Corrosion

Rev 1.06

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Corrosion Business Today

- ✓ Testing Aviation Turbine Fuel and Kerosene.
- ✓ Testing Automatic Transmission Fluid.
- ✓ Testing Base Oil.
- ✓ Testing Diesel.
- ✓ Testing Lubricants.
- ✓ Testing Fuel Oils.
- ✓ Testing Biodiesel.
- ✓ Testing Gear Oil.
- ✓ Testing Hydraulic Fluids.
- ✓ Testing Motor Gasoline.
- ✓ Testing LPG.
- ✓ Testing Greases.
- ✓ Testing Engine Coolants.

CORROSION BUSINESS, WHY?

- ✓ Crude petroleum contains sulfur compounds (most are removed during refining).
- ✓ Remaining sulfur compounds can have a corroding action on various metals.
- ✓ The copper strip corrosion test is designed to assess the relative degree of corrosivity of a petroleum product.
- ✓ The silver strip corrosion test is designed to assess the relative degree of corrosivity of a petroleum product towards silver and silver alloys.
- ✓ Evaluating the effects of engine coolants on metal specimens under controlled laboratory conditions

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COPPER CORROSION STANDARDS

• ASTM D130, IP 154, EN 2160:	Corrosiveness to Copper from Petroleum Products by Copper Strip Test.
• ASTM D849:	Copper Strip Corrosion by Industrial Aromatic Hydrocarbons.
• ASTM D1838, IP 411, EN 6251:	Copper Strip Corrosion by Liquefied Petroleum Gases.
• ASTM D4048, IP 112:	Detection of Copper Corrosion from Lubricating Grease.
• ASTM D7095:	Rapid Determination of Corrosiveness to Copper from Petroleum Products Using a Disposable Copper Foil Strip.

SILVER CORROSION STANDARDS

- IP 227: Determination of Corrosiveness to Silver of Aviation Turbine Fuels.
- ASTM D4814: Standard Specification for Automotive Spark-Ignition Engine Fuel. This method refers since 2013 to ASTM D7667 and/or ASTM D7671.
- ASTM D7667: Determination of Corrosiveness to Silver by Automotive Spark-Ignition Engine Fuel - Thin Silver Strip Method.
- ASTM D7671: Corrosiveness to Silver by Automotive Spark - Ignition Engine Fuel - Silver Strip Method.
- IP 611: Determination of corrosiveness to silver of automotive gasoline – silver strip method.

CORROSION TEST IN GLASSWARE

- ASTM D1384/8040:

The test methods cover a simple beaker type procedure for evaluating the effects of engine coolants or heat transfer fluids on metal specimens under controlled laboratory conditions. In the test method, specimens of metals specimens of metals typical of those present in engine coolant solutions or heat transfer fluids are totally immersed in aerated engine coolant solutions or heat transfer fluids for 336 hours at 88°C. The corrosion inhibitive properties of the test solution are evaluated on the basis of the weight changes incurred by the specimens. This test method will generally distinguish between coolants that are definitely deleterious from the corrosion standpoint and those that are suitable for further evaluation.

The Method

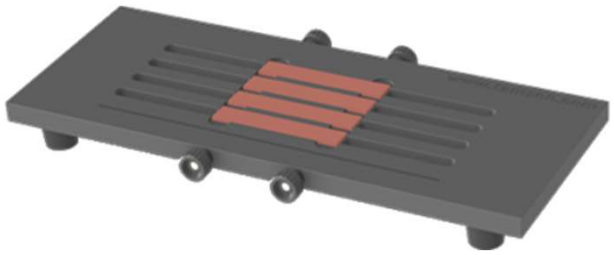
SHORT GENERAL SUMMARY

- A polished copper or silver strip is immersed in a specific volume of the sample being tested.

- The sample with immersed copper or silver strip is heated in a liquid bath under conditions of temperature and time that are specific to the class of material being tested.

- At the end of the heating period, the copper or silver strip is removed, washed and the color and tarnish level assessed against the ASTM copper or silver strip corrosion standard.

