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International Standard 6251

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Liquefied petroleum gases — Corrosiveness to copper — Copper strip test

Gaz de pétrole liquéfiés — Action corrosive sur le cuivre — Essai à la lame de cuivre

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 6251 was developed by Technical Committee ISO/TC 28, *Petroleum products and lubricants*, and was circulated to the member bodies in March 1981.

It has been approved by the member bodies of the following countries:

Australia	Iran	Peru
Austria	Iraq	Poland
Belgium	Ireland	Romania
Brazil	Israel	South Africa, Rep. of
Canada	Italy	Spain
China	Japan	Sri Lanka
Egypt, Arab Rep. of	Korea, Dem. P. Rep. of	Sweden
France	Korea, Rep. of	Switzerland
Germany, F.R.	Mexico	United Kingdom
Hungary	Netherlands	USA
India	Norway	USSR

No member body expressed disapproval of the document.

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Liquefied petroleum gases — Corrosiveness to copper — Copper strip test

1 Scope and field of application

This International Standard specifies a method for the detection of the corrosiveness to copper of liquefied petroleum gases.

NOTE — For an equivalent copper strip test applicable to less volatile petroleum products, see ISO 2160.

2 Reference

ISO 2160, *Petroleum products — Corrosiveness to copper — Copper strip test.*

3 Principle

A polished copper strip is immersed for 1 h at a temperature of 40 °C in 100 ml of water-saturated sample contained in a cylinder of suitable working pressure. At the end of this period, the copper strip is removed and rated as one of the four classifications of the table by comparison with a copper corrosion standard plaque.

4 Apparatus

4.1 Corrosion test cylinder, (see the figure) consisting of the following items :

4.1.1 Stainless steel cylinder, of the form and dimensions shown in the figure and tapped at the lower end to take a 6 mm needle-valve.

4.1.2 Top closure, of stainless steel with a chloroprene rubber O-ring.

The closure is tapped to take a 6 mm needle-valve and carries a stainless steel dip-tube at the lower end of which there is a hook from which the copper strip is hung.

4.1.3 Aluminium flexible connecting hose, with swivel connections and adapter to a 6 mm pipe.

The assembly shall be tested hydrostatically to a pressure of 7,0 MPa (70 bar) and no leak shall be detectable when it is filled with gas at a pressure of 3,5 MPa (35 bar) and immersed in the water bath (4.2).

4.2 Water bath, capable of being maintained at 40 ± 0,5 °C.

The bath shall be fitted with suitable supports to hold the test cylinder (4.1) in an upright position and be deep enough so that the entire cylinder and valves will be covered during the test.

4.3 Thermometer[1], of the total immersion type having a range of 0 to 50 °C, subdivided at intervals not greater than 0,2 °C, and having a scale error not greater than 0,1 °C.

4.4 Strip-polishing vice, for holding the copper-strip firmly without marring the edge during polishing.

Any convenient type may be used, provided that the strip is held tightly and that the surface being polished is supported above the surface of the holder.

1) A suitable thermometer would be ASTM 12 C, which is equivalent to IP 64 C.

