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**Non-petroleum base motor vehicle
brake fluids**

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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 chemical Industry Association (JACA)/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 K 2233:2006** is replaced with this Standard.

However, **JIS K 2233:2006** may be applied in the **JIS** mark certification based on the relevant provisions of Article 19 Clause 1, etc. of the Industrial Standardization Law until January 19, 2018.

This **JIS** document is protected by the Copyright Law.

Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, applications for a patent after opening to the public or utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, applications for a patent after opening to the public or utility model rights.

Non-petroleum base motor vehicle brake fluids

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 3871**:2000, Edition 4, and **ISO 4925**:2005, Edition 2, with some modifications of the technical contents.

The vertical lines on both sides and dotted underlines indicate matters not given in the corresponding International Standards. A list of modifications with the explanations is given in Annex JB.

1 Scope

This Standard specifies non-petroleum base brake fluids (hereafter referred to as brake fluids) used for motor vehicles.

NOTE : The International Standards corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 3871:2000 *Road vehicles—Labelling of containers for petroleum-based or non-petroleum-based brake fluid*

ISO 4925:2005 *Road vehicles—Specification of non-petroleum-base brake fluids for hydraulic systems* (overall evaluation: MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are **IDT** (identical), **MOD** (modified), and **NEQ** (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. For standards with the year indication, only the editions of the indicated year shall be applied and the revisions (including amendments) made thereafter shall not be applied. For those without the indication of the year, the most recent edition (including amendments) shall be applied.

JIS B 7410	<i>Liquid-in-glass thermometers for testing of petroleum product</i>
JIS B 7502	<i>Micrometers</i>
JIS B 7505-1	<i>Aneroid pressure gauges—Part 1: Bourdon tube pressure gauges</i>
JIS B 7515	<i>Cylinder gauges</i>
JIS D 2604	<i>Automotive parts—Hydraulic brake wheel cylinders for hydraulic brake systems using a non-petroleum base brake fluid</i>
JIS D 2605	<i>Automotive parts—Rubber cups for hydraulic braking cylinders using a non-petroleum base hydraulic brake fluid</i>
JIS D 2609	<i>Road vehicles—Elastomeric seals for hydraulic disc brake cylinders using a non-petroleum base hydraulic brake fluid</i>

- JIS G 3141 *Cold-reduced carbon steel sheet and strip*
- JIS G 3303 *Tinplate and blackplate*
- JIS G 5501 *Grey iron castings*
- JIS H 3100 *Copper and copper alloy sheets, plates and strips*
- JIS H 4000 *Aluminium and aluminium alloy sheets, strips and plates*
- JIS K 0050 *General rules for chemical analysis*
- JIS K 0068 *Test methods for water content of chemical products*
- JIS K 2251 *Crude petroleum and petroleum products—Sampling*
- JIS K 2254 *Petroleum products—Determination of distillation characteristics*
- JIS K 2283 *Crude petroleum and petroleum products—Determination of kinematic viscosity and calculation of viscosity index from kinematic viscosity*
- NOTE : Corresponding International Standard: ISO 3104:1994 *Petroleum products—Transparent and opaque liquids—Determination of kinematic viscosity and calculation of dynamic viscosity (MOD)*
- JIS K 2503 *Testing method of lubricating oil for aircraft*
- JIS K 6253-2 *Rubber, vulcanized or thermoplastic—Determination of hardness—Part 2: IRHD method (hardness between 10 IRHD and 100 IRHD)*
- NOTE : Corresponding International Standard: ISO 48:1994 *Rubber, vulcanized or thermoplastic—Determination of hardness (hardness between 10 IRHD and 100 IRHD) (MOD)*
- JIS K 6253-4 *Rubber, vulcanized or thermoplastic—Determination of hardness—Part 4: IRHD pocket meter method*
- JIS K 6885 *Unsintered polytetrafluoroethylene tapes for thread sealing*
- JIS K 7137-1 *Plastics—Polytetrafluoroethylene (PTFE) semi-finished products—Part 1: Requirements and designation*
- JIS K 8034 *Acetone (Reagent)*
- JIS K 8102 *Ethanol (95) (Reagent)*
- JIS R 3503 *Glass apparatus for chemical analysis*
- JIS R 3646 *Interchangeable conical glass ground joints*
- JIS R 6253 *Waterproof abrasive papers*
- JIS Z 8305 *Dimensions of printing types*
- JIS Z 8401 *Guide to the rounding of numbers*
- JIS Z 8703 *Standard atmospheric conditions for testing*
- JIS Z 8802 *Methods for determination of pH of aqueous solutions*
- ISO 4926:2006 *Road vehicles—Hydraulic braking systems—Non-petroleum-base reference fluids*

3 Classification

The classes of brake fluids shall be as shown in Table 1.

