

KES

Master Vac

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KIA MOTORS

1. Purpose

This standard aims at securing proper quality by standardizing specifications.

Remark : This standard communicates the required specifications accompanying the specification drawings.

2. Scope of Application

This standard specifies the Master Vac. of the vacuum booster equipment for automobile brakes. However, this specification represents the minimum requirements that the master Vac. should have other items and any contents in duplicate shall, in principle, conform to the specification drawing.

3. Meaning of Terminology

(1) Terminology for parts

- (a) Poppet: A diaphragm type valve that has the function of opening and closing the air and vacuum valves.
- (b) Poppet Washer: A part used on the inside, supporting the poppet.
- (c) Poppet Assy: A combination of (A) and (B)
- (d) Operating Rod: A part that delivers a component of depressing force to the master cylinder through a plunger and a reaction disc and makes the valve operate like a input axle.
- (e) Plunger Valve: Forms valve mechanisms while at the same time forms reaction force mechanisms. Also a component of the depressing force delivered to the master cylinder through the reaction disc.
- (f) Diaphragm: A part made of a movable thin plate that maintains, with a shell, air tightness in the engaged portion.
- (g) Diaphragm Plate: A part that sustains the diaphragm and delivers the force of differential pressure to the out-put axle, at the same time functioning as a valve sliding guide, air pathway and as a chamber of the reaction force mechanism.
- (h) Key Assy: A part composed of a key and stopper that defines the position of the plunger.
- (i) Filter: A part preventing alien substances in the air coming into the master vac.
- (j) Silencer: A part that muffles the air intake noise and prevents alien substances coming in.
- (k) Shell: A part that constitute the outer cover of the master vac. and maintains air tightness.
- (l) Reaction Disc: A part that has the function of distributing the reaction force of the master cylinder into the diaphragm plate and plunger. It maintains the air tightness of the outer periphery.

(2) Terminologies indicated in drawings

- (a) Vacuum Out Line : The increase of input at the connected conditions of the vacuum reservoir and booster equipment with the pressure difference operating the power piston reaching a maximum point. Beyond this point, further increases of output forces corresponds equally with the amount of input force. This point shall be defined as the vacuum out line.

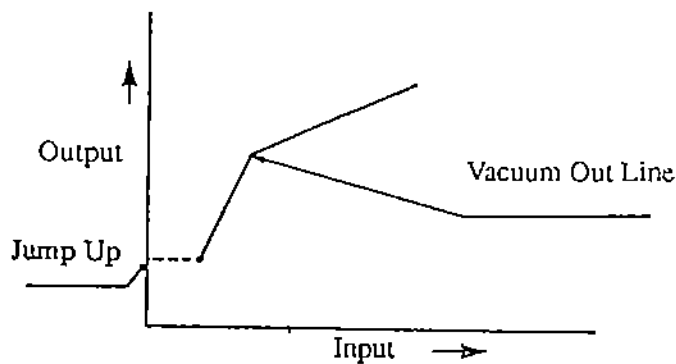


Fig. 1 Input - Output Linear Drawing

- (b) Vacuum Degree: The level below the atmospheric pressure and indicated by the pressure gauge.
- (c) Effective Stroke: The push rod stroke of the booster equipment.
- (d) Valve Stroke: The stroke of the valve, made from the poppet and valve body.
- (e) Jump Up: At the initial operation of the master vac., because of the valve operation resistance between the time of the vacuum chamber closing and the subsequent chamber opening, initial output force becomes effective beyond a specific point. The output value at this point shall be defined as jump up.
- (f) Boosting Force Ratio: The ratio of the input force against the output force below the vacuum out line.
- (g) Single Master Vac.: One vacuum chamber.
Tandem Master Vac.: Two vacuum chamber.

4. Specifications to be Indicated in Approved Drawings of the Suppliers

The following items shall be shown in the suppliers original drawings and submitted when requesting approval.

- (1) Characteristic linear drawing of the master vac.
- (2) Fundamental specifications that determines the performance of the master vac.
(Spring load, Push rod diameter, effective diameter of diaphragm, plunger full length, plunger diameter, etc.)
- (3) Required performance during test proposed in the specifications.
- (4) Other items specially requested in the specifications.

5. Evaluation Standard

The evaluation standards of the master vac. shall be in accordance with follows.

