution

Braking force distribution determined by the wheel cylinder diameters of front and rear wheels, the brake effective diameter, the friction coefficient of friction material and valve characteristics. (See (b) in Fig. 2)

Fig. 2
Example of braking force
distribution



(5) Strength standard weight Weight for evaluation of strength and durability

(6) Constant load weight Weight of a fully laden vehicle

(7) Performance weight Weight for evaluation of marketability

(8) Vehicle condition Road surface tilt angle of 0° in a vehicle

(9) Wet condition Condition that parts are thoroughly wet with brake fluid, etc.

5. Specification Indicated in Drawings

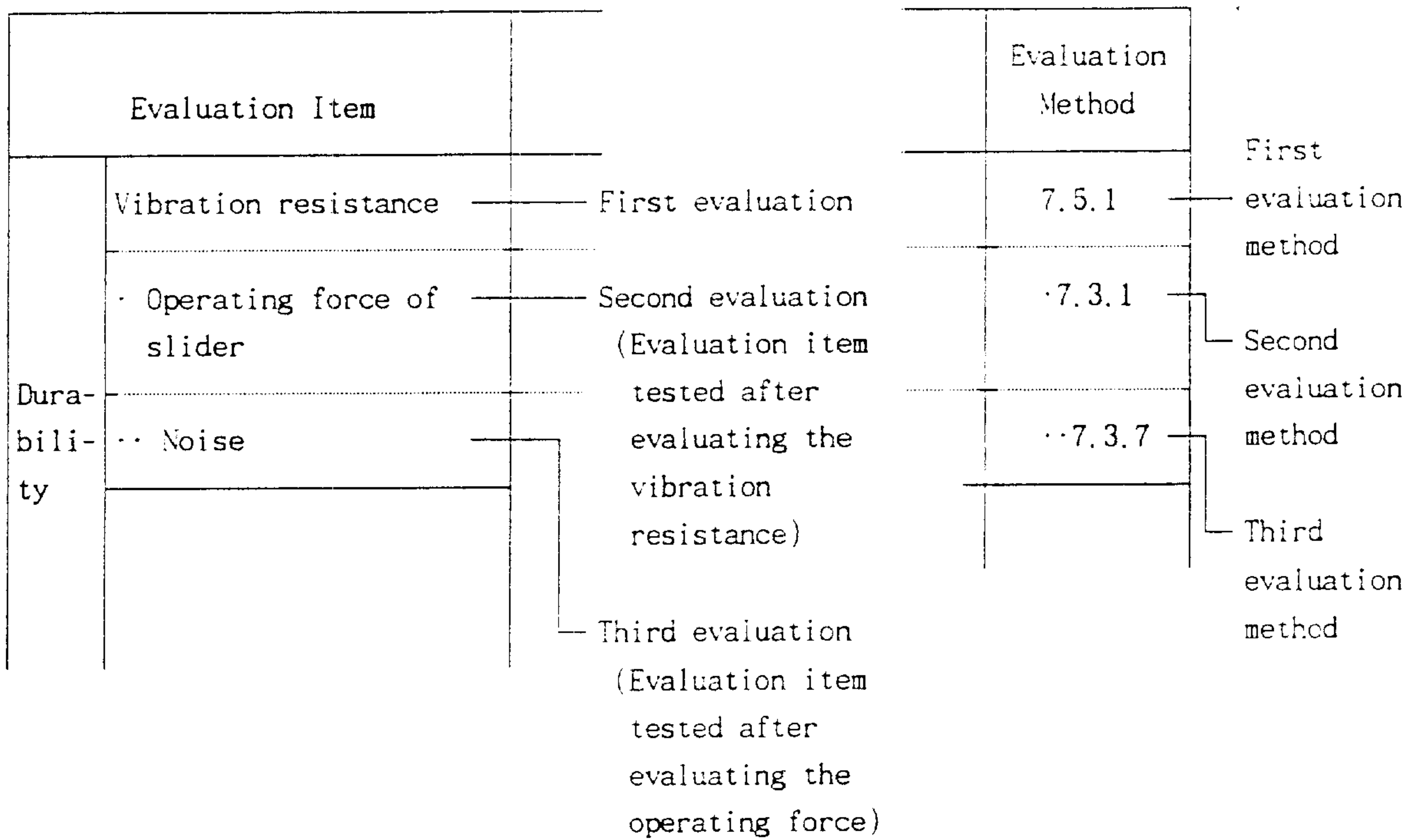
- (1) Caliper material and surface treatment
- (2) Caliper shape (Appearance, shape of attaching holes)
- (3) Rotor shape
- (4) Brake effective radius
- (5) Pad area, thickness (Effective full-abrasion thickness)
- (6) Application or non-application of vacuum air bleeding method
- (7) Minimum and maximum specified tightening torques of the connector bolt
- (8) Minimum specified tightening torques of attaching bolts
- (9) Maximum sectional shape and peripheral shape of the brake
- (10) Abrasion limit thickness of the rotor
- (11) Table of brake specifications (Pedal ratio, front brake size and type of the assistor, etc.)
- (12) Brake attaching angle
- (13) Vehicle classification of test mode for a noise dynamo (selected and indicated among type I-1, type I-2, type II and type III)
- (14) Destination
- (15) Performance weight
- (16) Strength standard weight
- (17) Constant load weight
- (18) Maximum speed