Table 1 Classification

Class	Symbol
Class 3	BF-3
Class 4	BF-4
Class 5	BF-5
Class 6	BF-6

4 Quality

Brake fluid shall be transparent liquid varying in colour from achromatic colour to amber, free from suspended matter, turbidity and sediment.

The quality of brake fluids shall conform to the specifications of Table 2 and Table JA.1 or Table JA.3 and the uniformity shall be ensured when tested in accordance with clause 8 and Method A or B in Annex JA.

Table 2 Quality

Item				Class				No. of clause	
				Class 3	Class 4	Class 5	Class 6		
Equilibrium reflux boiling point °C				205 min.	230 min.	260 min.	250 min.	8.1	
Wet boiling point °C				140 min.	155 min.	180 min.	165 min.	8.2	
Kinematic viscosity mm ² /s	(-40 °C)			1 500 max.		900 max.	750 max.	8.3	
	(100 °C)			1.50 min.					
pH value (23 ± 5) °C				7.0 to 11.5				8.4	
Stability	High temperature stability (185 ± 2) °C (120 ± 5) min			The change in boiling point ^{a)} shall be within 5 °C.				8.5	
	Chemical stability			The change in boiling point ^{a)} shall be within 5 °C.					
Metal corrosion resistance (100 ± 2) °C (120 ± 2) h	Condition of metal test piece	Change in mass mg/cm ²	Tinplate	± 0.20				8.6	
			Steel	± 0.20					
			Aluminium	± 0.10					
			Cast iron	± 0.20					
			Brass	± 0.40					
			Copper	± 0.40					
		Appearance		No visible surface corrosion, except in the contact part between test pieces. Stain or discolouration is permitted, however.					
	Condition of standard SBR cup	Change in base diameter mm		1.40 max.					
		Change in hardness IRHD		-15 to 0					
		Change in volume %		16.0 max.					
		Appearance		No stickiness, blisters, and sloughing.					
	Properties of fluid	Appearance		No gel at (23 ± 5) °C. No adhering crystals ^{b)} .					
		Sediment, volume fraction %		0.10 max.					
		pH value (23 ± 5) °C		7.0 to 11.5					
Cold resistance	(-40 ± 2) °C (144 ± 4) h		Appearance		The fluid shall be transparent and uniform, with no precipitation.				8.7
			Time required for air bubble to reach fluid level s		10 max.				
	(-50 ± 2) °C (6 h ± 12 min)		Appearance		The fluid shall be transparent and uniform, with no precipitation.				
			Time required for air bubble to reach fluid level s		35 max.				

Table 2 (concluded)