Remark 1. The evaluation item and method shall be as shown in follow:

Evaluation Item		
Durability	Vibration resistance	1st. Evaluation
	• Operation force of slider	2nd. Evaluation (Evaluation item tested after evaluating the vibration resistance)
	•• Noise	3rd. Evaluation (Evaluation item tested after evaluating the operation force)

Evaluation Method		
7.5.1		1st. Evaluation Method
• 7.3.1		2nd. Evaluation Method
•• 7.3.7		3rd. Evaluation Method

2. Quality Ranks shall be represented by A,AR,B or C. The definitions shall be in accordance with KES Q-A002 (Determination and procedure of quality rankings).

5.1 Performance

The evaluation standards for the general performance of the master vac: shall be accordance with Table 1.

Table 1

Evaluation Item	Evaluation Standard	Characteristic Rank	Evaluation Method
Effective Stroke of Push Rod	Over the specified value indicated in the specification drawing.	A	6.2.1
Valve stroke	0.5 mm or less	A	6.2.2
Air Tightness	Vacuum level drop amount: 25mm Hg {3.3 kPa} or less	A	6.2.3
Characteristics of Input and Output Force	① Boosting force ratio Specified value ± 0.15 for Single Type Specified value ± 0.20 for Tandem Type ② for Jump Up Specified value $\pm 5\text{kgf}$ ($\pm 49\text{ N}$) ③ for starting point of operation $6.5 \pm 1.5\text{ kgf}$ ($64 \pm 15\text{ N}$)	A	6.2.4
Responsive property	0.3 sec or less	A	6.2.5
Recovery speed	1.5 sec. or less	A	6.2.6
Quick pressure characteristics	Maximum input load up to 8 mm stroke shall be 40 kgf {392 N} or less	A	6.2.7
Low Temperature operating property		A	6.2.8
• Air Tightness	Vacuum level drop amount: 25mmHg{3.3kPa} or less	A	6.2.3
• Characteristics of Input and Output Force	① Boosting force ratio shall be more than 80% of the normal temperature output characteristics. ② Jump up shall be 80% or more of the normal temperature output characteristics ③ Starting Point of Operations: $6.5 \pm 1.5\text{kgf}$ ($64 \pm 15\text{ N}$)	A	6.2.4

Evaluation Item	Evaluation Standard	Characteristic Rank	Evaluation Method
High Temperature Operation Property		A	6.2.9
• Air Tightness	Vacuum drop Amount: 25mmHg(3.3kPa) or less	A	• 6.2.3
• Input and output characteristics	① Boosting force ratio: 80% or more of the normal temperature output characteristic ② Jump up: more than 80% of the normal temperature output characteristic ③ Starting point of operations: $6.5 \pm 1.5 \text{ kg f}$ ($64 \pm 15 \text{ N}$)	A	• 6.2.4

5.2 Rigidity, Strength

The evaluation standards for the strength of the master vac. shall be in accordance with Table 2.

Table 2

Evaluation Items	Evaluation Standard	Characteristic Rank	Evaluation Method
		Rank	
Shell Rigidity (1)	Under the specified value indicated in the specification	A	6.3.1
Shell Rigidity (2)	Variation of the Push Rod length: 0.3mm or less	A	6.3.2
Strength against Load	No irregularities such as destruction of parts, deformity, or friction wear. Permanent set of Front Shell: 1mm or less	A	6.3.3
Air Tightness	Vacuum drop amount: 25 mmHg (3.3 kPa) or less	A	6.2.3
Input and output characteristics	① Boosting force ratio Single Type: Specified value ± 0.15 Tandem Type: Specified value ± 0.20 ② Jump up: Specified value $\pm 5 \text{ kgf}$ ($\pm 49 \text{ N}$) ③ Start point of operating: $6.5 \pm 1.5 \text{ kgf}$ ($64 \pm 15 \text{ N}$)	A	6.2.4

5.3 Durability

The evaluation standards for the durability of the master vac. shall be in accordance with Table 3.