*1 If any evaluation standard of Kia's evaluation items(7.8.1, 7.8.4 to 7.8.6, 7.9.3 and 7.9.6) in a vehicle is not satisfied, the supplier's evaluation standard shall be changed even if other items evaluated by the supplier are successful.

6. Evaluation Standard

The evaluation standard of the disc brake shall conform to Table 1.

Remark 1. The way of reading evaluation items and methods in Table 1 shall conform to the following example.



Remark 2. The quality rank shall be represented by A, AR, B or C.
The definitions shall conform to KMS Q410001 (Determination and Procedure of Quality Ranking).

Table 1

Evaluation Item		Evaluation Standard	Quality Rank	Evaluation Method
Basic characteristics	Piston seal	To satisfy the standard of Type 2 in KS R 2069	A	7.2.1

Table 1 (Continued)

Evaluation Item		Evaluation Standard		Quality Rank	Evaluation Method	
Fluid amount required		(1) After regular air bleeding, the fluid amount required at the hydraulic pressure of 70 kgf/cm ² {6.86 MPa} shall be the standard value or less described in the below.		B	7.2.2	
		Cylinder diameter in. {mm}	Standard value ($\bar{x} + 4\sigma$) cm ³			
			New pad (with a shim)			Metallic Pad (Without a shim)
		1 7/8 {47.7}	1.2			1.0
		2 {50.8}	1.3			1.0
		2 1/8 {54.0}	1.4			1.1
		2 1/4 {57.2}	1.6			1.2
		2 3/8 {60.4}	1.9			1.5
		(2) The fluid amount required after full air bleeding shall be reported to Kia.				
Hydraulic pressure rigidity		The deformation at the hydraulic pressure of 70 kgf/cm ² {6.86 MPa} shall be the standard value or less shown in the table below.		B	7.2.3	
Standard value ($\bar{x} + 4\sigma$) mm						
New pad (with a shim)	Metallic pad (without a shim)					
		0.2	0.18			
Piston return amount		0.6 mm or less		B	7.2.4	

Table 1 (Continued)

Evaluation Item		Evaluation Standard	Quality Rank	Evaluation Method
Basic characteristics	Caliper sliding resistance	8 kgf {78 N} or less	B	7.2.5
	Piston sliding resistance	In the pressure-reducing direction: 10 kgf {98 N} or more	A	7.2.6
	Drag torque	(1) 45 kgf · cm {441 N · cm} within one rotation (2) 25 kgf · cm {196 N · cm} or less within 10 rotations	B	7.2.7
	Vacuum holding force	(1) When the vacuum air bleeding method is not applied: ① Piston seal vacuum holding force shall be 350 mmHg {46.2 kPa} or more (2) When the vacuum air bleeding method is applied: ① Piston seal vacuum holding force shall be 758 mmHg {100.1} or more. ② The vacuum drop shall be 1 mmHg {132 Pa} or less.	B	7.2.8
Airtightness	Low-pressure air leakage	(1) No air leakage (2) However, the air pressure drop of 0.08 kgf/cm ² {7.8 kPa} or less is permissible for some test equipment.	A	7.3.1
	Low-pressure fluid leakage	(1) No fluid leakage (2) However, the hydraulic pressure drop of 0.02 kgf/cm ² {2 kPa} or less is permissible for some test equipment.	A	7.3.2
	High-pressure fluid leakage	(1) No fluid leakage (2) However, the hydraulic pressure drop of 7 kgf/cm ² {686 kPa} or less is permissible for some test equipment.	A	7.3.3
	High-pressure air leakage	No air leakage	A	7.3.4
	Low-temperature fluid leakage	No fluid leakage	A	7.3.5

