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(PAJ)

**Crude petroleum and petroleum
products—Determination of vapour
pressure—Part 1: Reid method**

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal for establishment of Japanese Industrial Standard submitted by Petroleum Association of Japan (PAJ) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

Consequently JIS K 2258 : 1998 has been withdrawn and replaced with this Standard.

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Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

JIS K 2258 series consists of the following 2 parts with the general title "*Crude petroleum and petroleum products—Determination of vapour pressure*":

Part 1: Reid method

Part 2: Triple expansion method

Crude petroleum and petroleum products

–Determination of vapour pressure

–Part 1: Reid method

Introduction

This Japanese Industrial Standard has been prepared based on the third edition of ISO 3007 published in 1999 making some modifications in the technical contents to adapt them to the needs in the Japanese market.

The portions with continuous sidelines and dotted underlines are the matters in which the contents of the corresponding International Standard have been modified.

A list of modifications with explanations is given in Annex JB.

Warning The use of this Standard may involve hazardous materials, operations and equipment. This Standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this Standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This Standard specifies the measuring method of absolute vapour pressure at 37.8 °C of volatile and non-viscous petroleum products in accordance with the Reid method.

For petroleum products containing oxygenated hydrocarbons covered by this Standard, the maximum concentration of ethers containing 5 or more carbon atoms is 15 %, and for ethanol, 10%, and for alcohols containing 3 or more carbon atoms, 7 %.

When applying this test method to volatile crude petroleum with a vapour pressure exceeding 10 kPa, the precision in clause 13 can not be applied.

Four procedures are described in this Standard. Procedures A and B are for crude petroleum and petroleum products, excluding aviation gasolines, with a vapour pressure up to 180 kPa, Procedure C is applied to petroleum products with a vapour pressure above 180 kPa, and Procedure D applies to aviation gasolines with a maximum vapour pressure of 50 kPa.

NOTE 1 For all the test methods contained in JIS K 2258 series, see Annex JA.

NOTE 2 For product samples containing methanol or those containing oxygenated hydrocarbons exceeding the limits given in the above scope, the method described in JIS K 2258-2 can be applied. For liquefied petroleum gas, the method described in JIS K 2240 can be applied.

NOTE 3 The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 3007:1999 *Petroleum products and crude petroleum—Determination of vapour pressure—Reid method (MOD)*

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

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 7410 *Liquid-in-glass thermometers for testing of petroleum product*

JIS K 2251 *Crude petroleum and petroleum products—Sampling*

NOTE: Corresponding International Standard: ISO 3170 *Petroleum liquids—Manual sampling (MOD)*

JIS Z 8401 *Guide to the rounding of numbers*

JIS Z 8402-6 *Accuracy (trueness and precision) of measurement methods and results—Part 6: Use in practice of accuracy values*

3 Term and definition

For the purpose of this Standard, the term and definition in the following apply.

3.1 vapour pressure

pressure which a sample indicates in the saturated condition of air and water in a vapour pressure cylinder at 37.8 °C in a wet condition when the volume ratio of a sample section to a vapour layer section is 1:4

NOTE: A wet condition refers to a condition where the test is performed by taking a sample into a wet vapour pressure cylinder, and it is different from the condition used in the test specified in JIS K 2258-2 and ASTM D 4953 where a sample is taken into a test container without moisture (or dry state).

4 Principle

The sample chamber of the Reid vapour pressure cylinder is filled with the sample chilled to the temperature of 0 °C to 1 °C and connected to the vapour chamber that has been preheated to 37.8 °C. The assembled apparatus is immersed in a bath at 37.8 °C ± 0.1 °C until constant pressure is observed. The pressure reading, corrected using a verifying device if necessary, is the Reid vapour pressure.

As an alternative, an automatic vapour pressure tester with an equivalent measurement principle may be used. In this case, however, if any doubts arise in the test results obtained, the results of the above-mentioned test method shall be adopted.

5 Apparatus

The apparatus shall be as follows.