Item			Class				No. of clause	
			Class 3	Class 4	Class 5	Class 6		
Water tolerance	$\left((-40 \pm 2) ^\circ\text{C} \right)$ $\left(22 \pm 2 \right) \text{ h}$	Appearance	The fluid shall be transparent and uniform, with no precipitation.				8.8	
		Time required for air bubble to reach fluid level s	10 max.					
	$\left((60 \pm 2) ^\circ\text{C} \right)$ $\left(22 \pm 2 \right) \text{ h}$	Appearance	The fluid shall be transparent and uniform.					
		Sediment, volume fraction %	0.05 max.					
Compatibility	$\left((-40 \pm 2) ^\circ\text{C} \right)$ $\left(22 \pm 2 \right) \text{ h}$	Appearance	The fluid shall be transparent and uniform, with no precipitation.				8.9	
	$\left((60 \pm 2) ^\circ\text{C} \right)$ $\left(22 \pm 2 \right) \text{ h}$	Appearance	The fluid shall be transparent and uniform.					
		Sediment, volume fraction %	0.05 max.					
Antioxidization property		Change in mass mg/cm^2	Aluminium	± 0.05				8.10
			Cast iron	± 0.30				
		Appearance	No visible surface corrosion except in the parts in contact with tin foil. Stains or discolouration are permitted. No trace of gum on the surface excluding the part which is in contact with tin foil.					
Rubber swelling property	Standard SBR cup $\left((120 \pm 2) ^\circ\text{C} \right)$ $\left(70 \pm 2 \right) \text{ h}$	Increase of base diameter mm	0.15 to 1.40				8.11	
		Change in hardness IRHD	-15 to 0					
		Increase of volume %	1.0 to 16.0					
		Appearance	No stickiness, blisters, and sloughing.					
	Standard EPDM test piece $\left((120 \pm 2) ^\circ\text{C} \right)$ $\left(70 \pm 2 \right) \text{ h}$	Change in hardness IRHD	-15 to 0					
		Increase of volume %	0 to 10.0					
		Appearance	No stickiness, blisters, and sloughing.					
Stroking performance (normative)			As given in Table JA.1 or JA.3.				Annex JA	
Notes a) Boiling point here means equilibrium reflux boiling point.								
b) Confirm the absence of crystals on the wall of a glass jar or on the surface of a metal test piece.								

5 General items

General items common to the test shall be as specified in **JIS K 0050**. The values shall be rounded off as specified in **JIS Z 8401**. In addition, attention shall be paid to the following items during the test.

- a) **Use of protective equipment** Wear equipment to protect skins, eyes etc. as necessary.
- b) **Safety** Check the safety during operations.
- c) **Waste disposal** Dispose samples in such manner that they will not contaminate water, air, etc.
- d) **Observance of regulations** Handle brake fluids in accordance with the relevant regulations.

6 Sampling

The sampling shall be as specified in **JIS K 2251**.

7 Standard atmospheric conditions for testing

The standard atmospheric conditions for testing shall be ordinary temperature (5 °C to 35 °C), and normal humidity (45 %RH to 85 %RH) specified in **JIS Z 8703**.

8 Test methods

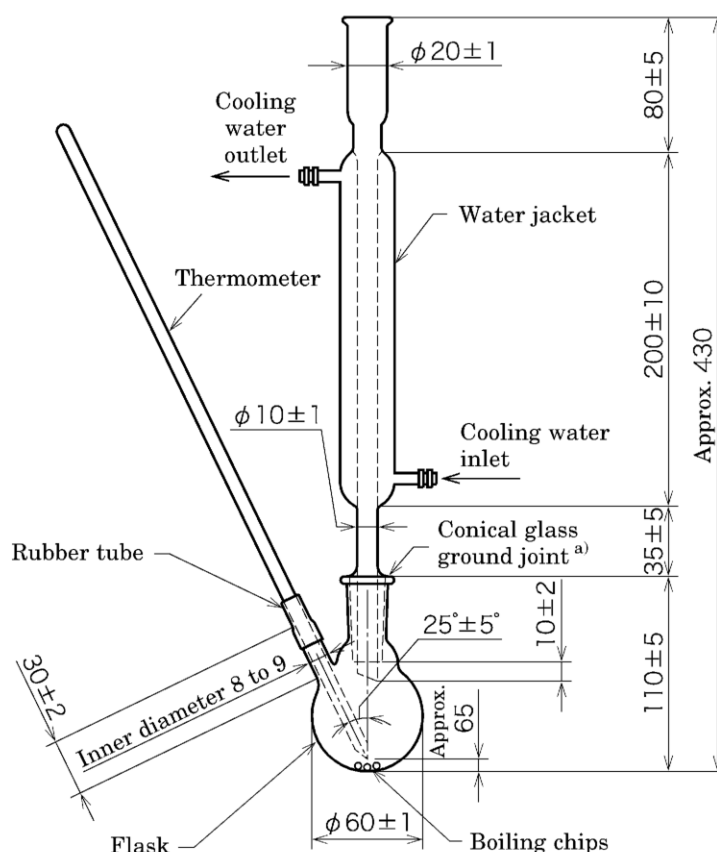
8.1 Equilibrium reflux boiling point

8.1.1 Apparatus

The apparatus shall be as follows.

