Thermostat

1. Scope

This standard specifies wax thermostats to be used for controlling water temperatures in water-cooled automobile engines (hereinafter referred to as "thermostats").

2. Types

The types of thermostats shall be as shown in **Table 1.** The shapes shall be as shown in **Fig. 1, Fig. 2** and **Fig. 3.** The air vent hole and jiggle valve to be used for the thermostats shall be as shown in **Fig. 4** and **Fig. 5** respectively.

Table 1

Type	Symbol	Remarks
In-line type	I	See **Fig. 1**
Side by-pass type	S	See **Fig. 2**
Bottom by-pass type	B	See **Fig. 3**

Fig. 1 In-line type (I type)

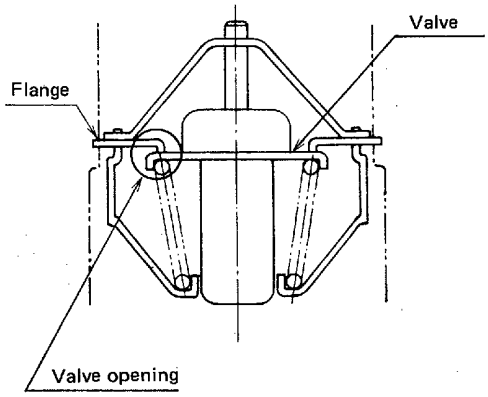


Fig. 2 Side by-pass type (S type)

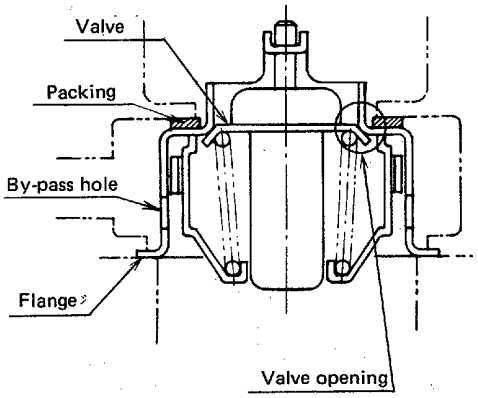


Fig. 3 Bottom by-pass type (B type)

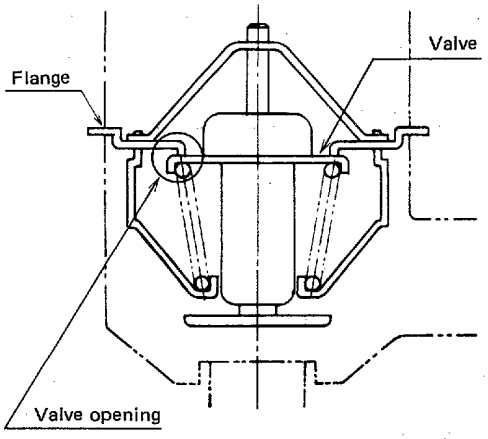
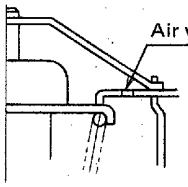
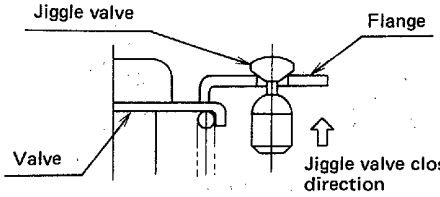


Fig. 4 Air vent hole



Remark: To be prepared on the flange or valve.

Fig. 5 Jiggle valve



Remarks 1: To be prepared on the flange or valve.
2: To be installed as shown above relative to the jiggle valve closing direction.

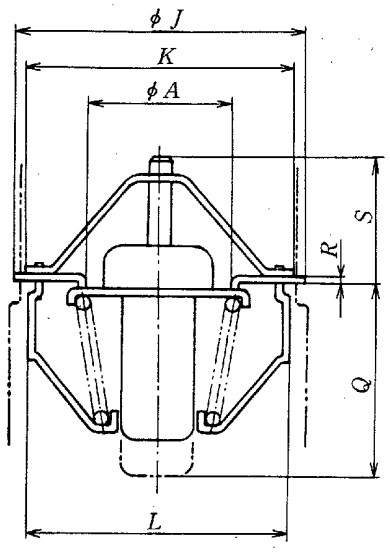
3. Dimensions

Dimensions shall be as follows for each type of thermostats.