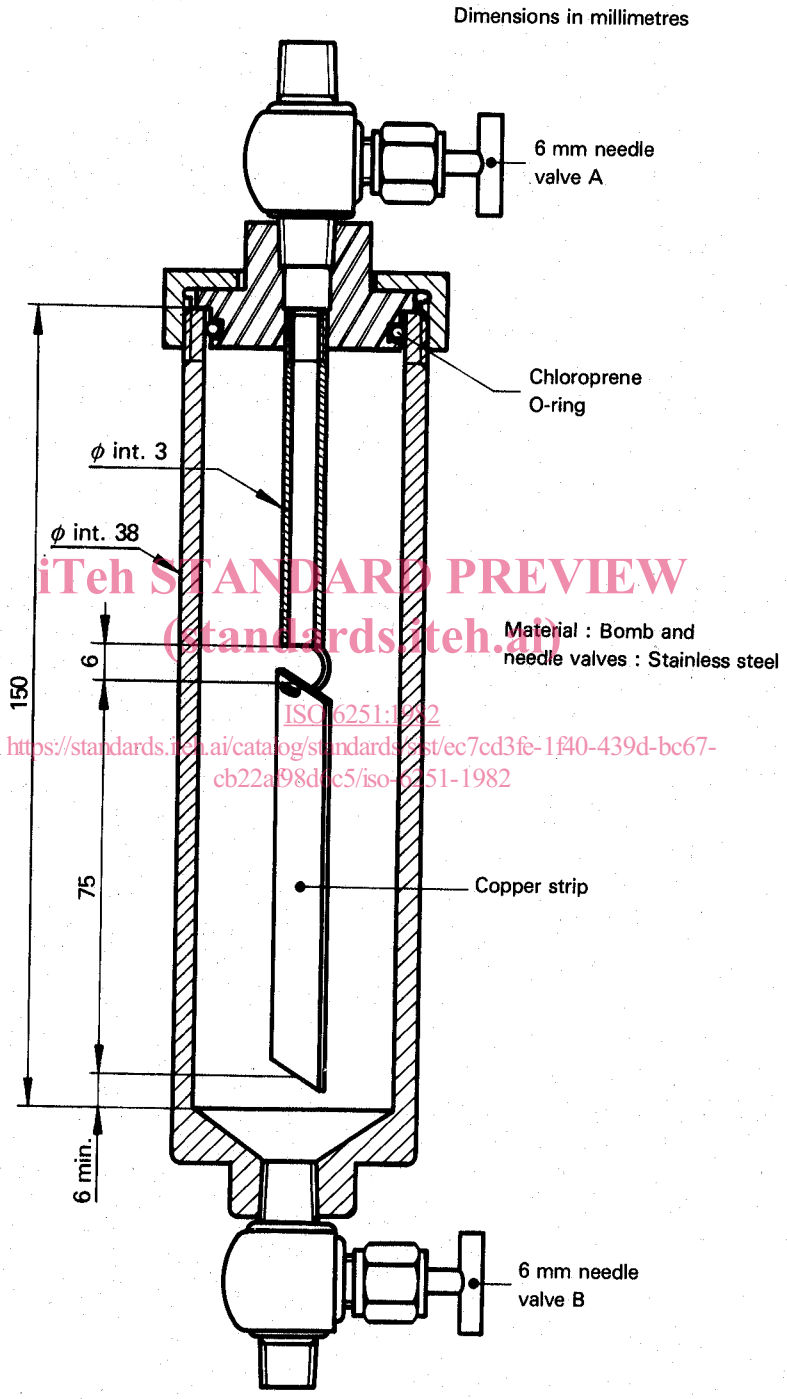

Figure — Copper strip corrosion test cylinder

5 Materials

5.1 Wash solvent, Knock test grade *iso*octane conforming with the requirements of the annex to ISO 2160.

5.2 Distilled water or **water of equivalent purity.**

5.3 Copper strip, 75 mm long, 12,5 mm wide, and 1,5 to 3,0 mm thick, of the quality of copper described in ISO 2160.

Drill a 3,0 mm hole approximately 3,0 mm from one end in the centre of the strip.

5.4 Polishing materials : Silicon carbide grit paper of various degrees of fineness including 63 µm paper or cloth; also, a supply of 90 µm silicon carbide grain and pharmaceutical grade absorbent cotton (cotton wool).

5.5 Copper corrosion standards.[1)]

The care and inspection for stability of such plaques are described in detail in ISO 2160.

6 Preparation of strips

6.1 Surface preparation

Remove all surface blemishes from all six sides of the strip with silicon carbide grit paper (see 5.4) of such degrees of fineness as are needed to accomplish the desired results efficiently. Finish with 63 µm silicon carbide paper or cloth, removing all marks that may have been made by other grades of paper used previously. Immerse the strip in the wash solvent (5.1) from which it may be withdrawn immediately for final polishing or in which it may be stored for future use.

NOTE — As a practical manual polishing procedure, place a sheet of the paper on a flat surface, moisten it with the wash solvent and rub the strip against the paper with a rotary motion, protecting the strip from contact with the fingers with an ashless filter paper. Alternatively, the strip may be prepared by use of motor-driven machines using appropriate grades of dry paper or cloth.

6.2 Final polishing

Remove the strip from the wash solvent. Holding it in the fingers protected with ashless filter paper, polish first the ends and then the sides with 90 µm silicon carbide grains picked up from a clean glass plate with a pad of absorbent cotton moistened with several drops of wash solvent. Wipe vigorously with fresh pads of absorbent cotton and subsequently handle only with stainless steel forceps; do not touch with the fingers. Clamp in the vice (4.4) and polish the main surfaces with silicon carbide grains on absorbent cotton. Rub in the direction of the long axis of the strip, carrying the stroke beyond the end of the strip before reversing the direction. Clean all metal dust from the strip by rubbing vigorously with clean pads of absorbent cotton until a fresh pad remains unsoiled. When the strip is clean, immediately attach it to the dip-tube (see 4.1.2) and immerse it in the prepared test cylinder (4.1.1).