The Method



Strip Preparation

- Basically, polishing is the most important part of the test and that is often not realized.
- Polishing vise, for holding the strips firmly without marring the edges while polishing. Tamson multi vise holds four strips tightly (P/N 31T0000).
- Surface preparation by removing all surface blemishes and use a specified silicon carbide paper (P220 or P240) or other specified polishing material for the silver strip methods.
- The final preparation is with 105-µm silicon carbide powder. The reason for this use of larger silicon carbide grains in the final preparation is to produce asperities on the surface of the copper, which act as sites for the initiation of corrosion reactions.
- Don't touch the strips with your fingers, use protective gloves.

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The Method

Liquid Bath

- Use a bath with a constant temperature. Temperature tolerance max. ± 1°C. LPG (ASTM D1838 temperature tolerance max. ± 0.5°C).

Standard	Temperature	Temperature stability	Test time (minutes)
ASTM D130, IP 154, ISO/EN 2160	40°C, 50°C, 100°C or higher	± 1°C	180
ASTM D849	100°C	± 1°C	30
ASTM D1838, IP 411, ISO/EN 6251	37.8°C	± 0.5°C	60
ASTM D4048, IP 112	100°C	± 1°C	1440
ASTM D7095	40°C, 50°C, 100°C or higher	± 1°C	45
IP 227	50°C	± 1°C	240
ASTM D7667	50°C	± 1°C	120
ASTM D7671	50°C	± 1°C	180
IP 611	50°C	± 1°C	180

- The temperature measuring device is a calibrated glass thermometer, accuracy ± 0.50°C or better. Alternatively, a Digital Contact Thermometer (DCT) is allowed.
- When operating at higher temperatures than 80°C, we recommend Tamson silicon oil as a bath fluid, suitable from 20 – 150°C (P/N 08T0001).

The Method

Liquid Bath

Standard	Sample Type	Material Used	Type of Strip
ASTM D130, IP 154, EN 2160	Volatile Petroleum Products	Test Tube in Pressure Cylinder	Copper Strip
	Non Volatile Petroleum Products	Test Tube in Holder	Copper Strip
ASTM D849	Industrial Aromatic Hydrocarbons	Glass Flask and Glass Condenser	Copper Strip with Hole and Copper Wire
ASTM D1838, IP 411, EN 6251	Liquified Petroleum Gas	LPG Pressure Cylinder	Copper Strip with Hole
ASTM D4048, IP 112	Lubricating Grease	Pour Point Test Jar in Holder	Copper Strip
ASTM D7095	Volatile Petroleum Products	Test tube in Pressure Cylinder	Disposable Copper Strip
	Non Volatile Petroleum Products	Test tube in Holder	Disposable Copper Strip
IP 227	Aviation Turbine Oil	Amber Test Tube, Amber Condenser and Glass Cradle	Silver Strip
ASTM D7667	Automotive Spark-Ignition Engine Fuel	Method A: SSCD in Test Tube and Pressure Cylinder	Thin Silver Strip
		Method B: SSCD in Test Tube and Holder	
ASTM D7671	Automotive Spark-Ignition Engine Fuel	Method A: PTFE holder in Test Tube and Pressure Cylinder	Silver Strip
		Method B: Cable Tie in Test Tube and Holder	
IP 611	Automotive gasoline	PTFE holder in Test Tube and Pressure Cylinder	Silver Strip

The Method

LIQUID BATH

Liquid bath shall be deep enough to submerge one or more pressure vessels completely during the test. The bath shall be fitted with suitable supports to hold each pressure vessel in a vertical position when submerged.

Liquid bath shall be fitted with suitable test tube holder to hold each test tube in a vertical position to a depth of about 100-mm as measured from the bottom of the test tube to the bath surface.

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The Method

EXAMINATION

- Empty the contents of the test tube into a suitably sized receiver.
- Immediately withdraw the strip with forceps and immerse in wash solvent.
- Dry the strip with ashless paper or dry it with air.
- Place the strip in a flat viewing tube (P/N 09T0011).
- Inspect for evidence of tarnishing or corrosion by comparison with the copper (P/N 31T0003) or silver (P/N 31T0304) strip corrosion standard.