Table 1 (Continued)

Evaluation Item		Evaluation Standard	Quality Rank	Evaluation Method
Airtightness	Boot waterproofness (I)	No water infiltration in a boot	A	7.3.6
	Boot waterproofness (II)	No water infiltration in a boot	A	7.3.7
	Airtightness of connector bolt area	No fluid leakage	A	7.3.8
	Airtightness of bleeder area	No fluid leakage	A	7.3.9
Strength and durability	Caliper pressure resistance	No fluid leakage nor destruction	A	7.4.1
	Torque destruction strength	No destruction	A	7.4.2
	Torque durability (I)	(1) no destruction, fluid leakage nor abnormal abrasion (2) The deformation of the torque plate shall be 0.5 mm or less.	A	7.4.3
	Torque durability (II)	(1) No destruction, fluid leakage, abnormal abrasion nor looseness (2) The drop in the tightening torque shall be 30% or less of the minimum specified tightening torque.	A	7.4.4
	High-pressure durability of caliper	No destruction nor fluid leakage	A	7.4.5
	Fixing bolt strength	(1) No destruction (2) No breakage	A	7.4.6
	Strength at bleeder threaded portion and connector bolt threaded portion	No destruction nor fluid leakage	A	7.4.7
	Vibration resistance	No destruction, deformation nor fluid leakage	A	7.4.8
	High-temperature operating durability	No fluid leakage	A	7.4.9

Table 1 (Continued)

Evaluation Item		Evaluation Standard	Quality Rank	Evaluation Method
Strength and durability	Low-temperature operating durability	No fluid leakage	A	7.4.10
	Caliper tilting rigidity	(1) $\delta 1 \leq 0.01 \text{ mm}$ (2) $\delta 2 \leq 0.005 \text{ mm}$	B	7.4.11
Environmental resistance	Aging resistance	No crack in a boot nor extreme adhesion	A	7.5.1
	Low-temperature bending	No crack in a boot. The tested boot shall return to the original shape within one minute.	A	7.5.2
	Permanent elongation	75% or less	A	7.5.3
	Ozone resistance	No crack which and be observed with a magnifying glass of two magnifications	A	7.5.4
	Corrosion resistance (Salt spray)	(1) The rusting area after one cycle shall be 10% or less of the surface area of the caliper and torque plate (excepting a machined surface).	B	7.5.5
		(2) No obstruction to pad exchange after 4 cycles (Rust on a pin, etc.) (3) The pad sliding resistance after 8 cycles shall be equivalent to the hydraulic pressure of 10 kgf/cm^2 {0.98 MPa} or less. (4) The measured caliper sliding resistance shall be approved by the Engineering Department concerned of Kia.	A	
Abrasion-resistance	Bias abrasion	(1) 1.0 mm or less in the circumferential direction (2) 0.5 mm or less in the radial direction	B	7.6.1
	• Drag torque	60 kgf · cm {588 N · cm} or less	B	7.2.7

Table 1 (Continued)

Evaluation Item		Evaluation Standard	Quality Rank	Evaluation Method
Heat damage	Heat damage on boot (I)	(1) No damage on boots (2) No crack on the pad	A	7.7.1
	Heat damage on boot (II)	(1) No damage on boots (2) No crack on the pad	A	7.7.2
Brake noise	Noise (Vehicle)	(1) Noise level ① Till 10000 km: Level D or lower in table 4 ② After 1000km: The occurrence frequency of the level C in Table 4 shall be 10% or less.	A	7.8.1
	Noise dynamo	(1) Noise index shall satisfy the following ① and ④ ① Type I-1 (a) From the 1st to 4th noise check: 0.1 or less (b) The 5th noise check: 0.25 or less However, groan shall be 0.1 or less from the 1st to 5th noise check. ② Type I-2 (a) From the 1st to 4th noise check: 0.5 or less (b) The 5th noise check: 1.0 or less However, groan shall be 0.1 or less from the 1st to 5th noise check. ③ Type II (a) From the 1st to 4th noise check: 2.5 or less (b) The 5th noise check: 5.0 or less (2) Noise level during fade: Level C or lower (3) No braking noise (squeaking noise) during non-braking	B	7.8.2