- a) **Apparatus for measuring equilibrium reflux boiling point** Assemble the apparatus as shown in Figure 1 using the following devices.
 - 1) **Flask**, as shown in Figure 1.
 - 2) **Water jacket**, as shown in Figure 1.
 - 3) **Thermometer**, of No. 38 specified in **JIS B 7410**, which has been corrected with a standard thermometer.
 - 4) **Boiling chips** Well-dried clean carborundum of diameter about 2 mm.
 - 5) **Heat source** Hot plate or a heating mantle with a variable resistor.

Unit: mm



Note a) Use JIS R 3646 specified in clause 6 of JIS R 3646.

Figure 1 Apparatus for measuring equilibrium reflux boiling point

8.1.2 Procedure

The procedure shall be as follows.

- Thoroughly clean and dry all glassware before use.
- Insert the thermometer into the side tube of the flask, and cover the joint with a thick rubber sleeve, ensuring that the lower end of thermometer is about 6.5 mm above the centre of flask bottom.
- Place 60 ml of sample and three boiling chips into the flask.
- When using a hot plate as heat source, centre a refractory having a diameter opening of 32 mm to 38 mm over the heating element of the electric heater and mount the flask on the refractory so that direct heat is applied to the flask only through the opening in the refractory. When using a heating mantle, select an suitable mantle for the flask to be used.
- Pass clean water of 28 °C or lower through a water jacket to cool. During measurement, the temperature of cooling water shall not rise by more than 2 °C.
- Apply heat to the flask at such a rate that the sample is refluxing within (10 ± 2) min at a rate of one to five drops per second. Adjust the heat input so as to obtain a specified equilibrium reflux rate of one to two drops per second over the

next (5 ± 2) min period. While maintaining this condition for an additional 2 min read the temperature to the nearest $0.5\text{ }^{\circ}\text{C}$ four times at 30 s intervals; record the average value of four temperature readings to take it as the measured temperature.

g) Repeat the procedures **a)** to **f)** using new samples.

8.1.3 Calculation and results

Calculation and results shall be as follows.

- a) Correct the measured temperatures to the values at standard atmospheric air pressure (101.3 kPa) in accordance with 4.7.2 (1.1) of JIS K 2254 to take as measured values.
- b) Average the two measured values and round to an integer to take as equilibrium reflux boiling point. When the difference between the two values exceeds $3\text{ }^{\circ}\text{C}$, carry out retest.

8.2 Wet boiling point

8.2.1 Apparatus and devices

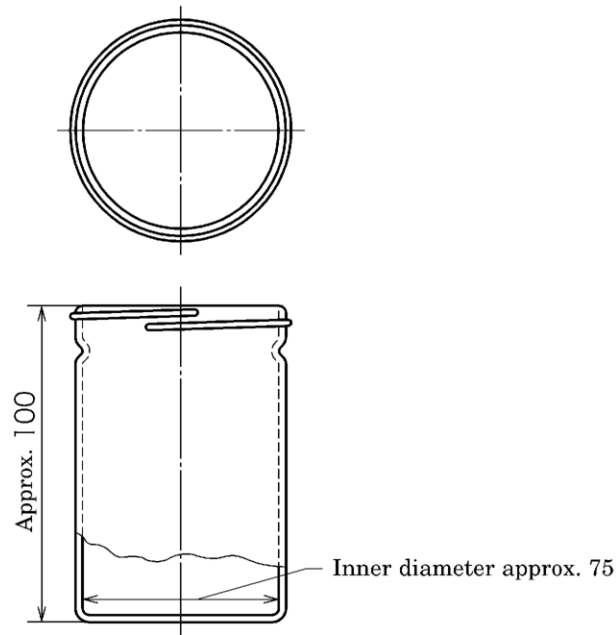
The apparatus and devices shall be as follows.

- a) **Glass jars** Four glass jars specified in Figure 2 that have been dried before use. The lids shall be made of organic-coating-free tinplate, having no holes and packing.

NOTE : Suitable glass jars (RM-49) and tinplate lids (RM-63) can be obtained from the Society of Automotive Engineers (SAE), USA.