NOTE — It is important to polish the whole surface of the strip uniformly to obtain a uniformly stained strip. If the edges show wear (surface elliptical), they are likely to show more corrosion than the centre. The use of a vice facilitates uniform polishing.

7 Procedure

CAUTION — Provide a safe means for disposal of liquid and vapour escaping during the entire operation.

7.1 With valve B open, place approximately 1 ml of the distilled water (5.2) into the clean test cylinder (4.1) and swirl to moisten the walls; allow the remainder to drain from the cylinder, insert the freshly polished copper strip suspended from the hook on the dip-tube, making sure that the bottom of the strip is at least 6 mm from the bottom of the cylinder when assembled. After assembly of the apparatus, close both valves A and B.

7.2 Holding the test cylinder upright so as not to wet the copper strip with water, attach the sample source to the test cylinder valve A by means of a short length of the flexible hose (4.1.3), which has been purged with the sample. Admit some sample to the cylinder by opening the valve at the sample source and then valve A.

7.3 Close valve A without disconnecting the test cylinder from the sample source. Invert the test cylinder and open valve B to purge the air from the test cylinder. Return the test cylinder to the upright position and drain any residual liquid through the open valve B. Close valve B with the test cylinder now in its upright position, open valve A and fill the test cylinder with the sample. When the test cylinder is full, close valve A, the valve at the sample source, and disconnect the flexible hose.

CAUTION — (See 7.1.)

1) The copper strip corrosion standard is available commercially. Details may be obtained from the Secretariat of ISO/TC 28 or from the ISO Central Secretariat.

7.4 As soon as the flexible hose is disconnected, and with the cylinder in its upright position, open valve A slightly so that all liquid above the end of the dip tube will be removed from the test cylinder. When vapour first emerges from valve A, close valve A.

7.5 Immediately after filling, immerse the test cylinder in the water bath (4.2), maintained at 40 ± 0,5 °C. Allow the cylinder to remain in the bath for 1 h ± 5 min.

CAUTION — (See 7.1.)

7.6 At the end of the test period, remove the cylinder from the bath and, holding the cylinder in a vertical position, open the bottom valve so as to discharge into a suitable disposal unit (see cautionary note) until all of the liquid and most of the vapour is discharged.

CAUTION — (See 7.1.)

7.7 When only a slight pressure remains in the cylinder, disassemble immediately and at once compare the copper strip which has been exposed to the liquefied petroleum gases with the copper corrosion standard plaque (5.5). Hold both the test strip and the plaque in such a manner that light reflected from them at an angle of approximately 45° will be observed. In handling the test strip during the inspection and comparison, the danger of marking or staining can be avoided if it is inserted in a flat test tube which is then stoppered with absorbent cotton.

7.8 If the copper strip shows a corrosion of 3 or 4, the interior of the cylinder shall be polished with steel wool and washed with the wash solvent soon after use so as to be clean for another test.

8 Expression of results

The corrosiveness of the sample should be expressed as Number 1, 2, 3 or 4, as shown in the table, depending upon which colour strip of the plaque the test strip matches. Interpret the colorations as described in ISO 2160 or on the reverse side of the standard plaque.

NOTE — The added distilled water frequently causes isolated brown spots on the copper strip. The presence of these spots should be disregarded or the test should be repeated.

Table — Copper strip classifications

Classification	Designation	Description[1]
Freshly polished strip	.....	2)
1	Slight tarnish	Light orange, almost the same as a freshly polished strip Dark orange
2	Moderate tarnish	Claret red Lavender Multicolored with lavender blue and/or silver overlaid on claret red Silvery Brassy or gold
3	Dark tarnish	Magenta overcast on brassy strip Multicolored with red and green showing (peacock), but no grey
4	Corrosion	Transparent black, dark grey or brown with peacock green barely showing Graphite or lustreless black Glossy or jet black

1) The copper corrosion standard is made up of strips characteristic of these descriptions.

2) The freshly polished strip is included in the series only as an indication of the appearance of a properly polished strip before a test run; it is not possible to duplicate this appearance after a test even with a completely non-corrosive sample.

9 Test report

The test report shall contain at least the following information :

a) the type and identification of the product tested;

b) a reference to this International Standard or to a corresponding national standard;

c) the result of the test, expressed in accordance with clause 8;

d) any deviation, by agreement or otherwise, from the procedure specified;

e) the date of the test.