3.1 In-line type

Dimensions shall be as shown in **Table 2.**

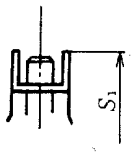
Table 2

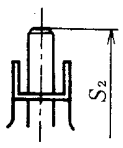


Unit: mm

Type · Nominal size	A	J	K (max)	L (max)	Q (max) (1)	R	S (max) (2)
I · 38a	20 ± 0.2	38 ± 0.2	33	33	38	0.8 ± 0.1	28
I · 38b	20 ± 0.2	38 ± 0.2	33	33	42	0.8 ± 0.1	28
I · 42a	25 ± 0.2	42 ± 0.2	37	37	38	0.8 ± 0.1	28
I · 42b	25 ± 0.2	42 ± 0.2	37	37	42	0.8 ± 0.1	28
I · 44a	28 ± 0.2	44 ± 0.2	38	37	38	0.8 ± 0.1	28
I · 44b	28 ± 0.2	44 ± 0.2	38	37	42	0.8 ± 0.1	28
I · 52a	33 ± 0.2	52 ± 0.2	47	47.5	38	1 ± 0.1	28
I · 52b	33 ± 0.2	52 ± 0.2	47	47.5	42	1 ± 0.1	28
I · 54a	33 ± 0.2	54 ± 0.2	47.5	47.5	38	1 ± 0.1	28
I · 54b	33 ± 0.2	54 ± 0.2	47.5	47.5	42	1 ± 0.1	28
I · 54c	33 ± 0.2	54.5 ± 0.2	48	47.5	38	1 ± 0.1	28
I · 54d	33 ± 0.2	54.5 ± 0.2	48	47.5	42	1 ± 0.1	28

Notes (1) *"Q"* indicates dimensions at 120°C.
(2) *"S"* shall include S_1 or S_2 illustrated in the figs. below.



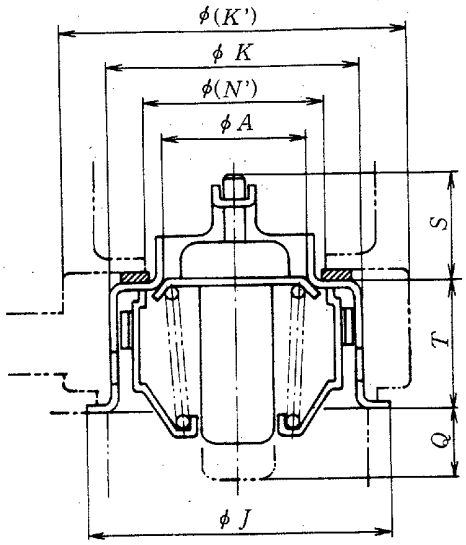


Remarks: **1:** *"A"* indicates valve diameters.
2: Jiggle valve(s) may be installed to decrease water leakage.
3: Rubber packing(s) may be placed at the valve opening(s) to decrease water leakage.

3.2 Side by-pass type

Dimensions shall be as shown in **Table 3.**

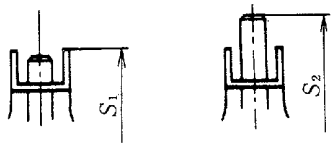
Table 3



Unit: mm

Type · Nominal size	*A*	*J*	*K*	*Q* (max) (3)	*S* (max) (4)	*T*	(*K'*) (5)	(*N'*) (min) (5)
S · 73	35 ± 0.2	73 ± 0.3	60	35	45	26 ± 0.3	(67)	(40)
S · 78	40 ± 0.2	78 ± 0.3	68	35	45	30 ± 0.3	(76)	(45)
S · 83	45 ± 0.2	83 ± 0.3	73	35	45	30 ± 0.3	(87)	(50)
(S · 84a)	48 ± 0.2	84 ± 0.3	72	35	45	25 ± 0.3	—	—
(S · 84b)	48 ± 0.2	84 ± 0.3	75	35	45	25 ± 0.3	—	—
S · 88	50 ± 0.2	88 ± 0.3	78	35	45	30 ± 0.3	(96)	(55)

Notes (3): *"Q"* indicates dimensions at 120°C.
(4): *"S"* shall include S_1 or S_2 illustrated in the figs. below.
(5): *K'* and *N'* indicate reference dimenions of mating part.

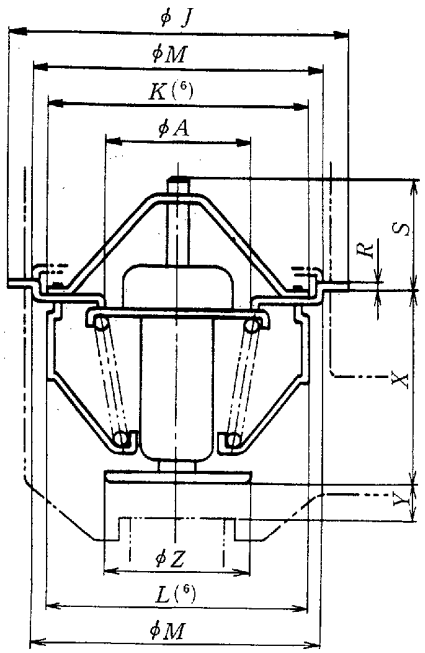


Remarks **1:** Use of those thermostats with their nominal sizes parenthesized shall be avoided whenever possible.
2: *"A"* indicates valve dimensions.
3: Jiggle valve(s) may be installed to decrease water leakage.
4: Rubber packing(s) may be placed at the valve opening(s) to decrease water leakage.