5.1 Vapour-pressure apparatus

- a) The vapour-pressure apparatus used for Procedure A shall be as given in Annex A. A vapour chamber and a one-opening sample chamber shall be used in the vapour-pressure cylinder.
- b) The vapour-pressure apparatus used for Procedure B shall be as given in Annex B. A vapour chamber and a one-opening sample chamber shall be used in the vapour-pressure cylinder. A Bourdon-tube or a pressure sensor shall be used for a pressure gauge.
- c) The vapour-pressure apparatus used for Procedure C shall be as given in Annex A. A vapour chamber and a two-opening sample chamber shall be used in the vapour-pressure cylinder. A sample shall be taken into a closed type sample container.
- d) The vapour-pressure apparatus used for Procedure D shall be as given in Annex A. A vapour chamber and a one-opening sample chamber shall be used in the vapour-pressure cylinder.

5.2 Cooling bath, to cool the samples to 0 °C to 1 °C and the sample chamber to 5 °C or lower. An ice water bath is a vessel containing water and ice; solid carbon dioxide should not be used as a cooling medium since it is soluble in gasolines, and may lead to erroneous results. A refrigerator with freezer compartment with sufficient consideration for safety is suitable.

5.3 Water bath

- a) Water bath to be used for Procedures A, C and D is shown in Annex A.
- b) Water bath to be used for Procedure B is shown in Annex B.

6 Samples and sampling

The samples and sampling shall be as follows.

- a) The extreme sensitivity of vapour-pressure measurements to losses through evaporation and the resulting changes in composition, is such as to require the utmost precaution and the most meticulous care in the taking and handling of samples.
- b) The samples shall be obtained by the procedures described in Annex 1 of JIS K 2251.
- c) For Procedures A, B and D, the sample containers shall be of 1 litre capacity, and shall be filled to 70 % to 80 % capacity with the sample. For Procedure C, the sample container shall be a closed type sample container shown in figure A.4, of a minimum 0.5 litre capacity.

With agreement between all the parties concerned, smaller samples, down to 0.3 litre minimum, may be taken when sampling inerted vessels for vapour-pressure measurement exclusively. In this case also, the sample container shall be filled to 70 % to 80 % with sample. The precision in clause 13, however, can not be applied.

- d) Sample containers shall be leak-free. Discard containers found to have any visible leak, and obtain a new sample.

- e) Official samples frequently require specific sampling arrangements, including a separate sample for the Reid vapour-pressure determination, and possibly the presence of a cooling bath or an insulated carrier at the sampling site. Regulations and/or specifications shall be consulted for any special instructions for sampling before samples are taken.
- f) In all cases, protect the samples between the sampling point and the cooling bath by measures such as covering with insulating material from excessive heat.

7 Sample preparation

The sample shall be prepared as follows.

- a) With the sample at a temperature of 0 °C to 1 °C, remove the sample container from the cooling bath and wipe dry with absorbent material. Verify that the container is 70 % to 80 % full, either by visual examination if the container is transparent, or, if the container is not transparent, by the use of a suitable gauge.
- b) Verify that the container is 70 % to 80 % full. If the container is less than 70 % full, discard the sample. If the container is more than 80 % full, pour out enough sample to bring the volume in the container to within the 70 % to 80 % range. Under no circumstances shall any sample poured out be returned to the container.
- c) Replace the sample container in the cooling bath for a sufficient time for the temperature to equilibrate to 0 °C to 1 °C.
- d) For Procedures A, B and D only, remove the sample container from the cooling bath at 0 °C to 1 °C, open it momentarily, reseal it, and shake it vigorously for 10 s to 20 s. Return it to the bath for a minimum of 2 min. Repeat this procedure twice more, and then return the sample to the cooling bath until ready for sample transfer.
- e) For Procedure C, do not disturb the sample in the cooling bath until it is removed for sample transfer.
- f) The sample container and its contents shall be cooled to 0 °C to 1 °C before opening. Sufficient time to reach this temperature shall be ensured by direct measurement of the temperature of a similar liquid in a like container placed in the cooling bath at the same time as the sample.
- g) The Reid vapour-pressure determination shall be performed on the first test portion withdrawn from the sample container. The remaining sample in the container shall not be used for a second determination. If necessary, obtain a new sample according to clause 6.

8 Apparatus preparation

8.1 Sample chamber

Completely immerse the open sample chamber in an upright position in the cooling bath for at least 10 min until it reaches a temperature below 5 °C. For Procedures A, B, and D, also immerse the sample transfer connection shown in figure 1 for the same cooling period. The freezer compartment of the refrigerator may be used to minimize the time required.

