

Lab Order No : JMC/10067798/06
 Product : 4 samples as shown below
 Company : Orx Resource
Company registration number (53058845E)
 Block 289 Tampines Street 22
 #12-450, Singapore 520289

Sample Recd. Date : 28-09-06
 Date Tested : 28-09-06
 Date Reported : 29-09-06

ANALYSIS REPORT

Product : (1) Mogas
 (2) Mogas + Fuel Stick
 (3) Gasoil
 (4) Gasoil + Fuel Stick

On testing, the following results were obtained :

Test	Method ASTM-D	Results			
		(1)	(2)	(3)	(4)
Copper Corrosion (3 hrs @ 50°C)	130-04	1b	1a	1a	1a
Silver Corrosion (3 hrs @ 50°C)	4814 Annex A1*	1	1	-	-

This laboratory is accredited under SINGLAS ISO/IEC 17025. The results reported herein have been performed in accordance with the laboratory's term of accreditation except calibrations/tests marked with an asterisk (*) in this report which are not within the scope of SINGLAS accreditation for our laboratory.

SGS Testing & Control Services Singapore Pte Ltd


 Soh Hong Chow
 Manager



- 1) Tests performed in accordance with the latest issue of relevant test method unless otherwise indicated.
- 2) Unless specified, above results relate only to the items tested.
- 3) Precision parameters apply in the determination of the above results. Also refer to latest ASTM D3244, IP 367 & Appendix E of IP Standard Methods for analysis & testing, for utilization of test data to determine conformance with specifications.
- 4) This report shall not be reproduced except in full, without the written approval of the laboratory.

if it is inserted in a flat glass tube (see [Appendix X1](#)), which can be stoppered with absorbent cotton.

11. Interpretation of Results

11.1 Interpret the corrosiveness of the sample in accordance with one of the classifications of the ASTM Copper Strip Corrosion Standard as listed in [Table 1](#).

11.1.1 When a strip is in the obvious transition state between that indicated by any two adjacent standard strips, rate the sample at the more tarnished classification. Should a strip appear to have a darker orange color than Standard Strip 1b, consider the observed strip as still belonging in Classification 1; however, if any evidence of red color is observed, the observed strip belongs in Classification 2.

11.1.2 A 2a strip can be mistaken for a 3a strip if the brassy underlay of the 3a strip is completely masked by a magenta overtone. To distinguish, immerse the strip in wash solvent; a 2a strip will appear as a 1b strip, while a 3a strip will not change.

11.1.3 To distinguish a 2c strip from a 3b strip, place a test strip in a 25-mm by 150-mm test tube and bring to a temperature of $340 \pm 30^\circ\text{C}$ in 4 to 6 min with the tube lying on a hot plate. Adjust to temperature by observing a high distillation thermometer inserted into a second test tube. Thus, a 2c strip will assume the color of a 2d strip and successive stages of tarnish; a 3b strip will take on the appearance of a 4a strip.

11.1.4 Repeat the test if blemishes due to fingerprints are observed, or due to spots from any particles or water droplets that may have touched the test strip during the digestion period.

11.1.5 Repeat the test also if the sharp edges along the flat faces of the strip appear to be in a classification higher than the greater portion of the strip; in this case, it is likely that the edges were burnished during preparation (polishing).

12. Report

12.1 Report the corrosiveness in accordance with one of the classifications listed in [Table 1](#). State the duration of the test and the test temperature in the following format:

Corrosion copper strip ($Xh / Y^\circ\text{C}$), Classification Z_p

where:

X = test duration, in hours,

Y = test temperature, $^\circ\text{C}$,

Z = classification category (that is, 1, 2, 3, or 4), and

p = classification description for the corresponding Z (for example, a, b).

13. Precision and Bias

13.1 In the case of pass/fail data, no generally accepted method for determining precision or bias is currently available.

14. Keywords

14.1 automotive gasoline; aviation gasoline; aviation turbine fuel; copper corrosion; copper strip; corrosiveness to copper; natural gasoline

TABLE 1 Copper Strip Classifications

Classification	Designation	Description ^A
Freshly polished strip	...	^B
1	slight tarnish	a. Light orange, almost the same as freshly polished strip b. Dark orange
2	moderate tarnish	a. Claret red b. Lavender c. Multicolored with lavender blue or silver, or both, overlaid on claret red d. Silvery e. Brassy or gold
3	dark tarnish	a. Magenta overcast on brassy strip b. Multicolored with red and green showing (peacock), but no gray
4	corrosion	a. Transparent black, dark gray or brown with peacock green barely showing b. Graphite or lusterless black c. Glossy or jet black

^A The ASTM Copper Strip Corrosion Standard is a colored reproduction of strips characteristic of these descriptions.

^B 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 noncorrosive sample.

medium rapid qualitative filter paper, into the prescribed clean, dry test tube. Carry out this operation in a darkened room or under a light-protected shield.

A1.8.3.1 Contact of the silver strip with water before, during or after completion of the test run will cause staining, making it difficult to evaluate the strips.