Table 3

Evaluation Item	Evaluation Standard	Charac- teristic Rank	Evaluation Method																
Normal Temperature Operation Durability	No irregularities such as destruction of parts, deformity or friction wear.	A	6.4.1																
• Air Tightness	Vacuum level drop amount: 25 mmHg (3.3 kPa) or less	A	6.2.3																
• Input and output characteristics	Output variation before the test shall be under the following values : <table><tr><th>Master Vac. diameter in{mm}</th><th>Output Variation kgf {N}</th></tr><tr><td>5{130}</td><td>12{118}</td></tr><tr><td>6{155}</td><td>14{137}</td></tr><tr><td>7{180}</td><td>16{157}</td></tr><tr><td>8{205}</td><td>18{176}</td></tr><tr><td>9{230}</td><td>20{196}</td></tr><tr><td>7 + 8{180+205}</td><td>20{196}</td></tr><tr><td>8 + 9{205+230}</td><td>20{196}</td></tr></table>	Master Vac. diameter in{mm}	Output Variation kgf {N}	5{130}	12{118}	6{155}	14{137}	7{180}	16{157}	8{205}	18{176}	9{230}	20{196}	7 + 8{180+205}	20{196}	8 + 9{205+230}	20{196}	A	6.2.4
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8 + 9{205+230}	20{196}																		
High Temperature Durability	No irregularities such as destruction, deformity or friction wear of the parts	A	6.4.2																
• Air Tightness	Vacuum level drop amount: 25 mm Hg (3.3 kPa) or less	A	• 6.2.3																
• Input and Output characteristics	Output variation before the test shall be the following: <table><tr><th>Master Vac. Diameter in{mm}</th><th>Output Variation kgf {N}</th></tr><tr><td>5{130}</td><td>12{118}</td></tr><tr><td>6{155}</td><td>14{137}</td></tr><tr><td>7{180}</td><td>16{157}</td></tr><tr><td>8{205}</td><td>18{176}</td></tr><tr><td>9{230}</td><td>20{196}</td></tr><tr><td>7+8{180+205}</td><td>20{196}</td></tr><tr><td>8+9{205+230}</td><td>20{196}</td></tr></table>	Master Vac. Diameter in{mm}	Output Variation kgf {N}	5{130}	12{118}	6{155}	14{137}	7{180}	16{157}	8{205}	18{176}	9{230}	20{196}	7+8{180+205}	20{196}	8+9{205+230}	20{196}	A	• 6.2.4
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Evaluation Item	Evaluation Standard	Charac- teristic	Evaluation Method																
Low Temperature	No irregularities such as destruction, deformity or	Rank A	6.4.3																
Operation Durability	friction wear.																		
• Air Tightness	Vacuum level drop amount: 25mmHg(3.3kPa) or less	A	• 6.2.3																
• Input and Output Characteristics	Output variation before the test shall be under the following: <table border="1"><thead><tr><th>Master Vac. Diameter In(mm)</th><th>Output Variation kgf (N)</th></tr></thead><tbody><tr><td>5(130)</td><td>7(69)</td></tr><tr><td>6(155)</td><td>9(88)</td></tr><tr><td>7(180)</td><td>11(108)</td></tr><tr><td>8(205)</td><td>13(127)</td></tr><tr><td>9(230)</td><td>15(147)</td></tr><tr><td>7+8(180+205)</td><td>15(147)</td></tr><tr><td>8+9(205+230)</td><td>15(147)</td></tr></tbody></table>	Master Vac. Diameter In(mm)	Output Variation kgf (N)	5(130)	7(69)	6(155)	9(88)	7(180)	11(108)	8(205)	13(127)	9(230)	15(147)	7+8(180+205)	15(147)	8+9(205+230)	15(147)	A	• 6.2.4
Master Vac. Diameter In(mm)	Output Variation kgf (N)																		
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8+9(205+230)	15(147)																		
Vibration Resistance and Durability	No irregularities such as destruction, deformity, or friction wear.	A	6.4.4																
• Air Tightness	Vacuum level drop amount: 25mmHg(3.3kPa) or less	A	• 6.2.3																
• Input and Output Characteristics	① Boosting force ratio Single Type: Specified Value ± 0.15 Tandem Type: Specified Value ± 0.20 ② Jump up: Specified Value $\pm 5\text{kgf}(\pm 49\text{N})$ ③ Start point of operations: $6.5\pm 1.5\text{kgf}(64\pm 15\text{N})$		• 6.2.4																

5.4 Environmental Resistance

The evaluation standard for the environmental resistance of the master vac. shall conform to Table 4.