TC16 Corrosion Bath

MAIN UNIQUE FEATURES

- ✓Features
  - ✓Temperature range
  - ✓Standard drain
  - ✓Lids with hooks
  - ✓Fan
  - ✓Cooling coil
- ✓Six or nine positions

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TC16 Corrosion Bath

FEATURES

- Standard range from ambient to +230ºC.
- Robust made from stainless steel.
- Equipped with fan at the backside, so that stable temperature @ 40°C can be reached when all bath lids are closed.
- Tap water or an external cooler can be connected to work at sub ambient temperatures.
- Standard equipped with a bath drain.
- Can also be used as circulator (using the standard pump).

TC16 Corrosion Bath

Cover with Six or Nine positions

- ✓Standard supplied with six lids with hooks to hold the pressure test cylinders (P/N 14T0100).
- ✓Test tube holders (P/N 14T0102).
- ✓Optional is a lid for nine positions.

TC40 Corrosion Bath

COVER WITH 18 POSITIONS

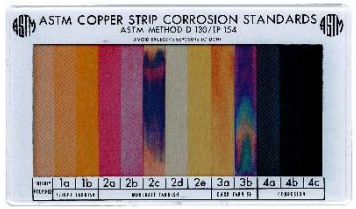
- ✓TC40 with range from ambient to 250°C.
- ✓18 positions with cover (P/N 03T2313).
- ✓Same characteristics as TC16 (see previous slides).

TC40 Corrosion Bath

COVER WITH 63 POSITIONS

- ✓TC40 with range from ambient to 250°C.
- ✓63 positions with cover (P/N 03T2315) for testing non-volatile samples in test tubes
- ✓Same characteristics as TC16 (see previous slides).

Copper Corrosion



ACCESSORIES

- ✓ Test vessel with O-ring, drilled from one piece and supplied with a works certificate for pressure and leakage tests (P/N 14T0100).
- ✓ ASTM copper strip corrosion test adjunct (P/N 31T0003).
- ✓ Copper strip (per one strip) 12.5 x 3.0 x 75 mm (W x thick x L) 99.9 % purity (P/N 31T0002).
- ✓ Sanding paper silicon carbide P220 (P/N 31T0001.100).
- ✓ Sanding paper silicon carbide P240 (P/N 31T0009.100).

Copper Corrosion

ACCESSORIES

- ✓ Test tube 25 x 150 mm (P/N 09T0010).
- ✓ Vented cork for test tube from silicon rubber for test tube (P/N 09T0010). 25 pieces (P/N 31T0008).
- ✓ Stainless steel test tube holder (P/N 14T0102).
- ✓ Silicon carbide powder 105 µm (1kg) (P/N 31T0005).
- ✓ Multi Vice Strip, holds up to four strips while polishing (P/N 31T0000).
- ✓ Flat viewing tube (P/N 09T0011).

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Copper Corrosion

ACCESSORIES

- ✓ Bath fluid silicon (P/N 08T0001) when operating above 80°C.
- ✓ Scourcing pad 400 grit, 20 pieces (P/N 31T0011).
- ✓ Disposable copper foil strip (P/N 31T0010).
- ✓ Test jar holder D4048 (P/N 14T0109).
- ✓ Test jar ASTM D4048 (P/N 31T0012).
- ✓ Vented cork for test for D4048 test jar (P/N 31T0013).
- ✓ ASTM thermometer S34C (P/N 25T0928BW) and thermometer holder (P/N 25T2154).