Table 1 (Continued)

Evaluation Item		Evaluation Standard	Quality Rank	Evaluation Method
Brake noise	Noise dynamo (Matrix mode)	(1) Noise index at each cycle shall be the value or lower below. ① passenger car (Inclusive of taxi but not one-box car): ② Truck (Inclusive of one-box car): 2.0 or lower (2) No noise exceeding the level B in Table 4	B	7.8.3
	Braking noise	No rattling noise, etc. exceeding the level C in Table 4	B	7.8.4
	Stick slip noise	85 dB or less	B	7.8.5
	Judder	No judder noise exceeding the level C in Table 4	B	7.8.6
Safety	Conformability to regulations	To satisfy structural requirements and parts approval standards of (1) to (4) below according to the destination indicated in the drawing (1) FMVSS No. 105 (2) ADR No. 31/35A (3) ECE No. 13 (4) Korean safety standard, and laws and regulations of other countries	AR	7.9.1
	Safety at full abrasion	No fluid leakage, disengagement of boots nor coming-off of the back metal	A	7.9.2
	Piston knock-back	Extension of pedal stroke: 10mm or less	A	7.9.3
	Missassembly and shortage of parts	To provide fool-proof or identification	A	7.9.4
	Foreign matter intrusion	Metal 10mg or less	A	7.9.5
	Parts transportation	No coming-off by vibration nor dust intrusion	A	7.9.6

Table 1 (Continued)

Evaluation Item		Evaluation Standard	Quality Rank	Evaluation Method
Pad wear indicator	Operation sound	(1) Level C or lower at braking described in Table 4 (2) However, not the same tone as squeal and not unpleasant	B	7.10.1
	Operating durability	No damage nor coming-off	B	7.10.2
	Maintenance ease nozzle tip	A special tool shall not be necessary.	B	7.11.1
	Air bleeding	Residual air: 0.1 cm ³ or less	B	7.11.2

7. Evaluation Method

7.1 Common evaluation condition

7.1.1 Standard atmospheric condition for testing

Unless otherwise specified, the standard standard atmospheric condition shall be a standard temperature condition of 20°C class 15 ($20 \pm 15^\circ\text{C}$) and a standard humidity condition of 65% class 20 ($65 \pm 20\%$) specified in KS A 0006 (Standard Atmospheric Conditions for Testing).

7.1.2 Standard condition of test sample

Unless otherwise specified, a new test sample shall be used.

7.1.3 Brake fluid for testing

C-BF25 specified in KES B-M023 or the equivalent

7.2 Basic characteristics

7.2.1 Piston seal

According to KS R 2069 (Elastomeric Seals of Hydraulic Disc Brake Cylinders for Automobiles)

7.2.2 Fluid amount required

(1) Perform regular air bleeding of the following ① and ② in the vehicle condition

(a new pad with a shim and metallic pad without a shim).

① Flow the brake fluid for 5 to 10 seconds.

② Taking (hydraulic pressure 20 kgf/cm² {1960 kPa} → bleeder release) as one cycle.

perform air bleeding of 10 to 20 cycles until no coming-out air is visually confirmed.

(2) After the regular air bleeding, apply the pre-hydraulic pressure of 70 kgf/cm² {6.86 MPa}

5 times in the vehicle condition (a new pad with a shim and a metallic pad without a