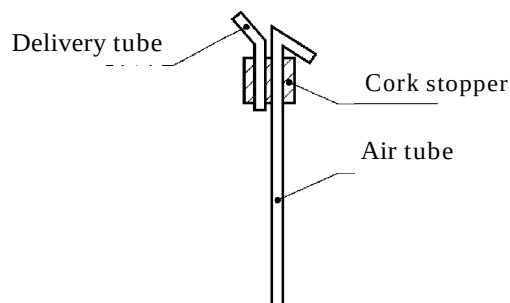


Figure 1 Sample transfer connection

8.2 Vapour chamber

The purged vapour chamber and pressure sensor shall be connected together and immersed in a water bath at 37.8 °C for at least 10 min, the depth of immersion at which time being such that at least 25 mm of water is above the highest level of the vapour chamber. Do not remove the vapour chamber until the sample chamber has been filled with sample.

9 Sample transfer and assembling vapour pressure cylinder

9.1 Procedures A, B and D

For Procedures A, B, and D, sample transfer and assembling of vapour pressure cylinder shall be as follows. Explanatory drawing of sample transfer from sample container to one-opening sample chamber is shown in figure 2.

- a) Remove the chilled sample container from the cooling bath, uncap it, and insert the chilled sample transfer connection.
- b) Remove the chilled one-opening sample chamber from the cooling bath, empty it, or confirm that it is empty by inversion, and place it rapidly over the sample delivery tube of the transfer connection. Invert the entire system rapidly, so that the sample chamber is upright with the end of the delivery tube extending to approximately but not exceeding 6 mm of the bottom of the sample chamber.
- c) Fill the one-opening sample chamber to overflowing, ensuring that the sample is free of air bubbles by lightly tapping the sample chamber against the work surface. Withdraw the delivery tube from the sample chamber while allowing the sample to continue flowing up to complete withdrawal. Ensure that suitable containment of excess sample is provided, and that no potential ignition sources are adjacent. Make suitable provision for the safe disposal of excess sample.
- d) Without delay, remove the vapour chamber from the water bath, and shake it gently to remove free water droplets. Do not allow undue movement of the vapour chamber that could promote exchange for the ambient air with the air at 37.8 °C in the vapour chamber. Couple the vapour chamber to the filled one-opening sample chamber as quickly as possible without spillage. The coupling shall be completed within 10 s of the vapour chamber being removed from the water bath.

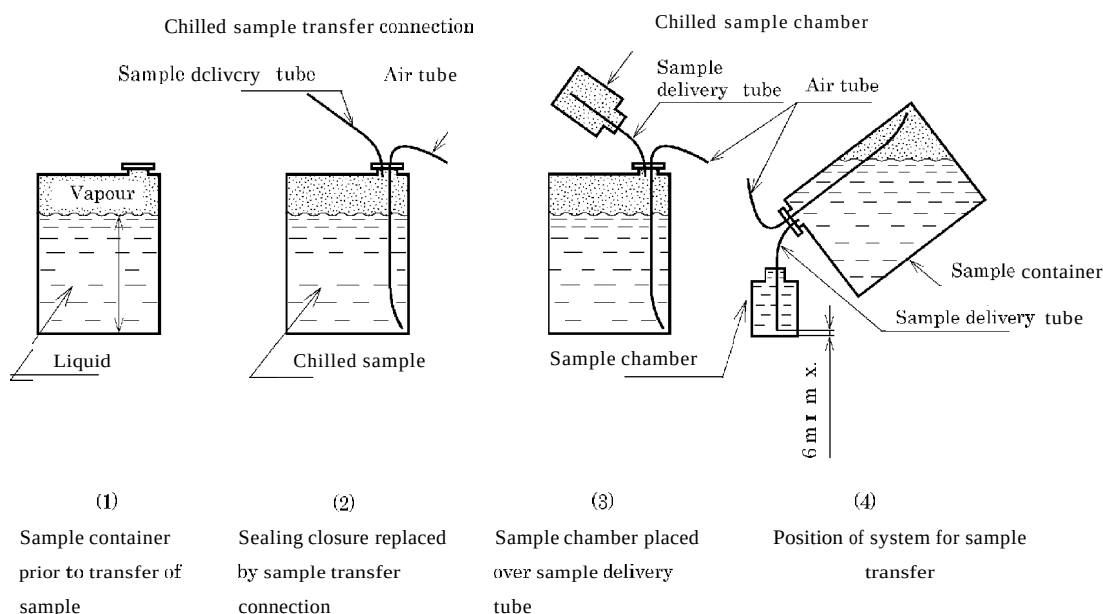


Figure 2 Simplified outline of sample transfer for Procedures A, B and D

9.2 Procedure C

For Procedure C, sample transfer and assembling of vapour pressure cylinder shall be as follows.