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Copper Corrosion

SUGGESTED ACCESSORIES

Item	Description	ASTM D130, IP 154,	IP112, ASTM D4048	ASTM D7095
14T0100	Test vessel with o-ring	○		○
31T0003	Test Standard	○	○	○
31T0002	Copper strip	○	○	
31T0001	Sanding paper P220	○		
09T0010	Test tube 25 x150mm	○		○
14T0102	Test Tube Holder	○		○
31T0005	Silicon carbide powder	○	○	
31T0000	Multi Vice Strip	○	○	○
09T0011	Flat glass viewing testtube	○	○	○
25T0928BW	ASTM thermometer S34C (non hazardous)	○	○	○
08T0001	Bath fluid Silicon oil 20-150C 20ltr		○	
25T2154	Thermometer holder	○	○	○
31T0009	Sanding Paper P240		○	
31T0008	Vented cork for test tube	○	○	○
24T0385	O-ring for test vessel (14T0100)	○		○
31T0011	Scourcing Pad 400 grit			○
31T0010	Disposable Copper Foil Strip			○
14T0109	Test jar holder D4048		○	
31T0012	Test jar ASTM D4048		○	
31T0013	Vented cork for test for D4048		○	

Silver Corrosion

ACCESSORIES

- ✓ Test vessel with O-ring, drilled from one piece and supplied with a works certificate for pressure and leakage tests (P/N 14T0100).
- ✓ ASTM silver strip corrosion test standard (P/N 31T0304).
- ✓ Silver strip (per one strip) 12.5 x 3 x 18 mm W x thick x L, 99.9 % purity (P/N 31T0303).
- ✓ Sanding paper silicon carbide P220 (P/N 31T0001.100).
- ✓ Sanding paper silicon carbide P240 (P/N 31T0009.100).

Silver Corrosion

ACCESSORIES

- ✓ Test tube 25 x 150 mm (P/N 09T0010).
- ✓ Vented cork for test tube from silicon rubber for test tube (P/N 09T0010). 25 pieces (P/N 31T0008).
- ✓ Stainless steel test tube holder (P/N 14T0102).
- ✓ Silicon carbide powder 105 µm (1kg) (P/N 31T0005).
- ✓ Multi Vice Strip, holds up to four strips while polishing (P/N 31T0000).
- ✓ Flat viewing tube (P/N 09T0011).

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Silver Corrosion

ACCESSORIES

- ✓ Scourcing pad 400 grit (P/N 31T0011).
- ✓ ASTM thermometer S34C (P/N 25T0928BW) and thermometer holder (P/N 25T2154).
- ✓ Test Tube for IP 227 (amber glass) (P/N 31T0300).
- ✓ Cold-finger condenser for IP 227 (amber + transparent glass) (P/N 31T0301).
- ✓ Glass cradle for IP 227 (P/N 31T0302).

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Silver Corrosion

ACCESSORIES

- ✓ Silver strip centering device (SSCD) for ASTM D7667 (P/N 31T0305).
- ✓ Thin silver strip (1 piece) for ASTM D7667 (P/N 31T0307).
- ✓ PTFE cradle holder to suspense silver strip for ASTM D 7671 (P/N 31T0308).
- ✓ Waterproof aluminum oxide cloth sanding sheet, box 20 pieces (P/N 31T0306).

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Silver Corrosion

SUGGESTED ACCESSORIES

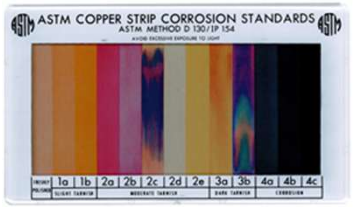
Item	Description	IP 227	ASTM D4814-12 Annex A (obsolete)	ASTM D7667		ASTM D7671		IP 611
				Procedure A	Procedure B	Procedure A	Procedure B	
31T0300	Amber Glass Test Tube IP 227	○						
31T0301	Cold-finger Condensor IP 227	○						
31T0302	Glass Cradle IP 227	○						
31T0303	Silver Strip (1 piece)	○	○			○	○	○
31T0304	Silver Strip Standard	○	○	○	○	○	○	○
31T0000	Multi Vice Strip	○	○			○	○	○
31T0005	Silicon carbide powder	○	○			○	○	○
25T0928BW	ASTM thermometer S34C	○	○	○	○	○	○	○
25T2154	Thermometer holder	○	○	○	○	○	○	○
31T0009	Sanding Paper P240	○	○			○	○	○
14T0100	Test Cylinder		○	○		○		○
09T0010	Test tube 25 x 150 mm		○	○	○	○	○	○
09T0011	Flat glass viewing testtube		○			○	○	○
14T0102	Test Tube holder				○		○	
31T0305	SSCD			○	○			
31T0011	Scourcing Pad 400 grit			○	○			
31T0307	Thin silver strip			○	○			
31T0306	Waterproof Oxide Sanding Sheets			○	○			
31T0008	Vented cork for test tube						○	
24T0385	O-ring for test vessel (14T0100)		○	○		○		○
31T0308	PTFE Cradle Holder					○		○
31T0309	Cable tie						○	