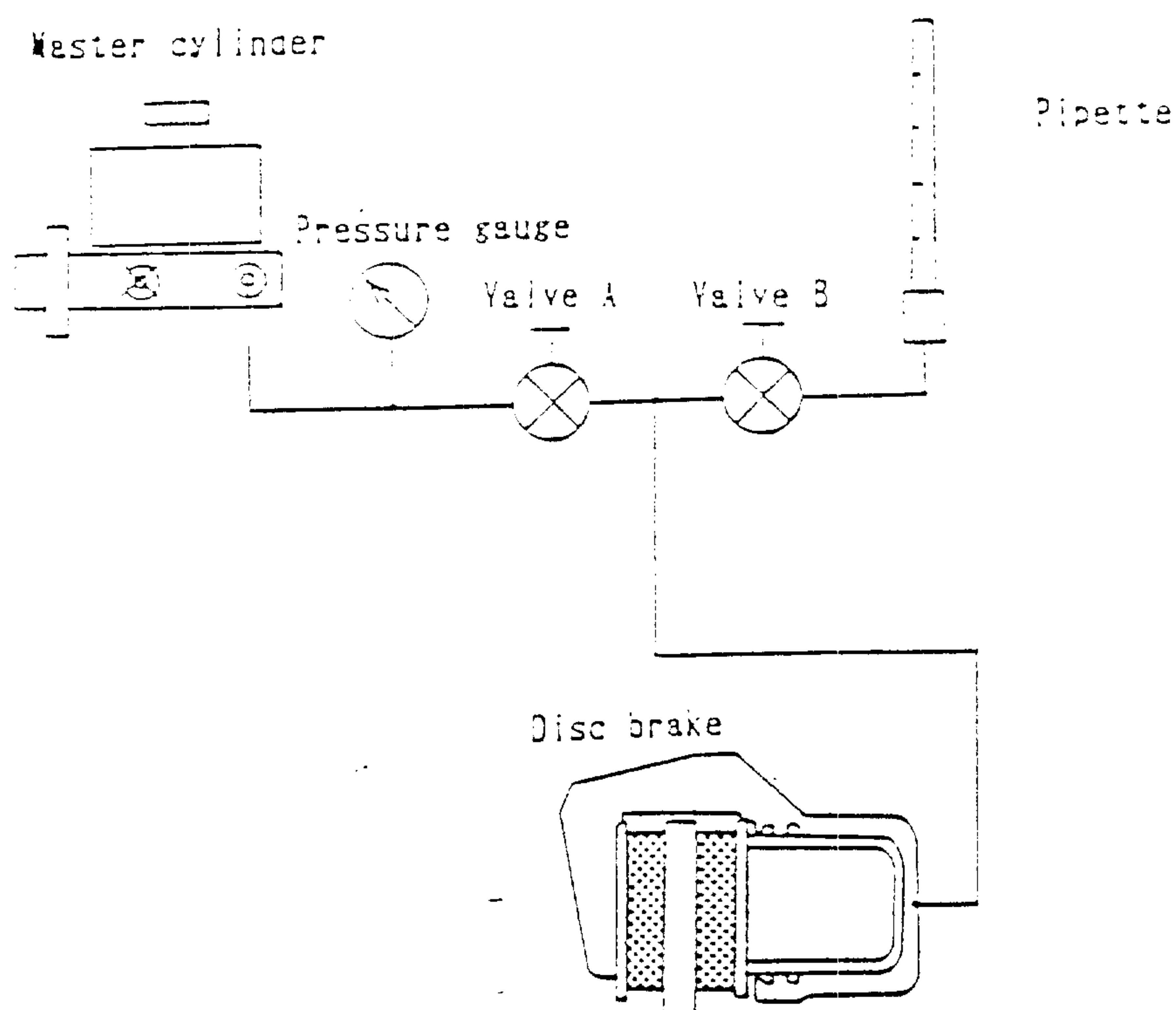
shim). Then, measure the fluid amount required at 5 kgf/cm² {0.49 MPa} , 10 kgf/cm²

{0.98 MPa} , 20 kgf/cm² {1.96 MPa} , 30 kgf/cm² {2.94 MPa} , 40 kgf/cm² {3.92 MPa}

70 kgf/cm² {6.86 MPa} and 100 kgf/cm² {9.81 MPa} 5 times respectively to calculate the average amount.

Fig 3 shows an example of a testing device

Fig.3



- (3) After the measurement, disassemble the disc brake and reassemble it in the brake fluid to bleed air fully. As a principle, the measurement after a full air bleeding shall be made at only the development stage.