3.3 Bottom by-pass type

Dimensions shall be as shown in **Table 4.**

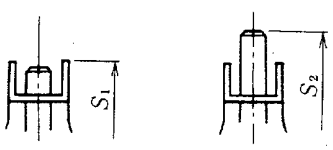
Table 4



Unit: mm

Type · Nominal size	A	J	M (max)	R	S (max)(7)	X	Y(8)	Z
B · 44	20 ± 0.2	44 ± 0.2	—	0.8 ± 0.1	27	33 ± 1	4	20
B · 48	25 ± 0.2	48 ± 0.2	—	0.8 ± 0.1	27	33 ± 1	6	25
B · 52a	28 ± 0.2	52 ± 0.2	—	0.8 ± 0.1	27	33 ± 1	6	28
(B · 52b)	33 ± 0.2	52 ± 0.2	—	1 ± 0.1	27	33 ± 1	6	28
B · 54	33 ± 0.2	54 ± 0.2	—	1 ± 0.1	27	33 ± 1	6	28
B · 73	40 ± 0.2	73 ± 0.3	65	$1.2^{+0.2}_{-0.1}$	38	35 ± 1	8	31
B · 75	40 ± 0.2	75 ± 0.3	65	$1.2^{+0.2}_{-0.1}$	38	35 ± 1	8	31
(B · 78)	50 ± 0.2	78 ± 0.3	69	$1.2^{+0.2}_{-0.1}$	38	43 ± 1	8	51
B · 82	45 ± 0.2	82 ± 0.3	72	$1.2^{+0.2}_{-0.1}$	38	43 ± 1	8	51
B · 88	50 ± 0.2	88 ± 0.3	78	$1.2^{+0.2}_{-0.1}$	38	43 ± 1	8	51
B · 94	55 ± 0.2	94 ± 0.3	84	$1.2^{+0.2}_{-0.1}$	38	43 ± 1	9.5	55

Notes (6): *"L"* and *"K"* shall not be greater than *"M"* in dimensions.
(7): *"S"* shall include S_1 and S_2 illustrated in the figs. below.
(8): When dimension *Y* is 8 mm or longer, the maxim lift of 10 mm or above shown in **Table 6** shall be used.



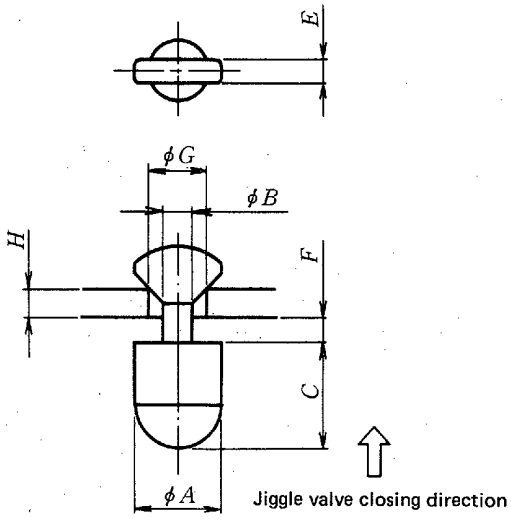
Remarks **1:** Use of those thermostats with their nominal size parenthesized shall be avoided whenever possible.
2: *"A"* indicates valve dimensions.
3: Jiggle valve(s) may be installed to decrease water leakage.
4: Rubber packing(s) may be placed at the valve opening(s) to decrease water leakage.

3.4 Jiggle valve (refer to Fig. 5)

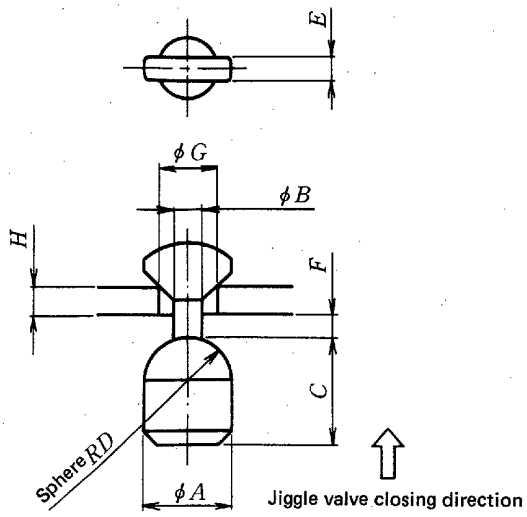
Forms and dimensions shall be as shown in **Table 5.**