Table 4

Evaluation Item	Evaluation Standard	Characteristic Rank	Evaluation Method
Corrosion Resistance (I)	Irregularities such as corrosion derivatives swell ups occurrence of peel offs and weakening of the paint film shall not be large than 2 mm in diameter per every 100 cm ² of the paint film.	A	6.5.1
Corrosion Resistance (II)	The performance and strength shall satisfy the following.		6.5.2
• Air Tightness	Vacuum level drop amount: 25 mm Hg {3.3kPa} or less	A	• 6.2.3
• Input and Output Characteristics	① Boosting force Ratio Single Type: Specified Value ± 0.15 Tandem Type: Specified Value ± 0.2 ② Jump Up: Specified Value $\pm 5\text{kgf}$ ($\pm 49\text{N}$) ③ Start Point of operations: $6.5 \pm 1.5\text{ kgf}$ ($64 \pm 15\text{ N}$)	A	• 6.2.4
• Strength against the Load	No irregularities such as destruction, deformity or friction wear. Permanent set of Front Shell: 1 mm or less	A	• 6.3.3
Low Temperature Operation Heakage	No destruction or deformity of the parts	A	6.5.3
• Air Tightness	Vacuum level drop amounts: 25 mm Hg {3.3 kPa}	A	• 6.2.3
• Input and Output Characteristics	① Boosting force ratio Single Type: Specified Value ± 0.15 Tandem Type: Specified Value ± 0.2 ② Jump-Up: Specified Value $\pm 5\text{kgf}$ ($\pm 49\text{N}$) ③ Start Point of Operations: $6.5 \pm 1.5\text{ kgf}$ ($64 \pm 15\text{N}$)	A	• 6.2.4
Heat Impact Resistance	Performance shall satisfy the following		6.5.4
• Air Tightness	Vacuum level drop amount: 25mmHg {3.3kPa} or less	A	• 6.2.3

Evaluation Item	Evaluation Standard	Charac- teristic Rank	Evaluation Method																
• Input and Output Characteristics	① Boosting force ratio Single Type: Specified Value ± 0.15 Tandem Type: Specified Value ± 0.20 ② Jump-up: Specified Value $\pm 5\text{kgf}(\pm 49\text{N})$ ③ Start point of operations: $6.5 \pm 1.5\text{kgf}(64 \pm 15\text{N})$	A	• 6.2.3																
Gasoline resistance operation	Performance shall satisfy the following		6.5.5																
• Air tightness	Vacuum level drop amounts: 25mmHg (3.3kPa) or less		• 6.2.3																
• Input and Output Characteristics	Output variation before the test shall be under the following values. <table><tr><th>Master Vac.Diameter in{mm}</th><th>Output Variation kgf{N}</th></tr><tr><td>5{130}</td><td>7{69}</td></tr><tr><td>6{155}</td><td>9{88}</td></tr><tr><td>7{180}</td><td>11{108}</td></tr><tr><td>8{205}</td><td>13{127}</td></tr><tr><td>9{230}</td><td>15{147}</td></tr><tr><td>7+8{180+205}</td><td>15{147}</td></tr><tr><td>8+9{205+230}</td><td>15{147}</td></tr></table>	Master Vac.Diameter in{mm}	Output Variation kgf{N}	5{130}	7{69}	6{155}	9{88}	7{180}	11{108}	8{205}	13{127}	9{230}	15{147}	7+8{180+205}	15{147}	8+9{205+230}	15{147}	A	• 6.2.4
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Preservation Corrosion Resistance	Performance shall satisfy the following:		6.5.6																
• Input and Output Characteristics	① Boosting force ratio Single Type: Specified Value ± 0.15 Tandem Type: Specified Value ± 0.20 ② Jump-up: Specified Value $\pm 5\text{kgf}(\pm 49\text{N})$ ③ Start point of operations: $6.5 \pm 1.5\text{kgf}(64 \pm 15\text{N})$	A	• 6.2.4																

5.5 Noise

The evaluation standards for noises of the master vac. shall be in accordance with Table 5.

Table 5

Evaluation Item	Evaluation Standard	Characteristic Rank	Evaluation Method
Operation Noise	No unpleasant noises Air intake noise: 75 phon or less	A	6.6.1

6. Evaluation Method

6.1 Common Evaluation Condition

6.1.1 Standard condition of test place

Unless otherwise specified, the standard atmospheric condition for testing shall be the normal temperature and normal humidity, that is grade 15 of 20°C ($20 \pm 5^{\circ}\text{C}$) and grade 20 of 65% ($65 \pm 20\%$) respectively specified as in JIS Z 8703 (Standard Atmospheric Condition for Testing).

6.2 Performance

6.2.1 Effective stroke of push rod

Connect the vacuum source to the master vac. and set the stroke by adding a load of 50 kgf {490N} or less to the operating rod having a vacuum level of 0.500 mm Hg {0.66.7kPa}. At this moment, measure the amount of the push rod stroke test equipment example is shown in Figure 2.

Fig. 2