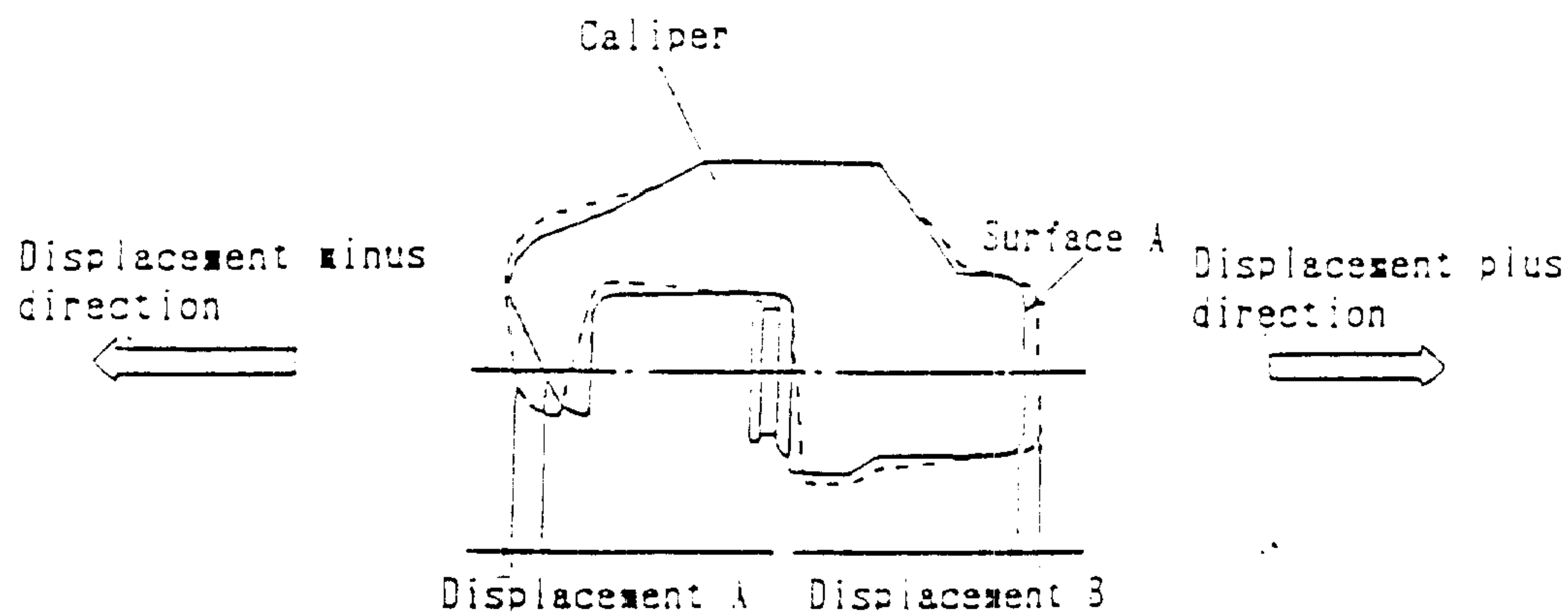
The measured value shall be reported, for reference, to the Engineering Department concerned of Kia.

- (4) After the full air bleeding, perform the same measurement as (2).
- (5) Evaluate a half number of the sample size specified in Appendix Table 1 for the RH and LH side disc brake respectively.

7.2.3 Hydraulic pressure rigidity

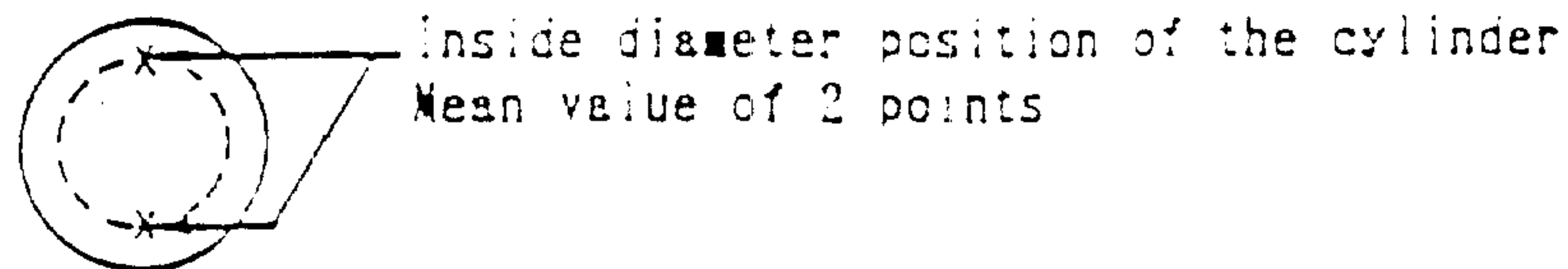
- (1) After applying the pre-hydraulic pressure of 70 kgf/cm² {6.86 MPa} 5 times in the vehicle condition, measure the displacement of the caliper on the cylinder center at every 5 kgf/cm² {0.49 MPa}, 10 kgf/cm² {0.98 MPa}, 20 kgf/cm² {1.96 MPa}, 30 kgf/cm² {2.94 MPa}, 40 kgf/cm² {3.92 MPa}, 60 kgf/cm² {5.88 MPa}, 70 kgf/cm² {6.86 MPa}, 80 kgf/cm² {7.85 MPa} and 100 kgf/cm² {9.81 MPa}.
- (2) Evaluate a half number of the sample size specified in Appendix Table 1 for the RH and LH side disc brake respectively.
- (3) Fig. 4 shows an example of a testing device.