A1.9 Preparation of Test Strips

A1.9.1 *Surface Preparation*—Remove all surface blemishes from all six sides of the strip obtained from a previous analysis (see **Note A1.1**). Use silicon carbide paper or cloth of such degrees of fineness as are needed to accomplish the desired results efficiently. Finish with 53 to 65- μm (240-grit) silicon carbide paper or cloth, removing all marks that may have been made by other grades of paper used previously. Immerse the strip in 2,2,4-trimethylpentane from which it can be withdrawn immediately for final preparation (polishing) or in which it can be stored for future use.

NOTE A1.1—Only final preparation (**A1.9.2**) is necessary for commercially purchased pre-polished strips.

A1.9.1.1 As a practical manual procedure for surface preparation, place a sheet of silicon carbide paper or cloth on a flat surface and moisten it with 2,2,4-trimethylpentane. Rub the strip against the silicon carbide paper or cloth with a circular motion, protecting the strip from contact with the fingers by using ashless filter paper or wearing disposable gloves. Alternatively, the surface of the strip can be prepared by use of motor-driven machines using appropriate grades of dry paper or cloth.

A1.9.2 *Final Preparation*—For strips prepared in **A1.9.1** or new strips being used for the first time, remove a strip from the 2,2,4-trimethylpentane. To prevent possible surface contamination during final preparation, do not allow fingers to come in direct contact with the silver strips, by wearing disposable gloves or holding the strips in the fingers protected with ashless filter paper. Polish first the ends and then the sides with the 105- μm (150-mesh) silicon carbide grains or powder picked up with a pad of cotton (cotton wool) moistened with 2,2,4-trimethylpentane. Wipe vigorously with fresh pads of cotton (cotton wool) and subsequently handle without touching the surface of the strip with the fingers. Forceps have been found suitable to use. Clamp in a vise and polish the main surfaces with silicon-carbide grains on absorbent cotton. Do not polish in a circular motion. 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 immerse it in the prepared sample.

A1.9.2.1 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 will likely show more corrosion than the center. The use of a vise (see **Appendix X7**) will facilitate uniform polishing.

A1.9.2.2 It is important to follow the order of preparation with the correctly sized silicon carbide material as described in **A1.9.1** and **A1.9.2**. The final preparation is with 105- μm silicon carbide grains or powder. This is a larger grain size than the 53

TABLE A1.1 Silver Strip Classifications

Classification	Designation	Description
0	No tarnish	Identical to a freshly polished strip, but may have some very light loss of luster
1	Slight tarnish	Faint brown or white discoloration of strip (see A1.11.1.1)
2	Moderate tarnish	Peacock colors such as blue or mauve or medium/dark straw or brown coloration (see A1.11.1.1)
3	Slight blackening	Spots and patches of black or gray on surface or uniform thin film of black deposit
4	Blackening	Uniform heavy blackening with or without scaling

to 65- μm paper used in the surface preparation stage. The reason for this use of larger silicon carbide grains in the final preparation is to produce asperities (controlled roughness) on the surface of the silver, which act as sites for the initiation of corrosion reactions.

A1.10 Procedure

A1.10.1 *Pressure Vessel Procedure:*

A1.10.1.1 Place 30 mL of sample, completely clear and free of any suspended or entrained water (see **A1.8.3**) into a chemically clean and dry 25-mm by 150-mm test tube. Within 1 min after completing the final preparation (polishing), slide the silver strip into the sample tube. Place the sample tube into the pressure vessel (**Fig. A1.1**) and screw the lid on tightly. If more than one sample is to be analyzed at essentially the same time, it is permissible to prepare each pressure vessel in the batch before completely immersing each pressure vessel in the liquid bath at $50 \pm 1^\circ\text{C}$ ($122 \pm 2^\circ\text{F}$), provided the elapsed time between the first and last samples is kept to a minimum. After $3 \text{ h} \pm 5 \text{ min}$ in the bath, withdraw the pressure vessel and immerse for a few minutes in cool water (tap water). Open the pressure vessel, withdraw the test tube and examine the strip as described in **A1.10.2**.

A1.10.2 *Strip Examination:*

A1.10.2.1 Immediately withdraw the strip with forceps and immerse in 2,2,4-trimethylpentane. Withdraw the strip at once, dry it with ashless filter paper (by blotting not wiping) and inspect it for evidence of tarnishing or corrosion.

A1.10.2.2 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 glass tube (see **Appendix X7**), which can be stoppered with absorbent cotton.

A1.11 Interpretation of Results

A1.11.1 Interpret the corrosiveness of the sample by comparing the appearance of the test strip with a freshly polished one to give a classification based on that given in **Table A1.1**. All surfaces, including the edges, shall be taken into account.

A1.11.1.1 The Color Standard for Tube Deposit Rating⁹ (referenced in Test Method D 3241) shall be used to differentiate between the brown colorations mentioned in classifications 1 and 2. Any brown coloration less than No. 4 on the Color Standard shall be rated classification 1. Any coloration equal to or darker than No. 4 on the Color Standard shall be rated as classification 2 or higher.