Table 5

Form I



Form II



Unit: mm

Jiggle valve designation	Valve closing pressure (max) (kPa)	Valve closing air flow rate (min) (L/min)	*A*	*B*	*C*	Sphere RD	*E* (max)	*F*	*G*	Form
J - 1	1	3	4.0	1.5	2.0	–	1.2	1	2.5	I
J - 2	1	5	4.0	1.5	2.0	2	1.2	2	3.0	II
J - 3	1.5	5	4.0	1.5	5.0	–	1.2	1	2.5	I
J - 4	1.5	7	4.0	1.5	5.0	2	1.2	2	3.0	II
J - 5	3	12	6.0	2.0	6.0	–	1.5	1.5	3.5	I
J - 6	3	14	6.0	2.0	6.0	3	1.5	2	3.5	II

Remarks 1: The values are specified on the following conditions; plate thickness = 1.0 mm, material of jiggle valve: brass, and direction of jiggle valve: that of gravity. Various kinds of materials (e.g. stainless steel, resin) may be used, provided that the forms and dimensions are different according to the material.

2: Jiggle valve(s) may be used regardless of the thermostat direction. Preferably, however, when the jiggle valve(s) is used in any direction other than that of gravity, the thermostat shall be placed on an engine so that jiggle valve(s) is in the place where the water level is the highest. It should be noted that, in this case, the valve closing water pressure, valve closing air pressure and valve closing air flow rate are all different from the above-mentioned values.

3: Jiggle valve-to-housing clearance shall be greater for Form II than for Form I, because the jiggle valve stroke of Form II is larger.

4. Performance

Performance shall be as follows when tested in accordance with the test procedures specified in section 5.

4.1 Valve opening temperature, valve fully opening temperature, full-open lift and valve closing temperature

Valve opening temperatures, valve fully opening temperatures, full-open lifts and valve closing temperatures for thermostats shall be as specified in **Table 6.**

Each measurement shall be made with the test temperature kept constant for about 4 times as long as the time constant of the water temperature.

4.2 Water leakage

Amount of water leakage when the thermostat valve is closed shall not exceed the values specified in **Table 7** for the case without jiggle valve under pressure difference of 20 kPa and 60 kPa, values specified in **Table 8** for the case with a jiggle valve(s), and values specified in **Table 9** for the case with a jiggle valve(s) and a rubber part(s) on the valve opening.

Table 6

Nominal valve opening temperature	Fully opened lift(9) mm			Valve opening temperature(10) °C	Valve fully opening temperature(10) °C	Valve closing temperature(11) °C
	In-line type	Side by-pass type	Bottom by-pass type			
71a	8 and above	8 and above	8 and above	71 ± 2	85	66 and above
71b	–	10 and above	10 and above			
76a	8 and above	8 and above	8 and above	76 ± 2	90	71 and above
76b	–	10 and above	10 and above			
82a	8 and above	8 and above	8 and above	82 ± 2	95	77 and above
82b	–	10 and above	10 and above			
88a	8 and above	8 and above	8 and above	88 ± 2	100	83 and above
88b	–	10 and above	10 and above			

4.3 Hysteresis, high-temperature resistance, durability, low-temperature resistance and response

Hysteresis, high-temperature resistance, durability, low-temperature resistance and response of thermostats shall not exceed the values shown in **Table 10.**

5. Test procedures

The test procedures shall be as follows. The thermostat to be used as a test specimen shall be fully opened and closed with hot water and cold water at least 5 times before each test.

5.1 Valve opening temperature test (Confirmation test)

The valve shall be confirmed to be closed after the thermostat is held for about 4 times as long as the time constant(12) in an agitating water bath of which water temperature is kept at the lower limit of the valve opening temperature specified in **Table 6.**

Table 7

Valve diameter (dimension A) mm	Water leakage L/min	
	20 kPa	60 kPa
33 and below	0.8	1.5
Over 33 thru 45	1.3	2.0
Over 45	1.8	2.5

Table 8

Valve diameter (dimension A) mm	Water leakage L/min	
	20 kPa	60 kPa
33 and below	0.3	0.5
Over 33 through 45	0.7	1.0
Over 45	1.2	1.5

Table 9

Valve diameter (dimension A) mm	Water leakage L/min	
	20 kPa	60 kPa
33 and below	0.15	0.2
Over 33 through 45	0.15	0.2
Over 45	0.15	0.2

Table 10

Classification by max. lift	Hysteresis °C	High-temperature resistance		Durability			Low-temperature resistance	Response
		Change in the valve opening temp. °C	Max. lift derease rate %	Change in the valve opening and closing temps. °C	Max. lift decrease rate %	Water leakage	Change in the valve opening temp. °C	(Time constant) S
Max. lift of 8 mm and above	3	3	12	3	12	12% increment from values specified in **Tables 7, 8** and **9**	1	65
Max. lift of 10 mm and above	3.5	3.5	12	3.5	12		1	120

Remarks 1: Classification by max. lift conforms to **Table 6.**

2: When measuring water leakage after a durability test, the valve and valve-seat may be cleaned to remove scale, foreign article, etc.