- b) **Desiccator** Two desiccators shown in Figure 3.
- c) **Porcelain plate** Two plates suitable for desiccators.
- d) **Injector** Injection cylinder of 2 ml to 5 ml and a needle for sampling, which have been dried before use.
- e) **Thermostatic chamber**, capable of keeping temperature at $(50 \pm 1)\text{ }^{\circ}\text{C}$.
- f) **Apparatus for measuring equilibrium reflux boiling point**, as specified in 8.1.1 a).
- g) **Water-content measuring apparatus**, in accordance with 6.3 or 6.4 of JIS K 0068.

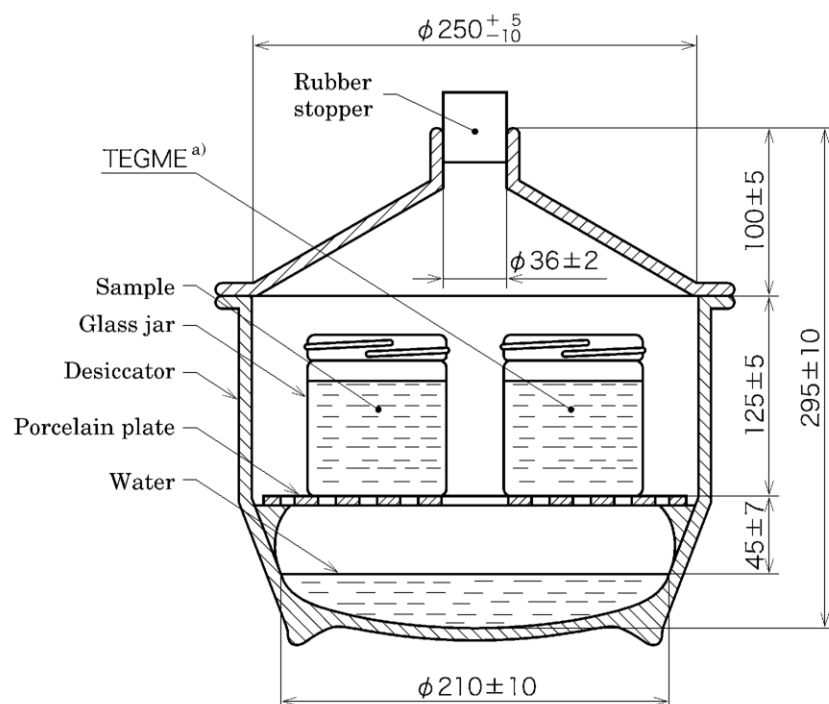
Unit: mm



Quality: borosilicate glass-1 (JR-1) or borosilicate glass-2 (JR-2)

Figure 2 Glass jar

Unit: mm



Note ^{a)} See 8.2.2 a).

Figure 3 Desiccator

8.2.2 Reagents

The reagents shall be as follows.

- a) **Triethylene glycol monomethyl ether** (hereafter referred to as TEGME) TEGME, commercially available, whose water content has been controlled to $(0.50 \pm 0.05) \%$.

NOTE : For recommended TEGME on the market, see Table 3.

Table 3 Quality of TEGME

Item	Specified value
Appearance	Suspension-free transparent liquid
Hue (APHA)	100 max.
Purity %	94 min.
Water content, mass fraction %	0.3 max.
Boiling point °C	240 min.
Acidity (as acetic acid) %	0.02 max.

- b) **Water**, of A2 or A3 specified in **D.1 of JIS K 0050**.

- c) **Grease**, for high temperatures on the market.

8.2.3 Preparation for measurement

The preparation for measurement shall be as follows.

- a) Apply grease lightly on the fitting parts of desiccator.
b) Pour (450 ± 10) ml of water into each desiccator and cover with a lid.

8.2.4 Procedure

The procedure shall be as follows.

- a) Transfer (350 ± 5) ml of the sample into each of two glass jars, and, without covering with lids, place them gently into the individual desiccators.
b) Put (350 ± 5) ml each of TEGME into two glass jars, and, without covering with lids, place them gently into the individual desiccators which contain samples.

Allow the two glass jars to stand still, avoiding the contact of the jars with each other and with the wall of desiccator.

- c) Put lids on the desiccators and fasten them with clips or the like to prevent the slippage owing to inside pressure.
d) Place the desiccators in the thermostatic chamber maintained at $(50 \pm 1) ^\circ\text{C}$, and allow them to absorb moisture of the sample and TEGME. During this procedure, remove the rubber stoppers on the desiccators as necessary to maintain the normal internal pressure. Take not more than 2 ml of TEGME with an injector, and immediately measure the water content in accordance with **6.3 or 6.4 of JIS K 0068**. In this case, the total amount of TEGME taken from each jar shall not exceed 10 ml.