Fig. 4



- ① Fig. 5 shows the calculation method of the displacement B.

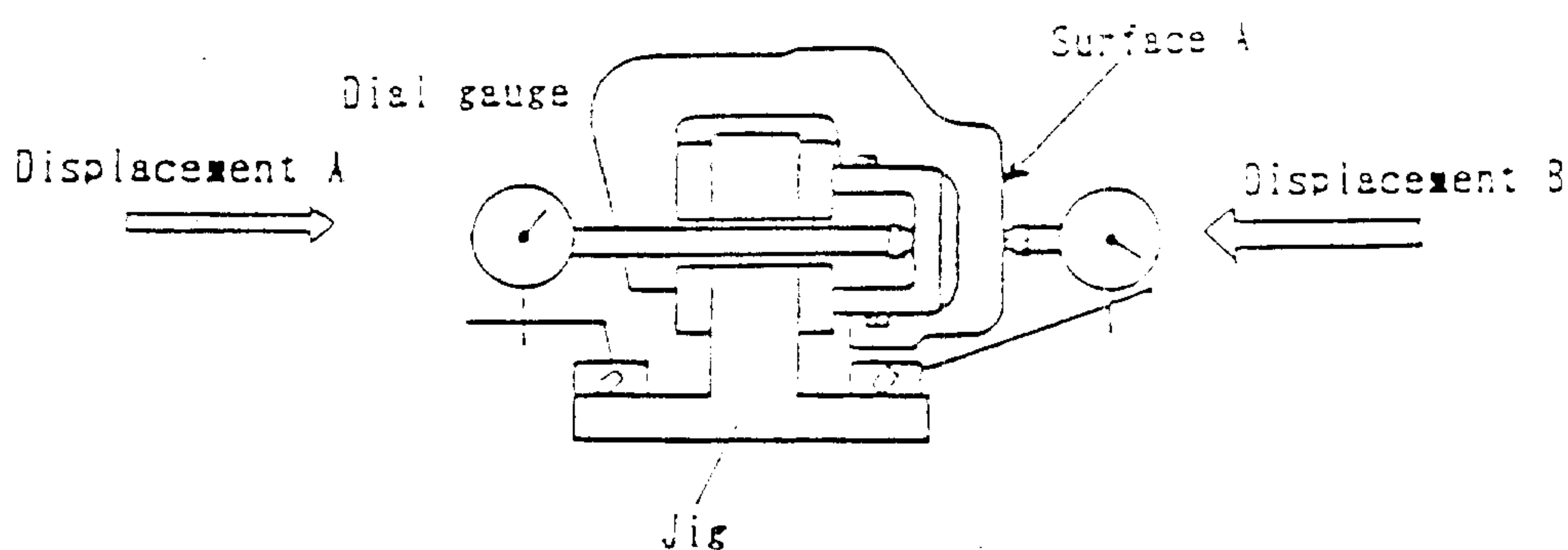
Fig. 5 (Surface A in Fig.4)