The valve shall be confirmed to be open when the above test procedure is followed with the water temperature changed to the upper limit of the valve opening temperature specified in **Table 6.**

Note ([12]): See sub-section **5.9** for the definition of the time constant and how to find it.

5.2 Full-open lift test

The valve lift shall be measured after the thermostat has been held about 4 times as long as the time constant in the agitating water bath of which water temperature is kept at the valve fully opening temperature specified in **Table 6**, or in the agitating water bath immediately after completion of the valve closing temperature test described in para. **5.1** above, with water temperature raised to the valve fully opening temperature specified in **Table 6.**

5.3 Valve closing temperature test (confirmation test)

After the thermostat has been warmed up in the agitating water bath so that the valve opens, or after completion of the test described in para. **5.2** above and lowering the water temperature to the lower limit of the valve fully opening temperature specified in **Table 6** and holding at this position for about 4 times as long as the time constant, confirm that the valve lift is not greater than 0.05 mm.

5.4 Water leakage test

The water leakage shall be measured on the thermostat immersed in cool water with pressure differences of 20 kPa and 60 kPa applied across the valve. The term "across the valve" means the portions before and after the flange illustrated in **Fig. 1** and **Fig. 3** or the packing illustrated in **Fig. 2**, and higher pressure shall be applied to the after side for each case. In case of a thermostat accompanying a jiggle valve, pressure shall be applied from the valve closing direction of the jiggle valve. In principle, the measurement shall be conducted at two points of 20 kPa and 60 kPa.

5.5 Hysteresis test

After placing a thermostat in an agitating water bath in which water temperature is kept constant, and holding it (for about 4 times as long as the time constant) until the valve lift is stabilized, the water temperature and valve lift shall be recorded. The measurement shall be achieved at the positions from the valve close to full open with the water temperature raised stepwise, and vice versa, that is, at the positions from the full open to valve close with the water temperature lowered stepwise. The hysteresis shall mean the width of temperatures at the point where the temperature – lift characteristic curves for both rising and falling temperatures intersect the lift of 2 mm on the graph showing values obtained in the measurement.

5.6 High-temperature resistance test

A thermostat on which the valve opening temperature and fully opened lift have been measured shall be immersed in a constant temperature bath of 135°C for one hour. Then the thermostat shall be taken out and the valve opening temperature and fully opened lift shall be measured again so as to determine any change in these values caused by this test.

5.7 Durability test

A thermostat on which the valve opening temperature, fully opened lift and valve closing temperature have been measured shall be immersed in cool water of – 40°C or below until the valve is closed, then left in hot water or steam of 97°C or above until the valve is fully opened. The test shall be repeated 20,000 cycles, then taken out and the valve opening temperature, fully opened lift and valve closing temperature shall be measured again so as to determine any change in these values caused by this test. In addition, amount of the water leakage shall be measured after this test.

5.8 Low-temperature resistance test

A thermostat on which the valve opening temperature has been measured shall be placed in a constant temperature bath of – 40°C for 24 hours. Then the thermostat shall be taken out and the valve opening temperature shall be measured again so as to determine any change in the value caused by this test.

5.9 Response test

Selecting arbitrary two temperature points t_1 and t_2 within a range forming essentially a straight line on the temperature – lift characteristic curve in the water temperature raising

cycle as described in para. 5.5 above (refer to Fig. 6), two agitating water baths maintaining water temperatures t_1°C and t_2°C respectively shall be prepared. Then a thermostat shall be immersed into the bath of t_1°C until the valve lift is sufficiently settled before quickly moving the thermostat into the bath of t_2°C. Assuming this moving time as zero (0) second, the time and valve lift shall be recorded. Their relations are represented in Fig. 7.

Fig. 6

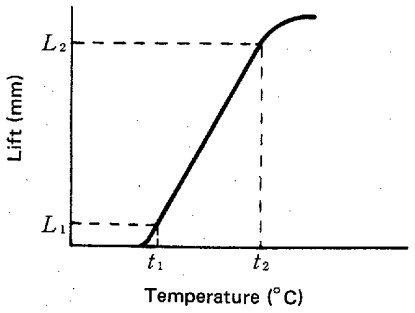
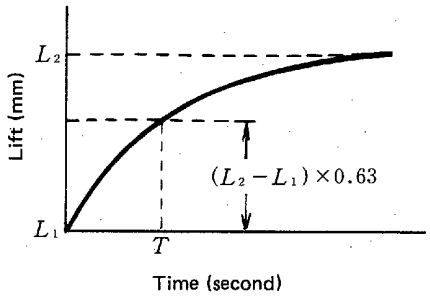


Fig. 7



5.10 Jiggle valve performance test

(1) A specified hole shall be bored on a round plate (1 mm in thickness), and a jiggle valve shall be installed in the hole.
(2) When installing the round plate on a testing device, a rubber packing or the like shall be used in order to prevent a leakage from the periphery of the round plate.