- e) When water content of TEGME reaches $(3.70 \pm 0.05) \%$ in mass fraction, remove the sample from the desiccators, immediately cover with lids, and leave to cool for 60 min to 90 min at $(23 \pm 5) ^\circ\text{C}$. Measure the equilibrium reflux boiling point of the sample in accordance with **8.1**.

8.2.5 Calculation and results

Calculation and results shall be as follows.

- a) Correct the measured temperatures to the values at standard atmospheric air pressure in accordance with **8.1.3 a)** to take as measured values.
- b) When the difference between the measured values of two samples is within $3 ^\circ\text{C}$, average the results and round off to an integer to take as wet boiling point. If the difference exceeds $3 ^\circ\text{C}$, carry out retest.

8.3 Kinematic viscosity

8.3.1 Procedure

The procedure shall be as specified in **JIS K 2283**.

8.3.2 Calculation and results

When the difference of two measurement results is within 1.2 %, average the results and round to an integer at the time of measurement at $-40 ^\circ\text{C}$ or to two decimal places at the time of measurement at $100 ^\circ\text{C}$, to take as kinematic viscosity. If the difference exceeds 1.2 %, carry out retest.

8.4 pH value

8.4.1 pH meter

The pH meter shall be as specified in **JIS Z 8802**.

8.4.2 Reagents

The reagents shall be as follows.

- a) **Water**, as specified in **E.2** of **JIS K 0050**.
- b) **Ethanol**, as specified in **JIS K 8102**.
- c) **Mixed solution of alcohol** Mixed solution of ethanol and water with volume ratio of 5:5, and its pH value adjusted to 7.0 ± 0.1 with 0.1 mol/L sodium hydroxide solution. In this case, do not use 4 ml or more of 0.1 mol/L sodium hydroxide solution per litre of mixed solution of ethanol and water.

8.4.3 Procedure

Add 50 ml of mixed solution of alcohol to 50 ml of sample, mix sufficiently, and measure its pH value in accordance with clause **8** of **JIS Z 8802** at $(23 \pm 5) ^\circ\text{C}$. Cloud and turbidity in the sample are permitted. During measurement, the liquid temperature shall not fluctuate by more than $\pm 1 ^\circ\text{C}$. Repeat this operation with newly taken samples.

8.4.4 Calculation and results

When the difference between two measured values is within 0.2, average them and round off to one decimal place to take it as pH value. If the difference exceeds 0.2, carry out retest.

8.5 Stability

8.5.1 Apparatus for measuring equilibrium reflux boiling point

As specified in 8.1.1 a).

8.5.2 Brake fluid mixture

Use reference brake fluid specified in **ISO 4926**.

NOTE : Prepare brake fluid mixture in accordance with Table 1 of **ISO 4926**, or purchase commercially available products ¹⁾.

Note ¹⁾ Brake fluid mixture RM-66-06 (reference fluid) of the identical composition as for **ISO 4926** can be obtained from the Society of Automotive Engineers (SAE), USA.

8.5.3 Procedure

The procedure shall be as follows.

a) High temperature stability

- 1) Put 60 ml of sample into a flask, assemble a testing apparatus for measuring equilibrium reflux boiling point as shown in Figure 1, heat to $(185 \pm 2)^\circ\text{C}$ and maintain for (120 ± 5) min.
- 2) Add three boiling chips into the top mouth of the water jacket. Control the temperature for the sample to reflux within 5 min at a rate of one to five drops per second.
- 3) For (5 ± 2) min after the refluxing at a rate of one to five drops per second is achieved, control the temperature so that the sample can keep refluxing at a rate of one or two drops per second.
- 4) While maintaining the condition in 3) for an additional 2 min read the temperature to the nearest 0.5°C four times at 30 s intervals; record the average value of four temperature readings to take it as final measurement temperature.
- 5) Repeat the procedures 1) to 4) using new samples.

b) Chemical stability

- 1) Put 30 ml of sample and 30 ml of brake fluid mixture into a flask, and mix them. Assemble the apparatus as shown in Figure 1, heat, and control the temperature for the sample to reflux for (10 ± 2) min at a rate of one to five drops per second.
- 2) Take the highest temperature obtained in the next 1 min as initial measured temperature.
- 3) Adjust the heat input to obtain a specified equilibrium reflux rate of one or two drops per second over the next (15 ± 1) min period.