TC40 for ASTM D849

Corrosion by Industiral Aromatic Hydrocarbons

- ✓ Range from +5°C .. +250°C.
- ✓ Standard drain and cooling coil.
- ✓ Can also be used as circulator.
- ✓ Complete set-up P/N 00T2015 (230V) or P/N 00T2016 (115V) is delivered with:
  - ✓ TC40 bath
  - ✓ Levelling platform.
  - ✓ Six sets of glassware (flask P/N 31T2012 + condenser P/N 31T2011).
  - ✓ Two boss heads and six clamps to keep glassware in upright position.

ASTM D849



ACCESSORIES

- ✓ ASTM copper strip corrosion test standard (P/N 31T0003).
- ✓ Copper strip (per one strip) 12.5 x 3.0 x 75 mm (W x thick x L) 99.9 % purity with Ø 3.2 mm hole (P/N 31T0007).
- ✓ Sanding paper silicon carbide P240 (P/N 31T0009).
- ✓ Soft copper. 99.9 % purity. 0.5 mm. Roll of 30 meter (P/N 31T0320).
- ✓ Bath fluid silicon (P/N 08T0001). Two cans needed.

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ASTM D849

ACCESSORIES

- ✓ Silicon carbide powder 105 µm (1kg) (P/N 31T0005).
- ✓ Multi Vice Strip, holds up to four strips while polishing (P/N 31T0000).
- ✓ Flat viewing tube (P/N 09T0011).
- ✓ ASTM thermometer S34C (P/N 25T0928BW) and thermometer holder (P/N 25T2154).

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ASTM D1838

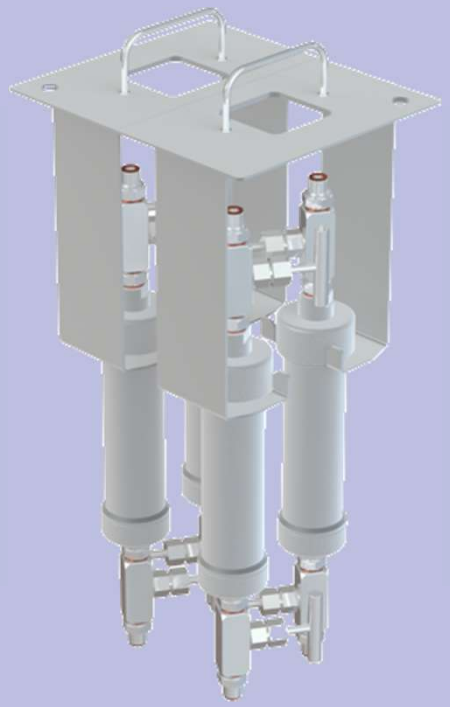
COPPER CORROSION OF LPG

- ✓ Range ambient ..80°C.
- ✓ Up to four positions.
- ✓ Cover with holders for test cylinder (P/N 03T2322).
- ✓ Holes in cover, to check for LPG leakage.
- ✓ Standard drain & overflow outlet.
- ✓ Designed to work at 37.8°C without an external chiller.
- ✓ All necessary accessories are supplied by Tamson.
- ✓ Optional combine ASTM D1838 and ASTM D130/D7667/D7671 with 3 x Ø 51 mm cover (P/N 03T2324).