5.10.1 Valve closing water pressure test

(1) The test shall be conducted using the testing device shown in Fig. 8 with the valve B opened and the valve C closed.
(2) Opening the valve A and filling the case with water, close the valve A so as to determine the zero point (H_0) of the manometer. The zero point shall be arranged on the upper surface of the round plate. (A hole provided at the position D which is aligned to the upper surface of the round plate is recommendable for easy determination of the zero point.)
(3) Opening again the valve A at a very slow rate, observe the rise of water level in the manometer.
(4) The water level in the manometer rises sharply at the moment the jiggle valve is closed. The value at beginning of the rise (H_1) shall be read. ΔH which is the difference between H_1 and H_0 is the valve closing water pressure.

5.10.2 Valve closing air flow rate

(1) The test shall be conducted using the testing device shown in Fig. 8 with the valves A and B closed.
(2) Opening the valve C at a very slow rate, flow the air through the flowmeter and observe the value on the flowmeter.
(3) The flowmeter indicates the maximum valve at the moment when the jiggle valve is closed. The value shall be read as the valve closing air flow rate.

Remark: If a thermostat is used for the test, the leakage from the valve opening shall be completely prevented with an adhesive agent before the test is conducted.

6. Designation

The designation of thermostats shall be as follows.

A – B – C

A : Designation of type and dimension
B : Designation of valve opening temperature
C : Designation of jiggle valve if it is used.

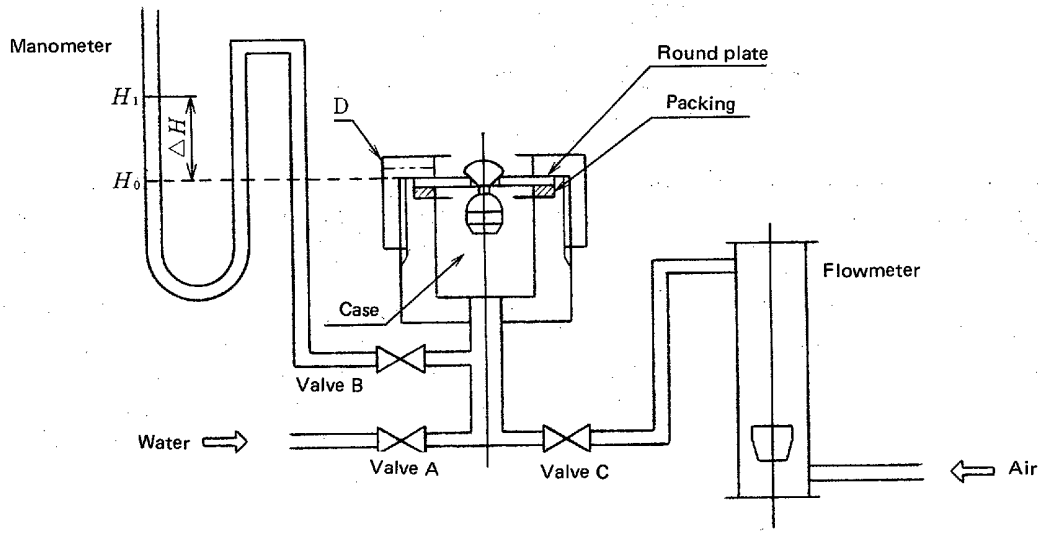
Example: **Without jiggle valve** I·44a – 82a
With jiggle valve S·77-88a-J·3

7. Marking

The thermostat shall be marked as follows.

(1) Manufacturer's name or its code
(2) Production date (month and year) or its code
(3) Valve opening temperature or its code

Fig. 8


Manometer
H_1
$\triangle H$
H_0
D
Round plate
Packing
Case
Flowmeter
Valve B
Water
Valve A
Valve C
Air

Explanatory note on JASO E 402-91 Thermostat

No standard for thermostats to be used in automobiles has been established except US **SAE Standard J 634a** "Forms and sizes of water thermostat pockets." Stated in the following part are those articles which aroused especially much discussion in establishing this standard. (Item numbers conform to the section or subsection numbers of the standard.)

2. Type

Although the in-line type, side by-pass type and bottom by-pass type are widely used in automobiles, there is also a top by-pass type (refer to **Explanation fig. 1**). In addition, an air vent hole and a jiggle valve, which are used in the thermostats, are added in **Fig. 4** and **Fig. 5** respectively as their illustrations.

3. Dimensions

It has been decided that nominal sizes shall be mainly based on dimension J representing a flange outside diameter. The reason why dimension Q from the flange surface to bottom is specified at a water temperature of 120°C is that the boiling point of pure water is 120°C at a system pressure of 100 kPa.