- 4) While maintaining this condition for an additional 2 min read the temperature to the nearest 0.5 °C four times at 30 s intervals; record the average value of four temperature readings to take it as the value of final equilibrium reflux boiling point.
- 5) Repeat the procedures 1) to 4) using new samples.

8.5.4 Calculation and results

Calculation and results shall be as follows.

a) High temperature stability

- 1) Correct the measured temperatures to the values at standard atmospheric air pressure in accordance with 8.1.3 a) to take as measured values.
- 2) Round the average of two measured values to an integer, and take the difference from the equilibrium reflux boiling point obtained in 8.1 as the change in boiling point.

b) Chemical stability

- 1) Obtain the difference between the initial measured temperature and the final equilibrium reflux boiling point, and take it as the measured value.
- 2) Round off the average of two measured values to an integer, and take it as the change in boiling point.

8.6 Metal corrosion resistance

8.6.1 Apparatus and devices

The apparatus and devices shall be as follows.

- a) **Waterproof abrasive paper** No. P320, Aw or Cw specified in JIS R 6253.
- b) **Test tube** Type I graduated test tube specified in Figure 4.

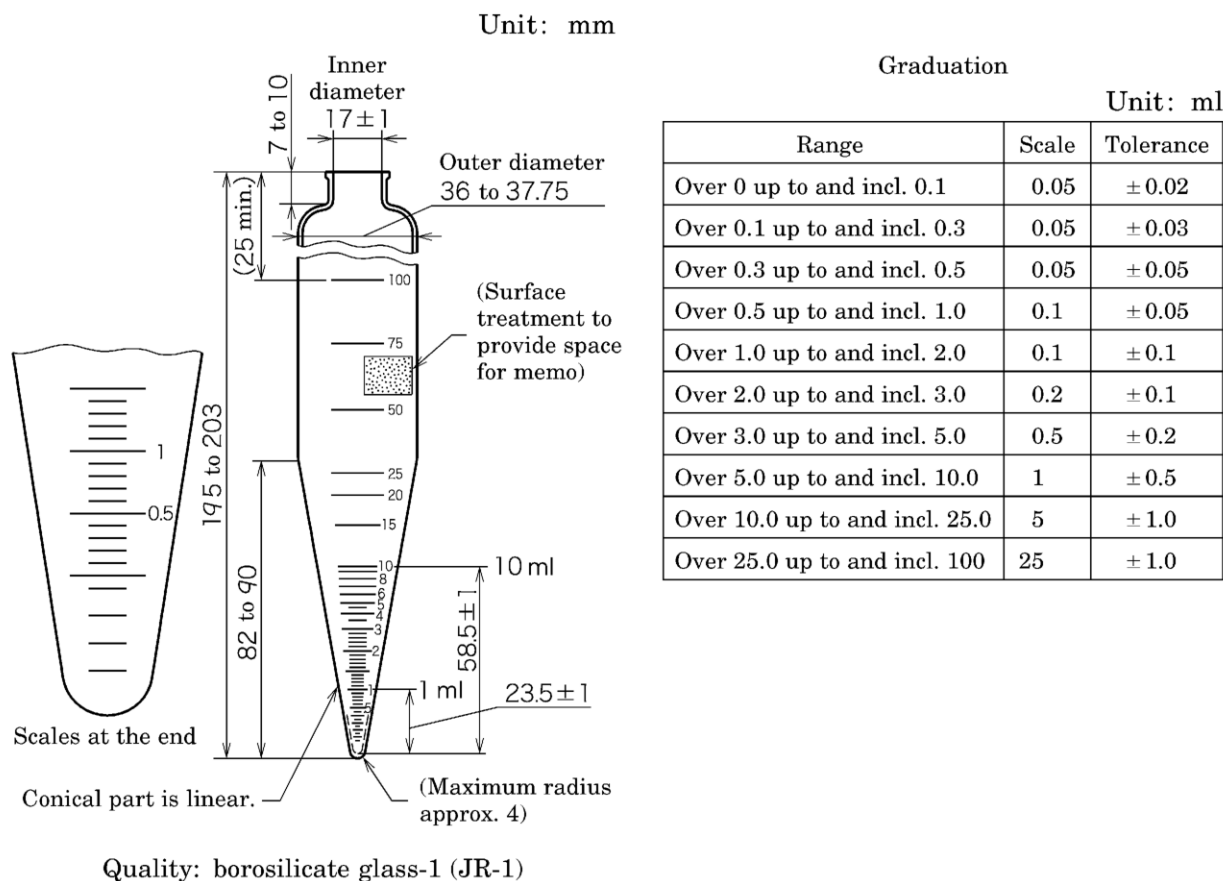


Figure 4 Test tube

- c) **Centrifugal separator**, as specified in 4.3 (2) of JIS K 2503.
- d) **Thermostatic chamber**, capable of keeping temperature at $(100 \pm 2) ^\circ\text{C}$.
- e) **Glass jars** Two glass jars specified in 8.2.1 a). The lids shall be made of organic-coating-free tinplate, having a hole of diameter (0.8 ± 0.1) mm at the centre, without packing.
- NOTE : Suitable glass jars (RM-49) and tinplate lids (RM-64) can be obtained from the Society of Automotive Engineers (SAE), USA.
- f) **Polytetrafluoroethylene tape or sheet** Polytetrafluoroethylene tape of Class 2 with a thickness of 0.1 mm, as specified in JIS K 6885; or polytetrafluoroethylene sheet of thickness 1 mm specified in JIS K 7137-1, which is perforated enough to be fitted with a lid hole of glass jar in e).
- g) **Desiccator**, of suitable dimensions, using silica gel or calcium chloride as desiccating agent.
- h) **Micrometer**, as specified in JIS B 7502.
