

STORAGE STABILITY OF RESIDUAL FUEL OILS

UOP Method 174-84

SCOPE

This is a rapid pass-fail oxidation test for predicting the stability of residual fuel oils in storage. The determination is particularly applicable to fuel oils that require preheating.

OUTLINE OF METHOD

The fuel oil sample is poured into a three-necked flask equipped with a thermometer, a reflux condenser and a gas inlet. The oil is heated to 140 C and the sample is oxidized by bubbling oxygen through the oil for a period of 2 hours. After this treatment, a water and sediment determination is made by ASTM D 1796. This value is compared to the water and sediment content of the unoxidized oil, and a conclusion as to the stability of the oil is drawn.

APPARATUS

Balance, top loading, readability of 0.1g

Beaker, Griffin, low form, 400-mL

Bottle, widemouth, 250-mL (for trap)

Condenser, Allihn, 300-mm, Sargent-Welch Scientific, Cat. No. S-22705C or equivalent

Controller, temperature, CMS, Cat. No. 282-509, or equivalent

Corks, No. 8 and 14

Cork ring, 110-mm OD

Density apparatus, (See ASTM Method D 1298)

Flask, distilling, three neck, 500-mL, Sargent-Welch Scientific, Cat. No. S-34070-G, or equivalent

Flowmeter, to measure 45-50 mL/min, CMS, Cat. No. 166-504, or equivalent

IT IS THE USER'S RESPONSIBILITY TO ESTABLISH APPROPRIATE PRECAUTIONARY PRACTICES AND TO DETERMINE THE APPLICABILITY OF REGULATORY LIMITATIONS PRIOR TO USE. EFFECTIVE HEALTH AND SAFETY PRACTICES ARE TO BE FOLLOWED WHEN UTILIZING THIS PROCEDURE. FAILURE TO UTILIZE THIS PROCEDURE IN THE MANNER PRESCRIBED HEREIN CAN BE HAZARDOUS. MATERIAL SAFETY DATA SHEETS (MSDS) OR EXPERIMENTAL MATERIAL SAFETY DATA SHEETS (EMSDS) FOR ALL OF THE MATERIALS USED IN THIS PROCEDURE SHOULD BE REVIEWED FOR SELECTION OF THE APPROPRIATE PERSONAL PROTECTION EQUIPMENT (PPE).

Heater, mantle, 500-mL, 270 W, CMS, Cat. No. 172-528, or equivalent

Holder, cylinder, bench type, Matheson Co., Model 508, or equivalent

Policeman, rubber, with glass rod, Sargent-Welch Scientific, Cat. No. S-73215-B, or equivalent

Probe, temperature, tubular, YSI immersible, + 93 to + 260 C, CMS, Cat. No. 231-373, or equivalent

Regulator, oxygen, Matheson Co., Model 8L, CGA540, or equivalent

Stopper, rubber, 2-hole, No. 8.5 (for trap)

Thermometer, – 2 to + 300 C, ASTM 7C, Sargent-Welch Scientific, Cat. No. S-80535, or equivalent

Tube, glass, bubbler, 7-mm OD, L-shaped, 70 by 190 mm

Tube, glass, 7-mm OD, L-shaped, 50 mm each side (2 required)

Tubing, Tygon, 6.4 by 1.6 mm, one meter

Valve, adjustable safety relief, 69-207 kPa, brass, Air Products, Cat. No. E33-41121, or equivalent

Water and sediment test apparatus, (See ASTM Method D 1796)

REAGENTS

All reagents shall conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, when such specifications are available, unless otherwise specified.

Oxygen, extra dry, 99.6% minimum purity

Toluene, 99.0% minimum purity (See ASTM D 1796)

PROCEDURE

Assemble the apparatus as shown in the drawing. The purpose of the trap is to protect the flowmeter from contamination with the oil, should back-pressure develop. Determine the density of the fuel oil by ASTM Method D 1298. Weigh the flask to the nearest 0.1 g, add the equivalent of 200 mL of oil to the flask and reweigh. Place the flask in the heating mantle and make connections as shown in the drawing. Heat the oil so that it reaches 140 C (284 F) in about 45 minutes. Adjust the oxygen flow through the flowmeter to 45-50 mL/min. *CAUTION: Vent oxygen to a safe location.* Maintain the oil at 140 ± 3 C and with an oxygen flow rate of 45-50 mL/min for two hours $\pm$ 5 minutes. Shut off the oxygen, remove the heat from the flask and allow the oil to cool to approximately 40 C.

Transfer the oil into a clean beaker, making certain that any deposit on the sides of the flask is removed; if necessary use a rubber policeman. Carefully mix the oxidized sample as thoroughly as possible. Determine the water and sediment content on a representative portion of the oxidized sample and on the unoxidized oil by ASTM Method D 1796.