3.1 In-line type

Four flange outside diameters, 44, 52, 54 and 54.5 of the dimension J, which are most widely used in Japan, have been adopted as standards. The dimension 54, among all, is the flange outside diameter which is most widely used in the U.S. and Europe, and conforms to SAE. Two values 38 and 42 are specified for dimension Q of in-line type thermostat. The dimension 42 is generally used while 38 is sometimes used for adjustment to thermostat pockets.
Furthermore, those for 38 and 42 of the dimension J representing the flange outside diameters have additionally been adopted.

3.2 Side by-pass type

Since there is not enough room for waterway in current products except for those with the valve diameter 35 of the dimension A and the dimensions of those products have not been well standardized, side by-pass type thermostats of dimension A 40 and large have newly been specified.
The reason for this is that the following formulae are required for the dimensions K and J in **Table 3** of the standard in order to assure a waterway sectional area as large as the valve area S_A in **Explanation fig. 2.**

$$K = 2\sqrt{\frac{S_A + S_A'}{\pi}} + 5$$

$$J = K + 10$$

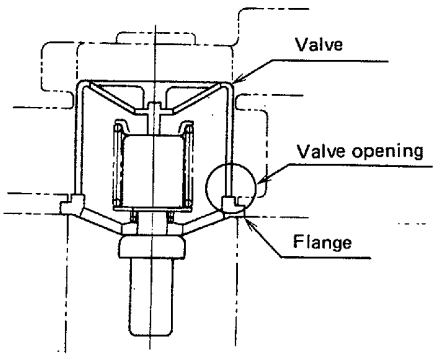
where S_A indicates the area when the valve diameter is taken as $A + 3$ mm. By using these formulae, dimensions K and J have been determined for S·83 (A = 45) and S·88 (A = 50).
The dimensions of currently used thermostats of this type are shown in **Explanation table 1.** S·78 has been adopted as the median between S·73 and S·83 which have the same dimensions as those of currently used thermostats. (S·84a) and (S·84b) have been provisionally adopted since they are widely used at the moment. Contradictions to realities, which may be found in plenty in this standard, shall be dealt with one by one in the light of the conditions of use and applications in future.

Explanation table 1

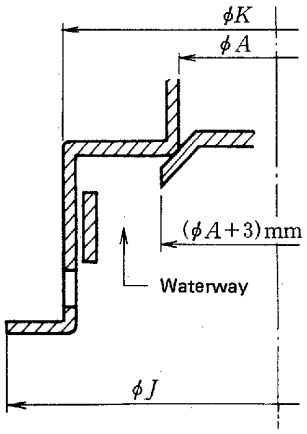
Unit: mm

A	J	K
45	75	65
50	84	72

Explanation fig. 1



Explanation fig. 2



3.3 Bottom by-pass type

The dimensions have been standardized in order to conform to those of currently used products. (B·52b), (B·73) and (B·78) are, however, parenthesized because they are not commonly used as the bottom by-pass type in their installation. For (B·52b) and B·54, considering the cases where a jiggle valve is used, the outside diameter *M* for flange drawing has been excluded from the standard in the same manner as in the cases of B·44, B·48 and B·52a.

3.4 Jiggle valve

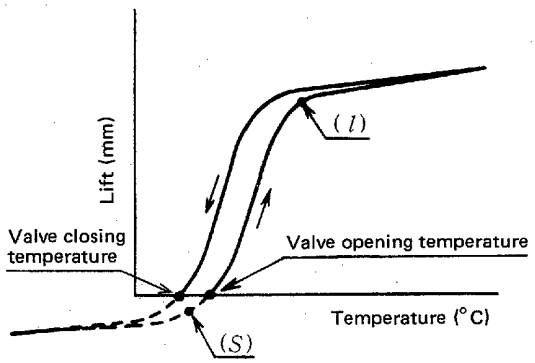
Since the direction of attachment of a jiggle valve is determined depending on a positioning between the cooling circuit and thermostat, the valve closing direction of the jiggle valve has been added.

4. Performance and 5. Test procedures

While valve opening temperatures are not well standardized in Europe, 160°F, 170°F, 180°F, 185°F and 190°F are used in the United States. With a slight adjustment, all those temperatures except 185°F have been adopted in this standard because of wide application in Japan and applicability to the United States.

The valve opening temperature and the valve closing temperature indicate temperatures at a time when the water leakage from the valve opening reaches the value specified in this standard. However, since accuracy of measurements for the valve opening temperature and valve closing temperature is not sufficient, the temperature at a time when the lift reaches 0.05 mm has been conveniently specified for this purpose. In case where, however, a rubber

Explanation fig. 3



packing is installed on the valve opening in order to reduce water leakage, the lift has not been determined because the relation between the lift and valve opening temperature or valve closing temperature varies depending on the shape of the rubber packing to be used and thus standardization is not practical. Furthermore, amounts of the water leakage specified in **Table 7**, **Table 8** and **Table 9** take the maximum values that could occur in existing thermostats.