7.2.4 Piston return amount

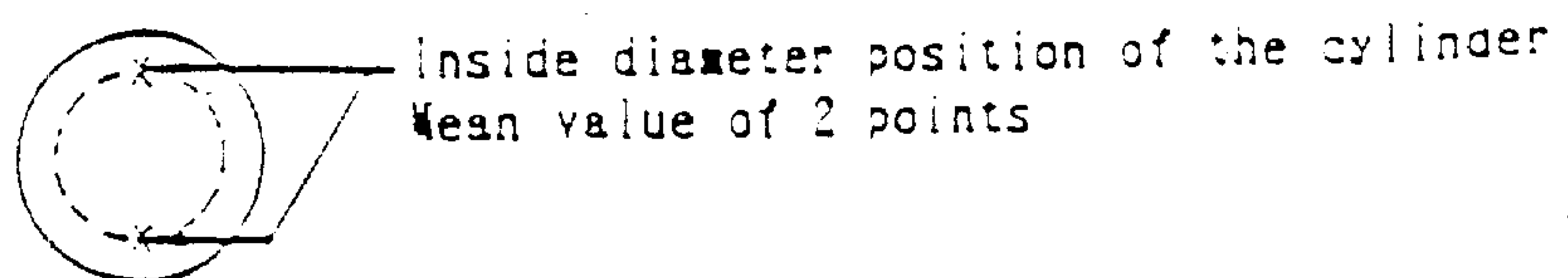
- (1) Install the disc brake together with a metallic pad (same thickness as the new one) to the jig and set dial gauges at the piston center and at the cylinder.
After applying the pre-hydraulic pressure of 70 kgf/cm^2 (6.86 MPa) 5 times, measure the displacement for the cylinder and that of the piston at 70 kgf/cm^2 (6.86 MPa) .
- (2) Measure the displacement of the cylinder and that of the piston after pressure release and calculate the piston return amount by the displacement of (1)
- (3) Evaluate a half number of the sample size specified in Appendix Table 1 for the RH and LH side disc brake respectively.
- (4) Fig. 6 shows an example of a testing device.

Fig. 6



- ① Fig. 7 shows the calculation method of the displacement B.

Fig. 7 (surface A in Fig. 6)



7.2.5 Caliper sliding resistance

- (1) Measure the sliding resistance by sliding the caliper of the disc brake.
- (2) The sliding directions shall be the pressurizing direction and the pressure-reducing direction.
- (3) Evaluate a half number of the sample size specified in Appendix Table 1 for the RH and LH side disc brake respectively.

7.2.6 Piston sliding resistance

- (1) Measure the sliding resistance by sliding the piston of the disc brake.
- (2) The sliding directions shall be the pressure-reducing (piston returning direction) direction.
- (3) Evaluate a half number of the sample size specified in Appendix Table 1 for the RH and LH side disc brake respectively.

7.2.7 Drag torque

- (1) Push back the piston in the vehicle condition (pad of the same thickness as the new one with a shim) and apply the pre-hydraulic pressure of 70 kgf/cm² {6.86 MPa} 5 times.
Measure the minimum and the maximum drag torque at the 1st and 10th rotation while rotating the rotor without the hydraulic pressure application.
- (2) The rotor runout of the disc brake shall be 0.05 mm or less in the vehicle condition.
- (3) The measuring position of drag torque shall be 10 mm inside the outer circumference of the rotor.
- (4) Evaluate a half number of the sample size specified in Appendix Table 1 for the RH and LH side disc brake respectively.

7.2.8 Vacuum holding force

- (1) When the vacuum air bleeding method is not applied.
- ① Vacuumize and disc brake with a vacuum pump and colse the valve shown in Fig. 8.
Measure the stable vacuum value (vacuum holding force).
- (2) When the vacuum air bleeding method is applied
- ① Vacuumize the disc brake with a vacuum pump, which is capable of vacuumizing to 759 mmHg {100.1 kPa} or more within 25 seconds, for 25 seconds to measure the vacuum.
 - ② Measure the vacuum 5 seconds after closing the valve to calculate the vacuum drop by the vacuum of ① above.
 - ③ The piping length and its diameter of Fig. 8 shall be arbitrarily chosen.
 - ④ At the mass production stage, vacuumize the disc brake to 700 mmHg {92.4 kPa} or more and measure the vacuum 5 seconds after closing the valve to evaluate the presence of the vacuum drop.
- (3) Fig. 8 shows an example of a testing device.

Fig. 8