INTERPRETATION OF DATA

Fuel oils in which the water and sediment content is not increased by more than 0.3% by oxidation under the conditions of this test should be stable in storage at 77 C (170 F) for periods of at least 180 days.

BASIS FOR INTERPRETATION

Fifty fuel oils, representing virgin, totally cracked and mixtures of virgin and cracked stocks were studied. The oxidation stability test was run on these fuel oils. The fuel oils were then stored for 6 months at 77 C (170 F). At the end of the storage period the water and sediment test was rerun. Those oils that showed an increase of 0.3% or less in water and sediment after oxidation at the beginning of the six month period had not increased more than 0.2% in water and sediment at the end of six months hot storage.

PRECISION

Based on six replicate determinations, the estimated standard deviation (esd) was calculated to be 0.09 vol-% for a water and sediment increase of 0.6 vol % on an unstable fuel oil.

Duplicate results by the same operator should not differ by more than 0.35 vol % at the stated level (95% probability).

TIME FOR ANALYSIS

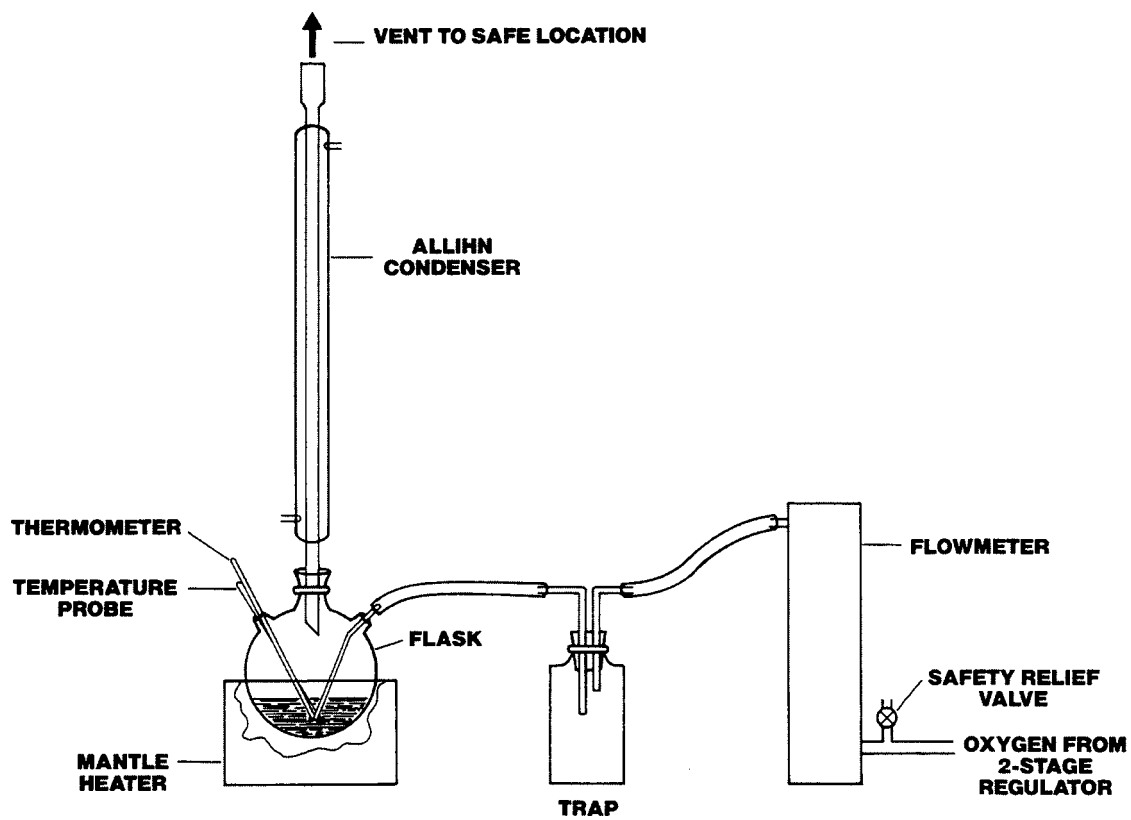
The elapsed time for one analysis is 3.5 hours. The labor requirement is 2 hours.

REFERENCE

ASTM Methods D 1298 and D 1796, www.astm.org

SUGGESTED SUPPLIERS

Air Products and Chemicals, Inc., Specialty Gas Dept., Box 538, Allentown, PA 18105
Curtin Matheson Scientific, 1850 Greenleaf Ave., Elk Grove, IL 60007
Matheson, P.O. Box 96, Joliet, IL 60434
Sargent-Welch Scientific Co., 7300 N. Linder Ave., Skokie, IL 60077



Oxidation Apparatus