For a temperature-lift characteristic, that of wax thermostat usually shows such curves as illustrated in **Explanation fig. 3.**

In this fig., the imaginary dotted lines are drawn for explanation. The segment on the left of the lower curve point (*s*) represents the solid expansion region of wax, the segment on the right of the upper curve point (*l*) represents the liquid expansion region of wax, and the segment between (*s*) and (*l*) represents the rapid expansion region where wax is transformed from a solid-state into a liquid-state. The upper curve point (*l*) in **Explanation fig. 3** is a temperature usually about 10°C higher than the valve opening temperature. However, the temperature at which the full-open lift is measured (valve fully opening temperature) has been set a little higher than the point (*l*) for convenience of measurement.

The characteristic curves are approximation obtained by connecting measured points, and the width of temperatures between the rising temperature curve and descending temperature curve is the hysteresis. Since the curves require more measuring points within a region nearer the curve points (*s*) and (*l*) so as to obtain more accurate drawn lines, it has been decided for convenience that the hysteresis shall be specified at a lift of 2 mm.

For the response, in a proces in which the wax is transformed from a solid-state into

a liquid-state (the segment between (*s*) and (*l*) in **Explanation fig. 3**), the latent heat of the wax may be considered as almost constant. Therefore in this segment, as long as the coefficient of cubical expansion of wax is constant, the relation between the ambient temperature and lift may be regarded as a phenomenon of first-order lag, thus **Fig. 7** obtained by the response test described in **5.9** represents first-order lag transient response characteristic.

For the time lag characteristic of thermostats, the time constant has been adopted which may be specified regardless of the value opening temperature and lift.

Namely, the lift (l_x) at an arbitrary time x in **Fig. 7** of the standard is expressed as follows.

$l_x = (L_2 - L_1)(1 - e^{-\frac{x}{T}})$ l_x : A lift at an arbitrary time in **Fig. 7**

L_1, L_2 : Lifts

T : Constant

And, if $x = T$,

$l_T = (L_2 - L_1)(1 - e^{-1}) = (L_2 - L_1) \times 0.63$

Therefore, time constant T is time x when the lift reaches $(L_2 - L_1)$ 0.63 in **Fig. 7.**

Meanwhile, t_1, and t_2 in **Fig. 6** should be temperatures for which +2°C and +8°C are respectively added to the median of the valve opening temperatures in **Table 6.**

Notes for use

Watchful care should be taken, during operation, of such phenomena as water temperature hunting or pressure surging which may take place in the cooling system. However, these phenomena are not dealt with here, since they may not be ascribed solely to thermostats.

In addition, an antifreezing solution is generally used in a cooling system, accordingly sufficient consideration should be given to influences of the antifreezing solution in selecting a thermostat.

When using a thermostat with jiggle valve(s), the following points should be taken into consideration to determine its specification.

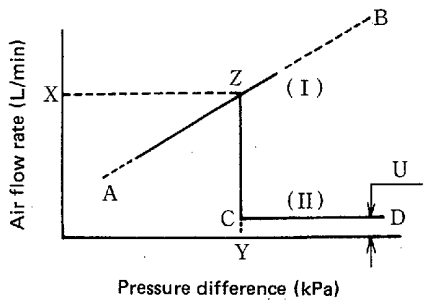
(a) Preferably, cooling water should be poured at less than 80% of the valve closing air flow rate (L/min).

(b) When idling, the pressure difference at the jiggle valve shall be greater than the valve closing water pressure.

(c) When a thermostat is used with jiggle valve(s), preferably the valve closing water pressure and valve closing air flow rate should be newly measured with the jiggle valve(s) installed, since these values are related to water leakage from the valve opening and other parts.

Explanation fig. 4 (dual logarithmic graph) shows the air flow rate – pressure difference characteristic. The straight line (AZB) indicates the relation between the rate of air flow through only the air vent hole and the pressure difference. The line (AZCD) indicates the relation between the rate of air flow through the jiggle valve(s) and the pressure difference. The point Z moves along with the straight line (AZB) according to the form, weight of the jiggle valve(s) and the passage area, while the points X and Y agree with the jiggle valve closing air flow rate and jiggle valve closing water pressure, respectively. The line (ZCD) is drawn after the jiggle valve closing, and U varies with the amount of water leakage after the valve closing.

Explanation fig. 4



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

SI : 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

Date of Establishment : 1968-08-30

Date of Revision : 1972-04-24

Date of Revision : 1980-05-16

Date of Revision : 1991-03-29

Sub Committee in which the draft was made : SC of Thermostat

Technical Committee under which the draft was discussed : TC of Engine

Investigating Committee : Standard Committee under the Standard Council

Published by

The Society of Automotive Engineers of Japan, Inc.

10-2, Goban-cho, Chiyoda-ku, Tokyo 102, Japan

This printed matter has been prepared with financial support from the Japan Auto-Race Organization.