- Remove the chilled and closed-type sample container from the cooling bath and allow it to warm to a temperature that will maintain a pressure above atmospheric pressure. Warm slightly if necessary, but not to above 35 °C.
- Connect an ice-cooled coil to the outlet valve of the closed-type sample container. A suitable ice-cooled coil can be prepared by immersing a spiral of approximately 8 m of 6 mm diameter copper tubing in a 10 litre container of ice water.
- Connect the lower valve of the two-opening sample chamber, removed from the cooling bath and emptied by inversion, to the ice-cooled coil.
- With the upper valve of the two-opening sample chamber closed, open the outlet valve of the closed-type sample container and the lower valve of the sample chamber. Open the upper valve of the sample chamber slightly and allow the sample chamber to fill slowly until it has overflowed by at least 0.2 L.
- In the order named, close the upper and lower valves of the two-opening sample chamber and then close all over valves in the sample system. Disconnect the sample chamber and cooling coil.
- Without delay, remove the vapour chamber from the water bath, and shake it gently to remove free water droplets. Do not allow undue movement of the vapour chamber that could promote exchange for the ambient air with the air at 37.8 °C in the vapour chamber. Couple the vapour chamber to the filled two-opening sample chamber as quickly as possible without spillage. The coupling shall be completed within 10 s of the vapour chamber being removed from the water bath. Open the upper valve immediately after coupling is completed.

10 Procedure

10.1 Introduction of the vapour pressure cylinder into the bath

10.1.1 Procedures A and D

For Procedures A and D, introduction of the vapour pressure cylinder into the bath shall be as follows.

- a) Turn the assembled apparatus upside down and allow all the sample in the one-opening sample chamber to drain into the vapour chamber. With the apparatus still inverted, shake it vigorously up and down eight times.
- b) With the gauge end up, immerse the assembled apparatus in the bath at 37.8 °C in an inclined position, so that the connection of the sample and vapour chambers is below the water level. Carefully examine for leaks.
- c) If no leaks are observed, further immerse the apparatus to a vertical position, with the water level a minimum of 25 mm above the top of the vapour chamber. Observe the apparatus for leaks throughout the test and discontinue the test at any time that a leak is detected. Liquid leaks are more difficult to detect than vapour leaks, and because the coupling between the chambers is normally in the liquid section of the apparatus, it should be given particular attention.

10.1.2 Procedure B

For Procedure B, introduction of the vapour pressure cylinder into the bath shall be as follows.

- a) While holding the apparatus vertically, immediately connect the spiral tubing at the quick-action disconnect. Tilt the apparatus to 20° to 30° downward for 4 s to 5 s to allow the sample to flow into the vapour chamber without entering the tube extending into the vapour chamber from the pressure sensor.
- b) Place the assembled apparatus in the water bath at 37.8 °C in such a way that the bottom of the one-opening sample chamber engages in the drive coupling, and the other end of the apparatus rests in the support.
- c) Turn on the switch to begin the rotation of the assembled vapour pressure cylinder. Observe the apparatus for leaks throughout the test according to 10.1.1 c). Discard the test at any time that a leak is detected.

10.1.3 Procedure C

For Procedure C, introduction of the vapour pressure cylinder into the bath shall be as follows.

- a) With care, turn the assembled apparatus upside down and allow the sample in the two-opening sample chamber to flow into the vapour chamber. Do not shake the apparatus.
- b) Re-invert the apparatus, and with the Bourdon-tube pressure gauge in the upper position, immerse it in the bath at 37.8 °C in the manner described in 10.1.1b) and 10.1.1c). Continue to examine for leaks throughout the test as specified in 10.1.1c) and discard the test at any time that a leak is detected.