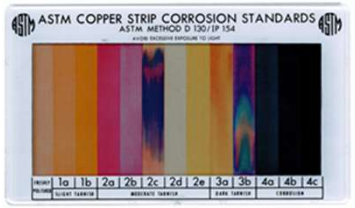
ASTM D1838

COPPER CORROSION OF LPG- ACCESSORIES

- ✓ LPG test vessel with o-ring, withstand a hydrostatic test pressure of 6900 kPa, leak free when tested at 3450 kPa with nitrogen (N2). Delivered complete with two needle valves, 1/4" BSP cylindrical inner thread (P/N 14T0115).
- ✓ Cover with holders for test vessel (P/N 03T2322). Each cover can hold two LPG test vessels. Cover needs to be bought as an accessory. Maximum is two covers per TB30 Bath, so the maximum capacity is four LPG cylinders.



ASTM D1838



ACCESSORIES FOR COPPER CORROSION OF LPG

- ✓ ASTM copper strip corrosion test standard (P/N 31T0003).
- ✓ Copper strip (per one strip) 12.5 x 3.0 x 75 mm (W x thick x L) 99.9 % purity with Ø 3.2 mm hole (P/N 31T0007).
- ✓ Sanding paper silicon carbide P220 (P/N 31T0001.100).
- ✓ Flexible inert hose, stainless steel connectors, 1/4"BSP cylindrical inner thread, length 60 cm, tested up to 10000 kPa or 100 bar (P/N 12T1070).

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ASTM D1838

ACCESSORIES FOR COPPER CORROSION OF LPG

- ✓ Silicon carbide powder 105 µm (1kg) (P/N 31T0005).
- ✓ Multi Vice Strip, holds up to four strips while polishing (P/N 31T0000).
- ✓ Flat viewing tube (P/N 09T0011).
- ✓ ASTM thermometer S34C (P/N 25T0928BW) and thermometer holder (P/N 25T2154).

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TC40 for ASTM D1384/D8040

Corrosion Test in Glassware

- ✓ Range from +5°C .. +250°C.
- ✓ Standard drain, float and cooling coil.
- ✓ Can also be used as circulator.
- ✓ Complete six-position apparatus P/N 00T2040 (230V) or P/N 00T2041 (115V) is delivered with:
  - ✓ TC40 bath
  - ✓ Levelling platform, cover with lids
  - ✓ Six sets of glassware (flask P/N 31T2050 + condenser P/N 31T2050 + aerator P/N 31T2052).
  - ✓ Two boss heads and six clamps to keep glassware in upright position.
  - ✓ Six calibrated flowmeters with tubing and connectors.
- ✓ Alternatively, a complete three-position apparatus P/N 00T2042 (230V) or P/N 00T2043 (115V) is available.

ASTM D1384

ACCESSORIES

- ✓ Complete set of test specimen. Complete assembled with spacers and insulators, ready for use. The coupons are pre-weighed and will be supplied with weight list and material test reports.(P/N 31T2056).
- ✓ Air compressor (P/N 31T2060).
- ✓ Cooling circulator TLC15-5 - 230V/50Hz. To replace tap water that circulates through the condenser (P/N 00T0565)
- ✓ Thermometer similar to ASTM 1C, white backed, -20+150:1°C, capillary tube specially coated inside, with non-wetting blue special liquid, immersion 76mm, max.327x6-7mm, durable pigment, with works certificate at 0° (P/N 25T0901B).
- ✓ Bath fluid silicon (P/N 08T0001). Two cans needed.

EASY INSTALLATION

- ✓ Bath is completely assembled and tested at factory (some manufacturer's ask their dealers to assemble the bath).
- ✓ Remove bath from packaging material.
- ✓ Clean inner bath thoroughly of any loose packing materials, etc.
- ✓ Place the bath spirit level.
- ✓ Use a mains supply that is well earthed and clean of interference and can carry the load of the bath. Be sure to check the power requirements (230V/50-60Hz, 115V/60Hz) marked on the tag plate at the back side of the bath.
- ✓ Check operating voltage (230V/50-60Hz, 115V/60Hz) and connect the bath to appropriate mains supply. The bath has to be filled with a liquid suitable for operating temperature.

The end

THANK YOU FOR YOUR TIME AND CONSIDERATION!