- i) **Reading microscope**, capable of reading to the nearest 0.01 mm.
- j) **Hardness meter** International rubber hardness meter specified in JIS K 6253-2 or IRHD pocket hardness meter specified in JIS K 6253-4.

- k) **pH meter**, as specified in **8.4.1**.
- l) **Chemical balance**, capable of reading to the nearest 0.1 mg.

8.6.2 Reagents

- a) **Water**, as specified in **8.2.2 b)**.
- b) **Ethanol**, in accordance with **8.4.2 b)**.

8.6.3 Metal test pieces

Metal test pieces and their preparation shall be as follows.

- a) **Metal test pieces**, classified into the following six types.

The size of a metal test piece shall be 20 cm² to 30 cm² (approximately 80 mm × 13 mm) in total surface area. Create a hole of diameter between 4 mm and 5 mm, at 6 mm from an end of each test piece, and smooth the hole with a file.

- 1) **Tinplate** SPTE, 2.8/2.8MR T-2.5B specified in JIS G 3303 with a thickness of approximately 0.5 mm.
- 2) **Steel** SPCC-S B specified in JIS G 3141 with a thickness of approximately 1 mm to 2 mm.
- 3) **Aluminium** A2024P specified in JIS H 4000 with a thickness of approximately 1 mm to 2 mm.
- 4) **Cast iron** FC200 specified in JIS G 5501 with a thickness of approximately 4 mm.
- 5) **Brass** C2801P specified in JIS H 3100 with a thickness of approximately 1 mm to 2 mm.
- 6) **Copper** C1100P specified in JIS H 3100 with a thickness of approximately 1 mm to 2 mm.

- b) **Preparation of metal test pieces** Prepare two metal test pieces as follows.

After polishing, handle metal test pieces with a pair of tweezers.

- 1) Polish all metal test pieces, except tinplate, with waterproof abrasive paper impregnated with ethanol until scratches and holes are removed. Use a new abrasive paper for each metal test piece.
- 2) Wash all metal test pieces, including tinplate, with ethanol. Air dry, put into a desiccator, and keep at (23 ± 5) °C for 1 h or more.
- 3) Weigh the masses of dried metal test pieces to the nearest 0.1 mg.

- c) **Test piece assembly** The test piece assembly shall be as follows.

- 1) Pass an uncoated steel bolt through the hole drilled from an end of each metal test piece, and assemble as given in Figure 5, bringing the metals into direct contact with each other.